TECHNOLOGY LEVEL, PRODUCTION STRUCTURE AND FARM SIZE: A STUDY OF ANDHRA PRADESH AGRICULTURE

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CERTIFICATE

Certified that the thesis entitled "Technology Level, Production Structure and Farm Size: A Study of Andhra Pradesh Agriculture" submitted by A. Venkateswarlu for the degree of Doctor of Philosophy is a *bona fide* work to the best of our knowledge and may be placed before the examiners for their consideration.

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CHAPTER - I

INTRODUCTION AND OBJECTIVE OF THE STUDY

Technology is the science of practical or industrial arts. It is an application of science for inventing or improving instruments of production. Primitive man's arts of production were different from those of today's man. As mankind are the only beings who gained an absolute control over the production of food on earth[1], it appears that technological development assumed somewhat autonomous progress, at least in the early stages of human history. The technology depends on the socio-economic and political development of the society[2] and is influenced by those institutions in the respective socio-economic formations, i.e., primitive, slave, feudal, capitalist and socialist societies. Yet, the technology is not passive and has

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1. Morgan's view quoted by F. Engels in his The Origin of the Family, Private Property and the State, Progress Publishers, Moscow, 1977, p.23.

2. In the developed society, the technology is controlled by dominant classes. See T.J. Byres, "The Political Economy of Technological Innovation in Indian Agriculture", and H.M. Cleaver, Jr., "Technology as Political Weaponry", both in R.S.Anderson, et al., (eds.), Science, Politics and the Agricultural Revolution in Asia, West view Press, Inc. Colorado, USA, 1982. Byres says "Technology does not fall from heaven and neither does it exist in a social and political vacuum. It is appropriated by specific classes and used to further class interests", (p.25). Cleaver says, "Politically there is no more neutrality in science than there is in its application: technological development", (p.263).

conditioned the social institutions. Thus, there is a dialectical interaction between technology and institutions.[3]

The interaction may be understood as follows. In a feudal society, the feudal institutions, through extra-economic coercion, do not allow technical progress. If the institutional change is introduced through land reforms and institutions of credit and marketing, there is an impetus for technical change. Johnston and Mellor call this as preconditions for agricultural development.[4] Once the technical change is in progress, it brings in changes in the institutions. Peasant farming may be replaced by collective or cooperative agriculture. But these processes of change may not always be smooth. A social conflict is involved when institutions become fetters on the development of productive forces (technology), as stressed by Marx.[5]

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3. H.Shigemochi, The Structure of Disparity in Developing Agriculture, The Institute of Developing Economies, Tokyo, 1978, (p.4). Further, as regards Marx's position V.W. Ruttan says, "Although Marx stressed the dialectical relationship between changes in modes of production (technical change) and changes in production relationships (institutional change), he believed the former provided the more dynamic source of change in social organisation", in "Induced Institutional Change", in H.P. Binswanger and V.W. Ruttan (eds.), Induced Innovation. The Johns Hopkins Press, Baltimore, 1978, p.330.

4. Bruce F.Johnston and John W.Mellor, "The Role of Agriculture in Economic Development", American Economic Review, Vol.51, September 1961.

5. Karl Marx, A Contribution to the Critique of Political Economy, Progress Publishers, Moscow, 1978, p.21.

Technology is of vital significance to both agriculture and industry. In the pre-industrial world, it was agriculture that occupied major shares both in employment and income of all the countries. In the developed world now, agriculture's share especially in employment, is reduced to extremely low levels.[6] On the contrary, in the less developed countries, this type of change is yet to take place in a big way; the share of agriculture is still dominant in such countries particularly in employment. These aspects depend *inter alia* on the state of agricultural technology. Thus, in this chapter we deal with various aspects of agricultural technology especially its importance in Indian agriculture.

1. Agricultural Technology

It was already stated that man's supremacy over other beings was established by the production of food. That is, the agricultural sector was the main sector in the economy of the primitive society. Agricultural technology has a long history. Its process of development was initiated as a struggle against nature. In the pre-industrial world, agricultural technology evolved itself through several

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6. In fact, the share of non-agricultural sector is growing, while that of agriculture declining. By 1980, in USA, UK, West Germany, Switzerland, Sweden and Canada, the shares of agricultural sector in the GDP and employment varied between 2 and 5 per cent only. See World Bank, World Development Report, 1982, p.115 and 117.

phases. In the most primitive cultivation, it was connected with digging stick, while the type of farming was forest fallow system. Later, bush fallow and short fallow were the types related with hoe and plough. Thus, pre-industrial civilization was connected with plough.[7] After the advent of industrial revolution based on the invention of steam engine agricultural technology also acquired new dimensions and inter-disciplinary complexities.

The modern agricultural technology may be divided into two main categories : (i) mechanical technology and (ii) bio-chemical technology.[8] Mechanical technology, contributed by physics and engineering sciences, is concerned with the instruments of production, both motive and stationary. Generally this is biased to scale, cost-reducing and capital-intensive. It requires higher doses of fixed capital. Biological-chemical technology provides the contributions of chemistry and biology. The chemical technology gives chemical fertilizers, pesticides, weedicides, herbicides etc., which help replenish the lost fertility of the soil and

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7. Ester Boserup, The Conditions of Agricultural Growth, George Allen & Unwin Ltd., London, 1965. Her main thesis was that the population pressure determined the agricultural technology, which was responsible for shortening of the fallow, (p.28).

8. H. Shigemochi, op.cit. He divides agricultural technology into four types. In addition to the above two categories, the other two are (a) hydrological and (b) managerial technologies. But (a) can be included in mechanical technology and (b) may be treated to be within labour itself as human capital formation, (pp.5 & 6).

protects plants from diseases and pests. Biological technology works on the genetics and physiognomy of the plant, ultimately giving higher yield. The bio-chemical technology is labour-absorbing, land-saving and scale-neutral.

Mechanical technology, though treated as capital-intensive may also be land-saving and labour absorbing as timely field crop operations lead to multiple cropping in a single year. In the same way, the bio-chemical technology, which is labour-absorbing, may also be labour-saving as is possible by using herbicides and weedicides.[9] "Yet, historically, the dominant factor for saving labour has been the progress of mechanisation; and the dominant factor for saving land has been the biological innovations".[10]

2. Role of Agricultural Technology - Internal and External Stimuli

In the pre-industrial world, the technical change was initiated summarily in the agricultural sector alone. Generation of agricultural surplus was the main driving force behind human civilization. Agricultural surpluses came largely through expanding food production due, in part, to

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9. Carl H. Gotch, "Technical Change and the Distribution of Income in Rural Areas", American Journal of Agricultural Economics Vol.54, No.2, May 1972, p.328.

10. Y.Hayami and V.W. Ruttan, Agricultural Development, An International Perspective, The Johns Hopkins Press, Baltimore, 1971, p.45.

improvements in agricultural technology and in part to man's continuing ingenuity, ever since the early stages of human history.[11] Even more important is the role of agricultural surplus, whose generation was caused by developed agricultural technology, in capital accumulation for industrial revolution. Historically, agricultural revolution preceded the industrial revolution in the developed countries of Europe and England. This was accomplished by increased land and labour-productivity in agriculture. Kaldor aptly says[12] :

> The growth of secondary and tertiary sectors is dependent on the growth of the 'agricultural surplus', that is, the excess of food production over the food consumption of the food producers themselves. This aspect of development was first emphasised by Adam Smith.

Marx also took a similar position, in analysing the development of capitalism.[13]

From the foregoing discussion, it might appear that agriculture did not get any outside stimuli; rather it acted

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11. It is well accepted that civilizations flourished in the ancient world, on the river valleys - Indus valley etc., as the fertile lands of such valleys were useful in saving time in production of food.

12. N.Kaldor, <u>Strategic Factors in Economic Development</u>, Cornell University Press, New York, 1967, p.55.

13. Karl Marx, <u>Capital</u>, Vol. III, Progress Publishers, Moscow, 1971. He says "... thus all the development of capital, has for its natural basis the productiveness of agricultural labour ... An agricultural labour productivity exceeding the individual requirements of the labourer is the basis of all societies, and is above all, the basis of capitalist production", pp.785 & 786.

upon its own internal impulses in improving technology to produce surplus.[14] Further, the agricultural technology so adopted could release surplus labour from agriculture. As a result, agricultural sector could provide supplies of foodgrains and labour to industrial sector. Industrial sector could exploit agricultural sector by unequal exchange between the two.[15] From this process of grabbing surplus from agriculture, the industrial sector gets impulses from agricultural sector for further industrialisation by more of capital accumulation. Thus, it is true that, at least, in the early stages of industrialisation, agriculture was governed by internal impulses and industry by external stimuli originating in agriculture.

In the past two centuries or so, agriculture has been crucially dependent on external stimuli, as the new agricultural technology has had a lot to receive from industrial development. This has resulted in the process of

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14. N.Kaldor, op.cit He says, "Agricultural production has an autonomous momentum which is mainly dependent on the progress of land-saving, as distinct from labour-saving innovations", p.56.

15. This process is termed, in the current economic literature, as 'terms of trade'. Our interpretation holds good mainly for the countries which did not go for 'primitive capital accumulation' by colonial exploitation and war indemnities out of wars. Further, it is in the spirit of 'primitive socialist accumulation' of Preobrazhensky in the Soviet Debate. See Ashok Mitra, Terms of Trade and Class Relations, Rupa & Co, Calcutta, 1979 (chapter-2) and V.M.Dandekar, Peasant-Worker Alliance: Its Basis in the Indian Economy, Orient Longman, New Delhi, 1981 (lecture one).

tapping the potentialities of agricultural technology. In the post-industrial revolution period, the increasing population, both in relative and absolute terms, had created doubts in the efficacy of agricultural technology. As the supply of land was limited, the sustaining of population was thought to be difficult. As a result, pessimistic theory of population was propounded by economists, notably Malthus. Added to this, the law of diminishing returns was also propagated.[16] However, Engels, sharply disagreeing with Malthus, has the following to say:[17]

> The extent of land is limited. All right! The labour-power to be employed on this land-surface increases with population. Even if we assume that the increase in yield due to increase in labour does not always rise in proportion to the labour, there still

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16. While discussing about capitalist agricultural development, Lenin says, "The 'Law of Diminishing Returns' does not at all apply to cases in which technology is progressing and methods of production are changing; it has only an extremely relative and restricted application to conditions in which technology remains unchanged." See his, The Agrarian Question and the Critics of Marx, Progress Publishers, Moscow, 1976, p.10.

17. F.Engels, "Outlines of a Critique of Political Economy", as an Appendix in K.Marx, Economic and Philosophic Manuscripts of 1844, Progress Publishers, Moscow, 1977, p.188. At the same time, we have to appreciate his dialectical approach in his letter, dated 1-2-1881, addressed to Karl Kautsky that says, (i) if limits are to be set for population, it can be regulated even in communist society, (ii) the education of the masses is necessary, if moral restraint is to be more effective counter-measure and this is possible by socialist transformation. See R.L. Meek(ed.), Marx and Engels on Malthus, PPH, Delhi, 1956, p.97. On analogy, this regulation of population can be extended to capitalist society also.

> remains a third element which, admittedly, never means anything to the economists - Science - whose progress is as unlimited and at least as rapid as that of population ... Science increases at least as much as population ... and thus under the most ordinary conditions also in a geometrical progression.

Engels's optimism expressed as far back as 1843 has turned true largely due to progress in science and technology. After certain stage of industrial development, agricultural sector had to depend on industry for the development of improved technology, so as to bring out agriculture from the confines of pure natural processes. Thus, agricultural technology requires external impulses from industrial sector in getting supplies of technological inputs. On the other hand, agricultural development is conditioned by the demand of industrial sector for (i) agricultural raw materials and (ii) food needs of urban and non-agricultural population. Thus,"The forces which stimulate and sustain growth and technical change in agriculture originate outside the agricultural sector."[18]

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18. Penelope Francks, Technology and Agricultural Development in Pre-war Japan, Yale University Press, London, 1984, p.17. Further, Sheila Bhalla also expresses a similar view that agriculture has to depend on external impulses while industry depends on internal impulses. See, her On the Applicability of Marxian Criteria and Laws of Motion to the Analysis of Agrarian Change in Contemporary India, Mimeo., ICSSR Library, New Delhi, 1984. Karl Kautsky also noted this point by 1899 "Industry forms the motor force not only of its own development, but also of the development of agriculture." See J. Banaji, "Summary of Selected Parts of Kautsky's the Agrarian Question", Economy and Society, 1976, p.46.

3. Traditional Agriculture - An Integrated Approach

Till recent times, agricultural technology in most of the less developed countries had been traditional. Explanations for backward agricultural technology were offered by several economists/authors. Among others, Schultz's work[19] made a profound influence on the planners and academicians. According to Schultz, traditional agriculture is characterised by tried and tested methods of production; the marginal productivities of labour and capital are very low and consequently there are weak incentives for more work, saving and investment in traditional inputs. For transforming traditional agriculture, he advocates investment in profitable modern material inputs and human skills. The supply of such high-pay-off inputs to the farmers is to be made through non-profit agencies and government to complement the operation of the normal market mechanism.

Schultz's diagnosis is not without its pitfalls. For example, as Dandekar[20] points out, Schultz does not count population growth and its consequences in the form of

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19. Theodre W.Schultz, Transforming Traditional Agriculture, Lyall Book Depot, Ludhiana, 1970.

20. V.M. Dandekar, "Transforming Traditional Agriculture: A Critique of Professor Schultz", EPW, August 20, 1966.

disinvestment, leading to continuous deterioration,[21] and secondly, he does not deal with the role of dynamic surplus sector within agriculture to initiate new changes. Some other scholars question his efficiency thesis as well.[22]

Without going further into the diagnostic and prescriptive details underlying Schultz's analysis, it is imperative to point out that a more effective procedure to understand the process of agricultural backwardness is to take an integrated view of the agrarian inter-connections. The crucial corner stones of these inter-connections are: (i) The process of evolution of less developed countries from pre-capitalist relations of production; (ii) The de-industrialisation process of those countries through the mechanism of colonial exploitation; (iii) The population growth and (iv) The adoption of capital intensive technology in industrial sector that has low labour-absorbing capacity, thwarting transfer of agricultural surplus population to non-agricultural sectors. If these four aspects are seen as a combined whole, we get an integrated view of traditional

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21. Dandekar was criticised for this by Tara Shukla, in her "Comments on Dandekar's Critique of Schultz-II", EPW RA, December 24, 1966; deterioration in capital/labour and capital/land ratios due to population growth were historically not held correct and thus Dandekar's view was incorrect. However, his second issue, relating to division of agrarian economy into surplus and subsistence sectors, would have thwarted such deterioration.

22. S.N. Mishra, "Transforming Traditional Agriculture: Comments on Dandekar's Critique of Schultz-I", EPW, RA, December 24, 1966.

agriculture. These aspects (other than population growth) have been dealt with by Marxian writers, with different degrees of stress in the context of slow transformation of traditional agriculture.

(i) Pre-capitalist Production Relations

Even until about the middle of the 20th century, most of the less-developed agrarian economies were evolving out of the feudal or semi-feudal relations of production. In such conditions, the exploiting feudal/semi-feudal land-owners extract surplus through extra-economic coercion, use this for unproductive investment or conspicuous consumption and would manipulate to keep the technology unchanged.[23] Further, the tenurial conditions are disincentive-ridden, as most of the surplus of tenants is exploited through rackrenting. Tenants and peasantry would not only be exploited in land market but other markets such as credit, labour and product markets, as in many cases there is interlocking of markets.[24] Thus, classes did exist in such

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23. Ashok Rudra, Indian Agricultural Economics, Allied Publishers, New Delhi, 1982, p.404.

24. Amit Bhaduri, The Economic Structure of Backward Agriculture, Macmillan India Ltd. Delhi, 1983, pp.6-10. He says that small peasants in backward economy are exploited in all the markets, though each is an undeveloped market. The merchant's and money-lender's capital as also land ownership may be united in land-owners who can extend exploitation over product, credit and land markets respectively. Thus, actual tillers remain technologically backward. Krishna Bhardwaj also expressed similar views, see her Production Conditions in Indian Agriculture, Cambridge University Press, London, 1974, p.4.

societies as well. Schultz treats the social structure of farming community as undifferentiated, as if the family peasant farms do not depend on hired labour on the same lines as Chayanovian family farms were conceived to operate.[25]

Whatever the forms of pre-capitalist relations of production in the less developed countries, it is acceptable that they had traditional technological conditions, as the economic interests of the classes in rural areas lay against the development of agricultural technology.

(ii) <u>De-industrialisation as Reinforcement of Pre-capitalist Relations</u>

Further, the existing pre-capitalist relations in those countries were reinforced by the process of de-industrialisation, which was again the result of colonial exploitation.[26] Marx expected a double mission of British

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25. A.V.Chayanov, <u>On the Theory of Peasant Economy</u>, Oxford University Press, Delhi, 1987. He says "Most peasant farms in Russia, China, India, and most non-European and even many European states are unacquainted with the categories of wage labour', p.1. The difference between Schultz and Chayanov is of time, the former dealt with early 1960s and the latter dealt with early 1920s.

26. This was not even referred to by Schultz. Further, UNO notes simply "In many of the under-developed regions of the world, tribal or feudal institutions still form the social framework, even though under European influence the economic and political basis of tribal and feudal society has changed", in its <u>Land Reform - Defects in Agrarian Structure as Obstacles to Economic Development</u>, UNO Publication, 1951, p.5. This goes against our interpretation here. Further England's racial policy caused investment only in white colonies to develop them, while the countries with non-white populations were neglected. See A.K. Bagchi, "Some International Foundations of Capitalist Growth and Underdevelopment", <u>EPW</u>, special, August 1972.

colonialism in India, viz. (i) destruction of old forms of production mainly traditional industries (handicrafts etc.) causing misery to masses, (ii) rejuvenating new productive forces for the development of industrial capitalism. The first mission was accomplished, leading to de-industrialisation in India; whereas the second mission was negated, as no factory industries were established to absorb the de-industrialised masses, (leaving aside the absorption of depeasantised proletariat, unlike that in Europe). Such people were also compelled to depend on agriculture. Despite the potentialities for independent development of industrial capitalism in such countries, it was blocked by the colonial plunder through import of industrial products for marketing and the drain of exports of raw materials and agricultural products at cheaper rates. Thus, colonial exploitation, for the development of the centre, caused under-development to the colonies or semi-colonies, keeping them more agrarian, dependent on traditional technology. Bagchi rightly points out in respect of India:[27]

> India ceased to be a leading manufacturing country of the pre-capitalist era and was reduced to the position of supplier of agricultural goods and raw materials to industrializing economies of the West, particularly British... The de-industrialisation of India, along with government policies relating to land and land revenue led to a structure of society which has often been characterised as semi-feudal.

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27. A.K. Bagchi, The Political Economy of Underdevelopment, Cambridge, 1982, p.82.

Though China was not completely colonised, the conditions were reduced to the same status.[28] In these two vast countries, the national liberation movements emerged. In China, the Communist Party could mobilise peasant masses, under the leadership of Mao-Tse-Tung, to overthrow semi-feudal domination within the country and semi-colonial exploitation outside. This is, more or less, in line with Marx's prognostication that the social revolution begins when the existing production relations (of feudal/semi-feudal) become fetters on the productive forces. In China of 1920s and 1930s, the experience of Rockfellar Foundation led to the view that to stabilise the countryside and to undercut growing peasant revolution, food-production increasing technology was to be coupled with institutional changes (land reform).[29] But it was in vain. In India also, peasant struggles grew in their dimension. The imperialist efforts in pacifying the peasant of the times did not succeed. In 1947, India became independent and in 1949 China was liberated. It became important for the imperialists after 1949, to do something for the newly independent bourgeois dominated Asian countries, for otherwise would accelerate peasant movements there, induced by communist ideology:[30]

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28. Ibid., pp. 101 & 102.

29. H.M.Cleaver, Jr., op.cit., p.268.

30. Robert S. Anderson and M. Morrison, "Introduction", in Robert S. Anderson, et al., (eds.), op.cit., p.3.

> This recognition led many of the new Asian governments to join the British - American - sponsored Colombo Plan in 1952 which explicitly set out to improve conditions in rural Asia as a means of defusing the communist appeal. Rural development assisted by foreign capital was prescribed as a means of stabilising the countryside.

(iii) Population Growth

After the first World-War, population started growing at relatively higher rates in the less developed countries. This growth is attributed very largely to biological control of deaths. This process of population growth became almost independent of economic development.[31] As these countries were mainly agricultural ones, based on traditional agriculture, the increase was largely absorbed by agricultural(rural) sector. Thus, the problem of relative and absolute surplus population was added to the two aspects of traditional agriculture dealt previously and it continued to operate till 1950s. Among other consequences of high growth rate of population, the problem of disguised unemployment became and is still continuing to be a source of debate in the developing world. Nurkse explains disguised unemployment as follows:[32]

> The term disguised unemployment is not applied to wage labour. It denotes a condition of family employment in peasant communities. A number of

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31. Shirley Faster Hartley, Population, Quantity Vs. Quality, Prentice Hall Inc., New Jersy, 1972, p.59.

32. R.Nurkse, Problems of Capital Formation in Under-developed Countries, Oxford University Press, Delhi, 1980, p.33.

> people are working on farms or small peasant plots, contributing virtually nothing to output, but subsisting on a share of their family's real income ... The people may all be occupied, and no one may consider himself idle. Yet the fact remains that a certain number of labour force on the land could be dispensed with, without making any difference to the volume of output.

The disguised unemployment discourages technical advancement of agriculture, as no surplus is left after consumption. This is also the combined effect of the other two aspects.

(iv) Capital-intensive Technology in Industrial Sector

The problem of low labour absorptive capacity of industrial sector, due to capital-intensive technology, belongs to the stage after the countries became independent by late 1940s. Since the early 1950s, most of these countries have adopted planned development. In industrial sector, due to heavy industry strategy, the ready-made technology has been borrowed from the developed countries. But in most cases, industrial technology has had limited labour-absorbing capacity. This is unlike in West Europe, where the technological progress took place in step-wise phases, extending over a prolonged period;[33] so that the

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33. Mao - Tse - Tung, "Democratic Centralism-III", Frontier, September 23, 1978. In 1960 he was asked whether 50 years time was enough for China's development and its emulation with developed countries, he reminded that the developed capitalist countries took 300 years to reach such levels of development.

depeasantised proletariat could be steadily absorbed in urban industries.[34] In that period, the industrial technology developed gradually from several phases of labour-intensive to labour-displacing capital-intensive type in the industrially developed countries. But, this is not so in the less developed countries, as Maitra aptly says.[35]

> In the third world, the industrialisation process today has skipped over the first phase of an extensive growth using human resources more productively and thereby creating the conditions for the emergence of an intensive phase.

4. Farm-Size Efficiency and Agricultural Technology

In terms of more recent history of economic development, the study of efficiency in agricultural production dates back to the late 19th century, when a debate ensued as to whether the small-scale agriculture was relatively more efficient. The debate assumed its colossal dimension, when Marxist writers, Kautsky and Lenin, on the one hand and agronomists-cum-liberalists such as David and Chayanov on the other exchanged their views. The Marxists took the position that the large-scale agriculture is superior, as Lenin says,[36]

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34. Utsa Patnaik, "Development of Capitalism in Agriculture", Social Scientist, September and October 1972.

35. Priyatosh Maitra, Population, Technology and Development, Gower Publishing co., Hampshire, England, 1986, p.5.

36. V.I.Lenin, "Capitalism in Agriculture - Kautsky's Book and Mr. Bulgakov's Article", in his Selected Works, Vol.XII, Moscow, 1938, p.19.

> The superiority of large-scale farming lies not only in the fact that there is less waste of cultivated area, a saving in livestock and implements, better utilisation of implements, wider possibilities of employing machinery and larger opportunities for obtaining credit; it also lies in the commercial superiority of large-scale production, the employment in the latter of scientifically trained managers. Large-scale farming utilises the co-operation of workers and division of labour to a large extent.

This view asserts that just as in industry, in agriculture also the superiority of large-scale production is true, with a few exceptions such as in vegetable gardening.

David, from the other school, claims that agriculture is different from industry for its biological nature, seasonal character, inapplicability of immobile machinery and its requirement of personal care. These aspects are favourable for superiority of small-scale agriculture. Further, in marketing also the small peasants need not depend on transport cost, as they can dispose of their surplus produce within the villages, not depending on the middlemen. They can thus withstand competition from large-scale farming and survive in the vagaries of economic depression.[37] Chayanov's arguments also proceed on similar lines. He

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37. Edward David, "Economic Differences between Agriculture and Industry" and "The Question of Competitive Capacity of the Small-scale Agricultural Enterprise" in Athar Hussain and Keith Tribe, (eds.), Paths of Development in Capitalist Agriculture, The Macmillan Press Ltd., London, 1984. (pp.3-12 & 41-59).

depends more on demographic differentiation,[38] which reflects itself mainly in theses: 1. Family size(x) determines farm-size (y), to say y = f(x).[39] 2. Consumer-workers ratio (c/w) determines the intensity of family labour, drudgery or self-exploitation[40] and it also determines the leased-in area of the farm-size.[41] Further, he describes the competitive capacity of the peasant farms as under:[42]

> Given a deterioration in the market situation negative quantities (loses), thanks to the mechanism of the labour calculation, appear much later on the peasant farm than on the capitalist one (hence, the exceeding viability and stability of peasant farms). Frequently, the family farm's internal basic equilibrium makes acceptable very low payments per labour unit, and these enable it to exist in conditions that would doom a capitalist farm to undoubted ruin.

From the above, it follows that the large farmers can utilise all the modern technological innovations for their better endowment in land, capital, education and so on. But the small farmers may not have such advantages and these

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38. A.V.Chayanov, The Theory of Peasant Economy (edited by D. Thorner, B.Kerblay, R.E.F. Smith with a Foreword by T.Shanin), Oxford University Press, Delhi, 1987, p.68.

39. Ibid., p.63.

40. Ibid., pp.76-79. Table 2.8 clearly indicates that the output and employment per worker is a function of c/w ratio.

41. Ibid., pp.132 & 133.

42. Ibid., pp.88 & 89.

farms are the family farms so long as they do not depend on hired labour. However, such farms also depend on the market for the sale of output and purchase of agricultural inputs. These peasant farms (referred to as small here) of David and Chayanov's perceptions are comparable to the medium peasantry of Lenin.[43] The Marxists, including Kautsky and Lenin, take into account the fact of persisting small-scale agriculture side by side with large-scale agriculture. They attribute its persistence to over-work and under-consumption of the small farmers.[44]

As noted above, till about the middle of the 20th century, the technological conditions of agriculture in the third world were traditional. In such a case, it can be presumed that techniques of production between the large and small farmers were not of much consequence. Nevertheless, in India, it was found in the mid-1950s that there was an inverse relationship between productivity per acre and farm-size; i.e., the small farms showed higher productivity. This

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43. N.K. Chandra, "Peasantry as a Single Class: A Critique of Chayanov", in Ashok Mitra (ed.), The Truth Unites - Essay in Tribute to Samar Sen, Subarna Rekha, Calcutta, 1985, (pp.194-217), p.196.

44. V.I. Lenin, op.cit., p.19. Also V.I. Lenin, The Agrarian Question and the Critics of Marx, Progress Publishers, Moscow, 1976, pp.99 and 117. Karl Kautsky's position in J. Banaji, op. cit., p.40. Also see Karl Kautsky, "The Competitive Capacity of the Small-scale Enterprise in Agriculture", in Athar Hussain and Keith Tribe, (eds.) op. cit., pp.25-26.

relationship was observed in many other less developed countries as well.[45] Long accepts this as a criterion of superiority of small-scale agriculture. He says:[46]

> First, it challenges the theory that fragmentation of the land through redistribution may have negative effects on efficiency of production. Second or conversely, it leads to the conclusion that land redistribution which creates farms small enough to permit intensive cultivation by spreading the cultivable land among a larger number of people is beneficial to productivity.

As revealed by most of the studies,[47] the inverse relationship was attributed to the higher labour-intensity on the small farms. This edge of the small farms over the large ones is the effect of using family labour to the limit where

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45. Pranab K. Bardhan, "Size, Productivity, Returns to Scale : An Analysis of Farm-Level Data in Indian Agriculture", Journal of Political Economy, Vol.81, No.6, November/December 1973. He notes, "It has been widely observed in many countries in Asia, Latin America and Eastern Europe that there is often an inverse relationship between farm-size (in terms of land area) and productivity per acre. Some may even regard it as one of the 'stylized facts' of traditional agriculture."

46. E.J. Long, "The Economic Basis of Land Reforms in Under Developed Countries", Land Economics, May, 1961. C.H.Hanumantha Rao also supported the criterion of output per acre as a good measure of efficiency. See his, "The Optimum Firm, the Optimum Farm", Economic Weekly, November 10, 1962.

47. Among others, A.K. Sen, "An Aspect of Indian Agriculture", Economic Weekly, Annual Number, February 1964; Dipak Mazumdar, "On the Economics of Relative Efficiency of Small Farmers", Economic Weekly, Spl. Number, July 1963; C.H.Hunumantha Rao,"Farm Size and the Economies of Scale", Economic Weekly, December 14, 1963.

the marginal productivity of labour may well approach zero. Roegen calls this the feudal formula in a new form.[48] He opposes the Marxists in attributing superiority to large-scale agriculture. He supports the view of Agrarian Economists whose prescription for the development of an over-populated country is to establish individual peasant holdings, that use family labour according to the feudal formula. Further, the superiority of the small farm was attributed to higher use of other non-labour material inputs as well, because of their strong complementarity with human labour.[49] But this efficiency is reported to reflect static superiority of small-scale over large-scale production.[50]

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48. N.Georgescu Roegon, "Economic Theory and Agrarian Economics", in Carl Eicher and Lawrence Witt (eds.), Agriculture in Economic Development, Mc Graw Hill Book Co; New York, 1964.

49. A.K.Sen, "Size of Holdings and Productivity", Economic Weekly, Annual Number, February 1964, Dipak Mazundar, "Size of Farm and Productivity: A Problem of Indian Peasant Agriculture", Economica, May 1965; C.H.Hanumantha Rao, "Alternative Explanations of the Inverse Relationship between Farm size and Output per Acre in India", Indian Economic Review, October 1966; Pranab K.Bardhan, "Size, Productivity, and Returns to Scale: An Analysis of Farm-Level Data in Indian Agriculture", Journal of Political Economy, Vol.81, No.6, November/December 1973, Krishna Bharadraj, Production Conditions in Indian Agriculture Cambridge University Press, New York, 1974.

50. Ajit Kumar Ghose, "Farm-size and Productivity in Indian Agriculture: A Reappraisal", Journal of Development Studies, Vol. 16, No.1, October, 1979. He says primitive technology and insufficient development of markets are the causes for this static superiority.

Tuma opposes Long and says that productivity per acre criterion is a short-run goal whereas it is productivity per labourer criterion which is important to reach long-run goals of economic development. This latter criterion is achievable in large-scale farming. He also says that labour-intensive cultivation and small farms are two sides of the same coin, leading to no capital formation (i.e., no technical progress), because the difference between per capita production and per capita consumption is negligible. Further, disguised unemployment would not become revealed unemployment so that the released surplus labour could generate tension in the economy for industrialisation by using cheap labour.[51] In a somewhat similar vein, Mogens Boserup arrives at such a conclusion about the technological backwardness of the small-scale peasant-owner tenures:[52]

> The peasant owner type of agricultural enterprise is unlikely to show technical progressiveness, it has little capital and is not strongly oriented towards market; and the entrepreneur, if one can use that word, sits on his holding by virtue of birth, more or less deeply embedded in a traditional way of life and work ... It seems broadly true to say that where the peasant owner predominated in Europe, the economy at large was somewhat slow to develop.

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51. E.H. Tuma. "The Agrarian Based Development Policy in Land Reform", Land Economics, August 1963. He supports for redistribution in ensuring economically viable size only.

52. Mogens Boserup, "Agrarian Structure and Take-off", in W.W.Rostow (ed.), The Economics of Take-off into Sustained Growth, International Economic Association Conference Papers, London 1964. (p.212)

In contradistinction to Boserup's observation, Joshi says, "Our hypothesis is just the opposite. In fact, the entire Asian developmental experience in the post-second World War situation confirms the emergence of the peasant as a vehicle of economic growth and rural transformation".[53] It appears that the argument is based on Japan's success of agricultural transformation depending on small peasant holdings. Further, this takes into account the fact that economically viable size should have been reduced by the new agricultural technology of the recent past also.[54]

5. Employment and Agricultural Technology

In most of the less developed countries, the share of agricultural population has not declined, despite the fact that the share of agriculture in national income has been declining steadily during the era of planned development. For example, in India, for over four decades since 1951, there has been no noticeable change in the share of population dependent on agriculture (nearly 70.0 per cent) although the share of agriculture in national income has come down to 35.0 per cent. That a bulk of population should have to depend on agriculture for employment, as employment is the source of production and income, is a matter of policy

53. P.C. Joshi, "Perspectives of Agrarian Reconstruction: India in Asian Context", Mainstream, Republic Day, 1978.

54. A.M.Khusro, The Economics of Land Reform and Farm Size in India, Macmillan India, Delhi, 1973, p.73; G.S.Bhalla, "Transfer of Technology and Agricultural Development in India", EPW, RA, December 22-29,1979.

concern in India as much as in many other developing countries.[55]

It is a fact that all the persons in rural sector are not fully employed, as agricultural sector alone cannot absorb their available labour time in full. Consequently, there is disguised unemployment, as the necessary volume of labour is spread over the total agricultural workers, than are needed.[56] Each person works for less than socially accepted maximum hours of work-say 8 hours. From this, it is clear that there is surplus labour in the agricultural sector and this can be diverted to non-agricultural sectors. But, the non-agricultural sectors do not have so much absorbing capacity, for the explanations already offered in our integrated approach of traditional agriculture (Section-3). At the existing pace, such absorption would be completed over several decades.[57] Till that time, the agricultural sector

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55. A.K.Sen, Employment, Technology and Development, Clarendon Press, Oxford, 1975, He distinguishes between three aspects of employment viz. production, income and recognition aspects, p.5.

56. Ibid. pp.32 & 33. This is apart from Nurkse's analysis, which does not clearly differentiate between labour and labourers, see R.Nurkse, op.cit.

57. Folke Dovering, "The Share of Agriculture in a Growing Population", in Carl Eicher and Lawrence Witt (eds.), op.cit. He deals with the time profile. It depends on the rate of expansion of non-agricultural employment and population growth. If 70 percent is the share of agricultural population in an economy and population grows at 2.0 per cent per year, and that share is to be brought down to 40 per cent, the time taken for this is 50, 70 and 35 years when the non-agricultural employment grows at 3.5, 3.0 and 4.0 per cent respectively (p.97).

inescapably gets overcrowded breeding conditions for the division and fragmentation of agricultural holdings. This leads to gradual expansion of the huge army of small peasant holdings. Yet, at the upper end of the land distribution ladder, a handful of large holdings, possess a lion's share of land.

Thus, historically, the small farm-efficiency has been an interminable source of debate. The general view is that the small-size agriculture can maximise per acre employment and output (income) and this is exactly what is required, as per Long, Roegon and Joshi. This lends support to the case for the redistribution of land as a short-run goal. But, as per Tuma, it is the maximum output per labourer criterion which is important from economic point of view. This criterion is readily achievable in large-scale agriculture particularly when both bio-chemical and mechanical technologies are adopted. There is a conflict between short-run and long-run goals, as Joshi says:[58]

> While politics promise a solution to the employment problem by multiplying small holders through redistribution of land, economics necessitates rationalisation of the agrarian structure by displacing the dwarf holders and marginal cultivators who constitute a large section of the rural population.

As a matter of fact, when modern agricultural technology is introduced, the problem of choice of technology

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58. P.C.Joshi, "Agrarian Structure and Employment", <u>EPW</u>, Annual, February, 1978.

arises in agricultural sector between bio-chemical technology and mechanical technology.[59] The former technology is not only size-neutral but also labour-absorbing and it is advantageous for the small-farm holdings to adopt it. It is, however, equally true in the case of the large farm-size groups. Whereas, the mechanical technology being highly capital-intensive, can be adopted only by the large holdings, as it is biased to large-size. Further, this type of technology is labour-displacing. Consequently, this aspect aggravates the situation of unemployment.

The aforesaid discussion makes it clear that farm-size, employment and agricultural technology are inter-related. From the point of view of employment, it is necessary that the small-scale agriculture has to be encouraged in the labour-surplus and land-scarce agricultural conditions of the rural sector. On the one hand, urban industrial sector is not in a position to absorb the surplus agricultural population, on the other, further redistribution of land by drastically lowering the ceiling on land holdings nullifies the impetus given by the new agricultural

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59. A.K.Sen, Choice of Techniques, OUP. Bombay, 1972. He calls these technologies as 'Landesque' and 'Labouresque' capitals, because they replace land and labour respectively, p.82.

technology.[60]

If we have to depend on small farm-size agriculture, even as a short run goal, as per Dandekar, we have to seek "an institutional structure which would hold and employ the residual population until an increasingly larger portion of it was withdrawn into the non-agricultural sector."[61] He further says about that institutional structure keeping Roegen's feudal formula in his view:[62]

> The solution has to be found in an organisation of the agrarian sector in large units of land and population, feudal in theory, modern in technology and oriented to a socialistic purpose. Because the basic production units would be large, it is inevitable that the relation between man and land in them should be much looser than the one implied in individual peasant holdings.

Such an organisation is possible by establishing large cooperatives through pooling of individual peasant

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60. V.M.Dandekar and N.Rath, "Poverty in India", EPW, January 9, 1971. A.M.Khusro, op. cit. He notes, "The non-absorption of many millions of small-farm population in non-agricultural employment, in the next one or two generations, will leave a seething mass of humanity, ever growing in numbers, to seek its fortune in agriculture ... Now, an abundance of a depressed wage-seeking mass of population, much in excess of demand, is the greatest drag on the improvement of technique, on inventiveness, on the use of machines and on productivity." (p.100)

61. V.M.Dandekar, "Economic Theory and Agrarian Reform", in Carl Eicher and Lawrence Witt (eds.), op. cit., p.179.

62. Ibid. p.179.

holdings, so that diversion of surplus agricultural population to non-agricultural sectors takes place. For this, gradual discouragement of proprietary rights in land has been advocated by Dandekar.

Even on such large co-operative holdings of Dandekar's perception, the question arises as to whether mechanical technology, e.g. tractorisation, can be adopted. For a while, we may refer to the experience of collectivised agriculture in China. In China, when Liu-Shao-Chi argued for immediate mechanisation of agriculture in the early 1950s, Mao stressed the importance of intermediate technologies which would not allow immediate mechanisation, as Luu says:[63]

> Mao advocated a more balanced policy of relying on both advanced and improved traditional technologies which meant that in the initial stages he called for the use of China's abundant labour force in order to economise capital, which was still scarce in China. Mao's policy was well suited to conditions in China, at least in the initial stage.

Further Mao criticised Stalin for taking up forced collectivisation for the sake of mechanisation.[64]

6. New Agricultural Technology in India - Preconditions for Adoption

Just as was pointed out in the preceding section, the

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63. Nguyen Ngoc Luu, The Technological Development of Agriculture in the People's Republic of China, Institute of Social Studies, The Hague, 1979, p.103.

64. Mao-Tse-Tung says "Collectivisation is not altogether determined by mechanisation." See his, A Critique of Soviet Economics, Progress Publications, New Delhi, 1982, p.48.

Britishers had reinforced feudal/semi-feudal relations of production in Indian agriculture. Under the British, agriculture had become more exploitative especially in the zamindari settlement areas. The tenants were charged exhorbitant rent, which did not allow surplus for reinvestment. Its precapitalist character is described as:[65]

> The rent collected by the landlord from the peasant (tenant) is not confined to the portion of surplus value which remains after deduction of owner's profits, but embraces the whole surplus product and sometimes even a part of the necessary product. The rent paid by the tenant is of a feudal and not of a capitalist nature.

The usurious interest rates too added their share to peasant misery. Further, there were other extra-economic ways of exploitation. Thus, under the colonial rule, the tenants and peasants did not have much interest in and incentives for the development of land through improvement of agricultural technology, as no surplus was left with them.

On the eve of Independence, one could discover traces of local efforts to do away with the existing land relations in the form of peasant armed struggles, like Tebhaga in West Bengal and Telangana in Andhra Pradesh. These struggles were organised largely by the Communist Party of India (CPI). During that phase of Indian history, the near-exclusive

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65. G.Kotovasky, <u>Agrarian Reforms in India</u>, Peoples Publishing House, Bombay, 1964, p.22.

attention on effecting institutional changes in agricultural sector kept the question of technical change in agriculture in abeyance for some years to come. Further, greater attention directed towards institutional change was a political compulsion of the times so as to pacify the rousing sentiments of nationalism, democracy and equality.[66] Thus, in the post-independent India, the immediate problem for the ruling class (Congress Party) was of the resolution of agrarian question.[67] The land reform measures, (i) abolition of intermediaries and (ii) tenancy reforms were taken up throughout the 1950s. All the states had passed and implemented acts for the abolition of intermediaries more efficiently so that no fewer than 20 million tenants were brought into direct relationship with the state.[68] Nevertheless, the tenancy reforms to regulate rent and to provide security of tenure were implemented only half-heartedly in most states.[69] The first phase of land ceilings was also enacted between 1960 and 1965 in almost all the

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66. P.C.Joshi, Land Reforms in India - Trends and Perspectives, Allied Publishers, Delhi, 1982.

67. National Commission on Agriculture, Agrarian Reforms Part-XV, Ministry of Agriculture, New Delhi, 1976. It was noted that prior to world war-II, Congress Party had not raised radical alteration of land system, p.20.

68. V.M.Dandekar & N.Rath, op.cit.

69. P.S.Appu, "Tenancy Reform in India, EPW, Spl. August, 1975.

states, but this ended in complete failure.[70] The latter two measures could not successfully be implemented because of (i) lack of political will and indifferent bureaucracy[71] and (ii) reactionary programme despite propagation of radical ideology.[72] In any case there was a true tapering down of land concentration at the very top of the land distribution hierarchy and a proliferation of petty farm operators at the bottom. By any reckoning, the rural society stood stratified into three classes by the middle of sixties, viz. (i) big land owning class, (ii) middle peasants and (iii) marginal and small farmers including agricultural labourers.

Soon after Independence, the ruling class recognised the importance of increasing food production. In that direction, agrarian reforms, as noted above, engaged the first attention. However, side by side government invested in medium/major irrigation projects in a big way. Other institutional changes were also introduced in the form of strengthening of co-operative credit, marketing and extension

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70. Suhas Chattopadhyaya, "On the Class Nature of Land Reforms in India since Independence", Social Scientist, November, 1973. Other studies also noted this fact, V.M.Dandekar and N.Rath, op.cit and National Commission on Agriculture, op. cit.

71. National Commission on Agriculture, op. cit p.80 & 87.

72. P.C.Joshi, "Land Reform and Agrarian Change in India and Pakistan since 1947", Journal of Peasant Studies, January, 1974.

services.[73] Despite all these measures, there was no major upsurge in agricultural production so as to meet the food needs of India's expanding population. Beyond mid-50s, the dependency on imports of foodgrains had grown year by year till the mid-sixties. From 2.3 million tonnes in 1947-48, it increased to 4.7 million tonnes in 1951-52.[74] During the First Plan Period, there was some reduction in it. Again in 1956, the net import of cereals was 1.39 million tonnes,thereafter, it went up regularly, reaching 10.34 million tonnes in 1966. This was indeed the peak level import of foodgrains in the whole of post-Independence era.[75] Thus, by the middle of sixties, an agrarian crisis had precipitated in the country. According to Bhawani Sen:[76]

> Under the (first) two five year plans, the improvement in agricultural technique was too inadequate to ensure an upsurge in agricultural production and that institutional changes were too insignificant to rouse the productive initiative of the peasant masses.

Mainly inspired by the FMS of mid-fifties, the debate on small farm efficiency acquired considerable impetus by the

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73. The government's efforts to give thrust to agriculture can be understood from its allocation of as high as 31 per cent of First Five Year Plan outlay.

74. Bhawani Sen, Evolution of Agrarian Relations in India, PPH, New Delhi, 1962, p.2.

75. Govt. of India, Economic Survey - 1981-82, Ministry of Finance, New Delhi, 1982. p.84.

76. Bhawani Sen, op-cit. pp.ix and x.

early sixties. For example, it was argued by Long and others[77] that it was better to distribute land among the landless and land-poor peasants, as they can optimise employment and output per acre essentially for a country with land-scarce and labour-surplus conditions. It holds good at least so long as the agricultural technology is stagnant, as the small-farm efficiency is treated as static superiority. But, the solution of land redistribution leading to increased production had not shown its promise since the ceiling legislations could yield negligible surplus land. Further, the ruling class was not interested in carrying out radical redistribution.[78] As a result, the alternative, as a necessity, fell on the improvement of agricultural technology to raise food production in the country.

Indian government, while importing foodgrains under PL 480 from USA, also invited agricultural experts from USA. The Ford Foundation team visited India in 1959 and recommended a highly area-selective strategy of agricultural

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77. See Section-4, dealing with Farm-size efficiency and Agricultural technology.

78. After Naxalite movement in the country, the govt. took up revised Land ceiling legislation after 1972.

growth.[79] As a result, Intensive Agricultural District Programme (IADP) was launched in India in 1960-61, first in seven districts and later extended to cover eight more districts. However, this programme could not significantly reduce the imports of foodgrain. Thus, it became evident to the Indian Government to somehow increase domestic food production. Accordingly, in the peak year of imports (1966) the Indian Government had to go in for new agricultural technology (Green Revolution) in a big way through the introduction of HYVs, chemical fertilizers and machinery. In these ventures, help was sought from many US agencies. It appears that those agencies had not only had business interest[80] but also feared from internal communist

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79. Aruna Nayyar Michie, "Agricultural Modernisation and Rural Inequality in the United States and India", in R.S. Anderson, et al., (eds), op.cit., p.89. The team says, "The physical resources of soil, water and climate are sufficient to yield at least a double, perhaps more than a double, the current production with full use of machines, chemical and other products of industry", quoted in A.N.Sadhu and R.K.Mahajan, Technological Change and Agricultural Development in India, Himalaya Publishing House, Bombay, 1985., pp.7 & 8.

80. In the same year, the foreign aid from World Bank sought import liberalisation accompanied by devaluation of rupee in 1966, see K.N. Raj, "Growth and Stagnation in Indian Industrial Development", EPW, Annual Number, February, 1976; also his "Food, Fertilizer and Foreign Aid", Mainstream, April 30, 1966.

movement,[81] in the situation of war and agrarian crisis in India, as by 1964 there was split in the CPI, giving birth to CPI(M) which took on a more radical mantle.

It seems fairly obvious that the question of improved technology in agriculture was not at all taken up seriously till mid-sixties and the nation faced chronic food shortages, high prices, excessive dependence on imports. Further, these conditions were exacerbated by the growing population. All these serious developments impelled the ruling class to adopt both bio-chemical and mechanical technologies to achieve agricultural growth, not bothering about equity in the first instance. The bio-chemical technology was intended to benefit both the large and small farms, due to its size-neutrality, whereas the mechanical technology was to insulate large farms from the labour-scarcity situations which would have led to higher wage bill on the large farms. By the time of the arrival of green revolution, the historical conditions placed some regions, such as Punjab, Haryana, Western UP, ahead of others due to huge doses of public investment of the fifties in irrigation and progressive institutional set-up

81. Rockfellor Foundation, having experimented in the 1950s with HYV seeds of wheat and corn, acted in collusion with the Ford Foundation to establish IRRI in Philippines in 1960 to develop HYV rice which was intended to defuse agrarian radicalism by easing food supply situation in the Asia, see R.S.Anderson and B.M.Morrison, "Introduction", in R.S.Anderson _et al_., (eds.), _op. cit_., p.7.

which had started paying off.[82] Such regions could benefit much from the green revolution and within each region, the large farmers being resourceful, could exploit those technologies to their full advantage. By mid-sixties the issue of redistribution of land on the basis of static superiority of small-farm efficiency (due to labour-intensive techniques) became less compulsive, while encouraging mechanisation of the large farms.[83]

Expansion of New Agricultural Technology

Having dealt with the preconditions for adoption of new agricultural technology, we may now consider the extent

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82. Amit Bhaduri, The Economic Structure of Backward Agriculture, Macmillan India Ltd., Delhi, 1983; pp.129-133.

83. C.H.Hunumantha Rao, Agricultural Production Functions, Costs and Returns in India, Asia Publishing House, Bombay 1965. He says, "Under the system of family-farming and labour-intensive techniques, productivity of land and total output can be increased if the structure of land ownership is altered and a more even distribution is ensured as this would, among other things, make for a greater identity between the factors of ownership, management and labour. Alternatively if the existing structure of land ownership is not to be disturbed, then the introduction of mechanised processes would become necessary for a more effective utilization of land, as this would lessen the supervising and managerial bottlenecks among larger farmers. Of these two alternatives, the former has already proved far from being feasible politically and the latter seems to be gradually developing in many regions of the country." (p.63).

of expansion of this technology in the country mainly in terms of irrigated area, machinery, area under HYVs and fertiliser use.

As irrigation is the most indispensable pre-requisite for the adoption of new technology, the investment on irrigation expansion was pursued in various parts of India with varying outcomes. At the national level, the net irrigated area (NIA) expanded from 20.853 m.ha. in 1950-51 to 26.344 m.ha. in 1965-66, with a growth of 1.57 per cent per annum. It increased to 41.760 m.ha. in 1985-86, showing a growth rate of 2.33 per cent per annum during the period 1965-66 to 1985-1986. The share of NIA in net sown area (NSA) was 17.56, 19.34, and 29.60 per cent in 1950-51, 1965-66 and 1985-86 respectively. Further, the irrigation intensity (ratio of gross irrigated area in NIA) increased rapidly in the latter phase from 117.30 in 1965-66 to 129.30 in 1985-86 (it was only 108.20 in 1950-51). This shows clearly that irrigation expansion was an item of high priority in the latter phase. As a result, gross cropped area increased so that the cropping intensity in the country rose from 114.01 in 1965-66 to 125.71 in 1985-86 (it was 111.05 in 1950-51). Another interesting feature is that the share of NIA under wells including tube wells rose from 28.67 per cent to 32.85 per cent and then to 45.70 per cent in the three respective years. Investment in wells and tube wells was largely on private investment.

If we consider modern implements and machinery, electric motors increased at a very rapid rate of 20.30 per cent per annum in the former phase (1951-56), while in the latter phase (1966-82) they grew at 14.40 per cent. However, the former higher rate may be attributed to lower base (in 1950-51). Oil engines grew equally well in both the phases at 12.27 and 12.50 per cent respectively. Tractors increased at 13.03 and 15.20 per cent in the two phases; higher growth in the later period unquestioningly may be attributed to green revolution.[84] This achievement could be understood well if we look at the remarkable reduction in the net sown area per item, over a period.

Item	Net sown Area in Hectares			
	1951	1966	1972	1982
Electric Motor	4567	328	87	40
Oil Engine	1431	289	91	46
Tractor	13808	2522	945	274

The weight of new agricultural technology depends on the bio-chemical package which includes mainly the extension

84. T.J.Byres, op. cit. He notes that total availability of four-wheel tractors was doubled and their domestic production increased four-fold in the decade 1966-67 to 1976-77. The peak level import of 12,032 tractors was in 1970-71, pp.28-29.

of area under HYVs and the use of chemical fertilisers. The area under HYVs for five major cereal crops (paddy, wheat, jowar, bajra and maize) increased from 1.886 m.ha. in 1966-67 to 56.118 m.ha. in 1986-87, recording a remarkable growth of 18.50 per cent per annum. The coverage of gross cropped area was of the order of 1.20 and 31.65 per cent respectively in the two years.

The use of chemical fertilisers rose from 0.066 m. tonnes in 1951-52 to 0.785 m. tonnes in 1965-66 and thereafter it went up rapidly, reaching 8.738 m.tonnes in 1986-87. The growth rate was 18.00 and 12.16 per cent respectively during 1965-66/1951-52 and 1986-87/1965-66 respectively. The higher growth during the former phase is due to a practically nil base in the initial year. It is interesting to note that there was a quantum jump in the fertilizer use from 0.785 m.tonnes in 1965-66 to 1.101 m.tonnes in 1966-67, i.e. in the very first year of the green revolution. Further, when we look at the consumption of fertilizers in terms of per hectare cropped, the figures appear amazing. It increased from 0.50 kg. in 1951-52 to 7.00 kg. in 1965-66 and then to 47.8 kg. in 1986-87.

The introduction of the green revolution technology entailed considerable costs which kept on increasing almost incessantly in the seventies and eighties. For example, per hectare irrigation cost under major/medium projects increased from Rs.1200/- under the First Plan to Rs.21,515 in the Sixth

Plan. Similarly, the minor irrigation costs increased from Rs.509 to Rs.4745 respectively.[85] In the first three years of the Seventh Plan, costs in the former case rose to Rs.44,000 per hectare.[86] Further, the government has to spend huge sums on fertiliser subsidies, in addition to committed expenditure on extension services, agricultural universities and so on. Of late, agriculture has become a high cost economy and the increasing capital: output ratio in this sector is emerging almost as an enduring reality. This is an area of great policy concern. See, for example, the following reaction of Bhalla:[87]

> Less costly, more appropriate, small and beautiful technological alternatives seem to exist in the imagination of some messiahs. In actual practice, the hard facts are that it is the modern package of irrigation and seed fertiliser technology which has yielded the results and also that this is an inevitable cost that has to be paid in an economy where population is growing at the rate of 2.1 per cent per annum.

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85. V.M.Rao and R.S.Deshpande, "Agricultural Growth in India: A Review of Experiences and Prospects", in P.R. Brahmananda and V.R. Panchamukhi (eds.), The Development Process of the Indian Economy, Himalaya Publishing House, New Delhi, 1987, p.171.

86. Moin Qazi, "Challenges ahead of Indian Agriculture", Yojana, May 16-31, 1989, He notes that this excludes the investments in command area development programmes and drainage works.

87. G.S. Bhalla, "Transfer of Technology and Agricultural Development in India", EPW, RA, December 22-29, 1979.

Impact of the New Agricultural Technology

The major hallmark of the new agricultural technology is that India could achieve self-reliance in the foodgrain production, overcoming the painful memories of the agrarian crisis of mid-sixties. Foodgrain production rose from 50.00 m.tonnes in 1950-51, to 152.4 m.tonnes in 1983-84. It is, really, a remarkable achievement, compared with population growth. The population got doubled, from 359 millions in 1950-51 to 754 millions in 1985-86, whereas the food grain production trebled between 1950-51 and 1983-84. However, it was pointed out by some scholars that there was deceleration in the growth of agricultural production in the post-green revolution period (1967-68 to 1983-84) compared with the pre-green revolution period (1949-50 to 1964-65). But, the studies of Sawant[88] and Bhalla[89] show that the deceleration hypothesis was not correct.

Another interesting feature is that the growth of yield has been compensating for the slow (or negligible) growth of cropped area. The contribution of yield expansion to output growth increased from 49 per cent in the pre-green revolution period to 81 per cent in the post-green revolution

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88. S.D. Sawant, "A Review of Performance in the Agricultural Sector", in P.R. Brahmananda and V.R. Panchamukhi (eds.), op. cit. pp.219-221.

89. G.S. Bhalla, "Some Issues in Agricultural Development in India - An Overview", in P.R.Brahmananda and V.R.Panchamukhi (eds.), op. cit., p.237.

period.[90] Rao says that its contribution should have reached cent per cent in the recent decade 1978-79 to 1988-89, as the cropped area remained more or less stationary.[91]

Because of the land-augmenting character of the bio-chemical technology, it is reported that more employment has been generated and that the labour-productivity has also increased.[92] Rao classifies the land-augmenting technologies into two types. The first type raises the yield of any particular crop per unit of land and the second increases total output per unit of land from all the crops grown over an agricultural year, through increase in cropping intensity. As the latter type increases employment due to higher cropping intensity, Rao says it is suitable to the labour-surplus and land-scarce regions (states) in the country.[93] Thus, the latter type of land-augmenting technology should have generated more employment in the country.

However, there are some imbalances in the agricultural development process after the introduction of

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90. Ibid., p.242.

91. C.H.Hanumantha Rao, "Technological Change in Indian Agriculture: Emerging Trends and Perspectives", IJAE, Oct.-Dec.1989.

92. G.S.Bhalla, op. cit., p.252.

93. C.H.Hanumantha Rao, "Factor Endowments, Technology and Farm Employment", EPW, RA, September 25, 1976. Also see his, "Science and Technology Policy : An Overall View and Broader Implications", IJAE, July-Sept.1986.

new agricultural technology. For example, one can think of region-bias, crop-bias and class-bias. The better endowed regions such as Punjab, Haryana, Western UP, and some parts of AP and Tamilnadu could immediately adopt the new technology, because of more and better irrigation facilities, while the eastern states lagged far too behind. As the HYVs were provided mainly for rice and wheat and they required irrigation to yield good results, the crop-bias led to the region-bias. These two biases together acted to reinforce class-bias, as the resourceful large farmers alone could adopt the new technology in full form and content. These biases were unavoidable at the beginning of the green revolution, since at that time, the food situation was so precarious that the distribution implications of the new technology were deliberately glossed over.

Moreover, since agricultural growth was considered to be a power mechanism towards alleviation of rural poverty, especially during the mid-sixties when it had touched fairly high levels, the equity question did not engage a serious attention. As Dantwala[94] says, "growth and equity become concordant" to begin with in the country with widespread poverty. In any case, it is gratifying that absolute poverty has come down in the states, over a period due to expansion

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94. M.L.Dantwala, "Growth Vs. Equity in Agricultural Development Strategy", in P.R. Brahmananda and V.R.Panchamukhi,(eds.), op.cit., pp.148-149.

of new technology, the highest decline being experienced by agriculturally advanced regions. It is particularly so in the period 1977-78 to 1983-84.[95] However, it is a fact that the relative poverty reflecting inequalities in the income distribution in terms of Loreng curve and Gini coefficient increased in the developed regions. In recent years, the crop-bias and region-bias seem to have come up quite high on policy agenda. Commenting on policy developments since 1978-79, Rao says:[96]

> The recent experience, therefore, suggests that the disparities in growth between the irrigated and rained or dry areas may not be as sharp as in the early years of green revolution. It is also heartening to find that many of the states where poverty is wide spread and where the growth of foodgrains output had slowed down in the first decade of green revolution, e.g., Assam, Bihar, Orissa, Madhya Pradesh and West Bengal have shown a much better performance in the last decade.

7. Objective of the Study

The technological transformation of agriculture brings about substantial changes in the production structure of particular country/region. In India, temporally, the post-green revolution production structure differs substantially from that of the pre-green revolution. Cross-sectionally, different regions stand at different technology levels,

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95. G.S.Bhalla, op.cit., p.254.

96. C.H. Hanumantha Rao, "Technological Change in Indian Agriculture : Emerging Trends and Perspectives", IJAE, Oct.-Dec.1989.

causing differences in their production structure. For example, it differs substantially between Punjab and Bihar.

As seen in the preceding section, at all-India level, the technological breakthroughs, since the mid-sixties, have made a substantial impact on agricultural production. However, it also takes note of the fact that the process of technological transformation has also suffered from region-bias, class-bias and crop-bias. By and large, the latter two biases are the result of differences in the adoption of new agricultural technology among the different farm-size categories. In the light of these realities, the study of the variations between the regions, differing in their technology levels; and of differences among different farm-size groups within a region would contribute to the understanding of the dynamics of agricultural development process, even in a single point cross-sectional study. The present study is a modest attempt in this regard.

The main objective of the study is, thus, to examine the farm-size variations and disparities in the production structure of agriculture between two regions of Andhra Pradesh. The two regions are different in their technology levels; one is already developed and the other one is yet to undergo a degree of development.

As would be elaborated in Chapter-II, Andhra Pradesh also experienced technological advancement in its agriculture in tune with developments elsewhere. However, within the state, Coastal Andhra and Telangana regions broadly represent the developed and the developing scenarios. As would be made clear in Chapter III, one representative district from either region was chosen for our study. The chosen districts are West Godavari and Khammam from the developed and the developing regions respectively. The former district (hereafter Region-I or simply R-I), with higher level of irrigation, mainly through government canals, has fertile lands; while the latter district (hereinafter Region-II or simply R-II), with lower level of irrigation and a dry land crop-mix requiring low resource use, typically represents a traditional agricultural regime.

To capture most of the differences between the regions and among the farm-size groups, we study various aspects of the farm-economy of the cultivators, in our survey areas, with the following specific objectives:

(i) To examine the differences in the stock and composition of fixed capital between the two regions and across the farm-size groups (say, small, medium and large ones).

(ii) To look into the variations in the intensity of resource-use (including capital services) between the regions and among the three farm-size categories.

(iii) To analyse farm-efficiency at regional and farm-size levels; efficiency being examined in terms of productivity/yield rate, cost per acre including cost structure, net returns per acre and production function analysis.

(iv) To examine the variations in the household employment, income and consumption pattern and also poverty levels between the regions and across the farm-size categories.

The present study runs into nine chapters. Chapter I takes a bird's eye view of the inter-relationship between agricultural technology and related aspects while laying down objectives of the study. Chapter II discusses some aspects of agricultural development in Andhra Pradesh. Chapter III depicts data base, variables and methodology. Chapter IV presents an overall view of survey areas, particularly about farm workers, land distribution, land-use and irrigation. Chapter V analyses the variations between the regions and across the farm-size ladder, in respect of the stock and composition of capital, while Chapter VI deals with intensity of resource-use, on per cropped acre basis, in respect of bio-chemical inputs (individual as well as total package), irrigation expenditure, capital services inclusive or exclusive of bullock expenditure, human and bullock labour, tractor-hours and short-term credit. The analysis of farm-efficiency, measured in terms of gross output, total cost and net returns (both on per acre of NOA and GCA), along with production function analysis is attempted in Chapter VII. Chapter VIII examines the crucial aspects of farming households, viz. employment, income and consumption pattern and also poverty level. Finally, the major findings of the study, along with a few policy implications, are summarised in Chapter IX.

CHAPTER - II

AGRICULTURAL DEVELOPMENT IN ANDHRA PRADESH : SOME ASPECTS

The present state of Andhra Pradesh was formed with effect from November 1, 1956, as a result of States' reorganisation. It consists of two main regions viz. Andhra region (Coastal Andhra Plus Rayalaseema)[1] and Telangana[2]. As per the 1981 Census, Andhra Pradesh occupies 8.4 per cent of India's area and is inhabited by 8.0 per cent of India's population. As revealed by the four successive decadal censuses since 1951, the share of population dependent on agriculture remains almost the same (around 70.0 per cent). Thus, agriculture is the most dominant sector of the state from the point of view of employment even today (as is the case with most other states of India). But, again as is true of other states, the share of agriculture in state's income has been declining gradually. Related with changing share of agriculture in employment and income, the state economy has undergone a few other changes as well. The present chapter

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1. Andhra Region was part of erstwhile Madras province which was under the British rule before independence. It was first separated to form separate Andhra State on October 1, 1953, with 11 districts then. They account for Coastal Andhra and Rayalasima regions. Those together are also called as Andhra Region.

2. Telangana was a part of erstwhile Hyderabad state (a princely state) under Nizam's rule. Hyderabad state was merged into Indian Union by police action in 1948. In states reorganisation Telangana was added to the Andhra State already formed by that time.

takes a broad overview of such changes. The prime focus is nevertheless fixed on changes in agricultural sector.

1. State's Income and Sectoral Distribution:

Table 2.1 furnishes broad details of NSDP and its sectoral distribution and growth over time. All figures are at constant 1970-71 prices. In 1960-61, the NSDP was only Rs.1891.8 crores and by 1985-86 it had grown to Rs.4339.9 crores, showing nearly 130 per cent increase in a period of 25 years. In the first decade (61-71), its growth was at 1.9 per cent. Whereas it went up to 3.27 per cent in the next decade (71-81), and it has gone up further to 3.91 per cent in rest of the period (81-86). The overall growth for the total period (1961-86) was 3.32 per cent which is higher than the rates of growth achieved by Kerala and Tamilnadu (3.17 and 2.95 per cent respectively) in the Southern India. Again viewing the growth from other reference periods, it crosses 4.0 per cent during 1968-76 and touches 5.0 per cent during 1977-86. Really this is a very impressive performance, which is sometimes attributed to the effect of green revolution in agriculture.

The per capita income in 1960-61 was only Rs.530 and it rose to Rs.743 in 1985-86, showing a rise of 40.2 per cent. The growth performance of per capita income is negligible during (61-71) and seems to be encouraging only in the subsequent years. Moreover, it is discouraging to note that the share of NSDP of the state in the NDP of the

Table 2.1: Net State Domestic Product by Industry of Origin
(in Rs. Crores at 1970-71 Prices)

Year/Item	Primary Sector: Agriculture	Primary Sector: Total	Secondary Sector	Tertiary Sector	NSDP	Per Capita Income (Rupees)
1. 1960-61	1128.13 (59.63)	1168.94 (61.79)	201.55 (10.65)	521.32 (27.56)	1891.81 (100.00)	530
2. 1965-66	1127.93 (54.49)	1185.97 (57.29)	283.06 (13.68)	601.00 (29.03)	2070.03 (100.00)	527
3. 1970-71	1385.11 (54.90)	1442.23 (57.17)	338.82 (13.43)	741.72 (28.40)	2522.77 (100.00)	585
4. 1975-76	1564.56 (52.45)	1636.87 (54.88)	422.48 (14.16)	923.61 (30.96)	2982.96 (100.00)	625
5. 1980-81	1584.78 (46.17)	1654.59 (48.21)	557.16 (16.23)	1220.42 (35.56)	3432.17 (100.00)	647
6. 1985-86	1738.78 (40.06)	1821.81 (41.98)	792.77 (18.27)	1725.28 (39.75)	4339.86 (100.00)	743
Growth Rates						
7. 1985-86 Over 1960-61	1.882	1.903	5.243	4.879	3.317	1.268
8. 1970-71 Over 1960-61	0.551	0.609	4.888	3.364	1.898	0.026
9. 1980-81 Over 1970-71	1.499	1.561	5.499	5.122	3.267	1.137
10. 1985-86 Over 1980-81	0.423	0.505	6.782	6.899	3.909	1.932
11. 1975-76 Over 1967-68	3.845	3.795	5.111	4.345	4.132	2.008
12. 1985-86 Over 1976-77	2.978	2.878	5.952	7.216	4.946	2.827

Note 1: The figures in parentheses are percentage shares.
Note 2: NSDP = Total Primary Sector plus Secondary and Tertiary Sectors
Note 3: Growth rate (r) has been calculated using log y = a + t log b, where b = (1+r), and r multiplied by 100

country fell from 7.77 per cent in 1960-61 to 7.01 per cent in 1985-86.

As regards the structural composition of the NSDP, the relative importance of agriculture declined from 59.63 per cent in 1960-61 to 40.06 per cent by 1985-86.[3] This shift is accompanied by an increase in the shares of both secondary and tertiary sectors. The share of secondary sector rose from 10.65 to 18.27 per cent and of the tertiary sector from 27.56 to 39.75 per cent. This is a positive structural change, despite no noticeable change in the workforce distribution among the major sectors of the state economy, during the period considered here.

In fact, changes in sectoral shares are the concomitant of the differential rates of growth in the respective sectors. In every period, the secondary and tertiary sectors grew relatively more rapidly. It is only in the post-green revolution phase that agricultural sector picked up its growth. Further, it is also noteworthy that only during this phase, the NSDP showed good growth performance. It is somewhat puzzling that the state's agricultural sector grew at a negligible rate of 0.42 per

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3. It is also important to note the fact that Andhra Pradesh remains to be more agricultural than India, as found from the shares of agriculture. In Andhra Pradesh, the share of agriculture in NSDP is always greater than India's share of agriculture in NDP. India's share of agriculture is 53.95 per cent in 1960-61 and 36.8 per cent in 1985-86.

cent during 1981-86. This casts doubts on the operation of green revolution any more, it seems the effect of new technology is nearly exhausted since the dawn of 1980s. It is thus clear that agricultural sector needs further stimulus in Andhra Pradesh.

As a single largest source of income, on the one hand, and the highest absorber of labour force, on the other, agricultural sector still dominates in AP's economy, as in most other states. As such, we proceed now to consider the performance of agriculture in Andhra Pradesh.

2. Performance of Agriculture

Having looked at the overall performance of agricultural sector, we take up the study of various aspects of agriculture in the state., viz. (i) cropping pattern (ii) indices of area, production and yield of different crops, (iii) growth rates of area, production and yield, and (iv) relative yield levels.

(i) Cropping Pattern :

Table 2.2 shows changes in the cropping pattern in Andhra Pradesh agriculture. It is clear that food crops dominate in the gross cropped area; more than 3/4 of gross cropped area (GCA) is under these crops, at almost all the points of time since 1950-51. Among different crops, paddy, jowar, groundnut and bajra dominate in their shares in that order over the entire time period. In 1950-51, these four crops together accounted for 55.0 per cent of the GCA and this share further increased to 59.5 per cent in 1985-86.

Table 2.2: Cropping Pattern at Five_Yearly Intervals

Year/	50_51	55_56	60_61	65_66	70_71	75_76	80_81	85_86
1. Paddy	20.80	22.13	25.06	25.97	26.38	30.06	29.32	28.56
2. Jowar	18.20	20.17	22.79	20.29	19.23	18.48	16.72	13.98
3. Bajra	4.70	5.30	5.23	4.39	4.38	4.80	4.20	3.01
4. Maize	1.32	1.54	1.54	1.79	1.92	2.35	2.61	2.56
5. Tur	1.44	1.32	1.23	1.50	1.49	1.67	1.85	2.17
6. Gram	1.09	1.07	0.76	0.59	0.55	0.68	0.37	0.39
7. Sugarcane	0.66	0.58	0.78	1.12	0.90	1.13	1.08	1.09
8. Groundnut	11.30	10.08	6.79	10.25	11.09	10.27	10.62	13.87
9. Castorseed	3.65	2.82	2.52	2.23	2.29	1.62	2.15	2.43
10. Cotton	3.43	3.31	2.65	2.31	2.37	2.01	3.41	4.96
11. Tobacco	1.36	1.30	1.21	1.26	1.66	1.21	1.38	1.24
Total of the above 11 Crops	67.95	70.22	70.53	71.70	72.26	74.28	73.71	74.36
12. Total Food Crops	73.61	76.98	81.94	78.38	76.79	81.08	77.79	78.75
13. Total Non food Crops	26.39	23.02	18.06	21.62	23.21	18.92	22.21	21.25

Source: Government of Andhra Pradesh, Statistical Abstract of Andhra Pradesh, for various years

The share of area under paddy continuously increased from 20.8 per cent in 1950-51 to 30.06 per cent in 1975-76 whereafter it declined, albeit negligibly. As regards jowar, there was a continuous decline from 22.79 per cent in 1950-51 to 13.98 per cent in 1985-86. It appears as though the decrease in the share of jowar is compensated by the increase in the share of paddy. This is also a possible way for displacement of low-priced cereal crops like jowar, whenever irrigation facilities are provided to the hitherto unirrigated cultivated lands.[4] Similarly, bajra has also witnessed decline since the beginning for the same reason.

Andhra Pradesh ranks second among Indian states in groundnut, by area and production.[5] Thus, the share of area under groundnut is not less than 10.0 per cent all the time (except in 1960-61). In the recent past, there has been an increase in its share from 10.62 per cent in 1980-81 to 13.87 per cent in 1985-86. It is really a redeeming feature that the recent government efforts in reducing edible oil imports, by encouraging indigenous production of oil seeds, have turned fruitful. Similarly, the share of area under cotton has begun to rise since the early eighties. We may anticipate

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4. C.T. Kurien, Dynamics of Rural Transformation - A Study of Tamilnadu, 1950-1975, Orient Longman, 1981. He observes: "During the past 25 years the two wet crops, paddy and sugarcane have improved their position while the dry crops, especially the non-paddy cereals have lost ground." (p.27)

5. Gujarat ranks first in groundnut and Tamilnadu assumes third rank.

further increase in its share inspired by increased profitability and favourable government measures, such as price support.

(ii) <u>Indices of Area, Production and Yield under different crops</u> :

Table 2.3 gives the indices of area, production and yield under different crops, at five yearly intervals from 1950-51 to 1985-86.

For the dominant crop of the state viz. paddy, the index of area increased continuously from 1950-51 to 1975-76 whereafter it declined. But the index of production increased continuously over the entire period since 1950-51, maintaining a substantial edge over the area index. This led to positive yield impact at each and every point of time.[6] Jowar, the second prominent crop showed a somewhat unique pattern. The indices of area and production increased only up to 1960-61. But from 1970-71, the production index started rising, despite the fact that the area index went on decreasing. The favourable gap between indices of production and area caused a positive yield impact.

As regards groundnut, the third important crop of the state, its index of area increased upto 1960-61 and later showed a declining trend. The production index maintained a U-Shape pattern, with a peak at the endpoint (1985-86). It

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6. The index of yield is Y, and if $Y>1$, there is a positive yield impact and if $Y<1$, there is a negative yield impact.

Table 2.3: Indices of Area, Production and Yield

Crop	Item	Absolute Figures in base year	Indices with Base 1950-51							
			50-51	55-56	60-61	65-66	70-71	75-76	80-81	85-86
1. Paddy	A	2209.4	1.00	1.23	1.34	1.42	1.59	1.76	1.63	1.57
	P	2272.3	1.00	1.36	1.61	1.74	2.11	2.84	3.09	3.57
	Y	1029.0	1.00	1.11	1.20	1.23	1.32	1.61	1.89	2.15
2. Jowar	A	1936.9	1.00	1.32	1.39	1.29	1.33	1.24	1.06	0.87
	P	743.6	1.00	1.55	1.79	1.37	1.30	1.37	1.46	1.51
	Y	384.0	1.00	1.17	1.29	1.08	0.98	1.11	1.37	1.73
3. Bajra	A	499.4	1.00	1.31	1.24	1.06	1.17	1.25	1.03	0.73
	P	225.2	1.00	1.39	1.30	1.07	1.29	1.56	1.49	0.97
	Y	451.0	1.00	1.07	1.05	1.01	1.10	1.25	1.45	1.33
4. Maize	A	140.1	1.00	1.35	1.30	1.54	1.82	2.17	2.29	2.22
	P	38.2	1.00	2.98	4.06	4.78	9.01	13.05	19.99	12.47
	Y	273.0	1.00	2.20	3.12	3.10	4.92	5.99	8.29	5.62
5. Tur	A	152.9	1.00	1.06	0.95	1.19	1.30	1.41	1.48	1.72
	P	39.5	1.00	1.13	1.59	1.70	1.57	1.11	1.12	2.14
	Y	258.0	1.00	1.06	1.67	1.44	1.21	0.79	0.75	1.24
6. Gram	A	116.4	1.00	1.13	0.78	0.61	0.63	0.75	0.39	0.40
	P	39.4	1.00	1.08	0.62	0.44	0.63	0.93	0.35	0.36
	Y	338.0	1.00	0.96	0.80	0.73	1.01	1.23	0.88	0.91
7. Sugar cane (gur)	A	70.5	1.00	1.00	1.30	1.93	1.70	2.08	1.88	1.87
	P	479.1	1.00	1.10	1.70	2.28	1.98	2.32	..	..
	Y	6797.0	1.00	1.09	1.31	1.19	1.17	1.11	..	..
8. Ground nut	A	1202.5	1.00	1.03	1.67	1.03	1.23	1.11	1.08	1.40
	P	1043.4	1.00	1.04	0.67	0.60	1.10	1.07	0.83	1.27
	Y	868.0	1.00	1.01	1.00	0.59	0.89	0.97	0.76	0.91
9. Castor seed	A	387.8	1.00	0.89	0.77	0.70	0.79	0.54	0.68	0.76
	P	60.8	1.00	1.04	0.94	0.63	0.90	0.35	0.43	0.86
	Y	157.0	1.00	1.17	1.23	0.90	1.14	0.65	0.64	1.13
10. Cotton	A	364.4	1.00	1.12	0.86	0.77	0.87	0.71	1.15	1.65
	P	116.6	1.00	1.15	1.02	0.75	0.71	2.05	6.43	6.17
	Y	55.0	1.00	1.02	1.18	0.96	0.82	2.84	5.53	3.71
11. Toba cco	A	144.3	1.00	1.11	0.99	1.06	1.54	1.08	1.17	1.04
	P	117.7	1.00	1.13	0.96	1.09	1.22	1.10	1.39	1.20
	Y	816.0	1.00	1.02	0.97	1.03	0.79	1.02	1.19	1.16

Note: A = Area, P = Production and Y = Yield
In Base year, A = '000 ha.
P = '000 tonnes
Y = Kgs/ha.
If Y < 1, it indicates negative yield impact and if Y > 1, it indicates positive yield impact

may be observed that the relative gap between the indices of production and area clearly suggests that there has been a negative yield effect since 1960-61. This is indeed a distressing fact that in the state, where more than 10.0 per cent of area is allocated to this crop, there is the negative yield impact, for such a long period. Thus, it requires special attention of the planners to attend to this urgent problem, since the country continues to import lakhs of tonnes of edible oil.

Maize has shown the best performance among all the crops, both in area and production expansion. It is the only crop that has shown the highest index of yield for all the points of time, with increasing trend. Cotton, which is rising to the level of some importance by area has recently shown the rising indices of both area and production, with substantial positive yield impact. Bajra, although punctuated by periodic ups and down in the indices of area and production, continued to show positive yield impact on the whole. All other crops exhibit fluctuations in the indices of area, production and yield.

iii) <u>Growth rates of Area, Yield and Production</u>

We may now look at the growth performance of different crops grown in the state. The total period of 34 years from 1950-51 to 1984-85, has been broken into two phases. Phase-I covers the pre-green revolution period from 1950-51 to 1965-66, while phase-II covers the green revolution period from 1965-66 to 1984-85. For calculating growth rates, we have used three yearly averages of area, yield and production, centering around the years 1950-51, 1965-66 and 1984-85. Table 2.4 provides the growth rates of the three phases.

In Phase-I, maize showed the highest growth of production (11.27 per cent) followed by sugarcane, paddy, tur and jowar (5.73, 4.83, 4.42 and 3.12 per cent respectively). The highest growth of maize is contributed by highest growth of yield (7.99 per cent) which accounts for 71 per cent of the production growth. If we consider the dominant crops paddy and jowar, their growth of production is equally shared by both area and yield. Among the foodgrain crops, only gram exhibits negative growth of production (-4.45), contributed by the negative growth in both area and yield. As it is not an important crop, this result does not make much difference at the aggregate level. Nevertheless, it is rather perplexing that groundnut which is one of the dominant crops in the state, also experienced a negative growth of production (-1.64) and further, it is disheartening that this result is contributed by higher negative growth of yield (-1.83 per cent) alone, though area growth is positive.

In Phase-II which tends to show the impact of green revolution, we are disheartened to see only moderate growth rates compared to those in Phase-I. Cotton shows the highest growth of production (10.86 per cent), followed by maize, groundnut and paddy (4.57, 3.20 and 2.80 per cent

Table 2.4: Growth Rates of Area, Yield and Production of Principal Crops

Item	Phase I			Phase II			Phase III		
	A	Y	P	A	Y	P	A	Y	P
1. Paddy	2.45	2.32	4.83	0.61	2.18	2.80	1.42	2.24	3.69
2. Jowar	1.44	1.66	3.12	-1.58	1.24	-0.36	-0.26	1.43	1.16
3. Bajra	0.55	0.84	1.40	-1.85	1.16	-0.76	-0.80	1.02	0.22
4. Maize	2.61	7.99	11.27	2.10	2.42	4.57	2.33	4.84	7.47
5. Tur	1.25	3.13	4.42	1.93	-2.24	-0.36	1.63	0.09	1.72
6. Gram	-3.21	-1.28	-4.45	-1.67	1.24	-0.44	-2.35	0.12	-2.33
7. Sugarcane (gur)	4.46	1.51	5.73	0.29	-1.10*	1.15*	1.98	0.46**	4.04**
8. Groundnut	0.20	-1.83	-1.64	1.88	1.29	3.20	1.14	-0.10	1.04
9. Castor seed	-2.47	0.33	-2.14	0.45	0.14	0.59	-0.85	0.22	-0.63
10. Cotton	-0.81	0.91	0.10	2.83	7.81	10.86	1.21	4.71	5.98
11. Tobacco	1.94	0.74	2.69	0.03	0.44	0.47	0.87	0.57	1.44

Note: 1) Growth rate is calculated from compound growth rate formula
2) Phase I = 1950_51 to 1965_66, Phase II = 1965_66 to 1884_85 and Phase III = 1950_51 to 1984_85
3) * = relates to 1966_76 only
4) ** = relates to 1951_76 only

Source: As in Table 2.2

respectively). All these are due to positive growth rates of both area and yield. Although the production growth of paddy is less than that in Phase-I, it is somewhat relieving that 80 per cent of the growth of production is contributed by the yield growth alone. As regards growth of groundnut production, we cannot count it as a big achievement, because the low level of production at the end of Phase-I, becomes the base for Phase-II, apparently resulting in positive and high growth of production. Further, an important observation during this period is that the crops jowar, bajra and gram show negative growth rates of production, mainly due to the negative growth in area, as the growth rates of yield are positive. Thus, these results in Phase-II, although by no means discouraging, show that green revolution did not ostensibly lead to higher growth rates, as was demonstrably experienced by Punjab.[7]

Now, we take up the growth profile for the total period. It may be seen from Table 2.4 that in almost all the crops (except gram and castor seed), there were positive growth rates of production. Maize showed the highest growth (7.47 per cent) followed by cotton, sugarcane and paddy

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7. G.S. Bhalla and G.K. Chadha, Green Revolution and the Small Peasant - A Study of Income Distribution among Punjab Cultivators, Concept Publishing Company, New Delhi, 1983. They point out that the Punjab experienced higher growth rates in the post 1965-66 period, (pp.7-9).

(5.98, 4.04 and 3.69 per cent respectively). For all these crops, the yield growth contributed much to the production growth. As regards groundnut, it is found that there is a negative growth rate for its yield and this is really a big disappointment as far as agricultural development strategy adopted in A.P. is concerned, particularly because this crop occupied as much as 14.0 per cent of the GCA in 1985-86.

If we look at Table 2.4, we observe that only three crops viz., paddy, maize and tobacco, show a secular growth trend i.e., showing positive growth rates for area, yield and production in both phases. Among other crops, jowar, bajra, cotton and castor seed exhibit positive growth rates of yield. Thus, on the whole the performance of the main crops appear to be fairly good in the total period.

iv) Yield levels and Comparison with the Punjab and All India

First, we look at the absolute levels of yield under different crops in the state, to find whether the yield levels in pre-and post-green revolution periods differ significantly from one another. Table 2.5 presents the yield levels, at five-yearly intervals from 1950-51.

The four cereal crops (paddy, jowar, bajra and maize) have very low levels[8] at the beginning of the pre-green revolution period. The yield levels of all of these crops reached peak levels only in the eighties. Unquestioningly,

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8. For each crop, h indicates highest level and 1 indicates lowest level of the yield.

Table 2.5: Yield Levels of Principal Crops in Pre and Post Green Revolution Periods (Kgs/ha.)

Crop	Pre Green Revolution Period				Post Green Revolution Period			
	50-51	55-56	60-61	65-66	70-71	75-76	80-81	85-86
1. Paddy	1029 l	1138	1236	1262	1359	1657	1947	2209 h
2. Jowar	384 l	450	495	414	377	426	527	663 h
3. Bajra	451 l	481	473	455	497	564	652 h	600
4. Maize	273 l	600	852	846	1344	1636	2263 h	1535
5. Tur	258	274	432 h	371	313	203	194 l	321
6. Gram	338	324	270 l	248	340	417 h	298	306
7. Sugarcane (gur)	6797 l	7427	8889 h	8060	7920	7526	NA	NA
8. Groundnut	868	877 h	865	508 l	772	841	660	789
9. Castorseed	157	183	193 h	142	179	102	100 l	177
10. Cotton	55	56	65	53	45 l	156	304 h	204
11. Tobacco	816	634	791	840	648 l	830	968 h	946

l = Lowest level of yield
h = Highest level of yield
Source: As in Table 2.2

it was very largely because of the contribution of the green revolution. Further, cotton, tobacco and gram also showed their peak level yields in the post-green revolution phase. However, it is distressing to note that the lowest levels of cotton and tobacco could also be seen at the beginning of that phase (1970-71). For other crops, tur, groundnut, sugarcane and castor seed, the highest level of yields were found in the pre-green revolution period. Thus, the yield level of groundnut, one of the major crops, has not risen to the pre-green revolution peak level, and this does not speak well for agricultural development in Andhra Pradesh. Yet, we cannot undernote the progress in other major crops and particularly in paddy in more than doubling its yield level over the entire period.

Now, we turn to locate the relative position of Andhra Pradesh in the performance of agriculture, by comparing the yield levels of a few crops of Andhra Pradesh with those of, say, the Punjab and all India. The comparison is taken up for four points of time, viz., 1953-54, 1960-61, 1970-71, and 1980-81. To make the data free from abrupt fluctuations we have taken triennial averages, centering around those years. We start with 1953-54 because by that time the impact of land reform measure - abolition of intermediaries - was being perceived in agricultural production. Table 2.6 shows these figures.

In the pre-green revolution period, Andhra Pradesh has shown higher levels of yield in respect of the crops -

Table 2.6: Yield Levels of Some Crops _ A Comparison with Punjab and All India (Kgs/ha.)

Year	State/ India	Crops being Compared in Yield							
		Paddy	Jowar	Bajra	Maize	Tur	G.nut	Cotton	Wheat
1. 1953-54	A.P	1156	487	470	848	280	858	53	262
	Punjab	957	263	402	1335	..	725	243	1090
	India	830	467	328	792	733	728	97	773
2. 1960-61	A.P	1273	517	509	822	366	820	64	221
	Punjab	1091	184	346	1233	563	895	264	1222
	India	993	486	312	940	702	808	104	837
3. 1970-71	A.P	1444	441	496	1232	339	770	63	366
	Punjab	1781	694	1149	1527	737	910	364	2292
	India	1114	485	503	1048	694	782	127	1303
4. 1980-81	A.P	1945	611	712	1859	229	833	240	548
	Punjab	2772	706	1107	1716	865	1034	317	2821
	India	1241	696	436	1102	694	841	160	1586

Source: As in Table 2.2

paddy, jowar and bajra, compared both with the Punjab and all-India. However, in the post-green revolution phase, the Punjab excelled both Andhra Pradesh and all India. Yet, it is noteworthy that Andhra Pradesh showed higher levels for paddy than all India even in the latter phase.

As regards wheat[9], it is the Punjab that is predominant. Recently, the area under paddy and wheat together account for nearly 70 per cent of the GCA in the Punjab and thus, the green revolution is the total success, with higher growth rates in the post-green revolution phase.[10] Whereas the impact of green revolution in Andhra Pradesh has been confined to less than 50.0 per cent of the total GCA in the State, when the four crops (paddy, jowar, maize and bajra) together are taken into account. But, as we have already seen for these crops the growth rates are not higher in Phase-II than in Phase-I. This may even be attributed to somewhat higher bases in the initial year in Andhra Pradesh than in the Punjab.

In respect of wheat, maize and cotton, the Punjab has had a much superior position in terms of their yields, at all points of time; for groundnut also, the same seems to hold (except in 1953-54). In regard to maize, Andhra Pradesh

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9. The green revolution in the late sixties in India was called wheat revolution, because of its success in the Punjab.

10. G.S. Bhalla and G.K. Chadha, op.cit.

showed higher yield than all India level at each point of time and could dominate the Punjab level only in 1980-81. For cotton, only in 1980-81, the yield level in Andhra Pradesh was higher than that in all India.

Thus, on the whole agriculture in Andhra Pradesh fares well when compared with India as a whole, in particular, yield rates for a few crops expanded sizably and the green revolution effect was discernible in more ways than one. In comparison with the Punjab, its performance was understandably much less impressive.

3. Land Reforms in Andhra Pradesh

As is evident from the analysis in the preceding sections, the performance of agriculture in Andhra Pradesh is undoubtedly a success story, despite some lacunae. To this success, the institutional and technological changes contributed their respective shares.

For fruitful application of technological innovations in agriculture, there should be change in the institutional set-up to absorb the new technology. The main institutional change is the change in the obsolete land tenure structure, and quite often this is one of the preconditions for agricultural development.[11] From this point of view, we take up the review of land reform measures implemented in Andhra Pradesh.

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11. Bruce F. Johnston and John W. Mellor, "The Role of Agriculture in Economic Development", American Economic Review, September, 1961.

As the two main regions of Andhra Pradesh, viz., Andhra and Telangana Regions, were under different rules in the pre-independence period, historically experienced different land tenure systems. The main reforms, (i) Abolition of Intermediaries, (ii) Tenancy Reform and (iii) Ceiling on landholdings, were carried in both the regions. However, the third aspect had common legislation.

(i) Abolition of Intermediaries:

In Telangana, during Nizam's rule, the peasants and rural masses were subjected to feudal oppression by illegal exactions and forced labour.[12] The peasant armed struggle was started under the leadership and inspiration of the then undivided Community Party of India (CPI), against Nizam's tyrannical rule. However, the struggle was gradually brought to an end after the merger of the Hyderabad state into Indian Union. In Andhra region, there were struggles against Zamindary also, but not of such a furious dimension. Thus, in both the regions, the abolition of intermediaries like, Zamindars, Jagirdars and Inamadars (institutions and persons) became imminent, just as in other parts of the country.

In the abolition of intermediaries, Andhra region was governed by "the Madras Estates Abolition and Conversion into Ryotwari Act, 1948" and Telangana by "The Hyderabad

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12. A.M. Khusro, Economic and Social Effects of Jamindary Abolition and Land Reforms in Hyderabad, Osmania University Press, Hyderabad, 1958.

(Abolition of Jagirs) Regulation, 1358 Fasli (1948)." By 1956, in Andhra Region, out of 32 million acres (79 per cent of the total area) covered under Zamindary, the abolition laws were passed to cover 24 million acres and implemented in 22 million acres, and the entire area under Zamindari system in Telangana was brought into Ryotwari.[13] Further, the 1970-71 Agricultural Census Report has the following to say:[14]

> The system of landholdings and land legislation was different in Andhra and Telangana Areas of the state. However, the legislation in both the regions abolishing intermediaries has brought about uniformity and has created a class of peasant proprietors who hold land directly from the government.

(ii) Tenancy Reforms

To comprehend the specificities of regional variations in agrarian backdrops, we may better deal with tenancy reforms separately for the two regions of the state.[15]

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13. G. Kotovsky, Agrarian Reforms in India, Peoples Publishing House, New Delhi, 1964, p.71. The author does not give figures for Telangana region separately, but shows figures for Hyderabad State, where complete area under Zamindari was covered by implementation of the laws.

14. Government of India, World Agricultural Census Report, 1970-71, Andhra Pradesh, Ministry of Agriculture, New Delhi, 1974, p.21.

15. Andhra Region was separated from Madras in 1953. As noted in foot note-1, Coastal Andhra and Rayalasima regions are its parts.

Telangana Region:

In Telangana, after abolition of intermediaries, the immediate solution to deplorable conditions of tenants became important, as otherwise it would have led to furtherance of peasants' struggle.[16] To accomplish this, "The Hyderabad Tenancy and Agricultural Lands Act, 1950" was enacted to protect the rights of tenants. The Act was intended to (a) regulate the period of tenure, (b) fix reasonable rent, (c) give the tenant the right to compensation in case of eviction, and (d) restrict the right of the landlord to evict the tenant.[17] The act provided for the creation of protected tenants in notified areas, and in non-notified areas, the tenants were called as ordinary tenants. For (a), all the protected tenants would have heritable rights so long as they did not default in rent payment, while for the ordinary tenants, the Act originally prescribed a minimum period of lease of 10 years, which was later cut to 5 years, with a condition to renew the tenure. The maximum rent fixed in the Act varied between 1/3 and 1/4 of the gross produce, depending on the level and type of irrigation facilities. In 1954, it was converted into a multiple of land revenue i.e., 3 to 5 times the land revenue. Further, the protected tenants were declared as owners, depending on the owned area,

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16. G. Parthasarathy and B. Prasada Rao, Implementation of Land Reforms in Andhra Pradesh, Scientific Book Agency, Calcutta, 1969, p.59.

17. Ibid., p.67

in terms of family holdings.[18] Accordingly, 33,000 protected tenants became owners of 82,000 hectares of land in Telangana.[19]

Andhra Region

Compared with Telangana region, Andhra Region was characterized by much less resentment among the peasantry. Only in 1956, the question of tenants was taken up by the government and "The Andhra Pradesh (Andhra Area) Tenancy Act, 1956" was enacted. This Act provided for [20]

> (a) Fixation of maximum rent, (b) minimum period of lease, (c) procedure for determination of fair rent in case of disputes and for remission of rent, (d) circumstances under which the landlords could terminate the tenancy, and (e) the machinery for settlement.

The Act fixed maximum rent upto 50 per cent of gross produce, which was rather high in terms of common perception. The period of lease was fixed as 6 years and on its expiry, the landlord could resume the land. Moreover, the Act could provide no protection against illegal evictions and whenever disputes arose,the revenue officials almost invariably acted

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18. The Hyderabad Tenancy and Agricultural Lands (Amendment) Act 1954, defined a family holding as an area yielding Rs.800/- of net income from cultivation. See, A.M. Khusro, Economics of Land Reform and Farm Size in India, Mcmillan India, Delhi, 1973, p.41

19. P.S. Appu, "Tenancy Reform in India", EPW, August, 1975 (Special).

20. G. Parthasarathy and B. Prasad Rao, op.cit., p.130.

against the tenants. Thus, the Act failed to achieve any concrete objective. To fill this gap, the government brought out an Amendment to the Act, viz. "Andhra Pradesh (Andhra Area) Tenancy (Amendment) Act, 1970". It provided for (i) fixing a fair rent, (ii) automatic renewal of lease and (iii) pre-emptive rights for acquiring ownership. The rent fixed was still upto 30 per cent of the gross produce. The numerous weaknesses of the Act led many observers to point out that this Amendment required still further modifications towards redefining personal cultivation, fixing the price of land along with giving tenants pre-emptive rights, not allowing resumption in case of non-resident land owners, applying all provisions to temple lands, and so on.[21]

(iii) Ceiling on Land Holdings

Like in most other states in India, in Andhra Pradesh also, the ceiling laws were implemented in two rounds. The first round was undertaken in 1961.[22] This Act could achieve practically nothing, because many loopholes and manipulable provisions were built into it. Important among them were: (i) the ceiling imposed was not only high but

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21. G. Parthasarathy and K. Suryanarayana, "Andhra Pradesh (Andhra Area) Tenancy (Amendment) Act", EPW, March 27, 1971.

22. "The Andhra Pradesh Ceiling on Agricultural Holdings Act, 1961." Originally ceiling imposed in Khammam District of Telangana ended in failure. It was done in 1955 by an Amendment to Tenancy Act.

varied widely from 27 to 324 acres and (ii) the unit of application was an individual, but not the family. Further, many exemptions were allowed, in addition to separate holdings for women (Stridhana) and grazing land. Though 6 lakh acres of surplus land was expected to accrue in Telangana alone yet, by 1968, only 55,715 acres[23] was declared surplus in the whole state. Still more distressingly, "in the six years since the enforcement of the ceilings, the government has acquired (only) 191 acres of surplus land."[24] Thus, the first round of ceiling legislation was a mere paper work. As a result, the discontent pervaded widely over the rural masses including the peasantry and led to peasant struggles in the state, most notably in Srikakulam. By late 1960s, such restlessness had encompassed not only the whole of Andhra Pradesh but many other parts of the country. The central and state governments took up the issue of land ceilings again in early seventies. For this purpose, national guidelines were issued in 1972.[25] These guidelines reduced the ceiling, ranging between 10 and 54 acres, made the family as a unit of application, treating every major son as a separate unit, and

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23. P.T. George, "Implementation of Ceiling on Agricultural Holdings in Andhra Pradesh", Artha Vijnana, June, 1968.

24. V.M. Dandekar and N. Rath, "Poverty in India", EPW, Jan. 9, 1971.

25. P.C. Joshi, Land Reforms in India - Trends and Perspectives, IEG, Allied Publishers, New Delhi. 1982, p.90.

the implementation was given a retrospective effect.[26] Accordingly, in Andhra Pradesh, the second round of ceiling was enacted.[27] Though the new law did not make any radical impact, yet, by 1981, it was reported to have achieved the following.[28]

Area declared surplus	:	10,17,467 acres
Area taken possession of	:	3,93,413 acres
Area distributed	:	2,71,627 acres
No. of beneficiaries	:	1,86,123 individuals

4. Distribution of Land Holdings and Tenancy

Having looked into the implementation of land reforms in Andhra Pradesh, now we may look into the distribution pattern of land holdings. Data on land holdings is available from three sources, viz., (i) National Sample Survey (NSS), (ii) Census of India and (iii) Agricultural Censuses. The NSS reports furnish data on (a) Household Ownership Holdings (HOH), (b) Household Operational Holdings (HOPH), and (c) Operational Holdings (OH).[29] These data are available at state level or zonal level in each state but not at district level. The Census of India gives data on cultivators for

26. Government of India, Report of the National Commission on Agriculture, Part-XV - Agrarian Reforms, Ministry of Agriculture, New Delhi, 1976, p.135.

27. "The Andhra Pradesh Land Reforms (Ceiling on Agricultural Holdings) Act, 1973."

28. K. Seetha Rama Rao and P. Hussain Khan, "Land Reforms in India - An Evaluation of Promise and Performance" in N.L. Murthy and K.V. Narayana, (eds.), Rural Economy of India, Mittal Publications, Delhi, 1989, p.58

29. S.K. Sanyal, "A Review of the Conceptual Framework of Land Holdings Survey", Indian Journal of Agricultural Economics, July-September, 1976.

1951 and 1961, based on percentage samples. The agricultural Census gives data at 5-yearly interval, from 1970-71 onwards. Both these latter sources deal with operational holdings only. As the NSS data are available for four rounds, viz., 8th, 17th, 26th and 37th rounds, relating to 1953-54, 1960-61, 1970-71 and 1980-81 years respectively, it is possible to bring out temporal changes also, not only for operational holdings but for household ownership holdings. Thus, we do well to base our analysis largely on NSS data.

As regards Andhra Pradesh the data for the years 1960-61, 70-71 and 80-81 is comparable straightway. But comparable data are not available directly for 1953-54 as the state's reorganisation had not been effected by that time. For Andhra region (as a part of Madras province) separate data are available.[30] For Telangana, no separate data are available. The data of Hyderabad state (of which Telangana is a part) have been split up in the proportion of Net Sown Area of Telangana (of 1953-54). Then, the data for Andhra Pradesh for 1953-54 have been computed by adding up data of Andhra region and Telangana, as a reasonable approximation.[31]

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30. As a matter of fact, Andhra Region was granted separate statehood with effect from October 1, 1953, due to Sri Potti Sri Ramulu, who went on an indefinite hunger strike for separating Andhra region from Madras province. This became the basis for constituting the States Reorganisation Committee.

31. A. Venkateswarlu, Regional Variations in the Agrarian Structure in India, 1953-54 to 1970-71, School of Social Sciences, J.N.U., New Delhi, 1984 (an unpublished M.Phil Dissertation). He made similar adjustments to Karnataka, Gujarat, Madhya Pradesh, Maharashtra and Punjab.

(i) Household Ownership Holdings (HOH):

Land is an asset and at the same time it is a primary input in agricultural production to generate income to the owner. When we consider the distribution of ownership holdings, we bring out the property relations among the rural households.

Looking at Table 2.7, we point out the following aspects. In Andhra Pradesh, rural landless households assumed as high as 26.5 per cent[32] of the total rural households in 1953-54. It fell to 6.9 per cent in 1960-61 and remained more or less the same in 1970-71. But it rose to 11.9 per cent in 1980-81. Very drastic reduction in the percentage of landless households from 1953-54 to 1960-61 is an observed fact for all India and other states too. This was explained partly in terms of (i) definitional change in regard to the ownership in the NSS of 1960-61,[33] (ii) distribution of waste land by the government among the rural landless households, and partly (iii) abolition of intermediaries. It is interesting to note that the percentage of landless households decreased despite the fact that there was an increase in the absolute number of total rural households (5153 thousands in 1953-54 to 8590 thousand in 1980-81).

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32. In fact, this is higher than the all India's share of rural landless households in 1953-54 (23.09 per cent).

33. S.K. Sanyal, op.cit. He says, "Besides pure ownership of 8th round, it also included land held in owner like possession, e.g., land held on long-term lease etc."

Table 2.7: Distribution of Household Ownership Holdings in Andhra Pradesh

	Farm Size (Ha)	Percentage Number of Holdings				Perecentage Area Owned			
		53-54	60-61	70-71	80-81	53-54	60-61	70-71	80-81
1.	0.002 - 0.40	36.53	44.59	43.67	42.49	1.21	1.50	2.23	2.15
2.	0.41 - 1.00	17.19	19.25	19.03	20.59	4.06	6.67	7.69	9.12
3.	1.01 - 2.02	14.95	12.30	14.67	15.93	7.90	9.69	13.16	15.29
4.	2.03 - 3.03	8.82	7.61	8.00	9.28	8.05	9.91	12.27	13.42
5.	3.04 - 4.04	5.50	3.77	4.06	3.09	7.15	7.06	8.92	7.28
6.	4.05 - 6.07	5.82	4.79	4.98	4.75	10.67	12.54	15.03	14.99
7.	6.08 - 8.09	3.37	2.44	2.15	1.89	8.79	9.07	9.38	9.00
8.	8.10 -10.12	2.05	2.02	1.01	0.95	6.84	9.67	5.74	5.83
9.	10.13 -12.14	1.46	0.87	0.79	0.61	5.95	5.28	5.41	4.65
10.	12.15 -20.24	2.58	1.37	1.15	1.04	14.59	11.47	10.74	10.83
11.	20.25 & above	1.73	0.99	0.49	0.38	24.79	17.14	9.43	7.44
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
12.	Total No. Of Holdings ('000)	3764	6187	6473	7565	..	..	..	..
13.	Total Area Owned ('000 ha)	..	..	..	..	10120	11370	10278	11083
14.	% of landless Households	26.53	6.84	6.95	11.93	..	..	..	..
15.	Average size (ha)	..	..	..	..	2.69	1.84	1.59	1.47
16.	Gini Coefficient	0.7283	0.7437	0.7050	0.6945	..	..	..	..
	Usual Five categories								
(i)	Marginal (1+2)	53.72	63.84	62.70	63.08	5.27	8.17	9.92	11.27
(ii)	Small (3)	14.95	12.30	14.67	15.93	7.90	9.69	13.16	15.29
(iii)	Semi Medium (4+5)	14.32	11.38	12.06	11.36	15.20	16.97	21.19	20.70
(iv)	Medium (6+7+8)	11.24	9.25	8.14	7.60	26.30	31.28	30.15	29.82
(v)	Large (9+10+11)	5.77	3.23	2.43	2.03	45.33	33.89	25.58	22.92

Source: 1. For 1953-54, NSS Report No.66 (8th Round)
2. For 1960-61, NSS Report No.144 (17th Round)
3. For 1970-71, NSS Report No.215.2 (26th Round)
4. For 1980-81, NSS Report No.330 (37th Round)

Average size of the ownership holdings in 1953-54 was 2.69 ha. which declined consistently in subsequent years finally reaching 1.47 ha. in 1980-81. This is partly the outcome of population explosion in the countryside which caused sub-division and fragmentation of holdings, leading to the increase in the number of holdings. In 1953-54, the number of households with ownership of land (>0.002 ha.) was 3764 thousand that increased to 6187 thousand in 1980-81.

In 1953-54, the percentage of households below 0.4 ha. (1 acre) was 36.5 per cent, it increased to 44.6 per cent in 1960-61, and by 1980-81 it stood at 42.5 per cent. Further, it is alarming to note that there is an increasing trend in the percentage of holdings below 2.02 ha (5 acres) and above this, the percentage of holdings exhibit decreasing tendency. Thus, it seems, the percentage of households had been increasing regularly among the marginal and small farmers.

As regards the percentage area, it seemed to have increased over time upto the farm-size 8.09 ha. As the marginal and small farmers (upto 2.02 ha.) show the increase in their percentage holdings, the beneficiaries in the distributional change are the farmers owning land from 2.03 ha. to 8.09 ha. In other words, the middle and upper-middle level peasantry seemed to have strengthened their base in Andhra Pradesh during the three development decades since 1953-54.

From the distribution point of view, the inequalities have been quite sharp at each point of time. In 1953-54, marginal holdings (below 1.00 ha.) assuming 53.7 per cent of the total holdings owned only 5.3 per cent area and in 1980-81, their number rose to 63.1 per cent and they owned 11.3 per cent area. If we find Inter-class concentration ratio,[34] it is 9.87 per cent for 1953-54 and 17.91 per cent for 1980-81, and the change is significant, as the computed Chi-square value (6.55) is significant. Further in 1953-54, the large holdings (above 10.12 ha.) assuming 5.77 per cent in the total holdings owned 45.33 per cent area and in 1980-81 such holdings with 2.03 per cent share in holdings owned 22.92 per cent area. Apparently, the concentration seems to have declined. When we found ICCR, it increases from 785.62 per cent in 1953-54 to 1129.06 per cent in 1980-81, showing a significant change (Computed Chi-Square value was 150.14). Thus, this change is not a favourable change from the point of view of distributional justice, it was favourable to large holdings. At both ends, the changes seem to be favourable to respective farm-size categories (marginal and large holdings). This is explained in terms of the fact that (i) for marginal farmers, the percentage holdings increased in a lower proportion than the area percentage, though both the

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34. This is found by multiplying the ratio of percentage area to percentage holdings in any farm-size with 100. Hereinafter, it is abbreviated as ICCR (Inter Class Concentration Ratio).

percentages showed increase, (ii) for the large holdings, though both the percentages decreased, the decrease in the percentage of holdings was of a higher proportion than that of the percentage area.

From the above analysis, dealing with land distribution at the two extreme ends, conclusive judgments cannot be formulated for the whole of the rural land owning hierarchy. There is still the scope for the inequality to increase or remain constant over time. To supplement the above, as a measure of inequality, we used Gini Coefficient. For all the years it is either equal to or greater than 0.70. In 1953-54 it assumes a value of 0.728 goes upto 0.744 in 1960-61, thereafter, it decreases to 0.695 for 1980-81. Further, and perhaps a unique unhappy situation is that the Gini Coefficient in the distribution of ownership holdings in Andhra Pradesh is always higher than that of all India level and it assume- top position among all the states for almost all the points of time.[35]

(ii) Operational Holdings :

Operational holdings are units of production under single management. They may also be under joint management,

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35. A. Venkateshwarlu, op.cit. For all India, the Gini Co-efficient values for 53-54, 60-61 and 70-71 are 0.6764, 0.6801 and 0.6748 respectively (p.108). For 1953-54 and 1960-61, Andhra Pradesh assumes 1st rank in the inequality and for 1970-71, it gets 2nd rank (p.109). For all India, in 1980-81, the measure of inequality assumes 0.6703 (by calculation).

and such holdings are referred to as joint operational holdings. In view of this, the number of operational holdings is less than the number of households, owning land. This is also possible due to interplay of leasing-in and leasing-out of the area.

It is clear from Table 2.8, that the number of operational holdings increased from 2971 thousand in 1953-54 to 3994 thousand in 1960-61, which shows an alarming rate of growth of 33.8 per cent. By 1980-81, it reached a still higher figure of 5147 thousand. Further, the average size of the operational holdings continuously fell from 3.57 ha. in 1953-54 to 2.01 ha. in 1980-81. On comparison, it is clear that the average size of operational holdings is higher than that of ownership holdings, at each point of time. The difference in the operated and owned area being apart, this may be attributed to the lower weight in the denominator.

Coming now to the distribution, at the lower end, the marginal and small farms together accounted for 39.83 per cent of holdings and 4.76 per cent of operated area in 1953-54 and in 1980-81, they occupied 48.51 per cent of holdings and 10.26 per cent of operated area. The ICCR was 11.95 and 21.15 per cent for the respective years and the change is also significant.[36] Then, at the upper end, the large holdings accounted for 8.36 per cent of total holdings, with

36. Chi-square value is equal to 7.08.

Table 2.8: Distribution of Operational Holdings in Andhra Pradesh

Farm size (Ha)	Percentage Number of Holdings				Percentage area Operated			
	53-54	60-61	70-71	80-81	53-54	60-61	70-71	80-81
1. 0.002 - 0.40	18.81	15.91	20.84	22.04	0.93	0.94	1.78	1.67
2. 0.41 - 1.00	21.02	25.99	26.45	26.47	3.83	5.82	7.50	8.59
3. 1.01 - 2.02	18.32	18.59	19.14	22.19	7.34	9.31	11.74	15.36
4. 2.03 - 3.03	11.32	12.73	12.52	10.80	7.83	10.38	13.24	12.96
5. 3.04 - 4.04	7.84	6.37	5.71	4.75	7.68	7.45	8.67	8.12
6. 4.05 - 6.07	7.17	7.80	6.76	7.10	9.81	12.67	14.29	16.33
7. 6.08 - 8.09	4.28	4.23	3.20	2.56	8.45	9.55	9.60	8.79
8. 8.10 - 10.12	2.88	2.77	1.91	1.15	7.35	8.38	7.43	5.08
9. 10.13 - 12.14	1.98	1.18	1.03	0.85	6.12	4.41	4.86	4.71
10. 12.25 - 20.24	3.96	2.72	1.71	1.70	16.93	13.68	10.96	12.86
11. 20.25 & above	2.42	1.71	0.73	0.39	23.73	17.41	9.93	5.53
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
12. Total No. of Holdings('000)	2971	3974	4431	5147	..	..	..	..
13. Total Area Operated('000 ha)	..	..	..	..	10603	11420	10178	10339
14. Average Size (ha)	..	..	..	..	3.57	2.88	2.30	2.01
15. Gini Coefficient	0.6524	0.6157	0.6028	0.5948	..	..	..	..
Usual Five Categories								
(i) Marginal (1+2)	39.83	41.90	47.29	48.51	4.76	6.76	9.28	10.26
(ii) Small (3)	18.32	18.59	19.14	22.19	7.34	9.31	11.74	15.36
(iii) Semi medium (4+5)	19.16	19.10	18.23	15.55	15.51	17.83	21.91	21.08
(iv) Medium (6+7+8)	14.33	14.80	11.87	10.82	25.61	30.60	31.42	30.20
(v) Large (9+10+11)	8.36	5.61	3.47	2.93	46.78	35.50	25.75	23.10

Source: 1. For 53-54, 60-61 and 70-71 as in Table 2.7
2. For 80-81, NSS Report No.331 (37th Round)

46.78 per cent of operated area in 1953-54 and in 1980-81, they were reduced to only 2.93 per cent in number with 23.10 per cent share of operated area. The ICCR value increases from 559.57 to 788.40 per cent and the change is also significant.[37] Thus, the change at upper end seems to be favourable to large holdings.

Despite the fact that the ICCR analysis suggests an unfavourable distribution overtime, we may still hope for less inequitable distribution compared to ownership holdings, as a result of combined effect of leasing-in and leasing-out. In fact, the Gini Coefficient of operational holdings is less than that of ownership holdings at each point of time. Yet, it is not lower than 0.60 at any time. It assumed a high value of 0.6524 in 1953-54 and gradually it decreased to 0.5948 in 1980-81. Except for 1980-81, for all other points of time, the Gini value of operational holdings in Andhra Pradesh is higher than that at the all-India level.[38]

(iii) Agricultural Tenancy

The data on tenancy in the NSS reports contain two types of leasing transactions. Area leased-out information is available with reference to ownership holdings and area leased-in is furnished with respect to operational holdings.

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37. Chi-square value is equal to 93.58.

38. For all India, the Gini value of operational holdings is 0.6213, 0.5832, 0.5879 and 0.6240 respectively for the years 1953-54, 60-61, 70-71 and 80-81.

As there are differences in the amounts of area leased-out and area leased-in and the tenancy structure is appropriate to be dealt with, in respect of operational holdings, we take recourse to information on area leased-in for discussion on tenancy. The leased-in area information for 17th round (1960-61) of the NSS was not published. However, the state level figures, in regard of area leased-in and operational holdings leasing-in are taken from Pranab Bardhan[39] and Sanyal,[40] Table 2.9 shows aggregate features.

Table 2.9: Leasing-in Aspects at Aggregate Level in A.P

Year	% of operational holdings				Percentage area operated	
	Entirely owned	Purely Land-less Tenants	Mixed Tena-nts	Total Tenants (Land-Less + Mixed)	Owned	Leased-in
1. 1953-54	67.39	11.21	21.40	32.61	81.40	18.60
2. 1960-61	81.48	3.04	15.48	18.52	90.85	9.15
3. 1970-71	78.34	0.71	20.95	21.66	90.99	9.01
4. 1980-81	83.45	1.04	15.51	16.55	92.98	7.02

We notice a striking feature in respect of the share of leased-in area, which sharply declined from 18.60 per cent

39. Pranab Bardhan, "Variations in Forms and Extent of Tenancy", EPW, September 11 and 18, 1976.

40. S.K. Sanyal, "Trends in some Characteristics of Land Holdings - An Analysis for a few States", Sarvekshana, July 1977.

in 1953-54 to 9.15 per cent in 1960-61. Such a sharp decline in a span of 7 years, certainly casts some doubt on the authenticity of the information used. In respect of all India and in some states (e.g. Gujrat, Madhya Pradesh, Maharashtra and Rajasthan) also, such a change was noticed. The possible explanations offered are (i) definitional change in the 17th NSS round to treat long term lease as equal to ownership, (ii) fictitious 'voluntary surrenders' by tenants and (iii) benami transfers and sales due to the then impending ceiling legislations. From 1960-61 to 1970-71, the percentage leased-in area remained almost the same and by 1980-81, it decreased to 7.02 per cent, including 0.79 per cent of area neither owned nor leased-in.

Another striking feature is about the landless tenant holdings. Its share in the total operational holdings was as high as 11.21 per cent in 1953-54 and it showed a remarkable decrease so that by 1960-61, it was 3.04 per cent only. This clearly suggests that either the unrecorded landless tenants (due to their weaker bargaining power) were thrown out by the landowners or such tenants could not prove themselves to be tenants in the courts of law, as the *onus probandi* lied with the tenants.[41] More or less, the same pattern was observed at all-India level and in most other states.[42] Further, in

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41. Government of India, op. cit.

42. A. Venkataswarlu, op.cit., p.260

Andhra Pradesh, the shares of total and mixed tenant holdings drastically fell in the period from 1953-54 to 1960-61. By 1970-71, the shares of mixed and total tenant holdings rose, throwing landless tenants with a negligible share (0.71 per cent). In 1980-81 the reverse of it took place and further, the share of operational holdings with entirely owned area increased to 83.45 per cent (from 78.34 per cent in 1970-71).

Farm-size wise distribution into eleven categories and five broad classes is shown in Table 2.10. At each point of time, there seemed to exist a systematic pattern for the landless tenant holdings and leased-in area to decrease over the farm-size ladder in all the eleven size-categories. This decreasing tendency is more systematic in the five farm-size classes. From this, we understand that the role of tenancy in Andhra Pradesh has been consistently on the decline. Another interesting observation is that in 1970-71 and 1980-81, the percentage of mixed tenant holdings seemed to be higher among the small, semi-medium and medium farms (three intermediate size-classes, operating between 2.03 ha to 10.12 ha), compared to the overall average percentage in the respective years.

Table 2.10: Leasing in Pattern of Operational Holdings by Size Class 1953-54, 70-71, 80-81

Farm Size (ha)	PERCENTAGE OF HOLDINGS REPTING AREA AS									PERCENTAGE OPERATED AREA					
	Entirely Owned			Entirely leased in			Mixed			Owned			Leased in		
	53-54	70-71	80-81	53-54	70-71	80-81	53-54	70-71	80-81	53-54	70-71	80-81	53-54	70-71	80-81
1. 0.002 - 0.40	77.13	86.94	87.19	16.92	1.86	3.17	5.95	11.20	9.64	74.73	91.04	90.98	25.27	8.96	9.02
2. 0.41 - 1.00	59.41	74.61	85.90	13.23	0.13	1.19	27.36	25.26	12.91	70.60	86.24	90.70	29.40	13.76	9.30
3. 1.01 - 2.02	62.13	77.43	80.88	8.92	0.92	0.12	28.95	21.65	19.00	75.98	88.97	91.49	24.02	11.03	8.51
4. 2.03 - 3.03	59.87	73.84	81.28	5.10	0.34	0.00	35.03	25.82	19.72	76.12	88.26	91.38	23.88	11.74	8.62
5. 3.04 - 4.04	56.88	77.57	73.62	7.05	0.12	0.04	36.07	22.31	26.34	76.28	91.15	88.37	23.72	8.85	11.63
6. 4.05 - 6.07	68.55	80.77	79.83	3.77	0.47	0.00	27.58	18.76	20.17	83.52	91.94	92.36	16.48	8.06	7.64
7. 6.08 - 8.09	65.92	75.04	85.62	3.26	0.99	0.00	30.82	23.97	14.68	82.25	90.01	94.71	17.75	9.99	5.29
8. 8.10 - 10.12	62.44	69.27	90.06	2.05	0.00	0.00	35.51	30.73	9.94	80.18	87.85	96.73	19.82	12.15	3.27
9. 10.13 - 12.14	62.13	81.76	92.63	2.91	0.00	0.00	34.96	18.24	7.37	79.94	93.42	99.11	20.06	6.58	0.89
10. 12.15 - 20.24	62.74	79.42	81.09	3.80	0.00	0.00	33.46	20.58	18.91	81.05	96.33	95.26	18.95	3.67	4.74
11. 20.24 & above	67.08	83.13	90.78	4.62	0.00	0.00	28.30	16.87	9.22	88.27	95.22	96.91	11.73	4.78	3.09
Total	67.39	78.34	83.45	11.21	0.71	1.04	21.40	20.95	15.51	81.40	90.99	92.98	18.60	9.01	7.02
USUAL FIVE CATEGORIES:															
12. Marginal (1+2)	71.78	80.04	86.49	15.81	0.89	2.09	12.41	19.07	11.42	71.24	85.64	90.75	28.76	14.36	9.25
13. Small (3)	62.13	77.43	80.88	8.92	0.92	0.12	28.95	21.65	19.00	75.98	88.97	91.49	24.02	11.03	8.51
14. Semi Medium (4+5)	58.65	75.01	78.94	5.89	0.27	0.01	35.46	24.72	21.05	76.20	89.40	90.22	23.80	10.60	9.78
15. Mediumm (6+7+8	66.59	77.37	82.92	3.27	0.54	0.00	30.14	22.09	17.78	82.15	80.38	93.78	17.85	9.62	6.22
16. Large (9+10+11	63.86	80.89	85.72	3.83	0.00	0.00	32.31	19.11	14.28	84.58	95.35	96.44	15.42	4.65	3.56

Source: As in Tables 2.7 and 2.8

Table 2.11 : Shares of total Leased-in Area among five broad classes

Year	Marginal	Small	Semi-Medium	Medium	Large	Total
1953-54	7.39	9.43	19.90	24.54	38.74	100.00 (19,72,000)
1970-71	13.21	14.36	25.74	33.42	13.27	100.00 (9,17,000)
1980-81	13.53	18.63	29.37	26.76	11.71	100.00 (7,26,000)

(The figures in parentheses indicate total leased-in area in hectares)

From Table 2.11, we may look at the distribution of total leased-in area among the five major size-classes. In 1953-54, the two top classes (medium and large farms) accounted for 63.28 per cent of the total leased-in area. By 1970-71, semi-medium and medium farms together assumed dominance with a leased-in area of 59.16 per cent of the total, and in 1980-81, the position remained the same with 56.13 per cent leased-in area. This clearly speaks of an inequitable distribution of the leased in area among the total tenant holdings,[43] that goes favourable to middle and upper middle class.

5. <u>Technological Transformation of Andhra Pradesh Agriculture</u>

From the preceding discussion, it is clear that the

43. The marginal and small farms together accounted for 62.69 and 63.51 and 65.24 per cent of total tenant holdings, with shares of 16.82, 27.57 and 32.16 per cent of total leased in area respectively in the years 1953-54, 70-71 and 80-81.

numerical strength of marginal and small farmers is growing over time and by 1980-81, they assumed nearly 3/4ths of the total farms under operation. In such a situation, the general technological advancement of agriculture depends on the capability of its adoption by the marginal and small farmers. In other words the size-neutral technology such as the bio-chemical technology, assumes importance both from production and employment points of view. If we look at the fact that more than half of the operated area is concentrated in the medium and large farmers (above 4.04 ha.), it is also feasible to invite the mechanical technology and consequently such farms could lead to displacement of labour. Further, growing owner-operated cultivation (due to declining tenancy as a result of land reforms and population growth) is helpful to an easy adoption of any type of agricultural technology, provided minimum needed incentives are available. Thus, it is time now for us to consider the technological changes in agriculture of Andhra Pradesh, in terms of (i) irrigation, (ii) implements and machinery, (iii) chemical fertilizers and (iv) area under HYVS.

(i) Irrigation:

For adoption of improved agricultural technology, the main prerequisite is irrigation. Table 2.12 shows irrigation expansion and its related aspects in Andhra Pradesh. In A.P., the indices of NSA (net sown area) and GCA (gross

Table 2.12: Irrigation Expansion in Andhra Pradesh and India

Item		50-51	55-56	60-61	65-66	70-71	75-76	80-81	85-86	The Area in in the base year (in '000 ha.)
1. Index of NSA	A.P	1.00	1.15	1.10	1.12	1.20	1.14	1.09	1.06	5819.3
	India	1.00	1.09	1.12	1.15	1.19	1.20	1.18	1.19	118753.0
2. Index of GCA	A.P	1.00	1.16	1.11	1.14	1.26	1.22	1.16	1.14	10639.3
	India	1.00	1.12	1.16	1.18	1.26	1.30	1.31	1.35	131870.0
3. Index of NIA	A.P	1.00	1.17	1.24	1.27	1.42	1.47	1.48	1.51	2342.9
	India	1.00	1.09	1.18	1.26	1.49	1.65	1.86	2.00	20853.0
4. Index of GIA	A.P	1.00	1.27	1.38	1.40	1.67	1.79	1.72	1.72	2523.8
	India	1.00	1.14	1.24	1.37	1.69	1.91	2.20	2.39	22563.0
5. Cropping Intensity (%)	A.P	108.35	108.96	109.58	109.97	113.74	115.98	114.38	116.05	
	India	111.05	114.06	114.70	114.01	117.76	120.23	123.57	125.71	
6. Irrigation Intensity (%)	A.P	107.72	116.49	119.36	118.66	127.46	131.74	125.35	122.58	
	India	108.20	112.67	113.46	117.30	122.80	125.22	127.78	129.26	
7. % NIA in NSA	A.P	23.86	24.33	26.98	27.08	28.23	30.76	32.26	33.93	
	India	17.56	17.62	18.52	19.34	22.09	24.25	27.67	29.60	
8. % GIA in GCA	A.P	23.72	26.01	29.39	29.22	31.64	34.94	35.35	35.84	
	India	17.11	17.41	18.32	19.90	23.04	25.26	28.61	23.55	
9. % NIA under Wells and Tubewells	A.P	12.94	10.36	11.27	15.27	13.39	17.00	22.43	23.66	
	India	28.67	29.61	29.56	32.85	38.22	41.64	45.70	NA	
10. % NIA under Canals (Govt. plus Private)	A.P	51.37	47.03	45.76	41.17	47.66	47.32	48.87	50.70	
	India	39.78	41.24	42.05	41.60	41.28	39.92	39.41	NA	

NSA = Net Sown Area , GCA = Gross Cropped Area
NIA = Net Irrigated Area, GIA = Gross Irrigated Area
Source: Government of Andhra Pradesh, Statistical Abstract of Andhra Pradesh, for various years

cropped area) reached their maximum by 1970-71 and thereafter began to decline; whereas at all-India level, the indices showed a continuously rising trend since 1960-61. Further, in AP, the indices of NIA (net irrigated area) and GIA (gross irrigated area) have been continuously rising over time in the same way that they did for India as a whole. However, since 1970-71, the indices in AP have shown relatively lower increase. In fact, in AP, the index of GIA reached its maximum by 1975-76 and thereafter stand constant at 1.72. All these four indices suggest that the performance of AP was less satisfactory compared with all-India, particularly from 1970-71 onwards.

It is nevertheless important to note that in AP, the share of irrigated area in NSA and GCA is always higher than that of all India. The initial better position has continued to hold throughout the period under study. From these developments, one can expect higher cropping intensity in AP than at all India. But it is disappointing to find lower cropping intensity for A.P. not only at the initial point (with a gap of 3 per cent points) but also at the end point (with a much wider gap of 10 per cent points). It is important to stress that there is a large potential for increasing GCA in AP, thereby causing cropping intensity to rise much above the present level. A still more important question is why such a lower cropping intensity has been observed in A.P. in spite of the fact that the state has a higher irrigation base. This we may possibly answer by looking into the composition of NIA.

The two main components of NIA are : (i) government canals and (ii) wells and tube wells. The former source may not stimulate a higher incidence of multiple cropping, after first crop for which water is provided. The latter source being the outcome of entrepreneurial capacity of the farmers, it has greater regularity and controllability, often leading to multiple cropping, thereby to higher cropping intensity. From Table 2.12, it can be seen that in AP, the share of irrigation due to canals is nearly half of NIA, greater by 10.0 per cent than at all-India level, at each point of time. But, the share of wells and tubewells in AP is less than half of what it is in all-India at every point of time. This difference should have resulted in lower cropping intensity in AP, compared to all India, as per our reasoning.[44] However, this fact by itself cannot be the sole cause of multiple cropping, as irrigation intensity is not higher in all India than in AP upto 1975-76, i.e., the higher cropping intensity is not due to multiple cropping with irrigation. The possible explanation is that well irrigation might be used only in one season (kharif or rabi), while the crop raised in the other season might not require irrigation or perhaps the inability of using well irrigation may be

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44. Our proposition made here is further corroborated by the fact that Punjab, with its share of irrigation through wells and tubewells being quite higher than all India, has experienced a higher cropping intensity too. See, G.S. Bhalla and G.K. Chadha, op.cit., pp.11 and 12.

generally true. It is possible that the Kharif crop may depend on rainy water of the monsoons.

(ii) Implements and Machinery:

Now we turn towards the expansion of implements and machinery (mainly modern) to understand the process of adoption of mechanical technology. The information is set out in Table 2.13. In AP, all modern implements and machinery, viz., iron ploughs, oil engines, electric motors, tractors and cane crushers show a continuous rise in absolute numbers. As regards the growth rates of their numbers extended over the total period under study (1956-82), they are higher in AP than in all India for iron ploughs, electric motors and cane crushers. In respect of tractors and oil engines, the growth rates in AP are catching up with those of all India.

When we break up the period into two phases, (i) 1956-66, representing pre-green revolution period and (ii) 1966-82, representing post-green revolution period, an important observation is that the rate of growth of tractorization in AP, in the latter phase, was as high as 13.31 per cent, though this is less than that of all India (15.19 per cent). Added to this, the growth rate of iron ploughs in AP is higher than in all India in the latter phase, as an effect of green-revolution. In the former phase, electric motors have grown perceptibly at 33.44 per cent in AP, compared to only 24.34 per cent in all India. Thus, it

Table 2.13: Expansion of Agricultural Implements and Machinery in Andhra Pradesh and India

Item		1956	1961	1966	1972	1977	1982	Growth Rates 56-66	66-82	56 - 82
1. Iron Ploughs ('000)	A.P	24.1	50.9	54.3	85.0	135.0	247.0	8.46	9.93	9.36
	India	1376.0	2298.0	3523.0	5359.0	6516.0	6628.0	9.86	6.52	6.23
2. Oil Engines ('000)	A.P	16.8	33.9	46.7	111.0	199.0	251.0	10.76	11.06	10.96
	India	123.0	230.0	471.6	1546.0	2359.0	3101.0	14.37	12.50	13.22
3. Elec. Motors ('000)	A.P	3.2	17.0	57.3	145.0	234.0	438.0	33.44	13.55	20.83
	India	47.0	160.0	415.0	1618.0	2438.0	3568.0	24.34	14.39	18.12
4. Tractors ('00)	A.P	16.3	17.6	29.1	63.0	111.0	215.0	5.97	13.31	10.43
	India	210.0	310.0	540.0	1482.0	2759.0	5188.0	9.90	15.19	13.13
5. Cane crushers operated by power ('00)	A.P	12.2	34.0	47.5	70.0	141.0	78.0	14.56	3.15	7.40
	India	233.0	333.0	451.0	872.0	1089.0	1204.0	6.82	6.33	6.52
6. Carts ('000)	A.P	1161.0	1221.0	1313.0	1429.0	1422.0	1418.0	1.23	0.48	0.77
	India	10968.0	12072.0	12697.0	12960.0	12670.0	12924.0	1.48	0.11	0.63
7. NSA per Tractor (ha.)	A.P	6927.0	6295.0	3778.0	1789.0	955.0	527.0	..	..	..
	India	6150.0	4297.0	2522.0	945.0	508.0	274.0	..	..	..
8. NSA per Elec. Motor (ha.)	A.P	3528.0	651.0	192.0	78.0	45.0	26.0	..	..	..
	India	2748.0	833.0	326.0	87.0	58.0	40.0	..	..	..
9. NSA per Oil engine (ha.)	A.P	672.0	327.0	236.0	102.0	53.0	45.0	..	..	..
	India	1050.0	579.0	289.0	91.0	59.0	46.0	..	..	..

NSA = Net Sown Area

Source: As in Table 2.12

gives an inference that the use of electric power in agriculture should have grown rapidly in AP in the first phase itself. In AP, 11.1 and 18.6 per cent of total electricity consumption was utilised for agricultural purpose, in 1962-63 and 1970-71 respectively, the corresponding figures for all India being only 5.9 and 10.2 per cent respectively.

In relative terms, we may look at the NSA per tractor, electric motor and oil engine. The higher the figure is, the lower is the development process in AP compared with all India and vice versa. In the initial year (1956), the NSA per tractor in AP was only a little higher than that of all India. But, by the end point (1982), this area in AP was almost double of that in India. This clearly suggests that the expansion of tractors in AP has been unquestioningly much slower compared to all India. The rapid acquisition of tractors in other agriculturally fast growing states, such as Punjab, Haryana and Uttar Pradesh should have caused this.[45] As regards electric motors, though AP had higher area at the initial point, by the end point, this became almost half of that in all-India. This we have already seen in the preceding para, as the result of higher

45. Further, the urgency of field crop operations to go for double or multiple cropping should have led to this important machinery expansion, and this phenomenon should have also caused higher cropping intensity in all India than in AP, as the machinery expansion and cropping intensity are positively correlated.

proportion of electricity consumption in agriculture in AP than in all-India. In respect of oil engines, the gap was higher at the beginning (in favour of AP), but by the end, the gap was almost nil and this is the outcome of rapid growth of oil engines in all India compared to AP, in both the phases, as if this was a compensating action for low proportion of electricity consumption in agricultural sector in all India.

(iii) Chemical Fertilizers:

The adoption of bio-chemical technology generally proceeds with the use of chemical fertilizers. As the higher use of fertilizers leads to higher agricultural production, largely under yield-increasing effect of new technology; we consider here the expansion of chemical fertilizers in AP. It is shown in Table 2.14 from 1959-60 onwards, from which year the Fertilizer Association of India (FAI) began to publish data for reorganised states.

The total chemical fertilizers contains three constituents, viz., Nitrogen (N), Phosphates (P_2O_5) and Potassium (K). It is easy to observe from the table that Nitrogen assumes predominantly large share, while the share of Potassium being the lowest throughout the period of our study. Further, the total fertilizer-use is rising over the period with a few exceptions. In 1959-60, the total fertilizer use in AP was only 36.91 thousand tonnes. By 1962-63, it increased to 117.17 thousand tonnes, which was

Table 2.14: Chemical Fertiliser Use in Andhra Pradesh

	Year	Quantity of fertilisers in '000 Tonnes				Share of A.P in all India (%)	Per ha. Use in A.P (Kg./ha)	Per ha. Use in all India (Kg./ha)
		N	P_2O_5	K	Total			
1.	1959-60	28.18	8.16	0.07	36.91	12.12	3.09	2.00
2.	1960-61	25.49	14.06	..	39.55	16.49	3.35	1.57
3.	1961-62	52.47	17.96	..	70.43	20.82	5.54	2.17
4.	1962-63	92.20	24.36	0.51	117.07	25.88	9.12	2.89
5.	1963-64	74.24	29.80	1.57	105.61	19.42	8.28	3.47
6.	1964-65	72.55	29.91	2.62	105.08	13.59	8.24	4.86
7.	1965-66	78.79	30.69	5.65	115.13	14.67	9.52	5.05
8.	1966-67	175.86	35.81	10.55	222.22	20.19	17.53	7.00
9.	1967-68	159.48	50.69	4.17	214.34	13.93	16.75	9.40
10.	1968-69	217.60	78.50	7.15	303.25	17.22	24.35	11.04
11.	1969-70	237.00	62.00	13.20	312.40	15.75	23.75	12.22
12.	1970-71	207.00	59.00	17.16	283.16	12.55	21.22	13.61
13.	1971-72	195.60	74.20	27.20	297.00	11.18	23.48	16.08
14.	1972-73	179.10	71.77	24.26	275.13	9.94	22.35	17.07
15.	1973-74	169.60	82.00	29.20	280.80	9.89	21.21	16.72
16.	1974-75	228.10	54.20	24.30	306.60	11.92	23.08	15.67
17.	1975-76	320.80	66.50	24.80	412.10	14.24	31.80	16.92
18.	1976-77	297.00	83.00	22.00	402.00	11.79	33.89	20.39
19.	1977-78	351.60	133.20	37.00	521.80	12.18	41.63	24.87
20.	1978-79	414.10	147.40	42.50	604.00	11.80	46.03	29.28
21.	1979-80	369.70	126.10	39.00	534.80	10.18	43.55	30.98
22.	1980-81	399.40	130.90	45.30	575.60	10.44	46.95	31.82
23.	1981-82	456.20	150.30	49.00	655.50	10.80	50.24	34.27
24.	1982-83	509.00	160.00	63.00	732.00	11.44	57.33	36.92
25.	1983-84	613.00	223.00	73.00	909.00	11.79	67.87	42.75
26.	1984-85	644.90	254.40	81.00	980.30	11.94	80.27	..
27.	1985-86	568.90	242.80	76.40	888.10	10.48	73.40	47.80

Source: FAI, Fertilizer Statistics, various issues more than three-fold compared to the initial period. It is interesting to note that in the very initial year of green-revolution (1966-67), the total fertilizers in AP showed a quantum jump to 222.22 thousand tonnes. Further, in the post-green revolution years, we find peaks during the years 1968-69, 75-76, 78-79 and 81-82. From 1981-82 to 1984-85, there was a continuous rise, with a maximum of 980.30 thousand tonnes in 1984-85.

In respect of the share of AP in all India consumption of fertilizers, it has always been greater than 1/10th (except in 1972-73 and 73-74). It is also interesting to see that the share of AP in the pre-green revolution period was predominant, crossing 20.0 per cent.[46] In the latter phase, the share became maximum with 17.22 per cent in 1968-69. From this, we can infer that in the latter phase, many other regions in the country should have expanded their consumption of fertilizers at a very fast pace compared with the pre-green revolution period.

As seen from per hectare fertilizer use, it is clear that AP position has always been higher than that of all-India, with nearly 50.0 per cent higher quantity. In 1959-60, in AP, per hectare use was 3.09 Kg. while in all-India it was 2.00 Kg. only. In 1966-67, the figures of AP and all-India were 24.35 and 11.04 Kg. and by 1985-86, they rose to

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46. In fact, the fertilizer use of AP in 1962-63 formed just more than 1/4th of the total fertilizer use in all-India.

73.40 and 47.80 Kg. respectively.

(iv) Area under High Yielding Varieties:

The increasing use of HYV seeds is another aspect of the bio-chemical technology. Table 2.15 shows the expansion of area under HYVs under five major crops, viz., paddy, jowar, bajra, maize and wheat. The data are shown from the initial year of the green-revolution, i.e., 1966-67. As seen from the Table, paddy has had a predominantly higher share in the total area under HYVs, followed by jowar while the lowest share was for wheat. The total area under HYVs was only 324 thousand hectares in 1966-67 and upto 1971-72, the increase was marginal. During 1972-75, the increase occurred at a rapid speed but thereafter, it was more or less gradual, reaching a maximum of 4278 thousand hectares in 1983-84, where the peak for HYV paddy could also be observed. A similar pattern is observed for the share of total HYV area in GCA of all crops and in cropped area of the five crops under consideration; and their peaks fell in 1983-84 and 1984-85 with 31.94 and 63.93 per cent respectively.[47]

Now we may also look at the shares of HYV paddy and jowar in their respective cropped area in AP. The share of HYV paddy began to show increasing trend at an accelerated rate from 1969-70 onwards.[48] During the 1980s, the share

47. At each point of time, the former share is almost equal to half of the latter share, as the GCA under those five crops is nearly half of the GCA under all crops.

48. This year being the initial year of the fourth five year plan, it appears, some impetus should have been given.

Table 2.15: Expansion of Area under High Yielding Varieties

Year	Area in '000 Hectares						% Share of HYV Area in GCA of A.P	% Share of HYV in GCA of the 5 Crops A.P	% share of HYV Paddy in GCA of Paddy in A.P	% Share of HYV Jowar in GCA of Jowar in A.P	% Share of HYV Area of A.P in HYV Area in all India	% Share of HYV Paddy of A.P in all India HYV Paddy	% Share of HYV Jowar of A.P in all India HYV Jowar
	Paddy	Jowar	Bajra	Maize	Wheat	Total							
1. 66-67	275	36	3	10	..	324	2.56	4.80	8.28	1.42	17.18	30.97	18.85
2. 67-68	351	32	25	20	..	428	3.35	6.38	10.33	1.29	7.09	19.66	5.31
3. 68-69	205	15	27	25	..	272	2.18	4.15	6.71	0.56	2.95	7.65	2.17
4. 69-70	676	21	23	28	10	758	5.77	11.01	20.48	0.77	6.64	15.57	3.78
5. 70-71	542	28	32	33	15	650	4.87	9.36	15.39	1.09	4.23	9.70	3.49
6. 71-72	725	37	42	33	26	863	6.82	13.51	23.84	1.46	4.75	9.76	5.38
7. 72-73	1200	130	130	50	70	1580	12.83	23.98	40.99	4.57	7.08	14.69	14.98
8. 73-74	1811	250	172	57	29	2319	17.52	33.09	53.61	9.11	8.91	18.15	21.65
9. 74-75	2413	168	189	89	43	2902	21.84	41.51	67.90	6.62	10.62	21.53	12.81
10. 75-76	2477	189	174	92	31	2962	22.86	40.90	63.60	7.89	9.29	19.91	9.65
11. 76-77	2024	150	203	73	32	2482	20.92	38.26	56.77	7.34	7.40	15.18	6.33
12. 77-78	2413	248	169	84	32	2946	23.50	42.90	65.89	10.74	7.57	14.97	7.90
13. 78-79	2671	240	213	99	37	3260	24.85	47.03	72.60	10.23	8.12	15.82	7.82
14. 79-80	2244	316	188	100	30	2878	23.44	43.42	64.68	13.17	7.50	14.03	10.35
15 80-81	2788	474	310	72	42	3686	30.01	56.66	77.44	23.08	8.15	15.07	11.33
16. 81-82	3086	449	309	124	30	3998	30.64	57.69	80.71	20.28	8.60	15.68	11.57
17. 82-83	3075	500	371	100	27	4073	31.90	61.72	84.53	23.61	8.58	16.32	11.43
18. 83-84	3460	342	270	180	26	4278	31.94	61.19	83.10	17.32	7.96	15.89	6.48
19. 84-85	3045	350	317	158	19	3889	31.85	63.93	87.06	18.79	7.18	13.37	6.89
20. 85-86	2786	433	281	138	18	3656	30.21	62.52	79.66	25.60	6.71	11.86	8.52
21. 86-87	3124	531	288	158	11	4112	..	..	..	..	7.33	13.01	9.66

Source: Fertiliser Association of India, Fertilizer Statistics, for Several Years assumed more than 80.0 per cent of cropped area under paddy, which is undoubtedly a remarkable rate of switch over. The area under HYV jowar started increasing from 1972-73, while its cropped area itself began to decline thereafter (both area in absolute terms). This combined effect resulted in an increasing share of HYV jowar in its cropped area and it is significant in the 80's, touching a maximum of 25.6 per cent in 1985-86. Thus, there is still a large potential for HYV expansion for jowar.

As regards the share of AP in the total HYV area of all India, it was the highest in the initial year (17.18%) and upto 1971-72 the share declined. However, later the share was never less than 6.71 per cent and varied between 1/15th and 1/9th of the total HYV area in all India. Looking at the share of AP in HYV paddy of all India, the initial year showed 31.0 per cent and most of the time, between 1972-73 and 1983-84, it was never less than 15.0 per cent. For jowar also, this share was fairly big especially from 1972-73 onwards (in the initial year, the share was as high as 19.0 per cent).

Summary

As a single largest source of income and the highest absorber of labour force, agricultural sector still dominates in AP's economy. Compared with India as a whole, AP is more of an agriculture-based economy. The growth in AP agriculture picked up in the post-green revolution period. The income generated in agriculture rose by 3.00 per cent during 1967-68 to 1975-76 and 3.85 per cent during 1976-77 to 1985-86.

The agricultural sector had its share of some significant developments. For the past two decades or so, food crops dominated the total crop production, with a 3/4th share of GCA. Paddy, jowar, groundnut and bajra are the main crops which together occupied nearly 60.0 per cent of GCA in 1985-86. Paddy alone commands a lion's share in the total cropped area (i.e. 30.06 per cent in the peak year 1975-76). In the pre-green revolution period, maize, sugarcane, paddy and tur had shown higher rates of growth in their output. The growth of output in respect of the most dominant crop - paddy - was contributed nearly equally both by yield and area expansions, whereas for the output growth of maize, yield expansion contributed a larger share. However, groundnut output showed a negative growth in this period, mainly because of decline in its yield levels.

In the post-green revolution phase, the growth rates of output of the major crops showed a moderate performance compared to those in the earlier period. In this period, cotton recorded the highest growth followed by maize, groundnut and paddy. For these crops (except groundnut), growth of output was contributed mainly by yield expansions. Further, a significant feature of state agriculture was that in this phase 80.0 per cent of output growth for paddy was contributed by yield alone. Although the growth performance of major crops was not higher in the post-green revolution period, as was demonstrably experienced in Punjab, yet it looked fairly well. Further, most of the crops have shown higher levels of yield in the post-green revolution phase. Compared with the national performance, yield rates for a few crops expanded more impressively in the state. Thus, on the whole, the green revolution effect was discernible in more ways than one.

To this, 'satisfactory' performance of agricultural sector in AP, the contribution of institutional and technological factors needs to be underlined. The land reforms, though not radical both in content and implementation, could still promote some degree of self-cultivation in the state. Besides, they provided some incentives to tenant operators by way of 'reasonable rent fixtures' or 'security of tenure'. Nevertheless, the total impact of land reforms was extremely limited in AP as in other parts of India. On the technological front, the agricultural sector experienced a few major changes, through expansion of irrigation, increasing investment in modern implements and machinery, use of chemical fertilizers and extension of area under HYVs at a fairly high rate. Thus, after the onset of the green-revolution in the late sixties, the performance of agriculture was better in many respects compared to that in the pre-green revolution years. Although we have not examined the inter-regional and/or inter-district differences in agricultural growth, yet it is fairly widely known by now that such spatial variations also assumed serious proportions.

CHAPTER - III

DATA, VARIABLES AND METHODOLOGY

In this chapter, we describe data base, variables and methodology, since this is important to keep our study free of ambiquities.

1. Data Base :

The present study is based on primary data, collected from a field survey. As our main objective is to look into the production structure both at farm-size and regional levels, we collected data on various aspects of the farming community (including employment, consumption etc.), with a special stress on the input-output structure in the agricultural production. The data relates to the agricultural year 1984-85. Data collection was done during September-December, 1985. As is usual in most of surveys, the limitations of the study are: (i) data relating to a single year and (ii) memory bias of the respondents, as survey method was followed.

2. Sample Design :

For our study, we have chosen two regions, which differ substantially in their technology levels, from Andhra Pradesh. They are Coastal Andhra and Telangana regions. Coastal Andhra is an agriculturally advanced region. In contrast, Telangana is much less developed.[1] The technological gap between Coastal Andhra and Telangana may be attributed to their different historical and socio-political conditions that persisted in the pre-independence period. Coastal Andhra was under the British rule whereas Telangana was under the Nizam's feudal rule. In Coastal Andhra, since the middle of 19th century, government canals were constructed under various irrigation projects, such as anicuts on the Godavari. Once irrigation was provided, the potential for agricultural development could be realised. G.N. Rao says, "Dam irrigation did bring out a significant change in the fortunes of the peasants. However, the agricultural stagnation of pre-anicut Coastal Andhra was in no small measure, due to the disincentives inherent in the exploitative agrarian system."[2] Whereas in Telangana, no state-sponsored irrigation systems were provided, except in a few pockets. As a result, agriculture in Telangana remained

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1. As a matter of fact, Andhra Pradesh may be divided into three administrative regions viz. Coastal Andhra, Rayalasima and Telangana. The three regions represent three levels of development and Rayalasima may be treated as an intermediate development scenario.

2. G.N. Rao, "Agrarian Relations in Coastal Andhra under Early British Rule", Social Scientist, Vol.6, No.1, August, 1977, p.19. Further, Rao says that agriculture was made worse by the Britishers due to permanent settlement of 1803-04 and the way they dealt with the land settlement between 1765 and 1803. See his article, "Stagnation and Decay of the Agricultural Economy of Coastal Andhra", Artha Vijnana, Vol.20, No.3, September 1978, pp.221-243.

backward. Further, from the point of view of institutional structure, in Coastal Andhra, there was mostly ryotwari tenure which was conducive to agricultural advancement. In contrast, in Telangana, there were mainly Jagirdari and Jamindari tenures that perpetuated feudal and semi-feudal relations of production and agriculture became disincentive-ridden.[3]

Coastal Andhra, endowed with a much better institutional structure and a network of irrigation facilities, opened up further ways for agricultural development in the post-independence period. And then, since 1960s, new agricultural technology has also penetrated into this region, when West Godavari district was chosen as IADP district and HYV programme for paddy was introduced in 1965-66. Thus, Coastal Andhra, which was a better agricultural region to begin with became more advanced in the post independence years.

By the time Telangana became part of Andhra Pradesh in 1956, land reform measures, viz. Abolition of Jagirdari system and Tenancy Acts, had already been undertaken there. Since then, agriculture in this region showed some dynamism, but in total terms, it could develop only marginally, due to

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3. A.M. Khusro, <u>Economic and Social Effects of Jagirdari Abolition and Land Reforms in Hyderabad State</u>, Osmania University Press, Hyderabad, 1958. He reports that there were 82 types of illegal exactions imposed against the peasantry, which represented an extra-economic coercion, that forms the basis of feudal/semi-feudal oppression.

its inherent and embedded traditional character in institutional and technological spheres. Thus, Telangana by contrast is still a much less developed region of Andhra Pradesh.

It is against this background, that we choose to bring out the contrasts between these two regions,differing significantly in their agricultural technology.

Selection of Districts :

Instead of spreading the sample over the entire regions, it is advisable to concentrate on one representative district from each region. From Coastal Andhra, our choice was in favour of West Godavari District. This District has the highest percentage of irrigated area, highest incidence of tractorisation in the state and it was also the IADP district where HYV programme was initiated from its very inception. From every conceivable angle, this district represents unquestionably an agriculturally developed scenario. In Telengana, our choice went in favour of Khammam District. This District is endowed with much lower levels of irrigation; in fact from every comparable angle, this district reflects a low level of agricultural development. Interestingly, this district is contiguous to West Godavari. Hereafter, we call West Godavari as Region-I or R-I and Khammam as Region-II or R-II.

Selection of Villages :

The selection of villages in each district was made on purposive basis. Seven villages were covered from each district, making a total of 14 villages in the Survey. As regards the villages in West Godavari, they were so chosen, so as to show very high level of irrigation development, in most cases cent per cent irrigation, spread over a few taluqs/mandals. The villages in Khammam District were taken from the least irrigated taluqs/mandals; so that the sample villages would represent the less developed agricultural conditions.

Selection of households

From each village, twenty (20) households were selected, thus making 140 households in each region and 280 households in the total survey. The households were drawn by random sampling. In each village, the complete listing of households was prepared on the basis of net operated area. The listing schedule contained the name of the head of the household and its net operated area so that a tick could be marked in the columns of the three pre-set categories of farm-size. In a big village, the listing was prepared only for the chosen hamlets of the village instead of listing the entire village.

Three farm-size categories are delineated for in-depth analysis. These are small, medium and large farms, defined as follows on the basis of net operated area (NOA) :

1. Small farmers : Operating NOA less than or equal to 5 acres.

2. Medium farmers : Operating NOA greater than 5 acres but less than or equal to 10 acres.

3. Large farmers : Operating NOA greater than 10 acres

3. <u>The Variables</u>

It is necessary to describe, in reasonable detail, the procedure followed for computing the variables used in the study. The computation involves some conceptual exercises both at household and crop levels. In case of a few variables, they are measured in physical terms, whereas in most other cases, they are in value terms (Rupees). Further, some of the input variables are traditional (land, human and bullock labour), some are modern (improved seeds, irrigation, chemical fertilisers and pesticides), and some are partly modern and partly traditional (implements and machinery). In view of this, we take up the description of the computation procedure in this section to keep the definitional aberrations at the minimum.

<u>Gross Output, Productivity/Yield Rate</u>

At the crop level, it is the value of gross output, including the by-product, evaluated at actual price for sold output and at harvest prices prevalent in the particular village for the unsold output. At farm level, it is the aggregate value of all the crops grown during the year. Further, productivity, overall yield rate and yield rate are defined as follows :

(i)	Productivity	: Gross output (of all crops) per acre of net operated area.
(ii)	Overall yield Rate	: Gross output (of all crops) per acre of gross cropped area.
(iii)	Yield Rate	: Gross output of an individual crop per acre of its cropped area (both seasons).

Land

(a) Net operated area (NOA) of the household is taken into account for consideration of capital assets and other assets on per acre basis. Further, it is this area on the basis of which we divide the farm households into different farm-size categories (small, medium and large), as mentioned above.

(b) Gross cropped area (GCA) is the aggregation of the cropped area under all the crops. In other words, it is the total of all cropped area under kharif and rabi crops.

An important point to be made clear is that we did not have to do any standardisation of land as an input factor, since each region of our study possesses the land more or less of the same quality.

Human Labour

Human labour is measured in terms of adult man-days, each manday consisting of 8 hours of work. This is derived by the summation of man-equivalent days of family, exchange, permanent and casual labour. As regards conversion of female labour into man-equivalent days, we have not applied blanket conversion ratio (1:0.75) to all field crop operations. For example, in a purely physical work performance, the female labour in weeding and transplantation operations is, no way less, efficient than male labour. As a matter of fact, in these operations, only a part of the work is taken up by the male labourers. As such for these two operations, conversion ratio 1:1 has been adopted. Child labour has been reported only in the family labour and in this case, conversion ratio 1:0.5 has been taken as usual. Thus, for each crop, computation has been made first and then aggregated at the household level.

Bullock Labour Days

This is measured in standardised bullock pair days. If each standardised bullock day is of 8 hours, a pair day automatically becomes equal to 16 hours work of bullocks. For each crop first and then for all the crops put together these pair days have been calculated. Hereafter, a bullock day may be taken as a pair day.

Capital Services

Capital services are measured as the expenditure on the flow of services of own capital assets going into crop production plus payment made for hiring in of those services. That is, the stock is first converted into a flow, per unit of time, and then allocated among different crops. For this purpose, capital assets are divided into (i) tractor and its ancillaries, (ii) sprayer, and (iii) traditional equipment (plough set etc.).

(i) Tractor and its Ancillaries

In R-II, none of the farms owns a tractor. In R-I, out of 140 sample households, only 11 households own tractor and/ancillaries. However, all households in R-I use tractor services. That is, in all 129 non-tractor owning cases, it is only hire charges that makes up this item. Thus, the computation in these cases is not a problem. In the case of owners of tractor and ancillaries, the computation assumes some problem, as all of the owners, hire out services and earn on it as if it is a source of income. In such a case, we cannot take the entire income as rent and subtract it from the depreciation, as was done in some studies.[4] Further, as regards the charge of interest on working capital and the inventory value of fixed capital, we feel it necessary. As far back as 1960, the charge of interest on working capital was an accepted norm, as Agrawal says:[5]

> A practice is to charge interest on total working capital for six months, i.e. half the agricultural year. For simplicity, this method commends itself and with increasing intensive farming in India, it is indeed necessary to charge interest on operating expenses.

Thus, in this spirit, it may be fully justified in charging interest on fixed capital to arrive at the

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4. G.K. Chadha, Production Gains of New Agricultural Technology, Publication Bureau, Punjab University, 1979, p.30.

5. G.D. Agrawal, "Apportionment, Evaluation and Allocation", p.130, in Indian Society of Agricultural Economics (ed.), Cost Studies in Agriculture, Bombay, 1961.

expenditure on capital services.

The total cost is computed by the summation of the items, (a) depreciation of tractor and tractor-ancillaries based on straight line method, (b) interest at 12 per cent per annum on their inventory value, (c) minor repairs and operating expenses, (d) interest at 12 per cent per annum for half year on item (c).

i.e. Total cost = (a)+(b)+(c)+(d)

If we divide the total cost by the total hours of use of the tractor (own use plus hired out), we get per hour cost on tractor services. On this basis, the own tractor services are calculated both at crop and farm levels. If we add the hired-in charges to this, we get the corresponding total expenditure on tractor services.

(ii) Sprayer

At farm level, own sprayer charges are calculated by the summation of the items: (a) depreciation and (b) interest at 12 per cent per annum on the inventory value of the sprayer. As regards the crop-level charges, it is arrived at by multiplying the total expenditure with the ratio of hours on the crop to the total hours of use on the farm. To arrive at total expenditure on sprayer, at crop and farm levels, the hired-in charges are added to own sprayer expenditure.

(iii) Traditional Equipment

Traditional equipment is mainly plough set (of different types), axe, sickle, hoe and spade. At farm level, the expenditure on this equipment is computed by the aggregation of the items: (a) depreciation, (b) interest on the inventory value for a year at 12 per cent, and (c) artisan charges in the village for their repair and maintenance. Allocation at crop level is arrived at on the basis of proportion of man-equivalent days on each crop.[6] Hired-in charges are then added to get the total expenditure.

Bullock Expenditure

This is also the expenditure converted into flow per unit time on the bullocks/draught cattle. First it is calculated at farm level as follows:

(i) Depreciation on draught bullocks and other draught animals is worked out on the basis of the age of the animals by the standard FMS approach. The first three years of age relates to appreciation of value, the fourth and fifth years have constant value and then depreciation starts.

(ii) Interest at 12 per cent per annum on their inventory value charged.

(iii) Expenditure on their feed and medicines. The feed mainly consists of green and dry fodder. The fodder is generally from own sources and this is evaluated at village level prices.

(iv) Interest for half year at 12 per cent per annum on the item (iii)

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6. J.K. Pande, "Principles of Evaluation and Apportionment of Items of Cost", p.141, in Indian Society of Agricultural Economics, op.cit.

(v) Cost of labour (permanent and casual) on the maintenance of these draught animals.

Items (iii) and (v) are separated out from the common expenditure of the total livestock. Then, total expenditure on draught cattle = (i) + (ii) + (iii) + (iv) + (v) at farm level.

At crop level, bullock expenditure is arrived at by multiplying the ratio of bullock labour days on a particular crop to the total bullock days, with the total bullock expenditure arrived at earlier. So far, it is only an evaluation of own bullock labour. To get at total bullock expenditure, we add hire bullock charges both at crop and farm levels.

Irrigation Expenditure

At farm level, this expenditure is arrived at by the addition of (i) depreciation of irrigation structures (oil engines, electric motor and pipe lines), (ii) interest on their inventory value, (iii) minor repairs and operating expenses, and (iv) interest charge for half a year on item (iii). From this sum, the earnings got by hiring out this equipment (mainly oil engine), have been subtracted, treating them as rent for the engine. At crop level, this is computed on the basis of proportionate irrigated area of the particular crop in the total irrigated area on the farm. Ultimately, the water cess etc. paid to the government have been added, along with hire charges, if any.

Rent Paid

It is the value of rent paid in cash or kind. This was available at crop and season levels in the developed region (R-I), whereas in the backward region (R-II), it was available on yearly basis. In such cases, it was allocated according to the proportion of area under the crop to the total area cropped.

Paid out Labour Charges

The hired-in labour is of two types, (i) permanent and (ii) casual. As regards the charges paid to the casual labour it was reported operation-wise for each crop and so the problem of evaluation is minimised. But, in regard to permanent labour, there is a problem. At farm level, the permanent labour is first divided into three heads : (i) crop production, (ii) upkeep of livestock, and (iii) household activities. The permanent labour is standardised in the first two categories only. The total of standardised permanent labour days on crop production and upkeep of livestock is used as denominator to compute the per day labour charges on permanent labour. As the permanent labour days were available on each crop in each operation, it is not much difficult to get crop-wise permanent labour cost. Finally, the aggregated paid out labour charges of casual and permanent labour, with interest for half year at 12 per cent, have been arrived at.

Miscellaneous Expenditure

This is the expenditure incurred towards transport of the harvested crop from the field to the home or to the market. In this item, we include some non-specific sundry expenditure items.

Bio-chemical Inputs

In bio-chemical inputs are included seed, manure, chemical fertilisers and pesticides. Among these, seed and manure involve evaluation problem, as some portion of these inputs are provided from family farm itself. In such cases, the evaluation has been done on the basis of village level prices. Further, since these inputs form part of working capital, they are charged interest at 12 per cent per annum for half a year. A similar procedure is observed when expenditure on individual items of the bio-chemical inputs or in some combination (for example, manure plus chemical fertilisers) are involved. As the crop level figures are easy to find, it is aggregated to give farm level information.

Total Cost (Cost A_2)

In the farm management literature, the total cost is defined in four major ways: Cost A_1, Cost A_2, Cost B, Cost C, depending on the nature and extent of imputations for own factors/resources. In our study, we confine ourselves to Cost A_2 only. However, our version of Cost A_2 is slightly different from the conventional format, as is made clear below. We get Cost A_2 by the summation of our variables viz.

(i) Total bio-chemical package
(ii) Capital Services
(iii) Bullock expenditure
(iv) Paid out labour charges
(v) Paid out rent on leased-in land
(vi) Miscellaneous expenditure

In our computation of these variables, we have included interest not only on working capital but also on fixed capital. In the FMS, interest on fixed capital is not charged in the definition of Cost A_2.

Farm Business Income (FBI) = I_1

Farm Business Income is the net return derived by subtracting Cost A_2 from value of gross output. This is got first at individual crop level and then aggregated to arrive at FBI at farm level as a whole. It is somewhat different from the usual FMS definition, in as much as our FBI is the composite returns for family land, labour and management.

Non-self Farming Income (NFI) = I_2

This is the income earned outside own farm activities, on part-time basis by farm family workers (FFWs) and on full-time basis by non-agricultural workers (NAWs) of the household and miscellaneous receipts. The FFWs may involve in agricultural wage-paid employment and non-agricultural employment - wage-paid and/self-employed. The NAWs work only in non-agricultural wage-paid and/self-employment. Further, the income from dairying is treated as the contribution of self-employment of the FFWs. Thus, income from avenues other than own-farm activity may be categorised as :

(i) Income from dairying by FFWs
(ii) Income from agricultural wage employment by FFWs
(iii) Income from non-agricultural avenues by FFWs
(iv) Income from non-agricultural avenues by NAWs

To the above 4 types of earned income, we add miscellaneous receipts, which are the receipts like pension, interest, rent etc. The main point here to be kept in view is that the amount of miscellaneous receipts is not due to any employment of the family members; it is the sum total of transfer payments.

<u>Net Household Income (NHI)</u> = I_3

This is the summation of individual income components. Thus

$$I_3 = I_1 + I_2$$

<u>Total Agricultural Employment</u> = E_1

Total agricultural employment of the household is based on three sources, viz. (i) Own-farm activity, (ii) Upkeep of animals, (iii) Wage-paid agricultural employment including bullock-cart driving. As a matter of fact, all these employments are taken up by the FFWs in various combinations. The summation of these three sources gives the total agricultural employment of the household.

<u>Total Non-Agricultural Employment</u> = E_2

This is the employment of the household in non-agricultural avenues (wage-paid and / self-employment) taken up by both FFWs and NAWs.

Total Household Employment = E_3

This is the aggregation of the total agricultural employment and total non-agricultural employments. Thus,

$$E_3 = E_1 + E_2$$

Poverty

We have adopted the simple head count method. First, we find the per capita net household income (NHI) of the farming households in each region and compare it with the cut-off point to compute the incidence of poverty in R-I and R-II.

Consumption Expenditure

To include consumption pattern in our study is to see the inter-relationship between income-consumption nexus. In line with the NSS pattern total consumption expenditure has been considered for 15 broad categories. Among them, eight are food items: 1) cereals, 2) pulses, 3) milk and milk products, 4) edible oils, 5) vegetables, 6) spices and salt, 7) meat and fish including eggs, and 8) sugar and tea. The remaining seven are non-food items: 1) tobacco and intoxicants, 2) fuel and light, 3) cloth and footwear, 4) health care and medicine, 5) conveyance and entertainment, 6) education, and 7) miscellaneous non-food expenditure. The miscellaneous expenditure includes expenditure on soap, paste etc., and social ceremonies (including marriages).

4. Methodology

In the present study, our main thrust is to look into the variations in the production structure of agriculture between the regions and across the farm-size categories. In most of the cases, we have made comparative analysis based on the averages of the regions and of the three farm-size groups within each region. These averages are mainly on per acre basis. While considering the capital stock, the net operated area is used as the denominator to arrive at per acre capital stock (Chapter V). In the study of resource-use efficiency (Chapter VI) and costs and returns (Chapter VII), the averages have been based on the gross cropped area of the individual and for total crop levels. In most of the cases, the averages have been tested for statistical significance either by t-test or Cochran and Cox test. The former test is used if the population variances for one or more pairs of samples are not statistically different; if otherwise, the latter test is applied, for comparing the means between any two farm-size categories.

We would like to explain the reasoning for taking up our analysis on per acre basis instead of per worker criterion. So long as an agricultural economy operates under land-scarce and labour-surplus conditions, the analysis on per acre basis would remain valid and extremely relevant, because the most critical condition for agricultural development is the maximisation of gross output per acre. This condition (maximum output per acre) allows the maximisation of employment of labour even when its marginal productivity approaches zero under labour-displacing effects that are at work all along the production contour. Roegen and Dandekar claim it to be a feudal formula[7] and support its application. Banaji says that this condition reflects itself in (i) Chayanovian view that accepts the viability of small-scale agriculture (due to consumer pressure or availability of surplus labour), and (ii) the Marxian view that small-scale agriculture persists, depending only on wasteful use of surplus labour that causes overwork and under-consumption. It is from this perspective, the criteria of maximum gross output per acre and maximum net return (FBI) per acre are justified from the household's point of view:[8]

> The labour-intensifying techniques which households, faced with the pressure of surplus labour or consumer demand (c/w), adopt by way of expanding the annual consumption fund will not necessarily increase the productivity of each unit of labour expended, they must, however, increase the gross output per unit of land area worked... Since, by the argument proposed, what matters to an enterprise of this sort is an expansion of family-income, adoption of labour-intensifying techniques would be fully justified from the household's point of view, as long as they expand net output (farm business income) per acre, even if at lower levels of labour-productivity and payment.

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7. N. Georgescu Roegen, "Economic Theory and Agrarian Economics", (pp.144-169) V.M. Dandekar, "Economic Theory and Agrarian Reform", (pp.169-180), both in Carl Eicher and Lawrence Witt (eds.), Agriculture in Economic Development, Mc Graw Hill Book Company, New York, 1964.

8. J. Banaji, "Chayanov, Kautsky, Lenin : Considerations towards a Synthesis, Economic and Political Weekly, October 2, 1976, p.1597. Further, he says that the entire agrarian policy followed by the capitalist states of the backward countries from the mid-sixties onwards hinged on the state promoted diffusion of the labour-intensive techniques.

For determining the relative significance of the selected input factors, a simple production function analysis has been adopted, using Cobb Douglas Production Function. The test for constant returns to scale has been done on the basis of F-test by the null hypothesis that sum of betas is equal to unity.

Then, we proceed to consider employment, income and consumption pattern. The analysis here is made, by and large, at the household level. Wherever it is deemed fit, the analysis was also made on per capita basis. In the study of employment and income, we have used household averages in the three farm-size categories, while for consumption we have used per capita basis. As regards consumption pattern, we have analysed it in various ways. The differences in the individual commodity expenditures, both in absolute and relative terms, have been considered. The variations in share of home produce in the individual commodity expenditures have also been taken up. To estimate expenditure elasticities and saturation limits for different commodities, Engel functions have been fitted. The types of Engel functions and their comparability are detailed in Chapter VIII.

To measure inequality in respect of net operated area (NOA), net household income (NHI), farm business income (FBI), and individual commodity expenditures and total commodity expenditure, we arrange data into deciles, on the basis of NOA. Also we compute Gini Coefficient for a number of items.

In regard to the incidence of poverty, two cut-off points are available to us: One is the minimum per capita income Rs.15.50 per capita per mensem and the other is Rs.20.00 per capita per mensem, both at 1960-61 prices. The former figure is due to Bardhan and the latter figure is as suggested by the Planning Commission. We work out incidence of poverty with reference to both cut-off points.

CHAPTER - IV

GENERAL INFORMATION OF SURVEY AREAS

As the objective of the study is to look into the variations in respect of the technology level and production structure between the developed and developing regions as also across the farm-size groups, an attempt is made in this chapter to grapple with the economic characteristics of the regions and the farm-size groups. These characteristics provide some background insights for explaining the technology and production structure variations. It is likely that even in terms of introductory information, the developed region throws up clues about the resource structure or technological superiority, particularly among one group of farm operators against another, and one can comprehend the relative agrarian situations in a much better way.

From each of the two regions, 140 households have been selected. The households have been so chosen that to the head of the family involves, agriculture is the main occupation. For analytical convenience, as also to fall in line with the general convention, the households operating less than or equal to 5 acres are treated as small farms, those operating between 5 and 10 acres as medium farms and those operating more than 10 acres as large farms.

1. Family Size and Other related Variables

We begin with a few introductory socio-economic indicators relating to the sample households set in Table 4.1.

Family Size

In R-I, the average family size is 4.99 against 6.38 in R-II. The small family size in R-I is perhaps the effect of the campaigns of family planning while the large family size in R-II can be attributed not only to low adoption of family planning but also to still prevailing joint family system. In both the regions, there is a positive association of family size with the farm-size. This is a well accepted aspect of agrarian reality and is variously confirmed by farm management data as well as national sample surveys. In respect of all categories of farm-size, the family size is higher in R-II than in R-I.

Educational Levels of Heads

In respect of educational level of the head of the household, the two regions present a very contrasting picture. In R-I, only 1/6th of the farmers are illiterate whereas in R-II, more than half are illiterate. In contradistinction to the relative picture in illiteracy, in R-I there are 15 per cent farmers with inter and higher level of education, while in R-II only 2 per cent farmers have had such education. Looking at farm size, it is observed that in R-I nearly 45 per cent of the large farmers have inter and higher level of education, whereas 4.0 and 12.5 per cent of the small and the medium farmers have had such education.

Table 4.1 : Introductory Information on Sample Farms

Item	REGION I				REGION II			
	Small	Medium	Large	Total	Small	Medium	Large	Total
1. No. of House holds	77 (55.00)	32 (22.86)	31 (22.14)	140 (100.00)	60 (42.86)	45 (32.14)	35 (25.00)	140 (100.00)
2. Family size	4.52	5.00	6.13	4.99	5.48	6.27	8.06	6.38
3. Education Level of Head of the family (%):								
(i) Illiterate	22.08	15.63	3.22	16.43	55.00	60.00	42.86	53.57
(ii) Primary	44.16	50.00	19.36	40.00	35.00	24.44	31.43	30.71
(iii) High School	29.86	21.88	32.26	28.57	10.00	13.34	20.00	13.57
(iv) Int.& above	3.90	12.49	45.16	15.00	–	2.22	5.71	2.15
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4. FFW per Household	2.29	2.09	1.74	2.12	2.30	3.04	2.80	2.66
5. % FFW to Family members	50.57	41.87	28.42	42.55	41.95	48.58	34.75	41.77
6. FFW/Acre of NOA	0.80	0.28	0.09	0.28	0.72	0.40	0.17	0.33
7. PW per Household	0.14	0.65	1.83	0.64	0.05	0.22	1.03	0.35
8. % Households Reporting PW	14.00	53.00	81.00	38.00	3.00	18.00	46.00	19.00
9. PW/Acre of NOA	0.05	0.09	0.09	0.08	0.02	0.03	0.06	0.04

Note: Figures in parentheses are percentages in total farms

FFW = Family Farm Workers
PW = Permanent Workers
NOA = Net Operated Area

Only one illiterate is found among the large farmers (forming 3.2 per cent). However, among the small and the medium farmers their percentage is 22.0 and 16.0 respectively. If we turn to R-II, illiteracy is less among the large farmers (only 43.0 per cent), but it is fairly high among the medium and the small farmers, being 60.0 and 55.0 per cent respectively.

Thus, on the whole, R-I represents a situation of higher education compared with R-II. However, the variations in educational standards across the farm-size ladder are more glaring in R-I than R-II.

Family Farm Workers (FFW)

The number of family farm workers per household is higher in R-II than in R-I (2.66 in R-II and 2.12 in R.I). Across the farm-size ladder, it seems to have a positive association with farm-size in R-II, whereas it appears to be in inverse relation in R-I. Further FFW per household among the small farms is almost equal in both the regions, but it is nearly 50 per cent higher on the medium and the large farms of R-II than in R-I. This is partly accounted for by the lower participation of family members in agriculture by the medium and the large farms in R-I as is also made clear below.

Percentage of FFW to total family members is the same (around 42 per cent) in both the regions. Further, it is inversely related with farm-size in R-I, although no systematic relation seems to exist in R-II. In both the regions, the percentages are relatively lower for the large farms; this is especially so in R-I. In any case, it is fairly evident that on large farms, a lot of labour is engaged from outside.

As regards FFW per acre of NOA, it is not much different between the two regions. In both the regions, there is an inverse relation between farm-size and FFW/NOA. In other words, the man : land ratio goes on shrinking as we climb up the farm-size hierarchy which tends to suggest a substantially higher dependence of family workers on land on small/marginal farms, possibly because of relatively limited non-agricultural employment openings available to them.

Permanent Workers (PW)

The percentage of households reporting permanent workers (PW) is 38 in R-I, whereas it is only half in R-II (19 per cent). The percentage maintains a positive association with farm-size in both the regions. In R-II, even among the large farms it is only 46 per cent. But in R-I, the medium and the large farms have the percentage as high as 53 and 81 per cent respectively.

The PW per household is almost double in R-I of what it is in R-II. Here also it is positively related with farm-size in both the regions. In R-I, the small and the medium farms have 3 times higher values than what their counterparts have in R-II.

In regard to the PW per acre of NOA, it is double in R-I of what it is in R-II. In both the regions, it has a positive association with farm size.

Thus, in respect of the above aspects for the PW, the values are positively associated with farm-size and all those values in absolute magnitudes are higher in R-I than in R-II for each category of farm-size. From this, it can easily be maintained that the incidence and the extent of engaging the PW is higher in the developed region (R-I) compared with the less developed region (R-II). Presumably, it assures a degree of labour supply to medium and big farmers of R-I while the demand for labour has a slightly different pattern in the less developed region (R-II).

2. Landholdings Distribution

Land in the developed region of our study, being rich in soil nutrients and canal irrigated, is costly. In the less developed region, the land *per se* is not of bad quality, but lack of irrigation facilities reduces its value in monetary terms. Moreover, cropping patterns cannot be attuned to changing technological possibilities that are available in R-II. This also helps further in making land less costly in this region.

As can be seen from Table 4.2, the average size of holdings is higher in R-II than in R-I. This is to be attributed to the fact that the NOA is greater in R-II, although the number of sample households is about the same in both the regions. In both the regions, the medium farms have almost equal shares in area and holdings. In R-I, the large farms with just about 1/5th of holdings have 2/3rds area at

Table 4.2: Operational Holdings, Area and Average size

Farm Size	No. of Hold ings	Percent age of Holdings	Net Operat ed Area (acres)	Percent age of Area	Average Size (acres)
REGION I					
Small	77	55.00	220.62	20.63	2.87
Medium	32	22.86	242.35	22.66	7.57
Large	31	22.14	606.60	66.71	19.57
Total	140	100.00	1069.57	100.00	7.64
REGION II					
Small	60	42.86	190.70	16.92	3.18
Medium	45	32.14	346.70	30.77	7.70
Large	35	25.00	589.55	52.31	16.84
Total	140	100.00	1126.95	100.00	8.05

their command and the small farms constituting nearly 55.0 per cent of holdings have only about 1/5th area at their disposal. In R-II, the large farms with 1/4th holdings have more than half of operated area whereas the small farms with 43.0 per cent holdings have access to only about 1/6th of the area operated. It is thus clear that in both the regions, there is inequitable distribution of.landholdings. If the data is further diaggregated into decile groups, the top decile group in R-I has 35 per cent area and in R-II its share is nearly 30 per cent. When the measure of inequality is found from the decile grouped data, the Gini co-efficient assumes values of 0.4761 and 0.3951 in R-I and R-II respectively. Thus, R-I has more inequitable distribution than R-II in operational holdings. This is confirmed by other studies also inasmuch land concentration tends to increase in areas which progressively become more productive under the impact of technological improvements.

As regards the land tenure structure, Table 4.3 reveals a few important features. In R-I, among the total cultivators more than 3/5ths are pure owner cultivators. In R-II, they are more than 4/5ths. Although, numerically pure tenants do not account for much in both the regions, yet their number is fairly high in R-I than in R-II. Owner-cum-tenants seem to play a major role in the land lease market. They are a little more than 1/4th in R-I, whereas in R-II they are less than 1/6th. From this, it is clear that in general the incidence of tenancy is higher in R-I than in

Table 4.3: Tenurial Structure of Sample Farms

Farm Size	Percent Holdings repoting as			Percent Area	
	Pure Owners	Owner cum Tenants	Pure Tenants	Owned	Leased in
REGION I					
Small	63.64	24.67	11.69	69.58	30.42
Medium	56.25	34.38	9.37	66.99	33.01
Large	70.97	29.03	0.00	82.43	17.57
Total	63.57	27.86	8.57	76.29	23.71
REGION II					
Small	88.33	10.00	1.67	94.49	5.51
Medium	86.67	11.11	2.22	91.78	8.22
Large	68.57	31.43	0.00	84.14	15.86
Total	82.86	15.71	1.43	88.24	11.76

R-II. The extent of tenancy is also higher in R-I as is reflected in the share of total leased-in area. The share of leased-in area in R-I is double of what it is in R-II (24.0 and 12.0 per cent respectively). In both the regions, the tenancy is oral and unrecorded. In R-I, the fixed kind rent tenancy is widely practised,[1] whereas in R-II it is the fixed cash rent tenancy which is widely prevalent.[2]

If the pattern across the farm-size ladder is considered, we may note the following features.

In R-I, the percentage of pure owners among the large farms is higher than the overall share of pure owners whereas among the small farms, it is equal to the overall percentage. The percentage of pure owners is relatively lower among the medium farmers of this region. In other words, a relatively higher proportion of the medium farms are involved in the land lease market. This is quite important as an agrarian feature of a developed agricultural region of Andhra Pradesh. It seems, middle level farmers are emerging as formidable contenders in the land lease market, *inter alia*, to capture benefits of mechanical innovations in addition to those of

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1. In this region, the fixed kind rent prevalent was 18 quintals of paddy per acre for Kharif and Rabi. For Kharif 10.5 quintals and for Rabi 7.5 quintals were collected as rent. Further, it was noticed that the owners preferred low caste farmers as tenants to make tenancy contracts safe and litigant-free.

2. In this region, the fixed cash rent varied from Rs.200 to Rs.500 per acre and there was no seasonal contract but a year's contract.

bio-chemical innovations. To pursue new technology in a comprehensive manner, every addition to land area is welcome.

For owner-cum-tenants, the percentage is the highest among the medium farmers lending further support to the above conclusion. Pure tenants as a category do not exist among the large farms while they are just about 10.0 per cent among small and medium farmers of this region (R-I).

For all categories of farmers in R-I, nearly 1/4th of the total area is leased-in. With the large farms, the leased-in area is about 1/6th of the operated area. The small and the medium farms operate with nearly 1/3rd of leased-in area (in their respective operated areas). It is evident that the large farms, having sufficient land area of their own, are not under big pressure to lease-in. Of course, in absolute terms, it is the large farms that dominate in the leased-in area.

In R-II, the percentage of pure owners is higher among the small and medium farmers than the overall share, whereas it is lower among the large farmers. It logically follows that a relatively high proportion of the large farmers are involved in the land lease market. The possible explanation for this is that the traditional agricultural scenario induces the large farmers to involve themselves in tenancy, to a large extent, for adding up more land area to avoid the diseconomies of scale in respect of their productive capital assets. After all, some balancing has to be done by them between endowment of capital equipment and the higher quantum of expenditure on many current inputs and for this, some additional land is welcome. For owner-cum-tenants, the percentage of the large farmers is the highest, being thrice as much as of the small/medium farmers, corroborating our earlier conclusion. Another important feature in R-II is that pure tenants are conspicuous by their nearly complete absence (among the large farms, there is complete absence).

In R-II, though the overall percentage of leased-in area is nearly 1/8th of the operated area, the large farms lease-in a very high proportion of their operated area (nearly 1/6th). Further, the percentage of leased-in area maintains a positive association with farm-size, indicating that increasing farm-size induces leasing-in, which may cause full utilisation of available labour and productive assets.

3. Some Aspects of Land-use

The FMS data pertaining to the mid-50's showed that the cropping intensity was inversely related to the farm-size.[3] Further, in some states, the cropping pattern was typical in making the very small and the small farms to grow cash crops in high proportion compelled by their distress economic conditions.[4] The government has realised the importance of providing irrigation since then and by the mid-

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3. Krishna Bharadwaj, Production Conditions in Indian Agriculture, Cambridge University Press, London, 1974, pp.18 & 95.

4. Ibid., p.64

sixties, irrigated area had witnessed an increase by well over 50.0 per cent. And from then onwards, especially after the onset of green revolution, the conditions have changed a lot, though not uniformly throughout the country. The seed-fertiliser technology, which, in some sense, is size-neutral, may have resulted in reversing the inverse relation of the cropping intensity, at least in the relatively progressive regions. However, the inverse relation still may be found in the underdeveloped regions. Similarly, the phenomenon of distress cropping pattern may have disappeared in some parts of India.[5] In this section, an attempt is made to deal with some of these aspects.

Cropping Intensity

In our study, the two regions represent two different development scenarios. Region-I hails from developed coastal Andhra where irrigation is also high and Region-II is from developing Telangana with low level of irrigation. As can be seen from Table 4.4, the cropping intensity is as high as 1.99 in R-I which indicates that there is cent per cent double cropping. Cropping intensity is 1.18 only in R-II which is in sharp contrast to R-I. As regards the variations across the farm size ladder, there is no variation across the

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5. G.S. Bhalla and G.K. Chadha, Green Revolution and the Small Peasant - A Study of Income Distribution among Punjab Cultivators; Concept Publishing Co., New Delhi, 1983. They say, "The distress cropping pattern pursued by marginal and to a lesser extent by small farmers, is nowhere in sight." (p.40)

TABLE 4.4: Percentage of Area Under Crops and Cropping Intensity On Sample Farms

ITEM	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Paddy	100.00	100.00	100.00	100.00	23.05	17.21	24.05	21.77
2. Jowar	–	–	–	–	26.24	28.41	22.66	25.11
3. G.Gram	–	–	–	–	25.57	20.71	9.35	15.91
4. Red Gram	–	–	–	–	3.16	7.82	7.04	6.54
5. Groundnut	–	–	–	–	12.63	17.12	26.84	21.15
6. Others	–	–	–	–	9.35	8.73	10.06	9.52
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
7. Cropping Intensity (GCA/NOA)	2.00	1.99	1.99	1.99	1.33	1.18	1.14	1.18
8. Share of each group in Total GCA	20.71	22.66	56.63	100.00	19.01	30.67	50.32	100.00

S,M,L and T are Small, Medium, Large and Total Farms three farm size categories in R-I. This is in consonance with our observation mentioned earlier, namely that the developed region tends to wipe out the differences in the cropping intensity with respect to farm-size. In contrast, in R-II, which is much less developed, there still seems to operate an inverse relation between the cropping intensity and the farm-size. Further, the following regressions from the disaggregated farm-level data also confirm the same, wherein, x = Farm-size (in acres) and y = Cropping intensity (GCA/NOA).

Region-I

$$\text{Log}_e\, y = 5.298 - \underset{(-0.6792)}{0.0024}\ \text{Log}_e\, x \qquad n = 140$$

Region-II

$$\text{Log}_e\, y = 4.952 - \underset{(-3.1655)}{0.0872^{*}}\ \text{Log}_e\, x \qquad n = 140$$

(Figures in parentheses are t-values)
* = significant at 0.01 level of t-distribution

Shares of Area under Different Crops

To probe into the cropping pattern, the shares of area under different crops are given in Table 4.4. Region-I is a region with specialization in a single crop, viz., paddy. In R-II, however, the cropping pattern is quite diversified. In the latter region, data for 14 crops was collected. Of them, only five dominant crops, viz., paddy, jowar, green gram, red gram and groundnut are chosen for individual discussion. The remaining crops together are put under the heading 'other crops'.

In R-I, paddy being the only crop, the farm-size differences could not be seen in the cropping pattern. Historically, this region has been under the regime of paddy cultivation ever since irrigation was introduced. Irrigation was provided even during the British reign, by constructing a dam on the Godavari. Further, from the point of view of agrarian constraints operating on its agriculture, this region was relatively better placed in as much as it was under the ryotwari tenure during the British rule.

In R-II, the cropping pattern is sufficiently varied. Most of the crops, being unirrigated, are so chosen as to conform to the conditions of dry land farming. At the overall level, jowar occupies 1/4th of the GCA, and paddy and groundnut each occupies a little more than 1/5th of the GCA. Thus, these three crops together occupy about 70.0 per cent of the GCA. Then, green gram and red gram occupy 4th and 5th ranks with 16.0 and 6.5 per cent of cropped area respectively.

The crops that dominate the production structure of the three farm-size categories in Region-II can be noted as follows:

(i) Among the small farms of R-II, jowar, green gram and paddy occupy nearly equal shares, around 25 per cent each. They allocate only 1/8th area for groundnut, which is the most important cash crop. From this, it can be inferred that the distress cropping pattern has not persisted in the developing region of our study.

(ii) Among the medium farms, it is jowar which is predominant and green gram comes next. These two crops together account for nearly 50 per cent area. Interestingly, in this group of farms, paddy and groundnut have equal weightages and together they occupy a more than 1/3rd area. Thus, these farms lag behind not only in respect of groundnut (cash crop) but also in paddy because of the most crucial bottleneck of irrigation.

(iii) Among the large farms, groundnut is the most important crop with nearly 27 per cent of total cropped area. Next are paddy and jowar which occupy 22 to 24 per cent of cropped area respectively. Thus, large farms alone have emerged as the main growers of the important cash crop, groundnut.

From the above it is clear that among the small and the medium farms it is jowar which is the most important crop while with the large farms it is groundnut. For this reason only, jowar becomes the dominant crop at the overall level and groundnut occupies the position on par with paddy.

For each crop, if the deviation in its share is measured from the overall percentage of cropped area, this should roughly indicate the crop preferences of each farm-size group, consistent with its land status and other resource constraints under which it has to operate. In this context, a few observations are in order :

(a) For paddy, the small and the large farms' shares are more than the overall share. As these farms have more of total irrigated area at their disposal (as can be seen from

Table 4.6 below), they grow this crop roughly in the same proportion.

(b) For jowar, the large farms have a lower than the overall share. With the small and the medium farms, the crop is fairly 'popular', perhaps because the cash requirements for cultivating some other crops especially groundnut and paddy, are rather difficult to be met in full. However, the large farms too have a share of nearly 23 per cent area under this crop, which provides fodder for their livestock.

(c) For green gram also, the small and the medium farms have higher than the overall share (with more than 1/4th and 1/5th of their areas respectively). For this crop, the large farms have a share as low as 9.4 per cent, presumably because of the labour intensive harvesting of the crop. As a result, the crop turns out to be non-remunerative to the large farms. Perhaps, they may prefer to keep the land fallow instead of growing this crop till October, when Rabi groundnut will be sown. If green gram turns out to be remunerative, the cropping intensity may be higher for the large farms, as the same land after harvesting green gram will be used for Rabi groundnut.

(d) For red gram, only the small farms have a lower than the overall share. The small farms enjoy higher cropping intensity presumably because, instead of concentrating more on this crop, they cultivate other short duration crop. It may be noted in passing that this crop takes 6 months' duration or more.

(e) For groundnut, only the large farms have a higher share than the overall share. The main reason that can be adduced for this is that the large farms can manage a relatively large dose of working capital that is typically needed for this crop over its entire production cycle. For the medium and the small farms, a free and adequate flow of working capital is generally a more live problem besides inflicting a higher degree of anticipated risk on them.

To lend statistical authenticity, to our oral reasoning, we compute Chi-square under the null hypothesis that the individual farm size-wise percentage does not significantly deviate from the overall percentage. It is found significant (at 0.05 level) only in respect of green gram for which the large farms have a share of 9.4 per cent as against the overall share of 15.9 per cent. However, the Chi-square is also significant at 0.10 level for groundnut for which the small and the medium farms have relatively lower shares than overall share.[6]

<u>Allocation of Cropped Area under Kharif and Rabi</u>

Table 4.5 read with Table 4.4, shows a few interesting features. As far as R-I is concerned, the distribution of total cropped area between Kharif and Rabi seasons

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6. For green gram, the computed Chi-square is 10.018 and for groundnut it is 5.731. At 2 degrees of freedom the table Chi-square is 5.99 at 0.05 level and 4.61 at 0.10 level.

Table 4.5: Percentage of Croped Area in Kharif and Rabi

Item	K/R	REGION I				REGION II			
		S	M	L	T	S	M	L	T
1. Paddy	K	50.06	50.26	50.33	50.26	92.81	95.03	88.72	91.04
	R	49.94	49.74	49.67	49.74	7.19	4.97	11.28	8.96
2. Jowar	K	–	–	–	–	–	–	–	–
	R	–	–	–	–	100.00	100.00	100.00	100.00
3. G.Gram	K	–	–	–	–	100.00	100.00	100.00	100.00
	R	–	–	–	–	–	–	–	–
4. R.Gram	K	–	–	–	–	100.00	100.00	100.00	100.00
	R	–	–	–	–	–	–	–	–
5. G.Nut	K	–	–	–	–	23.44	11.43	20.28	18.44
	R	–	–	–	–	76.56	88.57	79.72	81.56
6. Cereals	K	50.06	50.26	50.33	50.26	43.62	36.64	45.40	42.43
	R	49.94	49.74	49.67	49.74	56.38	63.36	54.60	57.57
7. Pulses	K	–	–	–	–	81.95	81.21	82.47	81.86
	R	–	–	–	–	18.05	18.79	17.53	18.14
8. Gross Cropped Area (GCA)	K	50.06	50.26	50.33	50.26	54.46	47.58	46.15	48.16
	R	49.94	49.74	49.67	49.74	45.54	52.42	53.85	51.84

S,M,L and T as defined in Table 4.4
K = Kharif, R = Rabi

is almost equal. An even inter-seasonal division of cropped area is also discernible in respect of each farm-size group. This is bound to be so because this region has only one crop (paddy) cultivated equally intensively in both Kharif and Rabi seasons.

In R-II, at the overall level, the cropped area under Rabi crops has a little edge over the cropped area under Kharif (52 and 48 per cent respectively). Across the farm-size ladder, the cropped area under Kharif maintains an inverse relation with farm-size. Between the medium and the large farms, there is not much difference, the values lying between 46 and 48 per cent. The reverse is the position for Rabi. The small farms have 55 per cent area under Kharif because they have higher share in green gram (25.6 per cent) which is a cent per cent Kharif crop.

We may as well look at crop-wise allocation of cropped area between Kharif and Rabi seasons.

As regards paddy, at the overall level, in R-II, 91 per cent area is under Kharif. Only the medium farms have a higher share (95 per cent). As water becomes a problem for Rabi, only the large farms can manage to grow paddy on a relatively higher area in this season and so they have 11.3 per cent of paddy area for Rabi season also. Jowar is cultivated only in Rabi while green gram and red gram are grown completely in Kharif. Pulses have more than 4/5ths area under Kharif at the overall level and at individual farm-size levels. In respect of groundnut, at the overall level, nearly 82 per cent area is under Rabi. Only the medium farms have higher share than the overall share. For cereals also, the medium farms show somewhat higher share than the overall share, as jowar which is cent per cent Rabi crop, has caused this tilt in favour of the medium farms, as they have higher share of GCA under this crop.

As seen from Table 4.4, it may be observed that among all the crops in R-II; paddy, jowar and groundnut together account for nearly 70.0 per cent. Further, jowar being a complete Rabi crop and groundnut being mostly a Rabi crop, at the overall level, Rabi season seems to have slightly higher share in the cropped area.

4. Irrigation

As the difference in technology levels manifests itself mainly due to differing irrigation levels, it is appropriate to look into variations in irrigation. As can be seen from Table 4.6, Region-I has cent per cent irrigation both in terms of NOA and GCA. In sharp contrast, in Region-II only 21.6 per cent of NOA and 21.2 per cent of GCA is irrigated. It has already been explained in the previous section, how R-I has been under the mono-culture of paddy since the inception of irrigation facilities through government canals. As such, we may also expect that the farm-size differences would be negligible in the irrigation. The picture in R-I, as emerging in Table 4.6, shows that there is

Table 4.6: Percentage Irrigated Area to Total Area: Source wise and Seasonwise

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. % NIA to NOA	100.00	100.00	100.00	100.00	25.80	19.05	21.65	21.56
2. % GIA to GCA	100.00	100.00	100.00	100.00	21.07	17.75	23.26	21.15
3. % Area Irrigated Source wise:								
(i) Wells	–	–	–	–	5.62		11.87	7.63
(ii) Canals	100.00	100.00	100.00	100.00		4.13	7.95	5.46
(iii) Tanks	–	–	–	–	87.45	87.60	61.58	73.18
(iv) Rivulets	–	–	–	–	6.93	8.27	18.60	13.73
4. % Gross Irr gated Area in GCA (K)	100.00	100.00	100.00	100.00	33.12	32.17	39.97	36.15
5.% Gross Irr gated Area in GCA(R)	100.00	100.00	100.00	100.00	6.67	4.66	8.92	7.22
6. Irrigation Intensity (GIA/NIA)	2.00	1.99	1.99	1.99	1.09	1.10	1.22	1.16

NIA = Net Irrigated Area
NOA = Net Operated Area
GIA = Gross Irrigated Area
GCA = Gross Cropped Area
K = Kharif, R = Rabi
S,M,L and T as defined in Table 4.4

no divergence in the irrigation base and use across the farm-size categories. it is not a trivial fact that irrigation intensity is almost equal to 2.00 on all farm-size groups. Thus, not only the cropping intensity but the irrigation intensity is cent per cent, for each farm-size category, thanks to the network of the public irrigation distribution system of this region.

In R-II, with respect to NOA, the small farms have a relatively higher share of irrigated area, while the large farms have a share almost equal to the overall level; the medium farms have a lower share. In contrast, when we see the position with respect to GCA, the large farms have a higher value, while the small farms have nearly the same share as at the overall level. For this inter-group differential position the explanation lies with differing levels of intensity of irrigation; on large farms, it is as high as 1.22, whereas it is only 1.09 and 1.10 for the small and the medium farms respectively. It is interesting to note that in this irrigation-deficient region, the large farms could provide irrigation for a relatively higher proportion of their cropped area. This may partly be explained by the higher proportion of ownership of irrigation structures among the large farms (as would be seen in Table 5.5 of the next chapter). Further, it may also be noted that in R-II, while the cropping intensity is in inverse relation with the farm-size, the irrigation intensity is in positive association with the farm-size.[7]

As regards the seasonal availability of irrigation, it is observed that for the total of all farm-size groups, only 36.2 per cent of cropped area is irrigated in the Kharif season, and it is as low as 7.2 per cent in Rabi. Perhaps, this is the unique pattern of any dry land agriculture. In Kharif season, whatever is the level of irrigation, it is due primarily to rains during that season and for Rabi, no water is left in tanks and wells. Again, as is typical of distribution in a regime of scarcity, in the present case also, both in Kharif and Rabi, it is the large farms who enjoy a relative edge as regards the availability of irrigation.

Looking at the source-wise irrigation in total irrigated area, in R-II, the pattern emerges as follows: In the total irrigated area, nearly 3/4ths of the area is irrigated through tanks. Nearly 14 per cent area is irrigated by rivers. Canals contribute only 5.5 per cent of irrigated area. In terms of farm level variations, medium and small farms have 7/8ths of irrigated area each under tanks. But the large farms have only 5/8ths area under tanks. The relative difference of 1/4th (or 25 per cent) has been compensated by the wells and rivers. Wells and rivers

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7. The inverse relation with cropping intensity is very largely due to the availability of higher amount of labour on small farms whereas the positive association with irrigation intensity is due to higher investment (capital) on the large farms for irrigation.

together account for 30.5 per cent of irrigated area on large farms, as they are in a position to invest in digging wells and creating minor canal channels from rivulets.

To look at variations among the crops and farm-size categories, crop-wise share of irrigated cropped area is set out in Table 4.7. It is very clear that in R-I, paddy is cent per cent irrigated for each farm-size category. In R-II, of the total cropped area under paddy, 86.5 per cent is irrigated. Only the small farms have slightly lower than this level, although in absolute sense, they have irrigation on more than 80.0 per cent of their paddy area. Of the total cropped area under groundnut, only 4.6 per cent area is irrigated. In terms of farm-size level variations, it is found that the percentages maintain an inverse relation with farm-size. In respect of 'Other crops', only 11.0 per cent of area is irrigated; tobacco enjoys a lion's share in the crop mix included in 'Other crops'.

From every conceivable angle and practically for each farm-size group, paddy emerges as the single most dominant irrigated crop. In Kharif, this crop occupies 97 per cent of irrigated area, and in Rabi, the irrigated area, although much lower, is still about 52 per cent. Thanks therefore, to such a preponderant position of paddy, any discussion on source-wise irrigation for paddy would be almost identical with source-wise irrigation of the total irrigated area. Thus, paddy in our study area is nearly the total 'usurper' of whatever irrigation facilities are available.

Table 4.7: Percentage Area Irrigated Under each Crop

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1.Paddy	100.00	100.00	100.00	100.00	80.31	88.21	87.97	86.53
2.Jowar	–	–	–	–	–	–	–	–
3.G.Gram	–	–	–	–	–	4.72	–	1.89
4.R.Gram	–	–	–	–	–	–	–	–
5.G.Nut	–	–	–	–	10.94	9.29	1.67	4.61
6.Other Crops	–	–	–	–	12.66	–	16.30	11.03
7.Season wise Share of irrigated Paddy in total irrigated area*:								
Kharif	100.00	100.00	100.00	100.00	93.44	93.61	100.00	96.94
Rabi	100.00	100.00	100.00	100.00	54.55	35.00	56.52	51.90
K + R	100.00	100.00	100.00	100.00	87.83	85.54	90.96	88.97

* = This is a measure of irrigated paddy as share in the total irrigated area. Further, in R II, the irrigated total area under Kharif and rabi is 82.3 and 17.7 per cent respectively.

Summary

The preceding discussion throws up a number of conclusions. The important among them are :

(i) The family size in all farm-size categories and at the overall level is higher in R-II than in R-I. In both the regions, it maintains a positive association with farm-size.

(ii) As far as the educational level of the head of the household is concerned, illiteracy is quite higher in R-II than in R-I, both at the overall level as well as at the level of each farm-size category. As regards other educational standards, in R-II, there are no significant variations across the farm-size ladder, whereas, in R-I, there are sizable such variations. The edge of large farms is quite conspicuous.

(iii) The number of Family Farm Workers (FFW) per household is higher in R-II than in R-I both at the overall and farm-size levels. The proportion of FFW in family members is less in respect of the large farms in both the regions. As regards FFW per acre of NOA, it maintains an inverse relation with farm-size.

(iv) Permanent workers per household, the percentage of households reporting permanent workers, and the permanent workers per acre of NOA maintain an increasing relationship with farm-size in both the regions. In terms of absolute magnitudes, all these values are higher in R-I than in R-II. Thus, the incidence and extent of engaging permanent workers is higher in R-I than in R-II.

(v) As regards the distribution of land, the usual pattern that the large farms have higher share in area compared with their share in the number of holdings, while the small farms have the reverse position, is visible in our study area also. In both the regions, there are severe inequalities in the distribution, but these are higher in R-I than in R-II.

(vii) As regards farm size-wise differences in cropping patterns, our data show that ;

(a) The level of cropping intensity is very high in R-I (equal to 2.00) compared with only 1.18 in R-II. In R-I, all the three categories enjoy nearly the same level of cropping intensity, while in R-II, it keeps on declining as we go higher on the farm-size ladder.

(b) R-I is under the regime of mono-crop culture (paddy), whereas R-II has a diverse cropping pattern. In R-II, among the medium and the small farms, jowar is important but among the large farms, it is groundnut.

(c) In R-I, the allocation of cropped area under Kharif and Rabi seasons is almost equal both at farm-size and overall levels. In R-II, cropped area under Rabi is slightly higher than in the Kharif season.

(viii) In R-I, there is cent per cent irrigation in terms of NOA and GCA. As such, irrigation intensity is as high as 2.00 for each of the three farm-size categories of this region. In R-II, on the whole, irrigated area in terms of both NOA and GCA is less than 1/4th; the medium farms have less than this overall share. Here, the irrigation intensity is quite low for farmers in general. However, across the farm-size ladder, a positive association exists. Among the crops, paddy alone is the biggest user of irrigation; it occupies as much as 90.0 per cent of the gross irrigated area.

(ix) As regards source-wise irrigation, in R-II, at the overall level, nearly 3/4ths of the irrigated area is under tanks. Across the farm-size continuum, the medium and the small farms depend on tanks to the extent of 7/8ths of their irrigated area, whereas large farms depend on tanks only for 5/8ths of area, since they fill the gap through wells and rivulet channels. In R-I, however, the entire irrigation is through government canals.

CHAPTER - V

STOCK AND COMPOSITION OF CAPITAL

Since the advent of green revolution in the mid-sixties, Indian agriculture has undergone remarkable changes. In this regard, apart from many issues raised, there has been a debate as to whether changed conditions are fully reflective of capitalism - in terms of an analytical category.[1] As our country is essentially labour-surplus economy and a very high proportion of population depends on agriculture, it may be thought that the capital-intensive implements and machinery need not be used. But, to increase production and productivity in agriculture, so as to feed increasing population and alleviate rural poverty, the timely and quick completion of field crop operations in a year are required for the intensive use of land by multiple-cropping. The need for effecting technological changes is, therefore, both urgent and imperative, as has been stressed by Mellor:[2]

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1. Daniel Thorner, who was unwilling to use the term capitalism in terms of Indians Agricultural conditions in the early sixties, had willingly accepted the same by the late sixties. The debate on capitalism, in Indian Agriculture, has been thoroughly reviewed in Alice Thorner, "Semi-feudalism or Capitalism", Economic and Political Weekly, 4, 11 & 18, Dec., 1982.

2. J.W. Mellor, "Determinants of Rural Poverty: The Dynamics of Production, Technology and Price", in J.W. Mellor and G.M. Desai, (eds.), Agricultural Change and Rural Poverty, Oxford University Press, Bombay, 1986, p.22.

> The argument that adoption of new technology to increase food production should be delayed until needed but uncertain institutional changes, such as radical redistribution of land, have occurred may be harmful to the poor.

Further, by the use of machinery, if a high order of multiple-cropping is possible, it is certain to increase total agricultural employment in a year. Thus, maximisation of income and employment is achieved through the process of capital-intensive technical change. However, modern capital equipment has not penetrated uniformly throughout the country and, consequently regional diversities have increased. Broadly, the stock and composition of capital assets in any region depends, *inter alia*, on the level of agricultural development of that region. Further, at farm-size level, variations in the capital assets depend on the resource constraints of the different farm-size categories.

In the present chapter, it is proposed to deal with fixed capital whose stock and composition leads to differences in the production structure both at region and farm-size levels.

1. Stock of Total Capital Assets

Table 5.1 gives the picture of the value of total capital assets, comprising implements and machinery, irrigation structures, draught animals and milch cattle. In R-I, total productive capital assets per holding are 70 per cent higher than in R-II. Similarly, their value per acre of net operated area (NOA) is 80 per cent higher in R-I than in

Table 5.1: Value of Capital Assets

(Rupees)

Region/ Farm Size	Per Holding	Per Acre of NOA	Percentage Distribution of Capital Assets
REGION I			
Small	3163.25	1104.03	15.75
Medium	15038.81 (5145.06)	1985.73 (679.35)	31.11
Large	26514.90 (10056.83)	1355.03 (513.95)	53.14
Total	11048.39 (5142.68)	1446.17 (673.15)	100.00
REGION II			
Small	3762.90	1183.92	24.73
Medium	6148.33	798.02	30.31
Large	11726.52	696.17	44.96
Total	6520.55	810.04	100.00

(Value in parentheses are after excluding tractors from the account)

R-II. This is due to the fact that in R-I, being a developed region, some of the medium and the large farms possess tractor, which is a costly equipment. However, if the tractors are excluded from the total assets, it is then interesting to note that the assets with respect to both per holding and per acre, are higher in R-II than in R-I. Thus, a shift from a traditional to a progressive agriculture makes a great difference as far as the composition of capital equipment is concerned.

At the farm-size level, as is to be expected, in both the regions, the capital assets per holding vary directly with the farm-size. The small farms of R-I have a lower value (by 16 per cent) than their counter-parts in R-II. But the medium and the large farms of R-I have 2 1/2 times higher averages respectively than their counter-parts in R-II.

As regards the value of capital assets per acre of NOA, there is a systematic inverse relation with farm-size in R-II, just as it was found in the FMS of the mid-fifties. This type of inverse relation is a typical offshoot of a backward agriculture. In contrast, in R-I, the value of assets per acre of NOA, is substantially less on the small farms than on the medium and the large farms and these two categories have nearly 80 and 23 per cent higher values respectively than the small farms. It seems medium farms are emerging as the best users of the new technology in R-I, especially because their investment in farm implements and machinery items is much higher than even the large farms;

small farms really stand nowhere near them. But in R-II, the small farms show on an average, 50 per cent higher investment per acre compared with medium farms and 70 per cent higher compared with large farms. Also these differences are statistically significant.

If we exclude tractors from our consideration, in R-I the capital assets per acre, shown in parentheses, maintain an inverse relation with farm-size. From this, we may draw an important inference that some farmers in R-I, have substituted tractors (modern capital) for the traditional equipment. Thus, R-I is steadily heading towards a capital-intensive agricultural technology whereas R-II remains under a highly traditional technology, with a total absence of tractorization.

Looking into the distribution of capital assets, it is natural to discover that it is more skewed in favour of the large farms in both the regions. In R-I, the small farms possess as low as 16 per cent of the total assets only. On further disaggregation of data into decile groups, it is found that the top decile of farmers in R-I owns a very high share (43 per cent) in the assets, whereas it has just a little more than 1/4th of the assets in R-II. From the measure of inequality, found from the decile groups, Gini coefficient assumes as high a value as 0.6640 in R-I, whereas it is only half of it in R-II (o.3422). From this, it is clear that R-I is reflective of much higher inequalities. It has been a well observed fact that in the development process, the relatively developed regions tend to suffer from more inequitable distribution.

2. Composition of Capital Assets

In the preceding section, we have considered the total capital assets. We may as well look into the quantity and quality of the components of capital assets which also vary both at across the regions and among farm-size groups. However, before going into such an analysis, the differences between R-I and R-II, particularly in regard to investment in tractors, irrigation structures and draught animals may be thrown up in bold relief.

In R-I, tractor is used generally for ploughing and threshing by all farms in each farm-size category, without exception, although only a few of the medium and the large farms own tractors. That is, many of the farmers generally hire-in tractor services. By now, the hire charges are fairly standardised and generally no price-discrimination is shown against the small farms. In view of this, there is no dependence on draught animals for those two operations. In this region, private investment in irrigation structures is negligible, primarily because irrigation is provided mainly through government canals.

R-II, characterized by low levels of agricultural productivity represents a scenario of underdeveloped agriculture. As there are no government canals to provide irrigation, there is some private investment albeit very low, in irrigation structures. Thus, only a small proportion (21.6 per cent) of area is under irrigation. These factors together give scope for lower cropping intensity, as has been noted in the previous chapter. As the double-cropped area is quite low, the question of timely and quick crop operations is not so serious in this region. Hence the tractor use is almost nil. Consequently, the farmers depend nearly completely on the draught animals for ploughing and other operations in contrast to R-I.

Table 5.2 brings out the composition of different assets per acre of NOA. It may be worthwhile making comments on each component of the assets.

Implements and Machinery (I & M)

In this head, four items viz. tractors, sprayers, irrigation structures and traditional implements have been included. In R-I, the value of investment per acre is nearly 5 times higher than in R-II. Thus, R-I in comparison with R-II shows a far more intensive use of capital in agricultural production. A superior switchover to new production technology in this region necessitates a much higher investment in diverse types of capital assets.

At farm-size level, in R-I the values generally show a rising trend, as we move up the farm-size ladder. The medium farms have 16 times higher and the large farms 10 1/2 times higher values than the small farms. These differences are also statistically significant. To reiterate, this is an

Table 5.2: Components of Capital Assets
(Value in Rupees per acre)

Item/Farm Size	REGION I							REGION II						
	S	M	L	T	Diifference Beween			S	M	L	T	Difference Between		
					S&M	S&L	M&L					S&M	S&L	M&L
1. Implements and Machinery	88.37	1401.82	924.39	860.13	SC2	SC1	NS	230.70	156.03	176.93	179.60	NS	NS	NS
2. Irrigation Structures	..	..	8.24	4.68	..	..	..	78.66	57.69	98.63	82.66	NS	NS	ST1
3. Draught cattle	73.88	68.08	79.95	76.01	NS	NS	ST2	544.31	336.31	285.30	344.82	SC1	SC1	SC2
4. Milch cattle	941.78	515.82	348.05	508.53	SC1	SC1	ST2	366.70	231.99	183.65	229.50	SC1	SC1	SC2
5. Livestock	1015.66	583.91	430.64	586.04	SC1	SC1	ST1	953.22	641.99	519.24	630.44	SC1	SC1	SC2
6. Total Capital, Assets	1104.03	1985.73	1355.03	1446.17	NS	NS	NS	1183.92	798.02	696.17	810.04	SC1	SC1	NS

NS = Not Significant,
ST1 = Significant at 0.05 Level of t
ST2 = Significant at 0.10 Level of t
SC1 = Significant at 0.05 Level by Cochran and Cox
SC2 = Significant at 0.10 Level of Cochran and Cox
S, M, L and T indicate Small, Medium, Large and Total Farms

established pattern of agricultural development, which is variously observed in other progressive regions of the country, like Punjab and Haryana. Further, it may also be pointed out that the small farms even in the developed region (R-I) cannot afford to invest in expensive machinery. In R-II, however, the values seem to maintain an inverse relation with farm-size, though not in a neat fashion. The small farms show nearly 50 per cent higher investment per acre compared with medium farms and 30 per cent higher compared with large farms. This type of inverse relation was reported in the FMS in mid-fifties, when farm implements and machinery were of traditional nature. R-II in our study represents such a scenario representing a pre-eminent position of traditional implements in the total stock of capital assets. In other studies also relating to relatively backward agriculture, per acre investment in farm implements has been seen to vary inversely with farm size. For various reasons, small farms have to maintain a minimum stock of capital assets against their limited land area and suffer diseconomies of indivisibilities.

Further, it may be interesting to note that investment per acre on small farms in R-II is nearly 2 1/2 times higher than that of their counter-parts in R-I. This is to be explained in terms of the fact that small farms in R-I, do not have to own even the traditional ploughset and other equipment, as under the widely prevalent hiring system, they hire in tractor services at reasonable rates. Another interesting feature is that small farms provide employment for the under-utilised capacity of tractors owned by medium and large farms, so that the latter may earn by hiring out tractors.

Irrigation Structures

As was made clear at the beginning of this section, in R-I investment in irrigation strcutures, is quite negligible. The figures in Table 5.2 lend full support to this point. In sharp contrast, in R-II, some investment on this account is found among the three farm-size categories. But only large farms fare better and have a value 25 per cent higher compared with small farms and 71 per cent higher compared with medium farms. This dominance of large farms accounts for a higher proportion of gross irrigated area among large farms, as has been observed in the previous chapter.

Draught Animals

In R-I, draught animals are not widely needed for ploughing and thrashing operations, but a few of the farms use them for transport purposes through bullock carts. To most of the owners, the driving of a bullock-cart provides a subsidiary occupation. But in R-II, the investment on this item is important because no mechanical force is used for ploughing. Thus, investment per acre on draught animals in R-II is 4 1/2 times higher than that in R-I.

At farm-size level, in R-I large farms have a value 17 per cent higher than medium farms and 8 per cent higher than small farms. In R-II, investment on draught animals per acre maintains a systematic inverse relationship with farm-size. Small farms have 62 and 91 per cent higher value than the medium and the large farms respectively, and, these differences are statistically significant. The low investment on draught animals by medium and large farms cannot be attributed to substitution of traction power by mechanical sources, such as tractors, as R-II represents a scenario of nearly zero-level tractorization. However, it is a generally accepted fact that this item is subjected to indivisibilities and represents a higher investment per acre on the small farms.

Milch Cattle

In R-I, investment per acre on milch cattle is more than twice the value in R-II (122 per cent higher). In R-I, though draught animals are unimportant in the total assets, milch cattle are reared by most of the farms (91 per cent). Further, the farmers in R-I are conscious about hybrid milch cattle and prefer to purchase the animals in milk, whereas in R-II, the milch cattle are local and under-fed and so are less costly.

As regards differences at farm-size level, in R-I, this investment per acre is systematically inversely related to farm-size. Small farms have 83 and 171 per cent higher value than medium and large farms respectively, and, these differences are statistically significant also. This relation is understandable, if we consider the fact that milch cattle are maintained mainly for meeting home needs. In R-II also, investment per acre maintains a neat, inverse relationship with farm-size, as seen earlier in R-I. Small farms have nearly 60 and 100 per cent higher value than medium and large farms respectively, and, these differences are also statistically significant. An important observation is that, in R-II, both at farm-size and overall levels, investment per acre on milch cattle is less than that on draught animals. This substantiates our earlier contention that there is the necessity of draught animals for agricultural operations in R-II, and accordingly small farmers suffer acute scale diseconomies on their account.

3. Relative Shares of Components in Total Assets

In the preceding section, we have considered the individual constituents of the total capital assets on per acre basis. It may as well be useful to look into the relative priority assigned to each of the components in the total investment. Table 5.3 throws light on these aspects.

At the overall level, the farmers in R-I allocate nearly 3/5ths (60 per cent) of their total investment on implements and machinery and the next priority goes to milch cattle (with 35 per cent). The lowest priority is given to draught animals (5 per cent). Thus, R-I, being a developed

Table 5.3: Relative Shares of Assets in Total Capital Stock (percent)

Region/ Farm Size	Machinery & Implements	Irrigation Structures	Draught cattle	Milch cattle	Live Stock Total	Total Capital Assets
REGION I						
Small	8.00	–	6.69	85.30	92.00	100.00
Medium	70.60	–	3.43	25.98	29.41	100.00
Large	68.22	0.61	5.90	25.69	31.78	100.00
Total	59.48	0.32	5.26	35.16	40.52	100.00
REGION II						
Small	19.49	6.64	45.98	30.97	80.51	100.00
Medium	19.55	7.23	42.14	29.07	80.45	100.00
Large	25.42	14.17	40.98	26.38	74.59	100.00
Total	22.17	10.20	42.57	28.33	77.83	100.00

Note: Only columns 2 and 4 are additive

region, assigns top priority to implements and machinery. The investment priorities in R-II, are in sharp contrast to those of R-I. Here the farmers allocate a high proportion of their investment in draught animals (43 per cent). The next priority goes in favour of milch cattle (28 per cent), and the lowest priority is assigned to implements and machinery. This is understandable when we consider the fact that R-II is agriculturally a less advanced region, where implements and machinery commanding very low investment priority, mostly consist of traditional equipment. These items are less costly in the basket of total capital assets. However, the use of traditional equipment depends on draught animals which occupy a higher share in the total investment. Further, it is interesting that in both the regions, the investment on implements and machinery and draught animals together occupies an equal share (65 per cent) in the total assets. But in R-I, the share of draught animals is negligible, whereas it is higher in R-II. This suggests that there has taken place a good deal of substitution of mechanical power for draught animals in R-I. This contrasting feature shows the development gap between the two regions.

As regards differences at farm-size level, in R-I, the medium and the large farms maintain the same priorities as at the overall level. These farms have equal and high share (around 70 per cent) on implements and machinery, whereas the small farms have a very low share for this item (8 per cent only). The small farms assign the lowest priority to draught animals (7 per cent), while giving the highest priority to milch cattle (85 per cent). Thus, small farms of R-I have a very small share of their investment in implements and machinery, because they do not own costly equipment such as tractor.

In R-II, all the three farm-size categories maintain the same order of priorities, i.e., first priority to draught animals next to milch cattle and then to implements and machinery. However, the large farms allocate the highest share to implements and machinery (25.4 per cent), whereas the small and the medium farms have smaller shares, (each with 19.5 per cent share). For this higher share, explanation comes from the fact that the large farms have higher share on irrigation structures (14.2 per cent). However, the position would be different, if the irrigation structures are excluded from implements and machinery. The shares of investment on irrigation structures alone show a positive relation with farm-size, indicating that large farms invest more on this item. If we exclude irrigation structures from implements and machinery, the large farms seem to accord the lowest priority to implements and machinery exclusive of irrigation structures (11.25 per cent), while irrigation structures alone assume third priority (14.2 per cent) with them. However, on small and medium farms, irrigation structures assume only the last priority, even when compared with implements and machinery exclusive of irrigation strcutures. Thus, large farms show an edge over the small and the medium farms in respect of irrigation structures. Further, as there is no alternate source of traction power, all the farm-size groups equally depend on draught animals, as seen from their higher but nearly equal shares (41 to 46 per cent) which assume top priority in each case.

4. Composition of Implements and Machinery

From the point of view of agronomic compulsions built into the new technology of production, mechanical innovations have to be adopted for deep, timely and quick ploughing, close planting, water conservancy, proper fertilizing, spraying, and so on. Timely completion of crop operations help in extending the level of double cropping. Again, the pattern of ownership and use of these modern mechanical innovations cause variations in the production efficiency both at farm-size and region levels. Keeping this in mind, we look into the quantity and quality of the implements and machinery found in use in our study area. For analytical convenience we divide them into modern and traditional components. In modern equipment, we include tractor and its ancillaries, sprayer, improved irrigation structures (e.g. pumpset including oil engine or electric motor). In traditional equipment are included ordinary ploughset, bullock cart, spade, hoe, axe, sickle, etc.

Table 5.4 furnishes the component items (in terms of value per acre) and their shares in total investment on implements and machinery. Investment in tractors, is Rs.773

Table 5.4: Composition of the main Assets in Implements and Machinery
(Rupees per acre)

Region/ Farm Size	Tractor & Ancillaries	Sprayer	Irrigation Structures	Total Modern I & M	Total Traditional Implements	Implements & Machinery	
						Total	Exclusive of Tractors
REGION I							
Small	–	10.66 (12.06)	–	10.66 (12.06)	77.71 (87.94)	88.37 (100.00)	88.37
Medium	1306.38 (93.19)	34.91 (2.49)	–	1341.29 (95.63)	60.54 (4.32)	1401.83 (100.00)	95.45
Large	841.08 (90.99)	31.35 (3.39)	8.24 (0.89)	880.67 (95.27)	43.72 (4.73)	924.37 (100.00)	83.31
Total	773.02 (89.87)	27.87 (3.24)	4.68 (0.55)	805.58 (93.66)	54.54 (6.34)	860.13 (100.00)	87.11
REGION II							
Small	–	–	78.66 (34.10)	78.66 (34.10)	152.04* (64.90)	230.70 (100.00)	230.70
Medium	–	–	57.69 (36.97)	57.69 (36.97)	98.34 (63.03)	156.03 (100.00)	156.03
Large	–	0.94 (0.53)	98.63 (55.75)	99.57 (56.28)	77.36 (43.72)	176.93 (100.00)	176.93
Total	–	0.49 (0.27)	82.66 (46.03)	83.15 (46.30)	96.45 (53.70)	179.00 (100.00)	179.00

* = The differences between Small & Medium, and Small & Large are statistically significant

per acre in R-I, accounting for 90 per cent of the total investment in implements and machinery. In sharp contrast it is nil in R-II. This relative gap has been explained in the preceding section. On sprayers, Rs.28 per acre (forming only 3 per cent of the total investment) has been invested in R-I, while the figure is quite negligible in R-II. Thus, among modern farm equipment, tractors and sprayers are the two most important and dominant items in R-I.

If we turn to improved irrigation structures, which is another item of modern equipment, it is only Rs.5 per acre in R-I, forming less than 1 per cent of total investment; whereas in R-II, it is as high as Rs.83 per acre, accounting for 46 per cent of the total investment under implements and machinery. Such a low investment on this item in R-I has already been explained in terms of the fact that irrigation in R-I is being provided through government canals.

When we consider the total of modern equipment, in R-I, it accounts for Rs.806 per acre, capturing a lion's share (94 per cent) in the total investment. In R-II, its value is only 1/10th of the same in R-I (Rs.83 per acre). However it is important to note that it occupies as high as 46 per cent in the basket of the entire investment.

As regards the traditional equipment, it is nearly 80 per cent higher in R-II than in R-I. It is understandable that R-II is bound to have higher values on this account since its agriculture is largely of a traditional nature. Further, the contrasts are really glaring if we look at the share of traditional equipment between R-I and R-II; it is only 6 per cent in R-I compared with 54 per cent in R-II.

Farm-size variations are equally revealing. As regards tractors, only the medium and the large farms have invested in this item in R-I, understandably the small farms have no investment of their own on this item, and the medium farms have an edge over the large farms. In R-II, none of the farms invests on this item. This fact, *inter alia*, lends some support for the agricultural backwardness of this region. In respect of sprayers, in R-II, only the large farms invest albeit negligibly, whereas in R-I, the medium and the large farms have nearly 3 times higher value than the small farms.

In regard to irrigation structures, investment in R-I is negligible and is confined only to large farms, whereas in R-II, it is the large farms that fare better in this investment than the small and the medium farms. Further, the small farms have a slight edge over the medium farms. It is significant to note that this investment has a sizable share in total investment on implements and machinery, in each farm-size category. The small and the medium farms have nearly equal share, with just more than 1/3rd of the investment in implements and machinery, whereas with the large ones its share is as high as 56 per cent. Thus, the large farms have fared better in terms of both per acre value and shares.

As regards the component of modern equipment, in R-I, the large farms have nearly 83 times higher and the medium farms 125 times higher values than the small farms. This sharp hiatus between the small and the large/medium farms is due to the fact that none of the small farms owns the costly equipment-tractor. In R-II, the modern equipment is identically equal to the irrigation structures (keeping aside negligible value of sprayers on the large farms), and the farm-size differences for the modern component remain the same as those for irrigation structures.

Turning now to the traditional equipment, we find that in both the regions, the values maintain an inverse relation with farm-size. In R-I, the small farms have nearly 80 per cent higher value compared with the large and nearly 30 per cent higher with medium farms. However, these differences are not statistically significant. Further, it is important to observe that its share with small farms is as high as 90 per cent of the total implements and machinery, compared to its very low share with the medium and the large farms (around 4.5 per cent). In R-II, the small farms have nearly 100 per cent higher value than the large and almost 55 per cent higher than the medium farms and these differences are also statistically significant. Further in all farm-size categories, the values are higher in R-II than in R-I.

In sum, modern farm equipment in R-I consists of tractor and sprayer only, whereas in R-II, it is largely confined to irrigation structures. Further, R-I highly dominates over R-II in modern equipment and the reverse is true as far as traditional farm equipment is concerned. Finally, while both medium and large farmers of R-I undertake some investment in modern farm equipment, in R-II, this is being done, at a very modest level, by large farms only. Thus, agricultural dynamism of R-I seems to have opened up opportunities for a much wider cross-section of farmers to invest in some selected items of modern farm equipment. In R-II, such opportunities have yet to grow in a big way.

5. Ownership versus use of Farm Equipment

So far, we have dealt with values per acre and shares of productive capital assets. It is possible that these average figures may hide the property relations behind them, in as much as the averages may tend to give us an erroneous impression that all the farms in each farm-size category own the capital assets. In respect of items like tractor, lumpy investments are not financially possible for the small farms, and even among the medium/large farms. it is not desirable for every holding to possess it, as under-utilisation of the tractor is a real problem. It is now a widely prevalent practice that most of the small farms (as also some among the medium/large farms) which are disadvantageously placed from the point of view of ownership are using capital services through the mechanism of hiring. Tractor hiring is the most common practice almost every where.

In this section, we look into the pattern of capital-use through hiring, in respect of some important productive assets. Table 5.5 brings out these details.

Tractor is owned only by 8 per cent of all farms in R-I, whereas none of the farms in R-II possesses this item. Further, none of the small farms of R-I possesses a tractor. Among the medium farms, the ownership is reported only by 12.5 per cent of them, whereas nearly 1/4th of the large farms own this item. Against such a disparate picture of tractor-ownership it is almost amazing that cent per cent of the farms in each farm-size category are using it, in R-I. It is a happy situation from the point of view of small farmers in that each one of them is able to use a tractor, albeit for specific crop operations and limited time duration. The moot point is that they are using a very costly and, in terms of timeliness of crop operations, an important item of farm equipment, without having to invest in the same. Moreover, the availability of tractor services through hiring enables many a small farmer to dispense with the maintenance of a very costly item of traction power-draught animals. This is really a very important feature of development process in this region.

Like in other parts of India, there are strong reasons in this region of Andhra Pradesh that compel the farmers to adopt a mutually supporting mechanism in regard to the use of tractor-services by owners and non-owners. The owners hire out services, for they have to ensure fuller utilisation of the tractor capacity, whereas the non-owners hire in its services to use land more intensively. In this

Table 5.5: Ownership versus Use (perecentage terms)

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Tractor:								
Owner	_	12.50	22.58	7.86	_			
User	100.00	100.00	100.00	100.00	_	4.44	8.57	3.37
2. Sprayer:								
Owner	7.80	43.75	80.65	32.14	_	_	8.57	2.14
User	94.00	100.00	100.00	96.00	_	_	8.57	2.14
3. Irrigation Structures:								
Owner	_	_	3.23	0.71	6.67	11.11	31.43	14.29
User	_	_	3.23	0.71	6.67	11.11	31.43	14.29
4. Draught animals:								
Owner	7.79	12.50	32.26	14.29	81.67	95.56	97.14	90.00
User	7.79	12.50	32.26	14.29	100.00	100.00	100.00	100.00
5. Milch cattle								
Owner	88.31	90.63	100.00	91.43	71.67	73.33	94.29	77.86

S,M,L and T means Small, Medium, Large and Total farms

region, double cropping is a universal fact with each category of farmers, since all supporting measures are available to them to achieve this end. Irrigation being a *sine qua non* for double cropping is available for both the seasons through government canals at fairly moderate rates. To gain timeliness in the completion of one field crop operation after the other, tractor services can be hired. The timely and quick operations on agricultural fields become another supporting measure towards the increase of cropping intensity. The agricultural fields are widened suitably to enable tractor-use, irrespective of the size of the farm.

As regards the sprayer, only 32 per cent of the total farms own it in R-I, as against its use by 96 per cent. Both its ownership and use is negligible in R-II. In R-I, about 2/5ths of the medium farms and about 4/5ths of the large farms report ownership, but each one of them is using it. It is equally striking to note that 94.0 per cent of small farmers are also using this item through hiring facility although only about 8.0 per cent of them report ownership of this item. This is yet another aspect of the changing conditions in the agriculture of R-I, namely that even small farmers are not precluded from participating in better production technology.

Turning now to irrigation structures, private irrigation structures are conspicuous by their absence in R-I. Irrigation through government canals precludes the necessity of having to invest on private account. In R-II, however, it is the main modern equipment and its ownership is reported by 14.3 per cent of farms, at the overall level. Across the farm-size ladder, the ownership percentage maintains a positive association with farm-size. Thus, irrigation structures, which are relatively costlier to be owned by small and medium farms, the large farms dominate the scene of investment on this item, even in terms of value per acre.

As regards draught cattle, it is found that only 14 per cent of the farms report ownership in R-I, as almost all the farms depend on tractor services for traction power, as has already been noted. In R-II, its ownership is reported by 90 per cent of the total farms. In R-I, the percentage of farms owning this item keeps on rising as we move up the farm-size ladder, yet it does not go beyond 32.0 per cent even among large farms. In R-II also, the ownership percentage is in a positive relation with farm-size. In this region, 82.0 per cent of small farms own draught animals of their own; this percentage shoots up to 96.0 and 97.0 per cent for medium and large farms respectively. It seems there is a system of hiring or exchange of bullock traction in R-II as it is for the tractor services in R-I. That is the reason that none of the non-bullock owning small (and medium/large) farms go without its use; each farmer from all the three categories reports the use of draught animal for traction.

For milch cattle, the percentage of ownership is higher in R-I than in R-II both at individual farm-size level and at the overall level. Further, this percentage maintains a positive relation with farm-size in both the regions. In R-I, 100 per cent of the large farms own this item, while there is not much variation in the percentage (nearly 90 per cent) between medium and small farms. In contrast, in R-II, the large farms report this percentage to be as high as 94 per cent, while small and medium farms show an almost equal proportion (slightly less than 3/4ths).

6. Gross Investment in the Total Capital Assets

In the preceding sections, we have examined the total capital assets and their components from different angles. It may be useful to get some idea about the process of capital formation as well. As it is not possible to obtain time series data on capital assets on the sample holdings, it is thought advisable to look into gross investment in the reference year, 1984-85, to reveal a close approximation of the dynamics of capital formation. Table 5.6 gives some broad details of gross investment.

At the overall level, gross investment in R-I, is 10 1/2 times higher in terms of per holding and 11 times higher on per acre basis than in R-II. Thus R-I dominates in gross investment, primarily because tractor and major repairs of tractor figure prominently in capital endowment of this region. It is interesting to note that, in R-I, gross investment in 1984-85 amounted to slightly more than 1/5th (21.5 per cent) of the total value of the capital assets,

Table 5.6: Gross Investment in the Total Capital Assets during 1984_85

Region/ Farmsize	Per Holding Gross Investment	Per Acre Gross Investment	Perecentage Shares of I & M	Live stock	Total	Distribution amomg Farm Size Groups
REGION I						
Small	177.51	61.98	26.11	73.89	100.00	4.10
Medium	4068.60	537.22	98.69	1.31	100.00	39.00
Large	6126.77	313.10	91.51	8.49	100.00	56.90
Total	2384.28	312.08	91.63	8.37	100.00	100.00
REGION II						
Small	175.02	55.07	86.00	14.00	100.00	33.04
Medium	120.82	15.69	40.41	59.59	100.00	17.11
Large	452.60	26.87	75.25	24.75	100.00	49.85
Total	227.00	28.20	72.84	27.16	100.00	100.00

I & M = Implements and Machinery

whereas in R-II it is less than 4 per cent. So far, in response to the soil conditions of R-I, mechanisation has been confined to the use of tractor and its ancillaries. If other machines, such as harvest combines, thrashers, transplanters etc., had been invented and made conducive to the soil conditions in R-I, the process of capital formation might have been much higher than what it is now.

Looking into farm-size variations, we find that in R-I, there is a positive association with farm-size both in terms of per acre and per holding. As has already been made clear in the preceding sections, it is the medium and the large farms that dominate the scene of current investment, as they alone can invest in the costly equipment-tractor. The small farms report very small figures, just as they have low values for the total capital assets (in Table 5.1).

On per holding basis, in R-II, gross investment seems to be in a positive association with farm-size. While the small farms fare better than the medium farms, the large farms have 2 1/2 times higher value than the small farms and nearly 4 times higher than the medium farms. On per acre basis, in R-II, the value of current investment shows a decreasing trend and the small farms show nearly 3 1/2 times higher value compared with the medium and 2 times higher compared with the large farms. Thus, in R-II, the medium farms reflect a poor showing both on per acre and per holding basis, whereas the small farms retain their edge over the large ones on per acre basis, as is usually found in traditional agriculture.

We may also look into the weightage of the two main components of the total current investment namely implements and machinery, and livestock. In R-I, at the overall level, implements and machinery occupies as high as 92 per cent of gross investment, whereas, in R-II, these account for a little less than 3/4ths. At the farm-size level, in R-I, medium farms show a very high share (99 per cent) in favour of implements and machinery, while the large farms maintain its share equal to the overall share. However, the small farms have 3/4ths of the total for livestock. It is easy to understand this behaviour, if we consider the fact that the small farms cannot invest in costly equipment. In R-II, the small and the large farms allocate high shares in favour of implements and machinery (80 and 76 per cent respectively), whereas the medium farms allocate nearly 60 per cent of the gross investment to livestock.

Another way of looking at gross investment is to consider its distribution among the farm-size categories. In R-I, the large farms have contributed the highest share in the total investment (60 per cent). However, it is rather disquieting to see that small farms account for only 4 per cent of the total. In R-II also, the large farms fare much better, occupying about one half of the total investment. Here, the small farms fare better than the medium farms, the former having their share twice of that of the latter.

Summary

From the foregoing analysis, the results may be summarised as follows.

The total capital assets per holding show higher value in R-I than in R-II and in both the regions, the values maintain a positive relation with farm-size.

On per acre basis, the total of capital assets and implements and machinery have higher values in R-I than in R-II at the overall level. In R-I, the medium farms assume the highest levels for those two indicators, whereas small farms stand nowhere near the medium and large ones. In contrast to this, in R-II, the small farms show higher value than both the large and medium ones, in respect of both the indicators. This contrasting result is due to the fact that, in R-I, these two categories of farm assets consist of modern costly equipment-tractor. The reverse relation in R-II shows the development gap between the two regions.

In R-I, investment per acre on draught animals is less than that of R-II. It is due to the substitution of mechanical power for draught animals in R-I. At the farm-size level, in R-I, the values seem to show an increasing trend with farm-size, whereas in R-II, the values maintain a systematic inverse relation with farm-size.

As regards investment per acre on milch cattle, both at overall and farm-size levels, the values are higher in R-I than in R-II. In both the regions, the values show a clear inverse association with farm-size.

Looking at the priorities in total investment, at the overall level, in R-I the highest priority goes in favour of implements and machinery, whereas in R-II, it is in favour of draught animals, though these two items together have equal weightage in the total capital assets (65 per cent) in both the regions. Milch cattle occupy an intermediate position in both the regions. Further, the priorities at farm-size level also remain nearly the same as at the overall level in both the regions, with an exception in respect of the small farms in R-I, where they give top priority to milch cattle, because their implements and machinery have a smaller share, since no costly equipment is owned by them.

As regards modern equipment, in R-I, it consists of tractor and sprayer, whereas in R-II, it is confined to irrigation structures alone. Further, R-I dominates in modern equipment, the ownership of which is confined to medium and large farms. In R-II, modern equipment is reported almost exclusively by the large farms.

Considering ownership versus accessibility (use) of the main productive assets, a few observations may be noted. In R-I, only some of the medium and the large farms own tractor; none of the small farms owns it. Further, sprayer is owned by only a few of the small farms (8 per cent).

Thanks to the mechanism of hiring capital services, all the small farms use tractor services and also most of them use sprayer as well. In R-II, both ownership and use of tractor and sprayer is negligible. For draught animals, R-II has higher ownership rates than in R-I, both at individual farm-size level as well as at the overall level, as all the farms depend on them for traction power.

Gross investment in the reference year is many times higher in R-I than in R-II. In R-I, the medium and large farms dominate in current investment as they invest in costly modern equipment-tractor. In R-II, the large farms dominate on per holding basis whereas, in terms of per acre, the small farms have higher value than the large farms.

CHAPTER - VI

INTENSITY OF RESOURCE - USE

In the preceding cnapter, we have thoroughly surveyed the pattern and the quantum of investment in the productive capital assets, that determine the likely differences in the production efficiency both at the regional and farm-size levels. In that analysis, we have considered the stock position of the fixed capital assets, whose life expectancy extends beyond a single production period. But it is the flow of capital services, emanating from those fixed capital assets, that determines the production on the farm, when these capital services are uniquely applied along with the current inputs - both labour and non-labour material inputs. The current inputs are used up in one single production period. The material inputs consist of mainly the bio-chemical inputs - seed, manure, chemical fertilizers, pesticides etc.

Before going into resource-use analysis, we bring out the importance of its study. Ever since inverse relationship between farm-size and productivity was observed in Indian agriculture, in the mid-fifties, from the FMS data; it has been constant research endeavour to bring out the factors behind this inverse relationship. In particular, the factors contributing to higher productivity on the small farms have been thoroughly examined, as the smallness *per se* cannot be the cause of higher productivity. Ashok Rudra depicts these factors in a neat fashion as follows:[1]

> In most regions of India, for which data are available, small farmers seem to cultivate their lands more intensely - in the sense that they put in more of labour per hectare and more of non-labour material inputs per hectare; they seem to arrange for irrigation for a greater proportion of their land, go in for a multiplicity of crops, and choose among crops those that are more remunerative.

Thus, the intensive use of labour and other inputs were the factors, that led to higher productivity on the small farms. The above set of explanations need not hold any more in as much as, "these explanations drew their sustenance mostly from the traditional structure of production which typified Indian agriculture during the fifties."[2]

Since the mid-sixties, there has been a great change in Indian agricultural scene due to adoption of bio-chemical and mechanical innovations. However, the level of adoption of these innovations has not been uniform throughout the country. In such regions or pockets, where the technological transformation has taken place, the capital intensity (in both fixed and circulating capital) is increasing, as bio-chemical innovations call for a high dose of working capital and mechanical innovations need a substantial capital

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1. Ashok Rudra, Indian Agricultural Economics - Myths and Realities, Allied Publishers, New Delhi, 1982, p.172.

2. G.K. Chadha, "Farm-size and Productivity Revisited - Some Notes from Recent Experience of Punjab", EPW, RA, September 30, 1978, p.A-87.

investment. In such a situation, the small farms may lose their traditional edge in respect of non-labour inputs, possibly leading to the reversal of the inverse size-productivity relation or weakening it, as the small farmers generally suffer from lack of resources - both owned and borrowed. However, this changed phenomenon may be operating largely in the technologically developed regions, although this may as well be possible in a developing region when the large farms are ahead a bit in the technological adoption.

It is from this background that we propose to study the intensity of resource-use in this chapter, so as to gain suitable insights for the size-productivity relation later. As the two regions of our study hail from two development scenarios, the differences in the intensity of resource-use are analysed in the first instance. Similarly, within each region, the differences in the quantity and quality of inputs of the three farm-size categories are examined so as to find whether the small farms still maintain their traditional edge or whether the changes in agricultural technology have enabled the large farmer to become the vehicle of technical progress thanks to their better command over the resources both owned and borrowed. Thus, in this chapter, we deal with the variations, both at regional and farm-size levels, in respect of the following input categories:

i) Bio-chemical inputs
ii) Irrigation expenditure
iii) Capital services

iv) Human labour
v) Bullock labour and Tractor hours
vi) Agricultural credit

1. Bio-chemical Inputs

Bio-chemical inputs are mainly composed of seed, manure, chemical fertilisers and pesticides. In traditional agriculture, seed and manure were the two important inputs of the biological nature. The development of science and technology has presented the humanity with (i) improved seeds - High Yielding Varieties (HYV), and (ii) Chemical fertilisers for fertilising the soil artificially. When these two inputs are used, there is a great possibility of getting higher yields. But it is also possible that the crop is spoiled due to diseases caused by pests and insects, which affect the growth of corn and plants; also rat and other animals eat away the crop when it gets ripened and so on. This demands crop protection which is accomplished through the use of pesticides and protective measures. Thus, the fourth ingredient, pesticides, is also important in the modern technology.

The aforementioned four ingredients together are called the package of bio-chemical technology. From the point of view of land augmenting character of the new technology, it is acceptable to all the farmers irrespective of the size. But, it is a fact that the small farms adopt the new technology more for its labour-absorbing capacity, as in a single season, the labour requirement increases, though not necessarily proportionate to the yield increase, and over the full agricultural year, the labour absorption is likely to be substantially higher. The large farms, on the other hand, view it from the angle of labour-saving character, as the labour requirement is less than proportionate to the yield increment.[3] Though bio-chemical technology is size-neutral in the sense that the bio-chemical inputs are perfectly divisible, they are not resource neutral as the resource position of the farming households is inequitable and it is in unison with the farm-size. However, the adoption of these inputs increases encouragingly, when the yield from the crop is certain and the chosen crop is profitable.

Table 6.1 gives the per acre expenditure on bio-chemical inputs. We take up individual items of bio-chemical inputs first, and then consider manure plus fertilisers together and finally the total bio-chemical inputs.

Seed

Per acre expenditure on seed is higher in the less developed region (R-II) than in the developed region (R-I), by 55 per cent, the values being Rs.63.76 and Rs.98.51 in R-I and R-II respectively. This is an interesting feature, somewhat contrary to what we may generally believe. As a matter of fact, in R-I, the HYV seeds have been used in 100 per cent cropped area for Kharif as well as Rabi seasons.

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3. C.H. Hanumantha Rao, Technological Change and Distribution of Gains in Indian Agriculture, The Mcmillan Co. of India Ltd., New Delhi, 1975, pp.41 and 42.

Table 6.1: Expenditure per Acre of Gross Cropped Area _ Total Crops
(Rupees per acre)

Item	REGION I							REGION II						
	S	M	L	T	Difference between			S	M	L	T	Difference betwe		
					S&M	S&L	M&L					S&M	S&L	M&L
1. Seed	63.28	63.53	64.02	63.76	..	..	..	73.95	81.85	117.95	98.51	..	..	..
2. Manure	37.43	47.92	55.59	50.09	..	..	..	45.11	35.12	37.70	38.31	..	..	..
3. Chemical Fertilizers	305.04	327.14	343.39	331.77	..	..	..	93.10	66.89	104.06	90.58	..	..	..
4. Pesticides	167.76	181.15	199.45	188.74	..	..	..	9.91	4.98	11.85	9.37	..	..	..
5. Manure plus C.F	342.47	375.06	398.98	381.86	NS	ST2	NS	138.20	102.01	141.76	128.89	SC1	NS	NS
6. Total Bio-chemical Inputs	573.51	619.74	662.45	634.36	NS	ST1	NS	222.07	188.84	271.56	236.78	NS	NS	ST2
7. Irri.Expenditure	43.44	43.99	57.27	51.40	NS	NS	NS	14.53	7.80	26.27	18.38	NS	NS	NS
8. Capital Services exclusive of Bu. Expenditure	171.50	171.41	163.40	166.90	NS	NS	NS	48.86	36.82	26.49	33.91	SC1	SC1	SC1
9. Improved Capital services	160.73 (93.72)	163.29 (95.26)	157.49 (96.38)	159.49 (95.56)	..	..	..	..	1.47 (3.99)	1.17 (4.42)	1.04 (3.07)	..	..	..
10. Hired-in Capital Services	159.26 (92.86)	135.71 (79.17)	118.34 (72.43)	130.76 (78.35)	..	..	..	..	1.47 (3.99)	0.91 (3.44)	0.91 (2.68)	..	..	..
11. Bullock Expenditure	25.23	30.25	27.62	27.72	NS	NS	NS	217.04	160.84	145.59	163.85	SC1	SC1	ST2
12. Capital Services inclusive of Bu. Expenditure	196.73	201.66	191.02	194.62	NS	NS	NS	265.90	197.66	172.08	197.76	SC1	SC1	ST1

(Figures in parentheses indicate the percentage share in the Total Capital services exclusive of Bullock Expenditure)
NS = Not Significant.
ST1 = Significant at 0.05 of t
ST2 = Significant at 0.10 of t
SC1 = Significant at 0.05 by Cochran and Cox test
SC2 = Significant at 0.10 by Cochran and Cox test
S, M, L and T mean Small, Medium, Large and Total Farms

The complementary input - irrigation - is also available on 100 per cent of cropped area. Most importantly, the region specialises in mono-crop cultivation, viz. paddy. Against this in R-II, the HYV seeds are used only in less than 5 per cent cropped area, which is not more than even one-fourth of the irrigated area of the region. Thus, higher expenditure on seeds in Region II is not at all reflective of a better technology. On the contrary, it is because of a diverse crop-mix including groundnut[4] and other cash crops (e.g. chilly, tobacco, etc.) which generally entail higher per acre expenditure on seed.

At farm-level, in R-I, the per acre expenditure shows a positive association with farm-size, though there is not much variation in the values. In R-II, the positive relation is quite systematic. The large and the medium farms show 60 and 11 per cent higher values than the small farms.

Manure

Per acre expenditure on manure in R-I (Rs.50.09) is higher than that in R-II (Rs.38.31), by 33 per cent. We expected R-II to show higher value in regard to this expenditure since the farmers there were observed to be maintaining draught animals on much larger scale. However, in R-I, there is practice of using the straw of paddy as manure, particularly on the medium and the large farms. For

4. Per acre seed expenditure on groundnut is nearly Rs.336, which is almost 5 times higher than on paddy.

this latter reason only, the medium and the large farms in R-I could show higher values than their counterparts in R-II.

Across the farm-size ladder in R-I, there is a systematic positive association with farm-size, for this expenditure. The large and the medium farms show 47 and 28 per cent higher values respectively than the small farms. Contrary to this position, in R-II, there seems to be negative association with farm-size, where the small farms have higher value than the large and the medium farms by 28 and 20 per cent respectively.

Chemical Fertilisers

Generally the strength of bio-chemical technology depends on the use of chemical fertilisers. Per acre expenditure is nearly 4 times as high in R-I as in R-II, being Rs.331.77 in R-I and Rs.90.58 in R-II. This great hiatus in respect of this important input may be attributed to the low application of complementary inputs, such as low irrigation and low adoption of HYV seeds in R-II. Nevertheless, the use of fertilisers is spread on 44.0 per cent of cropped area in R-II. Our first hand information gathered through actual field survey shows that farmers in this region generally use cheap variety of fertilisers. In sharp contrast, in R-I, the coverage of area is 100 per cent and the good quality fertiliser is used in most of the cases. Thus, R-II represents a developing scenario where better farm technology has yet to show itself in a big way while R-I seems to have acquired some degree of technological maturity in its crop production enterprises.

PERCENTAGE OF CROPPED AREA UNDER FERTILIZERS

REGION	SMALL	MEDIUM	LARGE	TOTAL
REGION-I	100.00	100.00	100.00	100.00
REGION-II	41.01	41.09	47.03	44.06

As regards farm-size differences, in R-I, the per acre expenditure on fertilisers maintains a systematic positive association with farm-size, thereby the large and the medium farms showing 13 and 5 per cent higher values respectively than the small farms. Further in R-I, 100 per cent area has been covered under fertiliser-use in all farm-size categories. In R-II, there is no systematic relation with the farm-size. However, here the large farms have 12 and 56 per cent higher value respectively than the small and the medium farms. In consonance with this, the large farms have covered relatively more cropped area under fertiliser-use than the medium and small farms. It is interesting that the small farms fare better than the medium farms in respect of this expenditure by 40 per cent. An important observation from the above analysis is that in both the regions the large farms dominate.

Pesticides

As regards expenditure on pesticides, R-II stands nowhere in comparison with R-I; R-I shows 20 times higher expenditure than R-II, the respective values being Rs. 188.74 and Rs.9.37. From this, it may not be inferred that low expenditure in R-II reflects low incidence of suffering from diseases and pests. In fact the low expenditure is primarily a part of the low level of adoption of modern technology in this region. In R-I, the farmers view plant and corn protection as very serious matter and tend to spend on this item for even preventive measures. Thus, the gap between the regions suggest that the farmers in R-I are highly conscious of the new technology.

At farm-size level, in R-I this expenditure maintains a systematic positive association with farm-size; and the large and the medium farms show 19 and 8 per cent higher values respectively than the small farms. But, in R-II, there is no systematic relation for this item, just as has been observed earlier in respect of fertilizer-use. However, the large farms show 20 and 138 per cent higher value than the small and the medium farms respectively. Further, the small farms fare much better than the medium farms.

Manure and Fertilisers together

As the manure and fertilisers together occupy a lion's share in the bio-chemical inputs, it may be interesting to look into the variations of this combined expenditure. In their case, we have also tested statistical significance.

Per acre combined expenditure in R-I is almost 3 times the value in R-II, i.e. Rs.381.86 in R-I and Rs.128.89 in R-II. This relatively large gap shows the difference in the levels of relative development of the regions.

At farm-level, in R-I, the values maintain positive association with farm-size. The large farms have 17 per cent higher value than the small farms and this difference is statistically significant, whereas the difference between the medium and the small farms (by 10 per cent) is not significant. In R-II, there is no systematic pattern with the farm-size. However, large farms show nearly 3 and 40 per cent higher value than the small and the medium farms respectively, though these differences are statistically non-significant. But in R-II, the small farms show better performance in respect of this combined expenditure than the medium farms, by 36 per cent higher value, and this difference is also statistically significant.

Total Bio-chemical Inputs

Finally, total expenditure on composite package of bio-chemical inputs shows interesting features. It has 170 per cent higher value in R-I than in R-II, the values being Rs.634.36 and Rs.236.78 respectively. This is easy to understand in terms of the fact that the higher per acre expenditure on fertilisers and pesticides has contributed to this higher total expenditure on bio-chemical inputs in R-I; there is lower expenditure on seed in R-I than in R-II.

Thus, the technological superiority of R-I clearly stands out in terms of the use of bio-chemical inputs.

As regards differences at the farm-level, in R-I, there is a systematic positive association with farm-size. The large farms have 15 per cent higher value than the small farms and this difference is statistically significant. In R-II, no systematic relation is discernible. However, the large farms show 44 and 22 per cent higher value than the medium and the small farms respectively, though the difference between the large and the medium farms only is statistically significant. Thus, both in R-I and R-II, the large farms dominate in terms of this expenditure. Further, it is interesting that the difference between the large and the small farms is significant in R-I, whereas it is not so in R-II. It seems, the development pattern in R-I has exacerbated the gap between the large and the small farms in the use of this composite package of inputs.

From the aforementioned discussion on the bio-chemical inputs, the important points may be summarised as follows:

In respect of all the individual items in the bio-chemical package, the levels in R-I are higher than in R-II (excepting seed) at the overall level. Further, a clear positive relation with farm-size is observable in R-I for all the items. On the other hand, in R-II, a clear picture of positive association with farm-size as regards seeds and a negative relationship as regards manure is discernible. For other items, no systematic pattern seems to operate. All the same, the large farms show higher values than the medium and the small farms, though the gap between the small and the large appears to be less. Another interesting feature in R-II is that on all items, except seed, the small farms fare better than the medium farms. Further, in R-I, the chemical fertilisers and pesticides together dominate in the basket of total bio-chemical inputs whereas, in R-II, seed and fertilisers together assume dominant position.

2. Irrigation Expenditure

As was observed earlier in chapter IV, R-I commands 100.0 per cent irrigation facilities, mainly through government canals. Hence, no specific expenditure on raising private irrigation structures is reported. However, water cess is paid to government. This varies from village to village, if at all. In R-II, irrigation is available mainly through private sources and the expenditure is mainly on irrigation structures (i.e. interest + depreciation + operating expenses). In such circumstances, the expenditure may be supposed to be higher in R-II than in R-I. In spite of the above qualitative differences between R-I and R-II, per acre expenditure on irrigation in R-II is only about 1/3rd of that in R-I, as can be seen in Table 6.1. This may be attributed to the fact that per acre expenditure has been arrived at on the basis of the GCA as a whole, although only

1/5th of GCA is irrigated in R-II.[5]

At farm-size level, in R-I, there is an increasing trend with the farm-size, as the large farms have 30 to 32 per cent higher value than the small and the medium farms. In R-II, there seems to be no systematic pattern, but the large farms have 80 per cent higher value than the small farms. However, the small farms fare better than the medium farms, with nearly 90 per cent higher value. Thus, the medium farms, in R-II, lag behind the small farms as regards irrigation expenditure; similar was their performance in respect of bio-chemical inputs. The important fact still remains that in both the regions large farms command a much better position as regards the availability of this most crucial input.

3. Capital Services

As has been said earlier, capital services include expenditure on implements and machinery on the one hand and bullock expenditure on the other. Here, our intention is to consider the flow of services from the fixed productive capital assets.

Capital Services exclusive of bullock expenditure

In R-I, expenditure on capital services is much

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5. If we find the expenditure per acre of actually irrigated area in R-II, it is Rs.86.89 which is undoubtedly higher than that in R-I (Rs.51.40) by 70 per cent. In R-II, total irrigated area under both the seasons is 282 acres out of 1333.2 acres of GCA.

higher and its value is 5 times as high as in R-II. The higher value in R-I may be interpreted in terms of the fact that the farmers in R-I apply modern and improved capital services (owned or hired-in) mainly from the tractor and sprayer. At farm-size level, in R-II, there is a systematic inverse relation with farm-size; the small farms show 85 and 33 per cent higher value than the large and the medium farms respectively and these differences are also statistically significant. In R-I, there seems to be an inverse relation with farm-size. However, medium farms have almost the same value as that of the small farms and the small farms have higher value by 3 per cent only than the large farms though this difference is not statistically significant. In some sense, taking cognizance of statistical significance in R-II may confirm a backward scenario, while its insignificance in R-I may be interpreted as reflective of technological advancement.[6] In particular, it is very important to emphasize the existence of very high value in R-I (3 to 5 1/2 times) than in R-II in each of the respective farm-size categories, as also at the overall level.

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6. In fact, R-I would have shown higher capital services per acre on the medium and the large farms, had the tractor-owning farms among those categories not hired-out the idle or excess capacity of their tractors to the others. As has been explained in chapter III, most of the interest, depreciation, and other operating expenses of tractor have been distributed over the hired-out hours, whereas the tractor-owners have been charged at the rate of actual expenditure per hour for own hours of tractor-use.

Improved capital services

As regards the improved capital services, the figures are negligible in R-II all along the farm-size continuum.[7] In R-I, at the overall level, it is Rs.159.50 per acre, which is as high as 95.6 per cent of the total capital services. There seems to be no variation across the farm-size continuum for this important item of improved production technology. A nearly equal level of expenditure on small and large farms of this region speaks well for the technological upgradation that has taken place, on farms of all sizes. For small farms, this has been possible because of the prevalent system of hiring out of capital assets by large farms or other commercial agencies.

In R-I, at the overall level, the hired-in capital services per acre is Rs.130.80, forming as high as 78.4 per cent of the total capital services. At the farm-size level, there is a systematic inverse relation with farm-size; while the small farms spend Rs.159.26, forming nearly 93 per cent of the total expenditure on capital services, the large ones spend Rs.118.34 on such hired-in capital services. It is thus a significant development that more than 90.0 per cent of small farmers' expenditure on capital services is on modern farm implements although, for this purpose, they have

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7. In R-II, only the irrigation structures are to be treated as modern equipment. But the flow of its expenditure has been covered under irrigation expenditure in section-2.

complete dependence on the system of hiring-in. It is an equally striking feature that the large farms too depend very heavily on this facility of hiring-in of capital equipment. The moot point that needs to be emphasized for R-I is that the usage of improved farm equipment/implements has become a universal practice with farms of all sizes. Naturally, a relatively larger percentage of medium farms depend upon the hiring-in facility compared with the large farms; and the percentage of small farms is understandably higher still. In fact, the incidence of hiring-in of tractor services among the small farms is 100.0 per cent (Table 5.5, chapter V).

Bullock Expenditure

Thanks to the rising importance of the improved farm implements/machinery in R-I, bullock as a source of traction-power has declined significantly in this region. That is why, per acre average expenditure on bullocks in this region is rather a nominal figure of Rs.27.72 only. Among the three farm-size groups also, the expenditure does not vary beyond marginal values. In total, R-I is a clear case of switch-over from bullock-traction to machine-traction. R-II, however, continues to depend heavily on bullock traction. In this sense, R-II is a typical case of a traditional agriculture where cultivation is carried out largely through bullock-traction and where improved farm implements have yet to show themselves up. It is indeed a sharply differentiating feature that bullock expenditure per acre in R-II is 6 times as high as that in R-I. This is in contradistinction to what has been observed in respect of capital services. Thus, the two regions represent sharply contrasting agricultural scenarios. Further, in R-II, the per acre expenditure on bullock shows a systematic inverse relation with farm-size. The small farms have about 50 and 35 per cent higher value than the large and the medium farms respectively and these differences are statistically significant. This result is in conformity with many other findings relating to traditional agriculture. Clearly, the severe diseconomies of scale arising out of indivisibilities add further to the economic disadvantage of small farmers of R-II.[8]

Capital Services inclusive of Bullock Expenditure

From the above analysis, it is clear that R-I dominates in the modern capital services, while R-II relies heavily on bullock traction. Thus, when we combine these two items under the head capital services (inclusive of bullock expenditure), the differences get neutralised at the overall level in both the regions, as this combined expenditure remains only 1.6 per cent higher in R-II than in R-I. Across the farm-size categories, there are no significant variations in R-I while in R-II, there is a systematic inverse relation

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8. Krishna Bharadwaj, Production Conditions in Indian Agriculture - A Study based on Farm Management Surveys, Cambridge University Press, London, 1974. The higher cost per bullock labour day on the small farms, she explains in terms of both indivisibilities and extreme seasonality in the use of services of draught cattle (p.33).

with farm-size for this composite item. The inverse relationship was observed earlier for capital services as well as for bullock expenditure. The small farms show 55 per cent higher than the large and 35 per cent larger than the medium farms and these differences are statistically significant. It is worthwhile to repeat that the higher expenditure in the case of small farmers of R-II is essentially because of very high level of bullock expenditure. The high cost of maintaining bullock-power is indeed their Achilles' heel.

In total, in R-I, the total capital services, the improved capital services, the hired-in capital services (all exclusive of bullock expenditure) are considerably higher than in R-II, as the bullock labour has nearly completely been displaced in R-I. In R-II, the hired-in capital services are negligible, as modern equipment is not used there. As against this position, bullock expenditure is quite higher in R-II, as the farmers here depend only on bullock labour for traction-power.

In R-I, the capital services on the small farms is higher than on the large farms, but the gap is quite narrow, reflecting a positive character of advanced agriculture, whereas in R-II, the capital services (being mostly traditional) on the small farms is higher than on the large farms, with the gap getting widened as we go up the farm-size ladder. In R-I, all the farm-size categories are incurring more or less the same level of expenditure on capital services. However, the small farms depend more on hiring-in of modern capital services. In regard to bullock expenditure, it is R-II that dominates and the small farms show higher expenditure per acre, reflecting under-utilisation caused by indivisibility of draught cattle.

4. Human Labour

Although agriculture is subjected to natural-biological processes[9] and despite rapid rhythm of agricultural production due to technological advancement, it is the human beings that work as an interacting agency. It is a well agreed fact that the bio-chemical technology increases the use of labour power, whereas the mechanical technology may lead to labour-displacement. But, it is not possible to mechanise entire agricultural operations simultaneously and the mechanisation takes place step by step or operation by operation gradually, by the economic necessity - for saving labour and for increasing the intensity of cropping, depending on the soil type, irrigation and other complementarities and also the cropping pattern which may involve crops requiring labour intensive

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9. (a) C.H. Hanumantha Rao, Agricultural Production Functions, Costs and Returns in India, Asia Publishing House, Bombay, 1965, pp.39 & 40.

(b) Edward David, "Economic Differences between Agriculture and Industry", in Athar Hussain and Keith Tribe (eds.), Paths of Development in Capitalist Agriculture - Readings from Social Democracy, 1891-99. The Mcmillan Press Ltd., London, 1984, p.9

operations. At least in the early stages, the mechanical technology increases agricultural employment due to high cropping intensity over a year, although in each season, the labour might get reduced.

Table 6.2 shows per acre labour days - total, family, permanent and casual.

Labour Days at the Overall level(Total Farms)

The total labour days per acre are 116 per cent higher in R-I than in R-II. This expected result is explained in terms of the fact that R-I is a cent per cent irrigated region and there paddy is the only crop grown during both the seasons. Further, paddy requires relatively more number of operations and only two of those operations - ploughing and threshing - have been mechanised by the use of tractor; the requirement of labour in other operations has gone up, due to higher yield, which is a result of higher doses of bio-chemical inputs as has been seen in the preceding section. On the other hand, in R-II, despite a very wide crop-mix, the total labour days per acre are even less than half of those in R-I, for the reason that per acre bio-chemical inputs in R-II have been less on the one hand, and on the other, the crop-mix is such that the crops grown, except paddy, require limited number of operations, thereby needing lesser number of labour days. This crop-mix is the natural concomitant of the low irrigation base in R-II. Now the immediate question that arises is what role the family

Table 6.2: Human Labour Days, Bullock Days and tractor Hours - Per Acre

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
I. Human Labour Days:								
1. Family Labour (Own + Exch.)	23.59 (34.59)	8.00 (13.31)	1.63 (2.62)	7.69 (12.10)	13.77 (46.62)	11.17 (42.65)	5.91 (18.80)	9.02 (30.61)
2. Pmt. Labour	4.05 (5.95)	7.77 (12.46)	9.02 (14.47)	7.71 (12.13)	1.13 (3.82)	3.01 (11.49)	6.75 (21.48)	4.54 (15.41)
3. Casual Labour	40.56 (59.46)	46.27 (74.23)	51.68 (82.91)	48.15 (75.77)	14.64 (49.56)	12.01 (45.86)	18.77 (59.72)	15.91 (53.98)
4. Total Labour	68.21	62.33*	62.33⁻	63.55	29.54	26.19#	31.43	29.46
5. Share of Casual Lab. in Total Hired in Lab.	90.92	85.62	85.14	86.20	92.83	79.96	73.55	77.80
6. Share of Pmt. Lab. in Total Hired in Lab.	9.08	14.38	14.86	13.80	7.17	20.04	26.45	22.20
II. Bullock Labour Days:								
1. Own + Exch.	0.81	0.71	1.11	0.96	9.63	9.33	9.57	9.51
2. Hired	..	..	..	..	1.45	0.38	0.60	0.69
3. Total	0.81	0.71	1.11	0.96	11.08	9.71	10.17	10.20
4. Share of Hired in the Total(%)	..	..	..	..	13.09	3.91	5.90	5.77
III. Tractor Hours:								
1. Own	..	0.27	0.46	0.32	..	..	..	..
2. Hired in	2.03	1.76	1.57	1.71	..	0.02	0.01	0.01
3. Total	2.03	2.03	2.03	2.03	..	0.02	0.01	0.01
4. % Area under Tractor use	100.00	100.00	100.00	100.00	..	1.10	1.19	0.94
5. % of Farms Hiring in	100.00	87.50	77.40	92.10	..	4.45	8.57	3.57
6. % of Hired in Hours	100.00	86.70	77.34	84.24	..	100.00	100.00	100.00

(Figures in parentheses are percentages in the Total Labour Days)

* = The difference between the S&M is significant at 0.05 by t test

⁻ = The difference between the S&L is significant at 0.05 by Cochran and Cox

\# = The difference between the S&M is significant at 0.10 by Cochran and Cox

S,M,L and T indicate Small, Medium, Large and Total Farms

labour plays in the agriculture of these two regions. The family labour days per acre in R-II are higher (by 17.3 per cent) than in R-I, as the farmers in the developed region (R-I) show disinclination to work on the farm, especially in respect of the medium and the large farms. This is further reflected in the proportion of family days to total labour days, showing only 12.1 per cent in R-I compared to as high as 30.6 per cent in R-II. However, this gap has been more than compensated by the higher use of permanent labour days in R-I than in R-II with 7.71 and 4.54 days respectively by a margin of 70 per cent. This higher use of permanent labour in R-I may be attributed to the higher incidence and extent of engaging permanent labour, as has been examined in chapter IV.

Further, the family and permanent labour days put together account for 15.4 days in R-I and 13.6 days in R-II, showing only a narrow gap between the two. Taking this aspect into account and considering the fact that the total labour days in R-I are more than double of those in R-II, there should necessarily be a larger gap in respect of casual labour days per acre. The casual labour days in R-I (48.2) are 3 times as high as those in R-II (15.9). Thus, the technical advancement of agriculture in R-I seems to have resulted in a relatively higher demand for casual labour. In addition to this, we notice a drastic casualization of hired labour in R-I, as is reflected in (i) the higher share of casual labour (75.8 per cent) in total labour and (ii) the higher share of casual labour (86.2 per cent) within the total hired-in labour (i.e. casual and permanent labour together). Further, if we consider the total hired-in labour, i.e. both casual and permanent labour together, the dependence on outside labour is as high as 88 per cent in R-I while it is 70 per cent in R-II.

Labour Days at Farm-level

At farm-level, in R-I, we observe a systematic inverse relation with farm-size in respect of total labour days. The small farms have nearly 10 per cent higher labour days than both the medium and the large farms and these differences are statistically significant. But, this result may again be attributed to the systematic inverse relation in respect of the family days, in which the small farms show 15 and 3 times higher days than the large and the medium farms respectively. In R-II, for total labour days, no systematic relation seems to exist. However, it is easy to see that the large farms have an edge over the small ones with 6.4 per cent higher total labour days. The small farms show 13.0 per cent higher labour days than the medium farms and this difference is also statistically significant. This behaviour of the medium farms is presumably the concomitant of their less enterprising nature, already reflected in other inputs. In R-II also the family labour days maintain an inverse relation with farm-size. A specially noticeable fact is that the small farms in R-I show 71 per cent higher family days than their counterparts in R-II. This could perhaps be explained by the fact that small farms use their family labour more intensively in as much as the main crop of the region (paddy) is very highly labour-intensive involving, *inter alia*, field operations spread well over the entire crop season. In both R-I and R-II, the permanent labour days maintain a positive association with farm-size, the levels being uniformly higher in R-I in all the farm-size categories than in R-II. The former is due to increasing incidence of permanent labour along the farm-size ladder and the latter is possibly because of higher incidence of engaging permanent labour among the farmers in R-I.

As regards casual labour, in R-I there is a systematic positive association with farm-size. In R-II, the large farms show higher casual labour days than the medium and the small farms; and the small farms use higher casual labour than the medium farms. In fact, this trend seems to explain well a similar behaviour for the total labour days. That is, the higher use of casual labour on the large farms in R-II has led to show higher total labour days on them. The higher casual labour per acre on the large farms in R-II may be attributed to the fact that the large farms allocate higher proportion of cropped area, for paddy and groundnut - 24.05 and 26.84 per cent respectively - nearly 51 per cent of gross cropped area for these crops together, which absorb on the whole higher casual labour in addition to higher permanent labour.

In R-I, casualization of hired labour is found to be increasing with the farm-size and it is 60 per cent of the total labour on the small farms and 83 per cent on the large farms. Whereas in R-II, the share of casual labour is higher (60 per cent) only on the large farms and less than 50 per cent on other farms. The higher casualization in R-I, is to be understood in terms of the mono-crop culture - paddy - that requires more casual labour on an emergency basis for its main operations - transplantation and harvesting.

Lastly, considering the proportion of family labour days in the total, it maintains an inverse relation with farm-size in both the regions (R-I and R-II). This is explained in terms of disinclination of the farmers to work as their farm-size increase. Further, the share of family labour days is higher in R-II than in R-I, in each of the three farm-size categories. The possible factors responsible for this are : (i) lower levels of income of the farmers in R-II, and (ii) crop-mix requiring limited operations that spread over the production cycle.

Thus, total, permanent and casual labour days are higher in R-I than in R-II. Consequently, only the family labour days are higher in R-II. The main crop, paddy, requires more number of operations and so more labour days per acre are to be expended in R-I. In R-I, the small farms show higher total labour days per acre than the large farms, whereas in R-II, it is higher on the large farms than on the small farms. Putting in more family days by the small farms in the former case, and engagement of more hired casual labour in the latter case may be attributed to such result. The casual labour days in R-I show positive relation with farm-size and in R-II also such a relation seems to exist. Further, casualization of hired labour is higher in R-I than in R-II.

5. Bullock Labour and Tractor Hours

Generally, the displacement of bullock labour occurs in advanced regions, as it is not economically feasible to allocate land for fodder or fodder-yielding low valued cereal crops for maintaining bullocks.[10] Further, it is possible that there would be competition for fodder from the modern livestock breeding. Thus, maintenance of bullock becomes costlier. Added to this, the extreme significance of timeliness in field crop operations encourages mechanisation in a progressive region. But in an underdeveloped agriculture, such economic calculations do not operate so compulsively and the maintenance of bullock consequently remains a *sine qua non* of the farming economy of the household, despite the problem of indivisibility on the smaller farms.

Table 6.2 furnishes us with figures on bullock days and tractor hours - owned, hired and total. We first take up

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10. In the mid-fifties, from the FMS, it was found that in Uttar Pradesh as high as 26 per cent of cropped area had been allocated to fodder crops. See, C.H. Hanumantha Rao, op.cit., p.33

the picture at the overall level and then go to farm-level figures.

While dealing with bullock expenditure, we have already exposed the contrasting differences between the two regions under our study. The agriculturally advanced region (R-I) shows a smaller expenditure on bullock, as tractor-use has been prevalent there, while R-II still depends completely on bullock for traction. Accordingly, as seen from Table 6.2, bullock days are negligible in R-I (being less than 1 day per acre), whereas in R-II they are as high as 10.2 days per acre. As a consequence, the position of tractor hours per acre is in contrast to what is observed for bullock days. In R-I tractor hours are 2.03, compared to near-zero hours in R-II. The contrast becomes really sharp when tractor-use is seen in terms of area. In R-I, 100 per cent of cropped area is under tractor-use while in R-II, it is less than 1 per cent.

Another feature is to look at the owned and hired-in components. In R-I, whatever bullock days are shown, they are only owned. Though the practice of hiring bullock cart exists in R-I, bullock services cannot be isolated from bullock cart. In R-II, own bullock days (9.51) dominate in the total days (10.20) put in; and hired-in days account for only 7 per cent. Considering tractor hours, we discover that in R-I, more than 84.0 per cent of tractor-use is sustained through the system of hiring-in of tractor services; own tractor hours are only 0.32 out of total of 2.03 hours.

Again, as regards the proportion of hirers in the total farmers in R-I, it is amazing to note that as high as 92 per cent of the total farmers operate through hired-in tractor services.

At farm-size level, in R-II the small farms show 14 and 9 per cent more bullock days than the medium and the large farms respectively. The higher bullock days on the small farms is a well observed fact in most of the studies related with backward agriculture. Hired-in bullock days per acre (1.45) are relatively higher on the small farms forming 13.1 per cent in the total bullock days. Thus, the small farmers are at a disadvantage, as 18.33 per cent of them do not own bullock.

As regards tractor hours, in R-I, all the farm-size categories show exactly the same number of hours. It also gives an inference that even owners of tractor may not put in more hours than that of non-owners, indicating technical indifference with respect to farm-size. As regards hired-in hours, they maintain an inverse relation with farm-size. It is understandable, because all farm-size categories have equal hours and among the small farms none of them owns a tractor.

Thus, in R-I, due to mechanisation of field operations, bullock labour has become unimportant, whereas in R-II, the farmers still depend completely on draught cattle for traction. In R-I, all the small farmers and most of the other farms also depend on hiring-in of tractor services.

In R-II most of the farmers own bullocks and thus, the hired-in component is relatively low. Across the farm-size ladder, tractor hours in R-I are invariant to farm-size and in R-II, bullock days are higher on the small farms than on other farm-size categories.

6. Credit use

Credit is required for both production and consumption needs. Leaving consumption credit aside, the credit for production purpose is divided into short-term and long-term operations. Of these, short-term credit meets the current needs of agricultural production. Thus, the facility of short-term credit plays an important role in raising the agricultural production and productivity, which ensures repayability at the end of crop-cycle.

The sources of credit may be divided into three : (i) co-operative societies, (ii) commercial banks, (iii) private sources (including all types of money lenders). By the time of independence, it were the private sources that were dominant in the rural-credit nexus. The gradual encouragement of the government for co-operative credit and the nationalisation of banks in 1969 have brought in some positive changes in the rural economy, as the dependence on private sources is substantially reduced. Our basic premise in this section is to see how the short-term credit needs of the farming households are being met in our study areas. Table 6.3 throws light on these aspects.

Table 6.3: Short Term Credit Per Holding and Per Acre and Source wise

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Per Holding (Rs.)	3135.07	7418.75	8561.29	5315.72	860.33	1456.67	2788.57	1534.07
2. Per Acre (Rs.)	547.72	492.33	220.22	349.70	203.67	160.29	145.50	161.10
3. Shares of Loan Source wise (%):								
(a) Coop. Societies	19.59	11.58	14.70	15.29	56.47	38.37	47.75	46.98
(b) Commercial Banks	45.49	53.25	59.68	53.02	23.77	34.17	10.24	20.80
(c) Private Sources	34.92	35.17	25.62	31.69	19.76	27.46	42.01	32.22
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4. Overdues:								
(i) Per Holding (Rs.)	..	..	..	..	551.67	526.67	448.57	517.86
(ii) Per Acre (Rs.)	..	..	..	..	130.60	57.95	23.41	54.38
(iii) % of Borrowers with Overdues	..	..	..	..	54.83	38.71	36.37	44.05
5. % of Farmers reporting the Source of Credit as:								
(a) Coop Societies	10.39	9.38	12.90	10.71	31.67	26.67	31.43	30.00
(b) Commercial Banks	28.87	37.50	35.48	32.86	11.67	31.11	14.29	18.57
(c) Private Sources	29.87	25.00	12.90	25.00	11.67	26.67	28.57	20.71
(d) Total	63.64	68.75	58.07	63.57	51.67	68.89	62.86	60.00

S,M,L and T indicate Small, Medium, Large and Total Farms

Per Holding and Per Acre Loans

In terms of per holding, the total loans advanced in R-I (Rs.5315.72) is 3.5 times as high as that in R-II (Rs.1534.07). Even on per acre basis, it is more than twice in R-I than that in R-II, with Rs.349.70 and Rs.161.10 respectively. It is understandable if we consider the fact that the farmers in R-I require more amount for the current inputs as was evident in the preceding sections.

At farm-level in both R-I and R-II, the amount per holding maintains a positive relation with farm-size, while on per acre basis, it maintains an inverse relation. The inverse relation on per acre basis needs some explanation. In R-I, the per acre borrowing on small farms is nearly 150 per cent higher than that on the large farms. It is quite possible that the large farms are using their own financial resources for the purchase of current inputs and consequently, may be getting only a part of the requirements from the credit market. This tendency gets support from the fact that the percentage of borrowers among the large farmers is low (58.07). In R-II, although the percentage of borrowers among the small farmers is lower (51.67), the per acre borrowing is relatively higher. The same explanation, as was given for R-I, may hold good for R-II also.

Source-wise Shares

The percentage share of each source has been arrived at to know which source is important. In R-I, commercial banks dominate in total borrowings (53 per cent), the second position goes to private sources, while the last position goes to co-operative societies. Thus, R-I, being a developed region with higher level of urbanisation and higher levels of education, gives scope for higher level of consciousness among the farmers to use the credit facility from commercial banks. In R-II, co-operative societies show higher share (47 per cent) in the total amount of loans, while the last position is assigned to commercial banks, intermediate position being given to private sources. This is to be attributed mainly to the fact that the farmers in R-II cannot offer acceptable collateral securities against commercial bank borrowings besides the general tendency of people in underdeveloped areas to stay on with traditional (and, in a sense, assured) sources of credit. Nevertheless, the inter-regional differences notwithstanding, an extremely happy feature is that in both the regions, the institutional finance meets the demand for credit to the extent of nearly 70 per cent.

As regards farm-level differences, in R-I, the order of priorities is the same for all farm-size categories - commercial banks, private sources, co-operative societies in that order. In R-II, for the large farms, the order of priorities is cooperative societies, private sources, commercial banks in that order. But the small and the medium farms give second priority to commercial banks, assigning private sources the least prominence; the first position is given to co-operative societies. Further, in relative terms, large farmers in R-I depend less on private sources, whereas in R-II they depend more on this source, compared with other farm-size categories.

Overdues

In respect of the overdues, in R-I there are no borrowing farmers with overdues; whereas they are as high as 44 per cent among the borrowers in R-II. Further, in R-II, the overdues amount to Rs.517.86 per holding and Rs.54.38 per acre. In R-I, the farmers settle their debts, through post harvest disposal of the crop in each season. As the crop failure is a rare phenomenon, clearing of debt is no problem for them. On the other hand, in R-II, crop failures occur every now and then, since most of the cropped area depends on weather gods. It is natural, therefore, that overdues in this rainfed farming area become a part of the life of the farming community.

At farm-size level, in R-II, both in terms of per holding and per acre, the values maintain an inverse relation with farm-size. The per holding values vary comparatively less than those on per acre basis as we go up the farm-size ladder. Thus, on per acre basis, the small farmers show 450 and 125 per cent higher value than the large and the medium farms respectively. Another feature, i.e. the percentage of borrowers, having overdues, is that it maintains an inverse relation with farm-size. As high as 55 per cent of the borrowers among the small farms report overdues, whereas it is 36 to 39 per cent on the other two farm-size categories.

<u>Borrowers among the Farmers</u>

As regards the borrowers among the total farmers, in R-I, they are as high as 63.6 per cent as against 60 per cent in R-II. Perhaps, one might have expected the percentage to be lower in R-I, due to higher income levels and higher level of development. In effect, however, due to the continuous need of costly current inputs over the production cycle of the crop (paddy), a fairly big proportion of farmers in R-I have to resort to borrowings. Further, more than one-half of the borrowers in R-I have dealings with commercial banks whereas in R-II, nearly one-half of the borrowers deal with co-operative societies for their credit needs.

At farm-size level, in R-I, the percentage of borrowing farmers is the lowest among the large farms, while in R-II, it is so in respect of the small farms. Further, in R-I, a high proportion of the small farms depend on commercial banks and private sources. Whereas, for the large farms, co-operative societies and private sources are equally less important. In R-II, for the small farms, the co-operative societies are the most important source, for the medium farms, all the sources are equally important, while for the large ones, co-operative societies and private sources are equally important.

Thus, in R-I, the short term credit demand is higher than in R-II, both on per acre and per holding basis. In R-I, commercial banks meet the credit demand of more than half of the farmers, whereas in R-II it is co-operative societies that occupy such a dominant position. While the overdues are nil in R-I, they are fairly high in R-II, with nearly 44 per cent of the farmers reporting overdues. The proportion of borrowing farmers to total farmers is higher in R-I than in R-II.

Both in R-I and R-II, per holding total credit maintains a positive association with farm-size, while on per acre basis, the total credit shows an inverse relation. The overdues, both on per acre and per holding basis, maintain an inverse relation with farm-size in R-II. In this region a high proportion of borrowers among the small farmers report overdues. In R-I, all the farm-size categories have the same order of sources as at the overall level in regard to the source-wise credit; commercial banks, private sources, and co-operative societies in that order. In R-II, while all the farm-size categories give first priority to co-operative societies, the medium and the small farms shift their second priority to commercial banks.

7. <u>Resource Use at Crop Level</u>

In the preceding sections, we have examined the input use at the aggregate level to understand the overall structure of agricultural inputs. We may now look into the input-use at crop level. It may be pointed out at the very outset that there is only one crop - paddy - in R-I and so the question of crop-level differences as such does not arise. However, we may compare the input-use for paddy in R-I with its counterpart in R-II. Tables 6.4 to 6.9 provide figures on all important inputs.

Tables 6.4 and 6.5 give the details on all components of bio-chemical inputs. From a perusal of Table 6.4, it emerges that in R-II, it is paddy that has higher values for all individual inputs (except seed). Groundnut has the highest value on seed (Rs.336.44) and it occupies the second position in respect of fertilisers and pesticides. Jowar assumes the lowest values for all individual items though this crop occupies a large proportion of cropped area (25.11 per cent).

Consequently, in regard to per acre expenditure on manure plus fertilisers and total bio-chemical inputs (as in Table 6.5), paddy dominates the scene; the second position goes to groundnut. In respect of manure plus fertilisers, the gap between paddy and groundnut is substantially higher, whereas for total bio-chemical inputs, the gap gets narrowed due to higher value on seed for groundnut. For total bio-chemical inputs, jowar shows a very smaller value (Rs.28.11), forming only 6 per cent of what it is for paddy.

As regards differences at the farm level, in R-II, in almost all the items under bio-chemical package, the small farms show an edge over the large farms though the gap is quite low (it is equal also in a few cases). Further, the

Table 6.4: Individual Bio-chemical Inputs - Per Acre (in Rupees)

Region/ Crop	SEED				MANURE				FERTILISERS				PESTICIDES			
	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	T
REGION I																
1. Paddy	63.3	63.5	64.0	63.8	37.4	47.9	55.6	50.1	305.0	327.1	343.4	331.8	167.8	181.2	199.5	188.8
REGION II																
1. Paddy	68.4	60.6	59.7	61.7	100.9	90.3	106.4	101.4	274.6	216.7	269.8	257.9	33.6	12.8	25.6	24.1
2. Jowar	11.1	10.7	10.2	10.5	5.6	7.8	15.4	10.8	8.5	8.3	4.9	6.8	..	..	..	..
3. G.Gram	28.6	28.7	29.2	28.8	46.7	46.2	20.4	38.7	25.9	34.9	27.1	29.8	..	1.9	..	0.8
4. R.Gram	36.6	32.4	27.3	30.0	33.1	29.7	17.0	23.1	11.9	19.1	8.3	12.6	..	1.7	..	0.6
5. G.Nut	344.0	313.5	344.0	336.4	26.5	8.7	8.8	10.8	88.8	40.3	80.4	71.4	8.9	..	10.6	7.8
6. Cereals	38.0	29.7	35.3	34.2	50.1	39.4	60.9	52.4	132.4	85.0	140.4	122.3	15.6	4.7	14.2	11.6
7. Pulses	27.3	36.8	27.4	31.0	37.3	33.8	15.2	27.8	19.1	32.8	15.3	23.0	..	1.5	..	0.6

S,M,L and T indicate Small, Medium, Large and Total Farms

Table 6.5: Manure Plus Fertilisers and Total Bio-chemical Inputs
(Rupees per Acre)

Region/ Crop	Manure Plus Fertilisers							Total Bio chemical Inputs						
	S	M	L	T	Difference between			S	M	L	T	Difference between		
					S&M	S&L	M&L					S&M	S&L	M&L
REGION I														
1. Paddy	342.47	375.06	398.98	381.86	NS	ST2	NS	573.51	619.74	662.45	634.36	NS	ST1	NS
REGION II														
1. Paddy	375.54	307.01	376.19	359.27	NS	NS	NS	477.47	380.42	461.49	445.03	NS	NS	NS
2. Jowar	14.03	16.05	20.29	17.58	NS	NS	NS	25.11	26.75	30.47	28.11	NS	NS	NS
3. G.Gram	72.55	81.03	47.42	68.51	NS	NS	NS	101.19	111.57	76.58	98.06	NS	NS	NS
4. R.Gram	45.06	48.70	25.27	35.68	NS	NS	SC1	81.62	82.75	52.60	66.32	NS	ST1	SC2
5. G.Nut	115.28	48.99	89.18	82.17	NS	NS	NS	468.22	362.44	443.82	426.39	SC2	NS	NS
6. Cereals	182.50	124.42	201.28	174.60	ST2	NS	NS	236.14	158.82	250.73	220.38	NS	NS	ST2
7. Pulses	56.44	66.57	30.43	50.80	NS	NS	NS	83.72	104.88	57.86	82.38	NS	ST2	SC1

NS, SC1, SC2, ST1, ST2; S, M, L and T are as in Table 6.1

Table 6.6: Irrigation Expenditure and Bullock Expenditure (Rupees per Acre)

Region/ Crop	Irrigation Expenditure							Bullock Expenditure						
	S	M	L	T	Difference between			S	M	L	T	Difference Between		
					S&M	S&L	M&L					S&M	S&L	M&L
REGION I														
1. Paddy	43.44	43.99	57.27	51.40	NS	NS	NS	25.23	30.25	27.62	27.72	NS	NS	NS
REGION II														
1. Paddy	36.19	28.39	61.98	48.64	NS	NS	NS	302.69	221.93	180.26	214.98	SC1	SC1	NS
2. Jowar	..	..	..	..	..	..	..	199.46	156.03	134.91	155.07	SC1	SC1	NS
3. G.Gram	..	..	..	..	..	..	..	148.75	124.44	103.82	125.77	NS	SC1	ST1
4. R.Gram	..	..	..	..	..	..	..	205.61	142.38	93.03	121.47	SC1	SC1	ST1
5. G.Nut	..	8.58	42.36	29.17	..	..	NS	249.38	172.79	148.72	166.12	SC1	SC1	ST1
6. Cereals	16.85	10.48	31.07	22.12	NS	NS	NS	247.57	181.11	156.63	181.82	SC1	SC1	NS
7. Pulses	..	..	..	..	..	..	..	154.42	123.79	106.94	125.40	NS	SC1	SC1

NS, SC1, ST1; S, M, L and T are as in Table 6.1

Table 6.7: Capital Services (exclusive and inclusive of Bullock Expenditure)
(Rupees per Acre)

Region/ Crop	Capital Services (exclusive of Bullock Expenditure)							Capital Services (including Bullock Expenditure)						
	S	M	L	T	Difference between			S	M	L	T	Difference between		
					S&M	S&L	M&L					S&M	S&L	M&L
REGION I														
1. Paddy	171.50	171.41	163.40	166.90	NS	NS	NS	196.73	201.66	191.02	194.62	NS	NS	NS
REGION II														
1. Paddy	90.92	76.16	48.29	63.64	NS	SC1	NS	393.41	298.09	228.55	278.62	SC2	SC1	NS
2. Jowar	35.89	21.29	16.68	22.10	SC1	SC1	NS	235.35	177.32	151.59	177.17	SC1	SC1	ST2
3. G.Gram	34.88	27.88	20.28	27.77	NS	SC1	SC2	183.63	152.32	124.10	153.54	NS	SC1	SC1
4. R.Gram	50.39	33.71	22.86	29.40	NS	SC1	SC1	256.00	176.09	115.89	150.87	SC1	SC1	ST1
5. G.Nut	40.29	37.55	16.57	24.47	NS	SC1	SC1	289.67	210.34	165.29	190.59	SC1	SC1	ST1
6. Cereals	61.60	41.93	32.55	41.07	SC2	SC1	SC1	309.17	223.04	189.18	222.89	SC1	SC1	NS
7. Pulses	34.63	27.09	20.78	26.64	NS	SC1	SC1	189.05	150.88	127.72	151.84	NS	SC1	SC1

Table 6.8: Human Labour Days Family, Permanent, Casual and Total - Per Acre

Region/ Crop	Family Days				Permanent Days				Casual Days				Total Labour Days				Difference between		
	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	T	S&M	S&L	M&L
REGION I																			
1. Paddy	23.6	8.3	1.6	7.7	4.1	7.8	9.0	7.7	40.6	46.3	51.7	48.2	68.3	62.3	62.3	63.6	ST1	SC1	NS
REGION II																			
1. Paddy	21.1	19.0	8.1	13.4	3.8	8.3	13.5	10.3	37.5	33.8	43.9	40.2	62.3	61.2	65.5	63.8	NS	NS	NS
2. Jowar	10.5	8.4	6.1	7.7	..	2.2	3.1	2.2	5.2	4.1	5.5	5.0	15.8	14.6	14.6	14.9	NS	NS	NS
3. G.Gram	10.9	9.0	4.6	8.3	..	2.0	4.0	2.0	7.2	8.5	10.9	8.8	18.0	19.4	19.5	19.0	NS	NS	NS
4. R.Gram	15.1	10.4	6.7	8.8	..	2.5	2.3	2.1	13.5	11.9	9.5	10.8	28.6	24.8	18.4	21.7	NS	ST1	ST1
5. G.Nut	13.1	11.2	4.1	6.9	..	1.0	6.1	4.1	11.6	9.1	13.4	12.1	24.7	21.2	23.5	23.1	NS	NS	NS
6. Cereals	15.5	12.6	7.1	10.4	1.8	4.5	8.3	5.9	20.3	15.1	24.9	21.1	37.6	32.1	40.2	37.3	NS	NS	NS
7. Pulses	11.6	9.4	5.7	8.6	0.2	2.2	3.3	2.1	7.7	9.1	10.3	9.2	19.5	20.7	19.2	19.8	NS	NS	SC2

NS, ST1, SC1, SC2; S, M, L and T are as in Table 6.1

Table 6.9: Bullock Days Own, Hired and Total Per Acre

Region/ Crop	OWN BULLOCK DAYS				HIRED BULLOCK DAYS				TOTAL BULLOCK DAYS			
	S	M	L	T	S	M	L	T	S	M	L	T
REGION I												
1. Paddy	0.8	0.7	1.1	1.0	..	..	..	..	0.8	0.7	1.1	1.0
REGION II												
1. Paddy	10.3	11.8	10.9	11.0	3.5	0.9	1.8	1.9	13.8	12.6	12.8	13.0
2. Jowar	9.9	9.2	9.5	9.4	0.8	0.4	..	0.3	10.7	9.6	9.5	9.7
3. G.Gram	7.9	7.5	7.1	7.5	1.0	..	..	0.3	8.9	7.5	7.1	7.8
4. R.Gram	10.1	8.3	6.6	7.5	..	..	..	..	10.1	8.3	6.6	7.5
5. G.Nut	12.5	11.3	10.0	10.6	..	..	0.6	0.4	12.5	11.3	10.6	11.0
6. Cereals	10.1	10.1	10.2	10.2	2.1	0.6	0.9	1.0	12.2	10.7	11.1	11.2
7. Pulses	7.7	7.2	7.0	7.3	1.2	0.2	..	0.4	8.9	7.4	7.0	7.7

S,M,L and T means Small, Medium, Large and Total Farms

small farms fare better than the medium farms with somewhat higher gap in all inputs for all the crops except jowar, green gram, and total pulses. It appears that the medium farms have concentrated much on jowar and pulses (they have allocated 63.55 per cent of the cropped area to these crops), because these crops are less capital-intensive. Thus, the medium farms in R-II seem to be a less enterprising lot even compared to the small farms, which reflects their tradition-bound attitude towards agriculture. Further, an important feature in R-II is that the large farms have almost risen to the level of the small farms (i.e. the traditional edge is being weakened), in the use of bio-chemical input package, as is further reflected in the higher value being assumed by the large farms than the small farms at the aggregate level,[11] for both (i) manure plus fertilisers and (ii) total bio-chemical inputs.

If we compare R-I with R-II, in the cultivation of paddy, on all farm-size categories, in all input items (except manure), R-I shows higher values than R-II.

As regards irrigation expenditure in R-II, only two crops dominate, viz. paddy and groundnut,[12] in this expenditure. For paddy, the large farms have higher value

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11. Because under 'other crops' tobacco and chilly are on some of the large farms and these crops have higher bio-chemical inputs.

12. Only the other crop is tobacco, which has irrigation expenditure but included in 'other crops'.

than the medium and small farms. For groundnut, the small farms have no expenditure on this item and the large farms have higher value than the medium farms. Thus, in R-II, the large farms dominate in this expenditure. Comparing between R-I and R-II in respect of paddy, R-I shows higher values at individual farm-size categories (except large farms) and overall levels.

For bullock expenditure (see Table 6.6), paddy has the highest value, the second position going to groundnut. However, jowar occupies third place instead of the last. At farm-level, without exception, for each and every crop, there is an inverse relation with farm-size for this expenditure. Also the differences between the small and the large farms are significant statistically in all cases.

Similar is the behaviour for capital services (inclusive of bullock expenditure), as can be seen in Table 6.7. In respect of capital services (exclusive of bullock expenditure), paddy, as usual, occupies the most dominant position; the second position is assumed by red gram and the last position goes to jowar. However, the inverse relation with farm-size remains valid for all crops.

If we compare paddy in R-I with that in R-II, bullock expenditure is quite low in R-I all along the farm-size ladder. In contrast to this, the expenditure on capital services (exclusive of bullock expenditure) is much higher in R-I than in R-II. However, if capital services (inclusive of bullock expenditure) is considered, it is quite higher in R-II than in R-I, consequent to the fact that the bullock expenditure is much higher in R-II than in R-I. Technological backwardness of R-II has already been pointed out more than once, and higher expenditure on bullock maintenance is but one important manifestation of the same.

As regards human labour days (Table 6.8), in R-II, again, it is paddy that emerges as a dominant crop with higher labour intensity (63.8 labour days per acre). As expected, the second position is captured by groundnut (with 23.1 days per acre). It may also be seen that paddy has more labour days per acre on all accounts - family, permanent, and casual labour, whereas for groundnut, it has depended on the strength of total hired-in labour days (both permanent and casual).

At farm-size level, family labour days maintain an inverse relation with farm-size in respect of all the crops, whereas permanent labour days maintain positive association in respect of paddy; and for other crops (small farms do not figure on this account), the large farms show more days than the medium farms. Further, for casual labour days, in almost all the crops (with the exception of red gram), the large farms show more days than the small and the medium farms. Thus, for hired labour days, the large farms unquestioningly show higher days, just as it has behaved at the aggregate level. However, for total days, the large farms have shown more days than the small farms for paddy and green gram as also the cereals, whereas for red gram, the small farms have shown more days than the large farms and this difference is statistically significant. For other crops also, the large farms show lower total labour days per acre than the small farms, the differences being insignificant. Thus, the inverse relation is true in respect of the family labour days, but it is not so for the hired-in labour days, which ultimately results in showing more total labour days on the large farms than on the small farms at the aggregate level (Table 6.2).

Comparing R-I with R-II for paddy, the total labour days do not vary much over the farm-size ladder. In respect of family and permanent labour days, the medium and the large farms show higher days in R-II than in R-I; and casual labour days in R-I on all farm-size categories are higher than their counterparts in R-II.

As regards bullock days, just as has been the case with other inputs, paddy occupies dominant position, with more bullock days per acre (13 days), while the second position goes to groundnut. Just as has been observed for bullock expenditure, for bullock days also, jowar gets the third position. Similar is the situation in respect of own bullock days. Hired-in bullock days are important only in respect of paddy. At farm-size level, an inverse relation is established for own as well as total bullock days in respect of all the crops.

Thus, in R-II, paddy and groundnut assume dominant position in all the inputs, among almost all the crops. In regard to all components of bio-chemical inputs, the small farms tend to show an edge over the large farms, for all the crops, although the gap is getting narrowed down. However, the small farms still maintain their edge over the large farms significantly in regard to capital services (exclusive or inclusive of bullock expenditure), bullock expenditure and bullock days. But in respect of human labour days, though the family labour shows an inverse relation with farm-size, the hired-in labour days are higher on the large farms. For total labour days, the large farms show more days per acre on paddy, green gram and total cereals; and this behaviour ultimately lead to higher total labour days on the large farms at the aggregate level.

Summary

In R-I, there is only one crop, viz. paddy. As such, whatever we say for total crop output is, *mutatis mutandis*, applicable to paddy. In other words, paddy is automatically dominant in the matter of all inputs in R-I. In R-II, among the individual crops, paddy and groundnut occupy dominant position in almost all the inputs. In what follows, we summarise the variations in the input-use at total crop level as also at individual crop level. Variations among the three farm-size groups are also simultaneously pointed out.

At the total crop level, all the individual items of bio-chemical inputs (except seed), on per acre basis, show higher levels in R-I than in R-II. For all these inputs, in R-I, there is a systematic positive relation with farm-size; whereas in R-II, there is a positive relation for seed and a negative relation for manure; while for other input items, the large farms show higher levels than the small and the medium farms. When we compare paddy between R-I and R-II, R-I shows higher levels than R-II in all the bio-chemical inputs (except manure), both at the overall and individual farm-size levels (except small farms in R-II for seed and manure plus fertilizers). In R-II, at farm level, the small farms tend to show an edge over the large farms, though the gap is low for most of the individual crops.

Per acre irrigation expenditure at the total crop level is higher in R-I than in R-II. At individual farm-level, in both the regions, the large farms show higher values in individual crops (paddy and groundnut in R-II and only paddy in R-I); and in R-II, the medium farms show lower level than the small farms.

At total crop level, in R-I, total capital services, improved capital services and hired-in capital services (all exclusive of bullock expenditure) are higher than those in R-II. Bullock labour has nearly completely been displaced by tractor-use in R-I. Naturally, therefore, bullock expenditure is higher in R-II than in R-I, as the farmers in R-II still depend on draught animals for traction purpose. In both the regions, expenditure on capital services (exclusive as well as inclusive of bullock expenditure) shows an inverse relation with farm-size. The differences between the small and the large farms are not significant in R-I, while they are quite significant in R-II. In R-II, on all the individual crops, the small farms tend to show higher levels than the large farms, the differences being significant as was so at the total crop level. For paddy the capital services (exclusive of bullock expenditure) is higher in R-I than in R-II, both at individual as well as overall levels. However, if bullock expenditure is added to capital services, they assume higher value in R-II than in R-I at each comparable level.

Again, at total crop level, in R-I, total, permanent and casual labour days are higher than those in R-II, whereas the family labour days are higher in R-II. In R-I the small farms show higher total labour days, whereas in R-II, it is the large farms that show higher total labour input. Further, casualization of labour is higher in R-I. Comparing paddy of R-I with that of R-II, the labour days do not differ between the regions. For all the individual crops in R-II, family labour maintains an inverse relation with farm-size; while the large farms show higher hired-in labour days.

Bullock labour is the main traction power in R-II, whereas tractor-use figures prominently in R-I, at total and individual crop levels. While tractor-hours are invariant with farm-size in R-I, the bullock labour days in R-II maintain an inverse relation with farm-size, both at total and individual crop levels.

Finally, a word about the availability of short-term credit. In R-I, the short-term credit demand is higher than that in R-II, both in terms of per acre and per holding. In R-I, commercial banks meet more than half of the demand; while in R-II, co-operative societies occupy a position of eminence. While the overdues are nil in R-I, they are much higher in R-II, with 44 per cent of the borrowers reporting overdues. As regards farm-size level differences, the per holding borrowings maintain a positive association and per acre loans a negative relation with farm-size, both in R-I and R-II. The overdues both per acre and per holding maintain an inverse relation with farm-size in R-II, while the proportion of borrowers with overdues is higher among the small farms.

CHAPTER - VII

PRODUCTIVITY, COSTS AND RETURNS

In the preceding Chapter, we have dealt with variations in the intensity of resource-use, at farm level, separately in the two chosen sample regions. At total crop-level, the farmers in the developed region (R-I) have shown higher values than their counter-parts in R-II. We observed differences in the input-use among the three farm-size groups, in each region. It is opportune, therefore, that differences in input-use are seen in relation to variations in output. In other words, it is important to see which category of farms transform inputs into output more efficiently.

To measure efficiency in agricultural production, one can think of numerous indicators, such as productivity per acre, cost per acre, cost-output ratio, net returns per acre, productivity per worker, profit rate, capital-output ratio, capital-labour ratio, value added-output ratio, value added-labour ratio, value added-capital ratio and so on. However, expressly relevant to our study, we concentrate on three main indicators, viz. (i) productivity/yield rate per acre, (ii) cost per acre (including cost structure), and (iii) net returns per acre. In more general terms, these three indicators capture the real essence of efficiency in Indian agricultural conditions. First, we deal with these three criteria in the following three sections. Ultimately, to throw some light on the contribution of the chosen input factors to output, the production function analysis is taken up in the fourth section.

1. Productivity and Yield Rates

In India, the inverse relation observed between farm-size and productivity, during the mid-fifties, was taken to reflect superiority of small-scale agriculture. Long was among the earlier analysts to express such views. Mainly on the basis of such a relationship, he supported redistribution of land as a measure of land reforms in the developing countries.[1] Later, Sen and many other economists debated this issue for the Indian situation and some of them also argued for land redistribution. Further, the major objective of labour-surplus and land-scarce agricultural economy is the maximisation of output per acre, as already explained in Chapter III. In the light of this background, we examine the productivity behaviour of the three farm-size groups to fix our idea on their relative production efficiency. First, we consider averages and then regressions on the basis of disaggregated data are attempted.

Table 7.1 gives information on productivity at total crop level in the three farm-size categories of the two regions.

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1. E.J. Long, "The Economic Basis of Land Reforms in Underdeveloped Countries", Land Economics, May 1961.

Table 7.1 : overall Productivity (in Rs.)

Region	Small farms	Medium farms	Large farms	Total farms	Difference between S&M	S&L	M&L
Reg. I	6384.57	6401.84	6284.73	6331.86	NS	NS	NS
Reg. II	1348.24	1060.96	1561.56	1371.46	SC_1	NS	SC_1

NS = Non-significant, SC, = Significant at 5 per cent level by Cochran and Cox; S,M and L show small, Medium and Large Farms.

From the Table, it is clear that the overall productivity in R-I is 4.6 times as high as in R-II. This striking contrast between the two regions is to be understood, *inter alia*, in terms of the relative technological gap, as was evident in Chapter VI. Looking at the differences in the farm-size categories, the medium farms in R-I show somewhat higher productivity than the small and large farms, while the small farms have an edge over the large farms. However, the differences are not statistically significant among the three categories. In contrast to this, in R-II, the medium farms show the lowest level of productivity. Further the large farms in this region show the highest productivity and it is higher by 47.2 and 15.8 per cent than the medium and small farms respectively. The small farms also show better performance than the medium ones, by a margin of 27.1 per cent. The differences, between the large and medium farms and between the small and medium ones, are statistically significant (at 5 per cent level).

Thus, in the developed agriculture (R-I), the differences across the farm-size ladder are rather negligible while in the relatively backward region, productivity level behaves in a somewhat unsystematic manner. The redeeming fact, however, is that small farmers are not much behind the large ones; in fact, in relation to medium farmers, they are performing better.

Table 7.2 gives the details of yield rates among the three farmsize categories. Yield rate at the total crop level in R-I is nearly 3 times as high as that in R-II. Similarly, going across the farm-size groups, we discover that the yield rates are much higher in R-I than in R-II. As regards farm size-wise differences within each region, in R-I, the overall yield rate does not differ significantly among the three groups; small farms are able to get nearly the same level of output for every acre of cropped area as do medium and large farms. This is similar to the neutral relationship between farm-size and productivity reported earlier from Table 7.1. However, the R-II situation is quite different. In R-II, the large farms appear to get higher value than the medium and the small farms by 53.0 and 35.0 per cent respectively. Again, the small farms fare better than the medium farms, showing 13 per cent higher value. Just as it was observed for overall productivity, the differences, between the large and medium farms and between the small and medium ones, are statistically significant, though at 10 per cent level. Thus, farm size-wise

Table 7.2: Gross Output Per Acre — Individual and Total Crop Levels
(in Rupees)

Region/ Crop	Small	Medium	Large	Total	Difference between S & M	S & L	M & L
REGION I							
Total Crop (= Paddy)	3195.91	3217.50	3163.27	3182.33	NS	NS	NS
REGION II							
1. Total Crop	1014.43	899.47	1372.44	1159.29	SC2	NS	SC2
2. Paddy	1922.80	1722.00	2209.75	2045.78	NS	NS	NS
3. Jowar	446.25	436.74	504.61	469.46	NS	NS	NS
4. Greengram	621.92	605.66	794.90	666.54	NS	SC1	NS
5. Redgram	940.63	896.89	651.91	768.33	NS	NS	ST1
6. Groundnut	1437.38	1184.13	1849.98	1637.89	NS	NS	NS
7. Cereals	1136.33	933.90	1359.69	1188.69	NS	NS	ST2
8. Pulses	635.41	630.41	658.80	641.99	NS	NS	NS

ST1 Significant at 5 per cent level of t
ST2 Significant at 10 per cent level of t
SC1 Significant at 5 per cent level of Cochran and Cox
SC2 Significant at 10 per cent level of Cochran and Cox
NS Not Significant
S, M, L means Small, Medium and Large Farms

differences for the overall yield rate show similar behaviour as was observed for the overall productivity in both the regions.

In R-I, total crop output is the sum total of paddy output over the two cropping seasons (no other crop is grown here), it is of interest to compare the corresponding figures of paddy with those in R-II, output per acre of paddy in R-I is 56 per cent higher than in R-II. At farm-size level, in R-II, output per acre on the large farms is higher by 15 and 25 per cent respectively than small and medium farms. None of these differences are significant. The small farms show 8.5 per cent higher value than the medium farms. In any case, the small farms do not seem to suffer any relative disadvantage.

In R-II, the yield rate is the highest for paddy. As regards other crops in R-II, the yield in the descending order is for groundnut, cereals, redgram, greengram, pulses and jowar. Except redgram, for all other crops, large farms show higher value than the medium and the small farms; and in turn the small farms exhibit higher values than the medium ones. This is more or less in conformity with what we have observed in regard to input-use pattern in R-II (Chapter VI).

Now, we would like to look at the farm-size and productivity relation, from the disaggregated data, through regression analysis. In conformity with the general practice, we use two types of functions, linear and log-linear; the latter functional form is used for the reason that the double log formulation has the potential of absorbing non-linearity in variables. Moreover, a quadratic function has also been used in the case of productivity and overall yield rate to ascertain whether the underlying relationship conforms to U-shape function.

Table 7.3 presents the three functional forms both for productivity and overall yield rate. The results are very interesting. For example, in R-I, none of the three functional forms show a significant relationship between farm size and productivity or overall yield level. In other words, both productivity and yield level are invariant to farm size. R-II, however, offers a sharp contrast. In this region, the quadratic function emerges in its most robust form; neither linear nor log-linear one captures the underlying relationship. And from the quadratic function, it is evidently clear that productivity and/or overall yield level keeps on declining till we reach a certain farm size, beyond which the declining relationship switches over to an increasing relationship. In the case of productivity, the reversibility sets in at 13.77 acres while in the case of the overall yield rate, it is 11.25 acres. This is in conformity with resource-use differences across the three farm size groups analysed earlier in chapter VI. It was seen that in many aspects of agricultural production, large farms were much ahead of lower farm size categories, and they seemed to have overcome their traditional infirmity of low labour :

Table 7.3: Productivity and Yield Rate at Total Crop Output in Relation with Farm-size - Regressions

Sl. No.	Dependent Variable/ Functional Form	REGION - I		REGION - II	
1.	Productivity				
	Linear	$Y = 6384.23 - 3.1884X$ (-0.4703)	n = 140	$Y = 1344.76 + 2.0317X$ (0.1573)	n = 140
	Log Linear	$\text{Log}_e Y = 8.77 - 0.0092 \text{ Log}_e X$ (-0.8717)	n = 134	$\text{Log}_e Y = 7.21 - 0.0906 \text{ Log}_e X,$ (-1.4608)	n = 137
	Quadratic	$Y = 6448.74 - 18.107X + 0.394X^2$ $(-1.086) \quad (0.980)$	n = 140	$Y = 1683.38 - 76.755^{*}X + 2.787^{*}X^2$ $(-2.401) \quad (2.684)$	n = 140
2.	Overall Yield Rate				
	Linear	$Y' = 3202.13 - 1.3014X$ (-0.4085)	n = 140	$Y' = 1050.83 + 10.3357X$ (1.0405)	n = 140
	Loglinear	$\text{Log}_e Y' = 8.08 - 0.0069 \text{ Log}_e X,$ (-0.7138)	n = 137	$\text{Log}_e Y' = 6.87 - 0.0034 \text{ Log}_e X$ (-0.0539)	n = 137
	Quadratic	$Y' = 3226.76 - 6.998X + 0.150X^2$ $(-0.892) \quad (0.795)$	n = 140	$Y' = 1270.09 - 40.614^{**}X + 1.805^{*}X^2$ $(-1.642) \quad (2.243)$	n = 140

(Figures in parentheses are t-values)
Y = Output/NOA = productivity
Y' = Output/GCA = Overall Yield rate
X = Farm-size
* = Significant at 0.05 level
** = Significant at 0.10 level

land ratio through higher capital : labour ratio. In a sense, the traditional inverse relation between farm size and productivity/yield rate stands modified. The inverse relationship now ceases to operate beyond a point. In brief, it seems in a strictly *ex post* sense, the large farmers have gained relatively more.

Now, we may look at the relationships for individual crops, by linear and log-linear functions, as presented in the Table 7.4. In R-I, for paddy the relation is neutral. in R-II, there seems to be a positive association of paddy yield with the farm-size, for which the regression coefficient is statistically significant at 10 per cent level. Cereals also exhibit similar relation at the same level of significance. Further, green gram has positive association which is significant at 5 per cent level. For red gram there seems to be an inverse relationship as the regression coefficient is significant at 10 per cent level in both the functional forms. Further, in respect of groundnut, the sign of the beta is positive in both functions, though non-significant, lending support to the contention that the large farms have an edge over the small farms. Thus in R-II, there seems to be positive relation with farm-size in respect of a number of individual crops (e.g. paddy, green gram and cereals). At the level of total crop output both linear and non-linear functions have not shown good results (See Table 7.3); instead, a U-shape relationship has already been authenticated to capture the production realities of this

Table 7.4 Relation between Yield and Farm-size by Regressions

Sl. No.	Crop	Region	Linear Function, $y = a + bx$		Double Log function, $Log_e y = a + b\ Log_e x$	
1.	Paddy	R-I	$y = 3202.13 - 1.3014x$ (-0.4085)	n = 140	$Log_e y = 8.0755 - 0.0069\ Log_e x$ (-0.7138)	n = 134
		R-II	$y = 1648.63 + 22.4175^{**}x$ (1.8764)	n = 87	$Log_e y = 7.3392 + 0.0477\ Log_e x$ (0.7099)	n = 85
2.	Jowar	R-II	$y = 469.25 + 1.9727x$ (0.6345)	n = 78	$Log_e y = 6.1524 - 0.0083\ Log_e x$ (-0.1428)	n = 78
3.	Green gram	R-II	$y = 662.72 + 10.2233^{**}x$ (1.9314)	n = 73	$Log_e y = 6.2605 + 0.1457^{*}\ Log_e x$ (2.1722)	n = 73
4.	Red gram	R-II	$y = 1031.37 - 13.0750^{**}x$ (-1.7462)	n = 47	$Log_e y = 7.1150 - 0.2009^{**}\ Log_e x$ (-1.7003)	n = 47
5.	Groundnut	R-II	$y = 1300.92 + 20.4686x$ (1.2863)	n = 57	$Log_e y = 7.0236 + 0.0787\ Log_e x$ (0.9691)	n = 56
6.	Cereals	R-II	$y = 1015.08 + 18.5430^{**}x$ (1.6541)	n = 127	$Log_e y = 6.7752 + 0.0346\ Log_e x$ (0.4207)	n = 125
7.	Pulses	R-II	$y = 669.24 + 2.2220x$ (0.4327)	n = 100	$Log_e y = 6.4353 + 0.0093\ Log_e x$ (-0.1206)	n = 100

Figures in parentheses are t-values

* = Significant at 5 per cent level.
** = Significant at 10 per cent level.

region.[2]

The aforementioned discussion may briefly be summarised now. The productivity as well as the yield rate at the level of total crop output is many times higher in R-I than in R-II, both at the overall and individual farm-size levels. As regards farm size-wise variations within each region, in R-I, they reveal no significant differences across the farm-size ladder, but they are significant in R-II. At individual crop level, in R-II, paddy and groundnut have higher yield rates. Further, in R-II, at farm-size level, the common feature is that the large farms show considerably higher levels of yield rates among all the crops, while the small farms fare better than the medium ones. Another important result, as revealed by regression analysis, from linear and log-linear functions, is that there seems to be neutral relationship for productivity as well as overall yield rate in the developed region (R-I). In R-II, there is a U-shaped relationship between farm size and productivity as well as overall yield rate.

2. Level and Structure of Production Costs

In a broad sense, net returns from crop production depend on the level of costs of production. The level of costs in turn depends on how efficiently the production is organized at individual farm level. Useful insights about

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2. For individual crops, the yield rates failed to show such relation. Hence the quadratic functions have not been shown here.

efficiency of production organisation can be derived through an analysis of the structure of costs. Moreover, both the level and the structure of production costs undergo a significant change due to technological transformation of agriculture. They vary over the regions because of the gap in the technology level and across the farm-size ladder in each region possibly because of a differential impact of the technology on different farm-size groups. It is, therefore proposed to deal with the cost and its structure in this section, and the insights developed here will be purposefully used to analyse the pattern of net earnings in the next section.

Total cost

Consistent with the usual practice, we use A_2 version of cost. However, our A_2 concept is different from its FMS counterpart in as much we are also adding interest on fixed capital to cost of cultivation (as already explained in Chapter III). In this way, our A_2 concept is exclusive of imputed values of family labour, own-land, and management input.[3] In doing so, we want to keep our analysis free from

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3. Unlike the double standards, in imputing value to labour and not imputing value to land, we do not impute value to both land and labour. See, G.R. Saini, "Holding Size, Productivity, and Some Related Aspects of Indian Agriculture", EPW, RA, June 26, 1971, where he supports imputing value to labour, as MVP of labour is more than the labour cost and he suggests that imputation of value to land is the cause of unremunerativeness of Indian agriculture as reported in the FMS of the mid-fifties, in some size-classes and so it need not be imputed.

aberrations due to imputation of value to those three inputs.

For cost analysis, we go by two points of view. First, we study it in absolute terms, with the belief that the higher the cost per acre, the higher is the output per acre.[4] In fact, the new bio-chemical and mechanical innovations sizably increase the cost per acre, thereby giving scope for the higher output per acre. As a matter of fact, the study of individual input-use on per acre basis, in absolute terms, has been dealt with in Chapter VI from this point of view only. Presently, we take up the analysis of cost (Cost A_2) per acre.

From the second point of view, the minimisation of the cost is an indicator of efficiency, as Raj Krishna says,[5]

> If we apply the principle that the criterion of optimality is least average cost and not the maximum output per unit of any single input, the land yield criterion has to be rejected. But what total average Cost is to be minimised - Cost A, or Cost C, Cost A_2 or Cost B?

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4. The higher output per acre on the small farms was attributed to the higher cost per acre. See, C.H. Hanumantha Rao, "Alternative Explanations of the Inverse Relationship between Farm Size and Output per Acre in India", Indian Economic Review, October, 1966, where Cost C as dependent and farm-size as independent variables, on non-per-acre basis, were related by double log function and concluded, "this decline in output per acre with the size of holding is traceable to a corresponding decline in the inputs per acre." Usha Rani also used such relation, by simple linear function with the same variables but on per-acre basis, see her, "Size of Farm and Productivity", EPW, RA, June 26, 1971.

5. Raj Krishna, "The Optimum Firm and the Optimum Farm", Economic Weekly, October 6 and 13, 1962.

Further, he suggests that the minimisation depends on the type of farm; if it is a family farm without leased-in land, it is Cost A; if it is a family farm with a part of operated area leased-in, it is Cost A_2; and if it is wage-based farm, then it is Cost C. For our purpose, the relevant version is cost A_2. But, the minimum cost *per se* cannot be treated as an index of efficiency, as it may also be possible due to lower technological conditions of agricultural production. Therefore, we prefer simply to look into the percentage share of the cost in the gross output per acre (i.e. it is cost : output ratio); for, the lower the share, the higher is the efficiency.[6]

Table 7.5 gives figures on the cost, at the total crop level. First, the cost per acre of gross cropped area, then the cost per acre of net operated area and lastly the share of cost in the output are given.

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6. A.M. Khusro, The Economics of Land Reform and Farm Size in India, Macmillan India, 1973. He used ratio of paid-out cost to output (Cp/O) as measure of efficiency, "It is, therefore, not C/O that farmers will minimise but Cp/O and this latter could be a measure of efficiency", p.107. Our cost A2 is almost equal to paid-out cost.

Table 7.5: Cost A_2 per Acre at Total Crop Level

Sl. No.	Item/ Region	Small Farms	Medium Farms	Large Farms	Total Farms	Difference between S&M	S&L	M&L
1.	Per Acre of Gross Cropped Area (Rs.)							
	R-I	1722.13	1892.33	1852.31	1834.50	ST_1	SC_1	NS
	R-II	690.43	575.70	802.55	711.65	SC_1	NS	ST_2
2.	Per Acre of Net Operated Area (Rs.)							
	R-I	3440.96	3765.14	3680.13	3650.10	ST_1	SC_2	NS
	R-II	917.62	679.07	913.16	841.89	SC_1	NS	SC_2
3.	Share of Cost in Gross Output (%)							
	R-I	53.90	58.81	58.56	57.65	-	-	-
	R-II	68.06	64.00	58.48	61.39	-	-	-

NS, ST_1, ST_2, SC_1 and SC_2; S, M and L are as in Table 7.2

First we take up cost per acre of cropped area. The cost per acre in R-I is 158 per cent higher than that in R-II. This difference is unquestioningly the result of the gap between the technology levels of the two regions. At farm-level, it is found that in R-I, the small farms show the lowest cost per acre (Rs.1722.43). The medium and large farms show higher cost per acre than the small farms, by 9.9 and 7.5 per cent respectively and these differences are statistically significant. In R-II, the cost per acre of cropped area does not seem to show a clear pattern. It seems to follow an elongated U-shaped relation. The large farms show 16.2 and 39.4 per cent higher value than the small and the medium farms respectively. Further, the small farms fare better than the medium farms, by 20.0 per cent. The differences between the small and medium farms and the large and medium farms are statistically significant.

To bring in the impact of cropping intensity, we may as well look into cost per acre of net operated area at the total crop level. As the cropping intensity on all the farms is equally well around 2.00, the figures of cropped area simply get doubled. But, in R-II, the cropping intensity is quite low and as a result, cost per acre of net operated area in R-I is 4.34 times as high as that in R-II. Thus, on this basis, the relative gap between the regions increased sharply. In R-I, the relative differences across the farm-size ladder remain the same, the cropping intensity being invariant with the farm-size. In R-II, as the cropping intensity is inversely related with farm-size, there is change in the relative positions of the cost, whereby the small farms show higher cost than the large ones, i.e. the reversal of the results obtained above for cropped area and this difference is also statistically significant. Further, the gap between the small and medium farms has gone up (35 per cent as against previous position of 20 per cent) and the difference is also significant.

For considering efficiency from the second point of view, we look at the share of cost in the output. In R-I, it is lower than that in R-II, indicating that the farmers in R-

I are more efficient converters of inputs into output. At the farm-level, in R-I there seems to hold a positive relation for the share of cost with the farm-size, while in R-II there is a systematic inverse relation. From this, we infer that in R-I the small farms are doing fairly well while in R-II the large farms show a higher level of production efficiency.

Combining the two points of view we may conclude that the farmers in R-I are superior to those in R-II in their efficiency, as in R-I the farmers show higher cost per acre and lower share of cost in the output. At farm level, in R-II the large farms are efficient compared to both small and medium farms, as revealed by both the criteria. But in R-I going by the cost : output ratio criterion, the small farms emerge efficient. Further, to some extent, the lower cost per acre of the small farms may be attributed to the lower cost of hired labour. Again in R-I, technology among farm-size groups is not different; this is the result of the use of more family labour which is, in a general sense, an added advantage to the small farms.

Now, we may look at the behaviour of cost with farm-size, for which we have fitted quadratic function. In the following functions, C = Cost A_2 per acre of gross cropped area, C' = Cost A_2 per acre of net operated area and X = farm-size.

Region - I

$$C = 1640.38 + \underset{(1.928)}{21.415^{**}} X - \underset{(1.283)}{0.344} X^2, \quad n = 140$$

$$C' = 3281.77 + \underset{(1.771)}{39.637^{**}} X - \underset{(-1.144)}{0.617} X^2, \quad n = 140$$

Region - II

$$C = 679.70 - \underset{(-1.917)}{31.668^{**}} X + \underset{(2.003)}{1.076} X^2, \quad n = 140$$

$$C' = 1137.69 - \underset{(-2.549)}{54.311^{*}} X + \underset{(2.417)}{1.076^{*}} X^2, \quad n = 140$$

Figures in parentheses are t - values and
* = Significant at 0.05 level.
** =Significant at 0.10 level.

From the regression equations, quadratic functions fit better to R-II conditions and not to R-I conditions. In other words, it appears that in R-I cost is positively related with farm-size. In R-II, the relations from both the functions show that the negative coefficient of X and positive coefficient of X^2 are statistically significant, revealing a U-shape relation of cost with farm-size. This confirms our earlier observation of a U-shaped relationship between farm size and productivity or overall yield rate (Table 7.3).

Now, in R-II we may look at what farm-size the cost becomes minimum. At 14.72 acres, cost per acre of gross cropped area (C') is minimum at Rs.446.69. Further, at 16.21 acres, cost per acre of net operated area (C') becomes minimum at Rs.697.74. Interestingly, both these cut-off points fall in the range relating to large farm-size category. As is seen from Table 7.6, it is clear that not only cost per acre of medium farms is on the falling curve of cost, but also over a limited range pertaining to large farms.

Table 7.6: Costs at Selected Farm-size Points in R-II

Sl. No.	Item	Farm size (acres)	Cost per acre of cropped area (C)	Cost per acre of net operated area (C')
1.	Maximum of the Small-farm category	5.0	548.26	908.01
2.	Maximum of the Medium-farm category	10.00	470.62	762.08
3.	Farm-size at which C'is minimum	14.72	446.69	-
4.	Farm-size at which C' is minimum	16.21	-	697.74

Now we may look at the crop level differences as presented in Table 7.7. As the total crop output in R-I is synonymous with output of paddy alone, we can compare it with the paddy in R-II. The cost per acre in R-I is 32.8 per cent higher than that in R-II. However, if we look at the share of the cost, it is higher in R-II, showing the inefficiency of the farmers in R-II and this inefficiency may be interpreted in terms of lower adoption of new agricultural technology. At farm-level, the cost per acre is higher in R-I than in R-II at every comparable level across the farm-

Table 7.7: Cost A2 Per Acre and Share of Cost in the Output

Region/Crop	Cost A2 Per Acre (in Rupees)							Share of Cost A2 in the Output (Percentage)			
	Small	Medium	Large	Total	Difference between			Small	Medium	Large	Total
					S & M	S & L	M & L				
REGION-I											
1.Paddy	1722.43	1892.33	1852.31	1834.50	ST1	SC1	NS	53.90	58.81	58.56	57.65
REGION-II											
1.Paddy	1402.08	1187.09	1458.35	1381.22	NS	NS	NS	72.92	66.99	66.00	67.52
2.Jowar	307.43	258.38	265.58	271.40	NS	NS	NS	66.69	59.16	52.63	57.81
3.Green gram	378.80	396.54	391.01	389.73	NS	NS	NS	60.91	65.49	49.19	58.47
4.Red gram	507.89	436.09	319.01	379.34	NS	ST1	ST1	54.00	48.62	48.93	49.37
5.Groundnut	918.19	758.44	984.70	921.00	SC2	NS	NS	63.88	64.05	53.23	56.23
6.Cereals	818.10	604.24	868.59	779.63	NS	NS	ST1	72.00	64.70	63.88	65.59
7.Pulses	366.88	391.08	349.67	369.89	NS	NS	SC2	57.74	62.06	53.08	57.62

NS, ST1, ST2, SC1, SC2; S, M, L and T are as in Table 7.2

size ladder. As regards the share of the cost, it maintains a positive association with farm-size in R-I, and it has a negative relation in R-II. This indicates the efficiency of the small farms in R-I and the large farms in R-II.

In R-II among all the crops, it is paddy which has the highest cost per acre followed by groundnut, while jowar has the least cost per acre, despite its importance in dry land agriculture of this region. In respect of paddy, groundnut and cereals, the large farms show higher cost per acre than the small and medium farms. Further, the large farms show lower shares of cost in the output, not only on these important crops, but also on most other crops. From this behaviour, it is inferred that the large farmers are performing efficiently in the less developed region (R-II) of our study, thanks to their urge for advancement even in the existing lower level of technology.

Cost Structure

A change over from traditional to improved technology brings in changes in the input-use and in consonance with this, the cost structure undergoes substantial changes. To get some insights into these aspects regarding quality of technology, the shares of individual inputs in the total cost (Cost A_2) have been calculated to look at the priority of one input over the other, between the regions and among the farm-size groups. Table 7.8 gives details of the component shares of the total cost at the level of total crop output.

Table 7.8: Shares of Components in the Total Cost _ Total Crop Level (in percentage)

Item of Cost	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Seed	3.67	3.36	3.46	3.48	10.71	14.22	14.70	13.84
2. Manure	2.17	2.53	3.00	2.73	6.53	6.10	4.70	5.38
3. Chemical Fertilisers	17.71	17.29	18.54	18.09	13.48	11.62	12.97	12.73
4. Pesticides	9.74	9.57	10.77	10.29	1.44	0.87	1.47	1.32
5. Capital Services	9.96	9.06	8.82	9.10	7.08	6.40	3.30	4.77
6. Bullock Expenditure	1.47	1.60	1.49	1.51	31.44	27.94	18.14	23.02
7. Irrigation Expenditure	2.52	2.33	3.09	2.80	2.10	1.35	3.27	2.58
8. Misc.Expenditure	3.01	1.73	1.64	1.92	0.15	0.72	0.17	0.30
9. Rent Paid	20.52	19.50	9.69	14.09	2.46	3.99	6.61	5.20
10. Labour Charges	29.23	33.03	39.50	35.99	24.61	26.79	34.67	30.86
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
11. Manure plus Chemical Fertilisers	19.88	19.82	21.54	20.82	20.01	17.72	17.67	18.11
12. Bio_Chemical Inputs_Total	33.29	32.75	35.77	34.59	32.16	32.81	33.84	33.27
13. Capital Services plus Bu. Expdr.	11.43	10.66	10.31	10.61	38.52	34.34	21.44	27.79

At the total crop level, in both the regions (R-I and R-II), paid out labour charges dominate in the components of the cost, with shares of 36.0 and 30.9 per cent respectively. Dependence on outside labour (permanent and casual labour together) may be attributed mainly to the necessity for timely completion of operations for paddy in R-I and the diversified crop-mix, with the bias towards cash crops on the large farms in R-II. Moreover, paddy in R-I is grown in both the seasons and as a result, the cropping intensity is 2.00. The second, third and fourth priorities in R-I go in favour of chemical fertilisers (18.1 per cent), rent (14.1 per cent) and pesticides (10.3 per cent) respectively and all these components show the impact of the technological upgradation of agricultural production in R-I. The relatively higher share of rent in R-I may be attributed to the fact that the land value and the extent of tenancy (due to scarcity of land) are higher in R-I. In R-II, however, the bullock expenditure assumes the second top priority (23.0 per cent) leaving seed and chemical fertilisers (13.8 and 12.7 per cent respectively) to the third and fourth positions respectively.

A striking contrast between the regions is in regard to the bullock expenditure. In R-I, due to the substitution of tractor for bullock traction power, the bullock expenditure gets the least share (1.5 per cent), whereas it is 23.0 per cent in R-II with second top position. Connected with this is the difference in the share of capital services between the regions. As the farmers in R-I operate with a greater component of mechanical technology, the share of capital services is quite higher (9.2 per cent) in R-I, while it is only 4.8 per cent in R-II. Further, an extremely important qualitative difference that needs to be highlighted is that capital services in R-I is very heavily of modern type whereas in R-II it is largely of traditional type.[7]

As regards the total bio-chemical package, its share does not differ much between the regions (34.6 and 33.3 per cent in R-I and R-II respectively). However, an important observation is that the package in R-I is nearly completely modern, while in R-II, it suffers from over-weightage of seed (mainly traditional) due to diversified crop-mix that is responsible for the higher share of the package. In regard to pesticides, which is also an important ingredient of the bio-chemical package, its share in R-II is negligible (1.3 per cent), whereas in R-I it assumes a far higher share (10.3 per cent) with fourth rank in the priorities.

At farm-size level, in R-I on most of the items, we do not find much variation in the relative shares. The share of labour charges shows a positive association with farm-size, from which it can be inferred that the hiring-in of

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7. As a matter of fact, in R-I the share of modern capital services in the total capital services is as high as 95.6 per cent. In R-II, it forms only 3.1 per cent. Thus, the capital services in R-I is nearly identical with the modern type and in R-II, it is traditional type. See Table 6.1 of Chapter VI.

labour increases as we move up the farm-size ladder. Further, the share of rent maintains a negative relation with farm-size, which possibly suggests that the large farms do not depend as much on the leased-in land as do the small ones. These results suggest that there is scarcity of own labour on the large farms and of own land on the small farms. An important feature in R-I to be highlighted is that the shares of capital services (modern type) do not vary much over the farm-size ladder, thanks to the availability of hiring-in facility that guarantees the most extensive use of modern capital equipment even by the small farms.

In R-II, the share of rent maintains a positive association with farm-size. This suggests that even the large farmers, in this region are under economic pressure to augment their own land area primarily because of low productivity of land. Further, the shares of capital services and bullock expenditure show inverse relation with farm-size, indicating the problem of indivisibility on the small farms, due to dependence on traditional equipment and traditional traction power from biological sources. On balance, it seems that modern technology in R-I does not lend special disadvantages to small farmers. They seem to be doing pretty well practically in each aspect of modern production technology. In sharp contrast under the traditional technology that still rules the agricultural landscape of R-II, the small farms suffer from scale indivisibilities and consequently diseconomies follow in their case.

Let us now turn to crop level analysis. Table 7.9 gives the component shares for individual crops in R-II. First, we may compare paddy in R-II with the total crop (paddy) in R-I. In respect of total bio-chemical package, the share remains almost the same in both the regions (R-I and R-II). In R-II, labour charges capture a lion's share (40.0 per cent) in the total cost of cultivation of paddy, while it is also somewhat higher in R-I (36.0 per cent). Chemical fertilisers show equally second top position in both the regions. Next, bullock expenditure in R-II and rent in R-I assumes prominence in the total cost. In R-I, pesticides get a share as high as 10.3 per cent, with a negligible share in R-II. At farm-level, a significant feature in R-II is that the shares of bullock expenditure and capital services maintain an inverse relation with farm-size.

In R-II, in respect of almost all the crops (except groundnut) the bullock expenditure and labour charges assume dominance in the total cost, as together they form 55.2 per cent for paddy and 79.6 per cent for jowar. In jowar, the bullock expenditure alone assumes more than half of the cost (57.1 per cent). This type of cost composition was clearly observed in the earlier studies related to backward agriculture. Further, in respect of groundnut, it is the seed that dominates in the cost, while bullock expenditure and labour charges which have equal shares, together account for 36.6 per cent. The share of chemical fertilisers is

Table 7.9: Component Shares in the Total Cost for Individual Crops in Region II

Item of Cost	PADDY				JOWAR				GREEN GRAM			
	S	M	L	T	S	M	L	T	S	M	L	T
1. Seed	4.88	5.10	4.09	4.46	3.60	4.14	3.83	3.88	7.56	7.23	7.44	7.39
2. Manure	7.20	7.60	7.29	7.34	1.82	3.00	5.80	3.98	12.33	11.65	5.20	9.93
3. Che. Fertilisers	19.59	18.26	18.50	18.67	2.75	3.21	1.84	2.50	6.82	8.79	6.90	7.65
4. Pesticides	2.40	1.08	1.76	1.75	..	..	..	..	..	0.47	..	0.19
5. Capital Services	6.48	6.42	3.31	4.61	11.67	8.24	6.28	8.14	9.21	7.03	5.18	7.13
6. Bullock Expdr.	21.57	18.70	12.36	15.56	64.88	60.39	50.80	57.14	39.27	31.28	26.50	32.27
7. Irrigation Expdr.	2.58	2.39	4.25	3.52	..	..	..	..	..	..	..	..
8. Misc. Expdr.	..	0.71	0.09	0.20	..	..	..	..	..	..	..	..
9. Rent Paid	2.50	3.71	5.03	4.24	0.74	0.66	3.34	1.87	..	..	..	..
10. Labour Charges	32.80	36.03	43.32	39.65	14.54	20.36	28.11	22.49	24.81	33.45	48.78	35.44
Total	100	100	100	100	100	100	100	100	100	100	100	100
11. Manure + C.F	26.79	25.86	25.79	26.01	4.57	6.21	7.64	6.48	19.15	20.44	12.10	17.58
12. Bio chemical Inputs	34.07	32.04	31.64	32.22	8.17	10.35	11.47	10.36	26.71	28.14	19.54	25.16
13. Capital Services plus Bull. Expdr.	27.05	25.12	15.67	20.17	76.55	68.63	57.08	65.28	48.48	38.41	31.68	39.40

Table 7.9 (contd.)

Item	RED GRAM				GROUNDNUT				CEREALS				PULSES			
	S	M	L	T	S	M	L	T	S	M	L	T	S	M	L	T
1.	7.20	7.43	8.57	7.92	37.46	41.33	34.94	36.53	4.65	4.91	4.06	4.38	7.44	9.42	7.85	8.39
2.	6.52	6.80	5.32	6.09	2.89	1.15	0.90	1.17	6.13	6.52	7.01	6.72	10.16	8.65	4.34	7.52
3.	2.35	4.37	2.60	3.32	9.67	5.31	8.16	7.75	16.18	14.07	16.16	15.68	5.22	8.37	4.36	6.21
4.	..	0.38	..	0.16	0.97	..	1.08	0.84	1.91	0.78	1.63	1.49	..	0.38	..	0.15
5.	9.92	7.73	7.17	7.75	4.39	4.95	1.68	2.66	7.53	6.94	3.75	5.27	9.44	6.93	5.94	7.20
6.	40.48	32.65	29.16	32.02	27.16	22.78	15.10	18.04	30.26	29.97	18.03	23.32	42.09	31.65	30.58	33.85
7.	..	..	..	..	..	1.13	4.30	3.17	2.06	1.74	3.58	2.84	..	..	..	..
8.	..	..	..	..	0.91	..	..	0.10	..	0.52	0.07	0.16	..	..	..	..
9.	..	..	..	..	5.11	11.49	12.15	11.22	2.14	2.86	4.81	3.81	..	..	..	..
10.	33.53	40.64	47.18	42.74	11.44	11.86	21.69	18.52	29.14	31.69	40.90	36.33	25.65	34.60	46.93	36.68
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
11.	8.87	11.17	7.92	9.41	12.56	6.46	9.06	8.92	22.31	20.59	23.17	22.40	15.38	17.02	8.70	13.73
12.	16.07	18.98	16.49	17.49	50.99	47.79	45.08	46.29	28.87	26.28	28.86	28.27	22.82	26.82	16.55	22.27
13.	50.04	40.38	36.33	39.77	27.73	16.78	20.70	37.79	36.91	21.78	28.59	51.53	38.58	36.52	41.05	

S,M,L and T means Small, Medium, Large and Total Farms

higher only in respect of paddy (18.5 per cent), followed by groundnut and greengram. Although jowar is another important crop of the region, its share for the bio-chemical package is quite low (10.4 per cent). At the farm-level, the striking feature among all the crops is that the bullock expenditure and capital services maintain a negative relation with farm-size, while labour charges tend to show positive relation.

In sum, it seems that, at the total crop level, the cost per acre is higher in R-I than in R-II by 2.5 and 4.4 times on the basis of per acre cropped and net operated area, respectively. On per cropped acre basis, in R-I, the small farms show lower cost per acre and in R-II, the large farms assume higher cost. On per acre of net operated area basis, the relative position among the farm-size groups remains unaffected in R-I, whereas in R-II the small farms could catch up with the large ones. Further, in R-II, among the individual crops, paddy and groundnut assume dominance in the cost per acre, while at farm-size level, the large farms exhibit higher values.

The priorities in the cost composition reveal that in R-I, modern inputs are used most extensively; the big shares of modern capital services and bio-chemical package standout quite clearly. On the other hand, R-II is overwhelmingly dominated by traditional inputs-human and bullock labour and traditional capital.

3. Net Return Per Acre

In the previous sections, per acre value of gross output and cost of production were worked out to develop some idea on the efficiency in the farm economy. It is, however, combined effect of these two indicators, more precisely the difference between the two, which gives a real measure of efficiency. In other words, it is the net return per acre which gives better ideas on relative production efficiency. The concept of net income does not have a single definition. Its definition varies according to the types of cost concept that we use.[8] For example, some researchers prefer to use net income as a composite return for land, labour, capital, and management, both purchased from outside as well as those

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8. In the FMS, four major definitions of the cost are : Cost A1, Cost A2, Cost B and Cost C. Cost A1 is the paid out costs, inclusive of maintenance of bullock and implements and machinery of the owned resources, when the farmer does not lease-in any land. If the farmer is a pure or a mixed tenant, the rent on leased-in land is to be added to Cost A1 and this is called Cost A2. If the imputed values of owned land and fixed capital (including bullocks) is added, we get Cost B. Further, when we add imputed value of family labour to Cost B, this final cost is cost C. Cost A_1 is a variant of Cost A_2 and so they may simply be termed as cost A. Thus, net income is also termed in three ways: if Cost A is subtracted from the value of gross output, we get Farm Business Income (FBI), if Cost B is subtracted, we get Family Labour Income (FLI) and if we subtract Cost C from the gross output, we get Net Income (NI).

contributed by the family.[9] Another version of net return could be to take cognizance of only paid-out costs; in this manner, net return is a composite return for the total of all family resources including family labour and management. Going by the most common convention, we use farm business income (hereafter FBI) per acre, based on a variant of Cost A_2 concept (which includes interest on fixed capital). In other words, FBI is the composite return for own land, family labour and management.

Table 7.10: FBI per Acre at Total Crop Level (Rupees)

Sl. No.	Item/ Region	Small Farms	Medium Farms	Large Farms	Total Farms	Difference between S&M	S&L	M&L
1.	Per Acre of Gross Operated Area							
	R-I	1473.48	1325.17	1310.95	1347.83	NS	SC_1	NS
	R-II	324.00	323.77	569.89	447.64	NS	NS	NS
2.	Per Acre of Net Operated Area							
	R-I	2943.62	2636.67	2604.57	2681.77	ST_2	SC_1	NS
	R-II	430.61	381.90	648.43	529.57	NS	NS	SC_2

NS, SC_1, SC_2, ST_2 and also S,M and L are as defined in previous Tables.

Table 7.10 shows FBI per acre at the total crop

9. C.H. Hanumantha Rao, Agricultural Production Functions, Costs and Returns, Asia Publishing House, Bombay, 1965, p.27.

level, based on both cropped acre and net operated acre. FBI per acre of gross cropped area is 201.1 per cent higher in R-I than in R-II, the two figures being Rs.1347.83 and Rs.447.64 respectively. This is indeed an alarming gap between the advanced and backward agriculture. At farm-level, in R-I there is a systematic inverse relation with farm-size. The small farms show 11.2 and 12.4 per cent higher value than the medium and large farms respectively and the difference between the small and the large farms is statistically significant. Thus, in the developed region (R-I), the small farms seem to perform efficiently. This efficiency is due to lower cost per acre on the small farms and this in turn is the effect of lower labour charges on the small farms (Rs.503.48) compared to those on the medium and large farms (Rs.625.08 and Rs.731.72 respectively).[10] In sharp contrast, in R-II, it is the large farms which get much higher FBI per acre. The small and the medium farms have almost the same level. The large farms show 75.9 per cent higher value than both the small and medium farms respectively. In the less advanced region (R-II), contrary to general expectation, the large farms show efficient performance. This may be attributed to the fact that the large farms concentrate relatively more on the cultivation of

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10. The small farms depend on family labour to the extent of 34.6 per cent of the total labour days, whereas the contribution of family labour on the medium and large farms is 13.3 and 2.6 per cent only. See Tables 6.1 and 6.2 in Chapter-VI.

high-value commercial crops, most notably groundnut. Moreover, expenditure on improved irrigation by large farms is relatively higher on per acre basis. In sum, large farms seem to be updating their production technology in a more comprehensive manner, compared with the lower two categories, even in the backward region. To put the record straight, their resource endowment status helps them readily in doing so although the general situation of the area is typical of agricultural backwardness.

On per acre of net operated area basis, FBI in R-I is 4 times as high as in R-II (i.e. 300 per cent higher compared with 200 per cent higher observed earlier on gross cropped area). Thus, the relative gap is widened on this basis. As regards farm-size differences, in R-I, they maintain the same relative gap, cropping intensity being equal all along the farm-size ladder in this region; while in R-II, the relative gap between the large and the medium farms has gone up, thereby this difference also turns out to be statistically significant. Still, the large farms in R-II and the small farms in R-I show higher values than other farm-size groups.

Now, we proceed to analyse the variations among the individual crops. Table 7.11 gives the details for this purpose. At the level of individual crops the differences are quite marked between R-I and R-II. For example, the FBI per acre for paddy is 102.8 per cent higher in R-I over R-II. In R-II, it maintains a positive association with farm-size, while it has negative relation in R-I. Thus, the small farms

Table 7.11: Farm Business Income Per Acre _ Individual Crops
(in Rupees)

Region/ Crop	Small	Medium	Large	Total	Difference between		
					S&M	S&L	M&L
REGION I							
Paddy	1473.48	1325.17	1310.95	1347.83	NS	SC1	NS
REGION II							
1. Paddy	520.72	584.92	751.40	664.56	NS	NS	NS
2. Jowar	138.82	178.36	239.03	198.06	NS	NS	NS
3. Greengram	243.12	209.12	403.07	276.81	NS	SC1	ST2
4. Redgram	432.74	460.80	332.90	388.99	NS	NS	ST2
5. Groundnut	519.19	425.69	865.28	716.89	NS	NS	NS
6. Cereals	318.23	329.66	491.10	408.84	NS	NS	NS
7. Pulses	268.53	239.13	309.13	272.10	NS	NS	NS

NS, ST2, SC1 are as in Table 7.2

in R-I and the large farms in R-II show efficiency in the cultivation of paddy. This is consistent with what was noted above for FBI at the aggregate output level.

Further, in R-II, groundnut has the highest FBI per acre, followed by paddy, redgram, greengram and jowar in that order. FBI in respect of groundnut is Rs.716.89 whereas for paddy it is Rs.664.56. Though the gross output per acre for paddy is higher than that of groundnut, the cost is relatively low for groundnut, resulting in a higher net return for it. At farm-level, except on redgram, in respect of all the crops, the large farms show higher values than the medium and the small farms. Further, the small farms fare better than the medium farms in respect of jowar, green gram, groundnut and pulses. But, the reverse is the case for paddy, redgram and cereals. The total effect of the above relationships is that at total crop level, there is practically no difference between the FBI per acre of the small and the medium farms.

4. <u>Determinants of Production</u>

So far we have dealt with simple averages of input factors (Chapter VI), and of productivity, total cost and net returns in the preceding three sections of this chapter for the purpose of determining the level of production efficiency. The individual findings of the previous section cannot delineate the contribution of individual resource inputs towards output. As is well known, these input factors may be interacting with each other. Further, it is the combined effect of all input factors that determines the output on the farms. In such circumstances, it is important to work out the contribution of each input to output through an appropriate technique. This job is conveniently accomplished by multiple regression analysis, in terms of a specified production function. Accordingly in this section, we take up production function analysis to see how far the chosen input factors explain the variability in the output both at the level of farm as a whole and at the level of individual crops.

As our aim is limited, we do not go for a rigorous exercise on different types of production functions and we prefer to use the Cobb Douglas Production Function for its ease of manipulation and goodness of fit. Moreover, as many studies suggest, the Cobb Douglas formation is more acceptable from the point of view of farm level cross-section data.[11] Again, Cobb Douglas function gives direct estimates of output elasticity coefficients with respect to input factors, as regression coefficients are equal to elasticity co-efficients.

The Cobb Douglas formulation for our purpose is with four independent variables (X_i) and the dependent variable (Y), defined as follows:

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11. G.K. Chadha, Production Gains of New Agricultural Technology, Punjab University, 1979, p.17.

$Y = A X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} U$, where

Y = Out put in Value (Rs.)

X_1 = Land input (Gross Cropped Area in acres)

X_2 = Human labour days (man-equivalent days)

X_3 = Capital services including bullock expenditure (Rs.)

X_4 = Total expenditure in bio-chemical inputs including irrigation (Rs.)

A = Efficiency parameter

U = Error term

b_i = Elasticity coefficients

Variables X_1 and X_2 are in physical terms, whereas all other variables are in value terms. X_3 in the developed region (R-I) is mainly of capital services that are modern in nature (of tractor, sprayer etc.), as bullock expenditure is practically negligible in this advanced region. On the other hand, in R-II, bullock expenditure is the major component in this variable and both bullock expenditure and capital services represent traditional capital. Thus, X_3 shows capital as a flow of expenditure. Further, X_4 is a completely modern package of bio-chemical inputs in R-I, while in R-II the proportion of traditional inputs in X_4 is very high. To recapitulate, only 5.0 per cent of gross cropped area was under HYV while chemical fertilisers were used on 44.0 per cent of such area. Incidentally, all the inputs showed non-zero entries in the input matrix for every individual crop for the sample farms. The Cobb-Douglas function did not, therefore, pose any estimational problems.

Although we have chosen only four independent variables for the purpose of production function analysis, yet, we encounter the problem of multicollinearity. The problem of multicollinearity is particularly severe in developed region (R-I). The correlation matrix in respect of total crop is set out in Table 7.12. From the table, it is clear that each of the inter-correlations in R-I is greater than 0.8, which is generally taken as the signal for the presence of multicollinearity.[12] A silver lining is, however, available because the multiple correlation coefficient is greater than any of the zero-order correlations. Accordingly, following Klein, we are still tempted to interpret the coefficients of the only regression equation of R-I. A brief explanation for this problem of multicollinearity in R-I is as follows. R-I, due to its high irrigation facilities, has a mono-crop culture - paddy. Further, as a result of better institutional and technological conditions, R-I has an advanced agriculture, though the crop-mix is not as diversified as the one in R-II. Given these favourable conditions, factor proportions are not showing very big deviations on farm-to-farm basis. Such a situation can possibly be visualized when technology has acquired a fair degree of maturity. To some extent, this seems to have happened in R-I.

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12. Earl O. Heady and J.L. Dillion, Agricultural Production Functions, Iowa State University Press, Ames, Iowa, 1964, p.136.

Table 7.12: Zero Order Correlation among Input Variables for Total Crops and Total Farms

Region	Variable	Land Input (X1)	Human Labour Days (X2)	Capital Services inclusive of Bu.Expr. (X3)	Bio_Chemical Inputs including Irrigation Expr. (X4)	Gross Output (Y)
REGION I						
	X1	1.000				
	X2	0.973	1.000			
	X3	0.911	0.874	1.000		
	X4	0.966	0.979	0.862	1.000	
	Y	0.994	0.954	0.905	0.952	1.000
REGION II						
	X1	1.000				
	X2	0.460	1.000			
	X3	0.808	0.355	1.000		
	X4	0.734	0.415	0.737	1.000	
	Y	0.768	0.419	0.773	0.911	1.000

The results of regression equations, for R-I and R-II, both at total crop and individual crop levels are set out in Table 7.13. In R-I, for total crop (paddy), the four inputs together explain 99 per cent of variation in the output. The elasticity coefficients only for two inputs, viz. land (X_1) and bio-chemical inputs (X_4) are statistically significant.[13] These input factors have a positive impact on the output. Land has the highest elasticity coefficient (0.922), which is significant at 1 per cent level. Really, this is an amazing result in a developed region. Rao found a higher elasticity coefficient for land, from the data related to 1953-54 of Hyderabad state in partially irrigated farms, while arriving at the conclusion:[14]

> It is, understandable, on theoretical grounds, that the greater the intensity of utilisation of land, the larger the elasticity of output that could be expected with respect to this factor.

In our developed region (R-I) also, the cropping intensity is as high as 2.00, and in the spirit of Rao's conclusion, it is expected to show a high elasticity coefficient for land. Further, from the same region (R-I), Chawdhari et al. found a higher coefficient for land (0.788), based on the data of

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13. We take multicollinearity problem into account for the insignificance of other coefficients, as this problem may also lead to insignificance of all the coefficients, despite higher R.

14. C.H. Hanumantha Rao, op.cit., pp.17 and 18.

Table 7.13: Production Functions Crop wise and Total Crop Level

Region/ Crop	REGRESSION COEFFICIENTS OF Intercept	Land Input (X1)	Human Labour (X2)	Capital Services inclusive of Bullock Expenditure (X3)	Bio-chemical Inputs including Irrigation Expenditure (X4)	Returns to Scale	No. of Observations	$\bar{R}^2$	F test with null Hypothesis $\Sigma b = 1$
REGION I									
Total Crop (= Paddy)	3.3107	0.9219* (16.331)	0.0312 (0.585)	0.0224 (0.788)	0.0747*** (1.663)	0.9688	140	0.99	1.157
REGION II									
1. Total Crop	3.0548	0.1228* (2.487)	0.6032* (8.827)	0.0530 (1.460)	0.2727* (7.297)	1.0517	139	0.92	2.852
2. Paddy	0.6878	0.0011 (0.008)	0.6682* (4.297)	0.1501** (2.167)	0.3451* (3.966)	1.1620	87	0.87	7.282*
3. Jowar	3.6200	0.2161 (1.601)	0.8605* (5.376)	0.0310 (0.495)	0.0347 (0.936)	1.1423	77	0.81	1.375
4. Green gram	1.7929	0.0937 (0.833)	0.9047* (6.554)	0.0212 (0.360)	0.0354 (0.656)	0.9418	73	0.69	0.562
5. Red gram	1.1205	0.0686 (0.520)	0.9946* (5.409)	0.0103 (0.055)	0.2279* (2.915)	1.1394	47	0.73	1.514
6. Groundnut	0.7691	0.2082*** (1.735)	1.0583* (6.609)	0.2308** (2.147)	0.1083 (1.298)	1.1893	57	0.92	13.767*
7. Cereals	1.7625	0.3978* (6.091)	0.3000* (4.571)	0.0807 (1.493)	0.2595* (8.135)	1.0380	126	0.88	0.711
8. Pulses	1.5468	0.0004 (0.003)	0.8880* (7.151)	0.0441 (0.647)	0.1120** (2.350)	0.9563	100	0.70	0.410

Figures in brackets are t values, * = Significant at 1 per cent level
** = Significant at 5 per cent level, *** = Significant at 10 per cent level

1966-67,[15] whereas Khan and Tripathy found negative elasticity for land (-0.0395) based on the data of 1969-70.[16] It is really very perplexing to find such differences among the estimates, more so because these relate to time points not much distanced from one another. Confronted with vastly different estimates for two consecutive time points (1967-68 and 1968-69), in respect of production function estimates for Muzaffarnagar, Rudra rightly points out that the differences between the estimates are quite often so large as to cast doubts on any economic significance attaching to estimates.[17]

Further, bio-chemical package has a positive impact on the output, though the coefficient has a smaller value (0.075) and is significant only at 10 per cent level. It is interesting to note that capital services inclusive of bullock expenditure has no significant impact on output, though its coefficient is positive. Finally, labour input has a negative but non-significant coefficient, indicating

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15. T.P.S. Chawdhari, et al., Resource Use and Productivity on Farms - Comparative Study of Intensive and Non-intensive Area, NICD, Hyderabad, 1969, p.67.

16. Waheeduddin Khan and R.N. Tripathy, Intensive Agriculture and Modern Inputs - Prospects of Small Farmers - A Study in West Godavari District, NICD, Hyderabad, 1972, p.87. Further, they got a very high elasticity coefficient (with positive sign) for Labour (1.03).

17. Ashok Rudra, Indian Agricultural Economics - Myths and Realities, Allied Publishers, New Delhi, 1982, pp.261-262.

that the application of this input has been stretched to the stage of constant total output. In other words, a little lesser use of labour would not affect output unfavourably nor would a little extra use of it affect the output favourably; output is more or less invariant to labour application. Our result cannot be interpreted better even by making a differentiation between labour and labourers.[18] Finally, the test for returns to scale indicates that there are constant returns to scale in R-I.

In R-II, at the total crop level, we find, all the four input factors have positive coefficients, with an insignificant coefficient only in respect of capital services, explaining 92 per cent of variation in the total output. In sharp contrast to R-I, it is remarkable that, in our backward region (R-II), the labour input assumes dominant position, showing a positive and significant coefficient, as high as 0.6032. Further, the bio-chemical package in R-II, though containing a low component of modern content, has a substantial impact on the output, with its significant positive coefficient (0.2727). This may be attributed to the diversified crop mix, with higher cost on seed and

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18. While contending with the result of positive marginal productivity of labour, arrived at by the fitters of Cobb Douglas production function, Rudra says that the production is to be expressed as a function of labourers (N) instead of labour (L), if the existence or otherwise of surplus labourers is to be found. See <u>ibid</u>., p.22.

fertilizers mainly on the large farms. Land input also has its significant positive impact on the production at total crop level. However, the capital services fail to show its significant impact on the output in R-II; may be, because of the composition of traditional content in them.

Paddy is a crop whose production function is directly comparable between R-I and R-II. In R-II, its regression explains 87 per cent variation in the output. The elasticity coefficients of labour, bio-chemical package and capital services are positive and significant. Interestingly, in contrast to the results for paddy in R-I, here the labour has the highest elasticity (0.668) and thus, paddy cultivation in R-II has a yield-increasing effect with respect to labour, while the land has negative impact on output, though insignificant. The elasticity coefficient of bio-chemical package[19] is substantial (0.345). The value of capital services for this crop is higher than that on other crops (irrespective of the farm-size), and accordingly its coefficient shows positive significant impact on paddy production.

Now we may look at the individual crops as a whole in R-II. From the regression equations, it is seen that the variation in output is explained to the extent of 69 to 92 per cent. One common feature is that labour input has

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19. In R-II, of 290.1 acres under paddy, 21.0 per cent of it is under HYVs, 86.5 per cent irrigated and nearly 50.0 per cent artificially fertilised.

significant positive impact on output for all the crops. The elasticity coefficient is the highest for groundnut (1.058), followed by redgram, greengram, pulses, jowar and paddy in the descending order, the coefficient for paddy being 0.668. A striking contrast is seen in respect of groundnut for which the elasticity coefficient of land is negative and significant (at 10 per cent level) while that of labour is as high as 1.058. As a matter of fact, the groundnut is grown mainly on the large farms,[20] i.e. land and labour are higher on the large farms. Further, the bio-chemical package has positive and significant impact on the output of the crops, viz. paddy, cereals, redgram and pulses in the descending order. Another interesting feature is that the capital services input has positive and significant impact on the production of paddy and groundnut. These two crops show increasing returns to scale. It is appropriate to recall that in R-II, these two crops showed their dominant position in the resource-use, as seen in Chapter VI.

Summary

In R-I, at the total crop level, the levels of gross output, total cost and net returns (all on per cropped acre basis) are higher than those in R-II, thus establishing the technological superiority of R-I over R-II. At the farm-

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20. Nearly 64 per cent of the total area under groundnut is cultivated by the large farms (180 acres out of 282 acres under this crop).

level, in R-I, the differences are negligible in respect of gross output per acre. In respect of total cost and net returns, the small farms perform efficiently, as they show lower cost and higher net returns than both the medium and large farms. This efficiency is attributable to the lower cost on hired-in labour (due to higher use of own labour) on the small farms. In R-II, the large farms show efficient production conditions, as they exhibit higher gross output, net returns, and total cost (all per cropped acre) than the small and the medium farms. Between the small and the medium farms, the small farms fare better.

At the level of individual crops, paddy in R-I has the highest levels of those three indicators, both at the aggregate and individual farm-size levels. In R-II, among the individual crops, paddy and groundnut dominate in the values of these three indicators. At farm-level, the large farms show higher values for those indicators in respect of almost all the crops.

As regards the cost-structure, in R-I, the modern capital services and the new bio-chemical package figure prominently in total cost estimates whereas in R-II, the cost composition, both at the total and individual crop levels, is still in favour of the traditional inputs - human and bullock labour and traditional capital.

By regression analysis, from linear and log-linear functions, there seems to be neutral relationship with farm-size for productivity as well as overall yield rate in the developed region (R-I). In the backward region (R-II), there is a U-shaped relation between farm-size and those two indicators. Further, in R-II, at the total crop level there exists a U-shape relation for Cost A2 (both in terms of per acre NOA and GCA) with farm-size.

Our production function analysis has not thrown up very neat results. Nevertheless, a few major features could be underlined. Firstly, at the total crop level, in the developed region (R-I), only land turns out to be the big contributor to output, whereas in the backward region (R-II), it is the labour input that has relatively higher impact on the output. Secondly, in R-II, the two dominant crops, paddy and groundnut, show significant and positive elasticity coefficients for labour and capital services. Finally, as regards returns to scale, at total crop level, there are constant returns to scale in both the regions. However in R-II, paddy and groundnut show increasing returns to scale.

CHAPTER - VIII

EMPLOYMENT, INCOME AND CONSUMPTION PATTERN

In the previous 2 or 3 chapters, we have analysed the production structure of different farm-size categories in the two regions, representing two distinct technology levels. In the agriculturally advanced region (R-I), the modern input-use and the productivity are higher than those in R-II, which typically represents backward agricultural conditions. Further, in R-I, the farm-size-productivity relation seems to be neutral to size, thereby showing that the inverse relation has been weakened in the developed region, whereas in R-II, there exists a U-shaped relation.

We have yet to discuss the crucial aspects of the farming households, viz. employment, income and consumption pattern. To capture all aspects of employment and earnings, the analysis in this chapter would have to be largely in terms of household estimates, and not per capita basis. In the first section, we consider the quantum of employment in self-cultivation and the extent of involvement in the non-agricultural avenues. In the second section, we deal with the total income generated through different sources, including distribution and poverty. In the third, we take up consumption pattern in a somewhat detailed manner.

1. Employment

Among the sample households, two types of workers are reported viz. family farm workers (FFWs) and pure non-agricultural workers (NAWs). Although the FFWs work on their own farms, yet they may also take up employment in others' farms and also get engaged in some non-agricultural activities. The inter-regional diversities apart, the dependence on the non-own farm activities is determined by factors such as (i) net returns on own-farm, (ii) availability of other avenues of employment, including self-employment, and (iii) ability to do the available work (i.e. skill formation). As per our field experience, the FFWs may involve themselves in four types of employment : (a) Own farm activity, (b) Upkeep of livestock, (c) Wage-paid agricultural employment, and (d) Non-agricultural employment - wage-paid and/or self-employed. As regards pure non-agricultural workers, wage-paid and/or self-employment has been taken into account. The total household employment in different sources is presented in Table 8.1.

Agricultural Employment

It is clear from Table 8.1 that per holding agricultural employment on own farm is 117 days in R-I, and is 36 per cent higher than that in R-II.[1] It may be

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1. We cannot rule out the possibility of underestimation of labour days in the crop production, as pointed out by A. Vaidyanathan, see "Labour Use in Rural India - A Study of Spatial and Temporal Variations", EPW, RA, December 27, 1986. He points out the differences in per hectare labour days in the FMS and NSS data, being 55-190 days in the former and 355-360 days in the latter.

Table 8.1: Employment Under Agricultural And Non-agricultural Avenues

Item of Employment	Region-I Small	Region-I Medium	Region-I Large	Region-I Total	Region-II Small	Region-II Medium	Region-II Large	Region-II Total
1.Own Farm	135.03	125.03	63.52	116.91	58.18	101.51	113.23	85.87
	(46.28)	(52.91)	(34.64)	(45.83)	(14.08)	(24.91)	(28.63)	(21.09)
2.Upkeep of Livestock including draught cattle	28.00	20.00	5.00	21.08	34.00	22.00	15.00	25.39
	(9.60)	(8.46)	(2.72)	(8.26)	(8.23)	(5.40)	(3.79)	(6.23)
3.Agricultural Wage Employment	57.08	25.63	12.90	40.11	51.25	45.33	5.71	38.18
	(19.56)	(10.85)	(7.04)	(15.72)	(12.40)	(11.12)	(1.45)	(9.38)
4.Total Agricultural Employment	220.11	170.66	81.42	178.10	143.43	168.84	133.94	149.44
	(75.43)	(72.22)	(44.40)	(69.81)	(34.71)	(41.43)	(33.87)	(36.70)
5.Non-agricultural Employment by FFWs	39.61	43.13	62.26	45.43	170.25	194.33	166.00	176.93
	(13.57)	(18.25)	(33.96)	(17.81)	(41.21)	(47.69)	(41.97)	(43.46)
6.Non-agricultural Employment by NAWs	32.08	22.50	39.68	31.57	99.50	44.33	95.57	80.79
	(11.00)	(9.53)	(21.64)	(12.38)	(24.08)	(10.88)	(24.16)	(19.84)
7.Total Non-agricultural Employment	71.69	65.63	101.94	77.00	269.75	238.66	261.57	257.72
	(24.57)	(27.78)	(55.60)	(30.19)	(65.29)	(58.57)	(66.13)	(63.30)
8.Total Household Employment	291.80	236.29	183.36	255.10	413.18	407.50	395.50	407.16
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
9.Main Source in Non-agricultural Employment by FFWs								
(a) Non-caste Self-Employment	12.46	18.84	60.62	28.46	17.62	18.70	22.37	19.12
(b) Services	48.52	52.17	34.20	44.97	9.45	10.00	-	7.42
(c) Casual	12.46	28.99	-	12.27	66.47	71.30	77.63	70.80
10.Main Sources in Non-agricultural Employment by NAWs (%)								
(a) Non-caste Self Employment	-	-	70.73	19.68	22.19	-	35.87	22.33
(b) Services	56.07	100.00	29.27	48.99	23.37	18.30	-	15.56
(c) Casual	26.72	-	-	14.93	25.63	45.11	30.49	30.50

Figures in parentheses indicate percentage shares in Total Household Employment explained in terms of the high labour-absorptive capacity of paddy on the one hand and the higher cropping intensity (2.00) in R-I on the other, compared with the unfavourable position of R-II on both these counts. For example, cropping intensity is as low as 1.18 in R-II. At farm-level, in R-I, it (own farm employment) maintains inverse relation with farm-size, whereas it has positive association in R-II. The former relation gives an inference that the increasing farm-size in R-I encourages leisure preference, whereas in R-II the increasing size makes the farmers to work more on their own farm, due to their crop-mix noted earlier and the exigency generated by the lower income levels.

In regard to the employment on upkeep of livestock, R-II shows 20.0 per cent higher number of days than in R-I. This is so because the farmers in R-II maintain both draught and milch cattle. In contrast to this, for wage-paid agricultural employment, R-I shows an edge over that in R-II, as it is understandable from the fact that agriculture in R-I creates more demand for labour as it has higher labour-absorbing capacity. In respect of these two employment categories, there is an inverse relationship with farm-size in both the regions, as the large farmers themselves hire in labour - both permanent and casual.

When we look at the total agricultural employment, we find it to be nearly 20.0 per cent higher in R-I than in R-II. The reason for this is that own-farm and wage-employment are higher in R-I. At the farm-level, in R-I, there is an inverse relation with farm-size, as has been already explained. But in R-II, the medium farms show higher days than both the small and the large farms; it seems, the medium farms use relatively higher amount of family labour on self-cultivation than the small farms who hire out a part of their labour.

Another way of looking at employment in agriculture is to see the relative importance of each component in the total household employment. The own-farm employment makes up 46 per cent in R-I whereas it is only 21.0 per cent in R-II. Wage-paid agricultural employment shows higher share in R-I than in R-II. The share of employment on upkeep of livestock being not much different in the two regions, naturally the total agricultural employment shows higher share in R-I than in R-II, being 69.8 and 36.7 per cent respectively. The shares of the three components and the total agricultural employment show the same relation with farm-size, just as their absolute levels. It is puzzling that the share of agriculture in the total employment in R-II is as low as 36.7 per cent. Perhaps, this is a manifestation of backward agriculture that does not provide sufficient employment and net income for the farming households, ultimately driving them to search for other avenues of employment outside agriculture. It is a different matter that such non-farm avenues may be none too lucrative but the push-out factors do operate intensely because agriculture just cannot absorb the rising numbers.

Non-Agricultural Employment

It is interesting that non-agricultural employment plays a dominant role in R-II in the total employment than in R-I (63.3 and 30.2 per cent respectively in R-II and R-I). Further, it is family farm workers (FFWs) that contribute relatively more to non-agricultural employment than pure non-agricultural workers (NAWs) in R-II. As the agriculture of R-II is less remunerative, less productive and less labour-absorptive, it necessitates the farming households to involve themselves in non-agricultural activities, so as to maintain their sheer livelihood. Such a scenario is aptly described as follows:[2]

> If agriculture is at low level of development, typified by low productivity levels, a near-absence of technological breakthrough, a negligible component of purchased inputs, a small quantum of marketable surplus per farm household, low agricultural incomes etc., non-farm-employment is essentially a distress type.

Generally, the FFWs go in for non-farm activities which are investment free, such as wage-paid employment within or outside agriculture; and they involve themselves in those avenues of employment as long as work on their own farms does

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2. G.K. Chadha, "Agricultural Growth and Rural Non-Farm Activities: An Analysis of Indian Experience", in Yang-Boo-Choe and Fu-Chen-Lo (eds.), Rural Industrialization and Non-Farm Activities of Asian Farmers, Korea Rural Economics Institute and Asian Pacific Development Centre, 1986, p.142

not suffer.[3] In some cases, self-employment with low investment is also taken up.

As non-agricultural employment is undertaken by FFWs also, in addition to NAWs, we separate out the contributions in non-agricultural employment due to (i) FFWs and (ii) NAWs. In R-II, the non-agricultural employment by FFWs is nearly 4 times as high as that in R-I (being 177.93 and 45.43 days respectively in R-II and R-I). This corroborates what we have noted in the preceding part of this section. At farm-level in R-II, the FFWs of the medium farms involves themselves to a larger extent (194.33 days) in non-agricultural employment, while the large farms too have this employment to the tune of 166.0 days. In R-I, this employment per holding by FFWs shows an increasing trend with farm-size.

Even in the employment of pure non-agricultural workers, R-II shows nearly 160 per cent higher days than in R-I (being 80.8 and 31.6 days respectively). In both the regions, the medium farms show lower days than the other farm-size groups.

As a concomitant of the above finding, the total non-agricultural employment should be higher in R-II than in R-I.

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3. G.K. Chadha, "The Off-Farm Economic Structure of Agriculturally Growing Regions: A Study of Indian Punjab", in R.T. Shand (ed.), Off-Farm Employment in the Development of Rural Asia, Vol.II, National Centre for Development Studies, Australian National University, 1986, p.157

In deed, in terms of actual figures, it is 3 1/2 times as high in R-II as in R-I. At farm-level, the employment does not show any clear-cut pattern with farm-size; if anything, it resembles U-shape curve in both the regions.

Within the non-agricultural employment, if we look at the ratio of employment of FFWs to that of NAWs, at the overall farm-level, it is 1.44 in R-I and 2.19 in R-II; it varies over the three farm-size categories between 1.25 to 1.95 in R-I and 1.70 to 4.40 in R-II, the upper limits being applicable to the medium farms in the two regions. Thus, the FFWs in R-II contribute non-agricultural employment in a higher proportion both at overall and farm-size levels.

Further, if we ascertain the main sources of non-agricultural employment, it is found that in R-I it is services, while in R-II it is casual labour that dominate for both FFWs and NAWs. The next important source, in both the regions, is self-employment. In R-I, the services include occupations, such as teachers, clerks, drivers, etc., which are relatively more remunerative, whereas in R-II, non-agricultural casual labour is mainly related to manual labour, such as quarrying and construction of road. Further, in self-employment of R-I, contract work, trade and running rice mill etc., which are highly profitable, are also taken up. Thus, in sharp contrast to R-II, the available non-agricultural employment in the developed region (R-I) seems to be of a longer duration in a year as also more remunerative on any comparable basis.

Total Employment

As seen from the previous analysis, though agricultural employment is higher in R-I than in R-II, the non-agricultural employment in R-II is substantially higher than in R-I. From this it naturally follows that the total household employment is to be higher in R-II. In terms of shear mandays of work, the total employment is 60.0 per cent higher in R-II than that in R-I. At farm-level, there is a systematic inverse relation with farm-size in both the regions. In R-II, the variation across the farm-size groups is not much, varying between 395.5 days on the large farms to 413.2 days on the small farms.

In R-II, there is a higher incidence of non-agricultural employment for both FFWs and NAWs among all farm-size categories. In R-I, the share of non-agricultural employment of FFWs in the total employment is 17.8 per cent, whereas it is 43.5 per cent in R-II. But the share of NAWs is only 12.4 per cent in R-I, while it is nearly 20.0 per cent in R-II. Thus,FFWs dominate in the total employment, if we count their total employment (agricultural as well as non-agricultural). Their share is as high as 87.6 per cent in R-I while in R-II also it is not less (80.2 per cent).

Per Worker Employment

So far we have dealt with employment on per household basis. It may be of crucial significance to look into the differences in the availability of employment on per worker basis for different categories of employment under different norms. This is especially important from the point of view of the impact of better technology on employment days for each working member of the farming households. The details are shown in Table 8.2.

It is clear from Table 8.2 that employment per family farm worker(FFW) on own farm and total agricultural employment are higher in R-I than in R-II, both at the overall as well as individual farm-size levels. An important feature that draws our special attention is that in R-II, per FFW non-agricultural employment is higher than that in R-I, again both at the overall and farm-size levels. This edge of R-II in non-agricultural employment leads to show higher levels in respect of (i) per FFW total employment and (ii) per worker total employment. As agriculture in R-II does not provide enough employment, the farming households there depend on non-farm activities to a greater extent, compelled by distress economic conditions. Further, by any norm, except for pure non-agricultural workers, there seems to be a good amount of underemployment[4] for the labour of the farming households.

As all the FFWs do not participate in wage-paid agricultural employment and in non-agricultural employment (wage-paid or self-employed); if we consider the employment

4. Even if some weightage is given to underestimation of labour days in crop production, as per note(1)

Table 8.2: Per Worker Days of Employment by Different Norms

Item	REGION I S	REGION I M	REGION I L	REGION I T	REGION II S	REGION II M	REGION II L	REGION II T
1. Per FFW on Own Farm	59.07	59.72	36.46	55.11	25.30	33.34	40.44	32.23
2. Per FFW Total Agri. Employment	96.30	81.51	46.74	83.95	62.36	55.36	47.84	56.09
3. Per FFW Non-agri. Employment	17.33	20.60	35.75	21.42	74.02	63.83	59.28	66.41
4. Per FFW (Agri.+ Non-agr) Empt.	113.63	102.11	82.49	105.37	136.38	119.29	107.12	122.50
5. Per NAW (Non-agri.) Empt.	352.92	360.00	307.60	339.83	271.34	332.50	238.93	269.30
6. Per Worker (Mixed) Total Empt.	122.78	109.58	98.01	115.21	154.94	128.24	123.60	137.36
7. Per Male FFW on Own Farm*	94.52	78.45	40.18	77.94	44.75	56.40	58.28	52.96
8. Per FFW Partici-Pated agri. Wage Empt.	77.10	91.15	66.67	78.01	60.88	65.80	49.96	62.16
9. Per FFW Partici-pated Non agri. Empt.	234.66	230.00	241.22	235.50	141.88	145.75	170.89	149.22

FFW = Farm Family Worker, NAW = Non Agricultural Worker (purely)
* = If male FFW only are taken into account on own farm

per FFW, among the participating FFWs, both wage-paid agricultural and non-agricultural employment per FFW would be higher in R-I. Further, employment per NAW, is higher in R-I compared with R-II. It cannot, however, be brushed aside that the proportion of NAWs in total workers is fairly low even in R-I.

As regards farm-size differences, in most of the cases, a negative relation with farm-size is noticed. This gives an idea that the increasing farm-size in most of the categories of employment dampens the willingness to work, as also reflecting partly the impact of the increasing workers per holding on the farm-size ladder.

2. <u>Household Income</u>

The income of cultivating households is generated both from farm and non-farm sources. In our study, the income of the farming households is derived from the following sources:

(i) Farm Business Income (FBI)[5],
(ii) Income from dairying,
(iii) Agricultural wage employment, including bullock-cart driving,
(iv) Non-agricultural earnings of the FFWs in self-and/or wage paid-employment,
(v) Non-agricultural earnings of NAWs,
(vi) Income from miscellaneous receipts (i.e.not due to employment) as defined in chapter-III.

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5. Unlike in Farm Management Surveys, here the FBI is exclusive of interest on fixed capital. That is, it may be treated as Composite Returns, being the returns of own farm activity for family labour, land and supervision, (See Chapter VII).

The first three sources account for agricultural income and the latter three sources may be treated as non-agricultural income. Further, the first four sources together are due to the engagement of FFWs. The break-up of income is shown in Table 8.3.

Agricultural Income

In R-I, composite returns (FBI) are 5 times as high as that in R-II, being Rs. 20,488.2 and Rs. 4,262.8 respectively. The returns account for 78 per cent in the total household income in R-I, whereas it is only 42 per cent in R-II. Thus, such a great hiatus between the own-farm incomes of the two regions is the effect of the glaring gap between the technology levels.

Further, dairying and agricultural wage incomes are also higher in R-I than in R-II by 71 and 55 per cent respectively. These higher levels may be explained in terms of the rearing of milch cattle of improved quality and the expanding capacity of R-I to provide higher agricultural wage employment. These two sources together account for only 6.10 and 9. 65 per cent in the total household income in R-I and R-II respectively.

At farm-level, in both the regions, FBI maintains a positive relation with farm-size while agricultural wage income maintains an inverse relation with farm-size. These are the results that are usually observed in farm level studies. In regard to dairying there is an inverse relation

Table 8.3: Income by Different Sources Per Household (Rupees)

Item	REGION I				REGION II			
	Small	Medium	Large	Total	Small	Medium	Large	Total
1. Farm Business Income	8434.07	19968.67	50965.45	20488.21	1368.63	2942.36	10921.96	4262.81
(Composite Returns)	(69.93)	(81.85)	(80.52)	(78.13)	(19.50)	(35.83)	(62.80)	(42.64)
2. Dairying	1071.44	1048.50	510.01	941.88	471.21	514.50	731.65	550.23
	(8.89)	(4.30)	(0.81)	(3.59)	(6.71)	(6.26)	(4.21)	(5.50)
3. Agricultural Wage inclu ding Bullock cart driving	756.37	639.07	438.77	659.21	623.50	453.78	45.76	424.50
	(6.27)	(2.62)	(0.69)	(2.51)	(8.88)	(5.52)	(0.26)	(4.25)
4. Total Agricultural Income	10261.88	21656.24	51914.23	22089.30	2463.34	3910.64	11699.32	5237.54
	(85.09)	(88.77)	(82.02)	(84.23)	(35.09)	(47.61)	(67.27)	(52.39)
5. Non agricultural Icome by FFWs	1005.20	1309.38	2512.90	1408.57	1904.92	2617.22	1965.14	2148.93
	(8.33)	(5.36)	(3.97)	(5.37)	(27.13)	(31.87)	(11.30)	(21.50)
6. Non agricultural Income by NAWs	490.91	375.00	2451.61	898.57	2217.00	917.33	2818.86	1949.71
	(4.07)	(1.54)	(3.87)	(3.43)	(31.58)	(11.17)	(16.21)	(19.50)
7. Total Non agricultural Income	1496.11	1684.38	4964.51	2307.14	4121.92	3534.55	4784.00	4098.64
	(12.40)	(6.90)	(7.84)	(8.80)	(58.71)	(43.04)	(27.51)	(41.00)
8. Other Receipts	303.12	1056.61	6415.33	1828.77	435.42	767.78	909.14	660.48
	(2.51)	(4.33)	(10.14)	(6.97)	(6.20)	(9.35)	(5.22)	(6.61)
9. Net Household Income	12061.11	24397.23	63294.07	26225.21	7020.68	8212.97	17392.46	9996.86
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
10. Total Non Own Farm Income	3627.04	4428.56	12328.62	5737.00	5652.05	5270.61	6470.55	5733.85
	(30.07)	(18.15)	(19.48)	(21.87)	(80.50)	(64.17)	(37.20)	(57.36)
11. Per Day Earnings on Agricultural Employment(Rs.)	13.25	24.93	34.01	16.44	12.17	10.01	8.01	11.12
12. Per Day earnings in Non agricultural Employment by FFWs (Rs.)	25.38	30.36	40.36	31.00	11.19	13.47	11.84	12.15
13. Per Day earnings of NAWs (Rs.)	15.30	16.67	61.79	28.46	22.28	20.69	29.50	24.13

Figures in parentheses indicate percentage shares in Net Household Income (NHI) with farm-size in R-I and a positive relation in R-II. In R-I, the income from dairying decreases with size of the farm, due to increasing maintenance cost and depreciation, whereas in R-II, the larger farmers maintain milch cattle of better quality, and correspondingly get higher income from dairying.

As incomes through all sources of agricultural employment are higher in R-I, it follows that the total agricultural income in R-I is higher than in R-II. At farm-level, in both the regions, there is a systematic positive relation with farm-size, as we may visualise it. In R-I, the medium and the large farms have 2 and 5 times as high as that of the small farms respectively. In R-II also, more or less the same relative gap is found among the farm-size groups, as the medium and the large farms show 1.6 and 4.75 times the value of the small farms respectively.

As regards the share of total agricultural income in the total household income, it is as high as 84.2 per cent in R-I and it is only 51.9 per cent in R-II. Thus, in R-II, agricultural income plays a less dominant role both in absolute and relative terms in comparison to the same in R-I, just as we saw earlier in respect of agricultural employment. At farm-level in R-I, there are no substantial variations among the farm-size groups. But in R-II, the variations are high across the farm-size ladder, showing a positive relation with farm-size. The small farms in R-II get as low as 35.1

per cent[6] from agricultural sources, while the large farms derive 67.3 per cent of the income from this source. One may possibly be tempted to say that the small farms in the backward region (R-II) may not be treated as cultivating holdings just because income from crop production makes a low proportion of total income. Nevertheless, agricultural income still remains the biggest single source and in the absence of a more secure source of alternative employment, their involvement in farming still remains the best economic choice. Hence, cultivation still remains their most secure source of work.

As the composite returns are not the returns to only labour of the cultivating households, per day earnings are not calculated for comparison sake. If per day earnings in agricultural wage employment are considered, they are higher (48 per cent) in R-I than in R-II, being Rs.16.44 and Rs.11.12 respectively. At farm-level, these earnings show positive relation with farm-size in R-I and negative relation in R-II. As bullock-cart driving is also included in agricultural wage employment and such income is available

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6. From a similar rainfed region of Punjab also, such low share of agricultural income was found among the marginal farmers (upto 2.5 acres) and small farmers (2.5 to 5.0 acres). For the former group it was 27.61 per cent and for the latter group, it was 58.34 per cent based on 1974-75 data. See G.S. Bhalla and G.K. Chadha, <u>The Green Revolution and the Small Peasant - A Study of Income Distribution among Punjab Cultivators</u>, Concept Publishing Company, New Delhi, 1983, pp.84 & 85 from Table 4.4

even on the large farms in R-I, the earnings show an increasing trend. In R-II, the large farms do not have that occupation and as a consequence, a decreasing tendency is observed.

Non-Agricultural Income

Non-agricultural income may be earned or unearned. As referred to at the beginning of this section, the earned income is derived from the wage paid - and/or self-employment by the FFWs and NAWs in non-agricultural avenues. The unearned incomes are those which are received simply without having to work.

Non-agricultural earned income by FFWs is higher (by 52.6 per cent) in R-II than in R-I. Further, if we look at its share in the total income, it is much higher in R-II (21.3 percent) while it accounts for only 5.4 per cent in R-I. The contribution of non-agricultural income by FFWs is higher because of higher employment on this account (43.5 per cent in the total employment) in R-II. At farm-level, in R-I, this income maintains a systematic positive relation with farm-size. In R-II also there seems to be such relation, but the medium farms show higher value. The share of this income is higher on the small and the medium farms in both the regions; it is particularly so in R-II.

As regards income of NAWs, it is also higher by 117 per cent in R-II than in R-I. Its share in total income (19.3 per cent) is also much higher in R-II, compared to only

3.4 per cent in R-I. At farm-level, in both the regions, the medium farms show lower value than other farm-size groups, ostensibly with a U-shape relationship. It is amazing to find the share of this income on the small farms in R-II to be as high as 31.6 per cent.

If we look at the total non-agricultural income (earned), it is higher (by 77.7 per cent) in R-II than in R-I. Its share in R-II is very high, being 40.6 per cent in the total income, whereas it is only 8.8 per cent in R-I. At farm-level, in R-I, there is a systematic positive relation with farm-size. In R-II, the medium farms show lower value than other farm-size groups. Further, its share in the total income is much higher in all the farm-size categories in R-II than their counterparts in R-I. It is interesting to note that the small farms in R-II depend for 58.7 per cent of their total income from non-agricultural employment and for the medium farms, it is 43.0 per cent. Thus, due to distress economic conditions caused by backward agriculture in R-II, the small and the medium farms have to depend on non-agricultural sources. As a point in fact, it may be noted:[7]

> Perhaps, one could visualise a situation of economic catastrophe if such sources of off-farm incomes were not available to them, where many

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7. G.K. Chadha, "The Off-Farm Economic Structure of Agriculturally Growing Regions: A Study of Indian Punjab", in R.T. Shand (ed.), Off-Farm Employment in the Development of Rural Asia, Vol.II, National Centre for Development Studies, Australian National University, 1986, pp.153 and 155.

might be forced to dispose of their tiny land holdings and join the ranks of the rural or urban proletariat.

The income by miscellaneous receipts in R-I is nearly 3 times as high as that in R-II, but its share in the total income remains to be the same in both the regions (a little less than 7 per cent). At farm-level, there is a systematic positive relation with farm-size in both the regions, as the increasing farm-size gives scope for this income. Further, the large farms in R-I and the medium farms in R-II show higher share than other farm-size categories.

As expected, per day earnings in non-agricultural employment by FFWs is higher in R-I than in R-II, being Rs. 31.00 and Rs. 12.15 respectively. At farm-level, in R-I there is a positive relation with farm-size, the small farms showing Rs. 25.4 per day and the large farms Rs. 40.4 per day. In R-II, the differences are not high among the farm-size groups, but the medium farms show somewhat higher earnings per day, just as they have had higher earnings from this employment.

Similarly, per day earnings of NAWs are higher in R-I than in R-II, with Rs.28.50 and Rs.24.1 respectively. At farm-level in both the regions, the large farms show relatively higher earnings per day. From this we may understand that the large farms have better and more remunerative employment/self-employment.

Net Household Income

Net household income (NHI) is higher in R-I (by 160 per cent) than in R-II. This is directly explained by both a higher share and a higher amount of agricultural income in R-I. At farm-level, in both the regions, there is a positive association with farm-size. In R-I, the gap is increasing along the farm-size continuum, as the medium and the large farms have 102.3 and 424.8 per cent higher values respectively than the small farms. In R-II also, the gap increases along the farm-size ladder, as the medium and the large farms show 17.0 and 147.7 per cent higher values than the small farms, though the gap between the small and the medium farms is not high.

Though it seems in R-II that the non-agricultural income plays a dominant role; the combined income, from both agricultural and non-agricultural sources, of FFWs is 73.2 per cent in the total income. Thus, it is appreciable that FFWs among the small and the medium farms are rationally utilising the available non-agricultural avenues. In fact, all such avenues are welcome if only the total household income is to be lifted to keep them well above the poverty level.

Further, it is of interest to look at the contribution of the non-self farming income (NFI) in the net household income (NHI). NFI does not differ much in both the regions. At farm-level, the differences are glaring in R-I, while it is not so in R-II. The share of NFI in NHI is only 21.9 per cent in R-I, whereas it is as high as 57.8 per cent in R-II. Thus, the income derived from crop production in R-II is only 42.2 per cent. The share of NFI is greater in R-II in each farm-size category than in R-I and the small farms in R-II has its share as high as 80.5 per cent.

Distribution of Income

We now propose to look into the distributional differences in the two regions. We consider the three income categories, viz. (i) FBI, (ii) Non-self farming income (NFI) and (iii) Net household income (NHI). Table 8.4 gives these incomes in the decile groups.

Farm business income is much skewed in both the regions. About 50 per cent households at the lower end get their share as low as 19.14 per cent in R-I and 17.77 per cent in R-II, while the top 20 per cent households usurp 52.25 per cent in R-I and 59.55 per cent in R-II. From this, it is clear that the distribution in R-II is somewhat more inequitable than in R-I, as is also reflected in the Gini coefficient, 0.4858 in R-II and 0.4509 in R-I.

Non-self farming income is almost equitably distributed in R-II, as is further confirmed by very low Gini coefficient, 0.0361. In R-I, the lower 50 per cent households obtain only 33 per cent of the income while the top 20 per cent capture 44.4 per cent income. Thus, this distribution in R-I is inequitable, with Gini coefficient 0.3149.

Table 8.4: Income Distribution FBI, NFI and NHI

Decile Group		Percentage Distribution of						Cumulative Percentage of					
		FBI		NFI		NHI		FBI		NFI		NHI	
		R I	R II	R I	R II	R I	R II	R I	R II	R I	R II	R I	R II
1.	1 10	2.04	2.25	5.69	7.44	2.84	5.23	2.04	2.25	5.69	7.44	2.84	5.23
2.	10 20	2.90	4.30	6.11	14.28	3.60	10.02	4.94	6.55	11.80	21.72	6.44	15.25
3.	20 30	3.92	3.52	5.70	9.62	4.31	7.02	8.86	10.07	17.50	31.34	10.75	22.27
4.	30 40	4.70	3.10	6.45	7.98	5.08	5.90	13.56	13.17	23.95	39.32	15.83	28.17
5.	40 50	5.58	4.60	9.01	8.34	6.32	6.74	19.14	17.77	32.96	47.66	22.15	34.91
6.	50 60	8.15	7.94	3.21	8.43	7.08	8.22	27.29	25.71	36.17	56.09	29.23	43.13
7.	60 70	7.80	6.85	4.74	8.47	7.13	7.78	35.09	32.56	40.91	64.56	36.36	50.91
8.	70 80	12.66	7.89	14.72	12.57	13.11	10.58	47.75	40.45	55.63	77.13	49.47	61.49
9.	80 90	18.12	18.11	12.30	9.57	16.85	13.21	65.87	58.56	67.93	86.70	66.32	74.70
10.	90 100	34.13	41.44	32.07	13.30	33.68	25.30	100.00	100.00	100.00	100.00	100.00	100.00
	Total	100.00	100.00	100.00	100.00	100.00	100.00						
Gini Coefficient		0.4509	0.4858	0.3149	0.0361	0.4212	0.2279						

FBI = Farm Business Income
NFI = Non-Own Farm Income = Non-self Farming Income
NHI = Net Household Income = FBI + NFI

As net household income is the combined total of the other two income categories, it is natural that the distribution is more equitable in R-II compared with that in R-I. The lower 50 per cent households get 22.2 per cent in R-I and 34.9 per cent in R-II, whereas the top 20 per cent households receive 50.53 per cent in R-I and 38.51 per cent in R-II. From this, it is understood that the distribution in R-II is less inequitable as is also seen from the Gini coefficient (0.2279) which is lower than 0.4212 worked out for R-I.

Thus, in the distribution of total net household income, the inequality is higher in R-I than in R-II. This is in conformity with the distribution of net operated area and capital assets, as seen earlier in chapter V.

Per Capita Income, Surplus/Deficit and Poverty

As seen from Table 8.5, it is clear that the per capita income in R-I is nearly 3.3 times as high as that in R-II. At farm-level, there is a clear positive association with farm-size in both the regions. But the differences across farm-size ladder are much higher in R-I (as reflected from higher Gini value in distribution).

If we look at the per capita surplus, we do not notice deficit (negative surplus) in any farm-size group in R-I. But in R-II, the average deficit is clearly discernible among the small and to a lesser extent among the medium farms, ultimately leading to deficit at the overall level.

Table 8.5: Per Capita Income, Surplus/Deficit and Poverty

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Per Capita NHI (Rs.)	2668.68	4879.45	10326.98	5260.09	1280.30	1310.57	2158.65	1582.93
2. Per Capita Surplus over Consumption(Rs)	695.23	1948.92	6221.20	2486.83	235.04*	210.75*	331.64	32.74
3. % of House holds with deficit	29.87	12.50	3.23	20.00	76.27	62.22	65.71	69.29
4. % of House holds below Poverty line by Bardhan's criterion	3.90	..	..	2.10	40.00	20.00	8.57	25.71
5. % of House holds below Poverty line by Criterion of Planning Commission	10.39	..	..	5.71	51.67	35.56	25.71	40.00

S,M,L and T indicate Small, Medium, Large and Total farms
* = The negative sign indicates deficit
NHI = Net Household Income

Further, the percentage of households with deficit in R-II is alarmingly high (69.29 per cent), whereas in R-I, it is a bare 20 per cent. At farm-level, the percentage shows decreasing tendency in both the regions and in R-II, it is as high as 76.27 per cent among the small farms. The well-known fact that there is a greater likelihood for the farming households in an area of backward agriculture to fall below the poverty line, thus gets reaffirmed in terms of our field data also. It is time, therefore, we turn our attention towards poverty.

Our intention is to estimate incidence of poverty in the two regions, markedly differing from each other in terms of technology levels. We adopt the simple head count method. Again, following Bhatty[8] we prefer to use income as a criterion, instead of consumption which is subject to some amount of overestimation at the lowest 2-3 deciles of the rural consumers and thus being liable to underestimate poverty. In the usual headcount method, we treat all those households, with per capita income below a certain minimum standard of living, as poor. However, there is no uniformity in the adoption of the minimum standard. For our purpose, we

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8. I.Z. Bhatty, "Inequality and Rural Poverty in India", in T.N. Srinivasan and P.K. Bardhan (eds.), Poverty and Income Distribution in India, Statistical Publishing Society, Calcutta, 1974, p.308.

prefer to use both (i) Bardhan's standard[9] of Rs. 15.50 per capita per mensem for Andhra Pradesh at 1960-61 prices, and (ii) Rs. 20.00 at 1960-61 prices, as this standard was arrived at by the famous study group set up by the Planning Commission, as Sen calls this a magic figure.[10] The annual equivalents for these figures are Rs. 186.00 and Rs.240.00 at 1960-61 prices. We adjust them on the basis of the Consumer Price Index for Agricultural Labourers[11] and the corresponding figures for 1984-85 are arrived at as Rs.846.30 and Rs.1092.00 respectively. Table 8.5 shows the incidence of poverty, i.e. the percentage of households below the minimum as arrived at by both norms.

As seen from Table 8.5, in R-I, the incidence of poverty is very much low, by both the norms, and it is visible only among the small farms. In R-II, the percentage of households below the poverty line is 25.7 per cent by the first standard and it is as high as 40.0 per cent, by the second standard. Thus, by any standard, poverty is rampant in R-II. By both the norms in R-II, the poverty incidence maintains an inverse relation with farm-size. It is indeed disturbing that the small farms show 40.00 and 51.70 per cent

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9. P.K. Bardhan, "On the Incidence of Poverty in Rural India in the Sixties", in T.N. Srinivasn and P.K. Bardhan (eds.), <u>op.cit</u>., p.277, Table-3.

10. A.K. Sen, "Poverty, Inequality and Unemployment: Some Conceptual Issues in Measurement", in T.N.Srinivasan and P.K.Bardhan (eds.), <u>op</u>. <u>cit</u>., p.68.

11. This index for 1984-85 in Andhra Pradesh is 455, with 100 for 1960-61.

poverty by first and second standards respectively.

Thus, the technologically advanced region (R-I), despite characterised by a high degree of inequitable income distribution, has poverty at a fairly low levels. On the contrary, the agriculturally backward region (R-II) has germinated conditions for a higher incidence of poverty.

It may not be out of place to add a few words in regard to the planning strategy adopted in our agriculturally backward region (R-II). As there had been potentialities for industrial development, due to coal mines, a very high capital-intensive technology had been poured into the industries established there, such as Thermal Power Station, Sponge Iron Plant etc. If the planners had thought in terms of industrial-agricultural interaction, the industrial development strategy would have cared for the removal of the main bottleneck for agriculture - lack of irrigation. Though the industrial development had generated demand for agricultural products, throwing up some impulses for agricultural development, the same could not however be locally realised, as the most crucial wherewithal - irrigation - could not be arranged for such a long time. From this, it is clear that the industrial development strategy followed has ultimately culminated in competitive interaction between industrial and agricultural sectors, rather than being complementary to each other.

3. <u>Consumption Pattern</u>

After having seen the employment/income levels of farming households in R-I and R-II, it is essential to look into their consumption behaviour. This follows in the present section. In concrete terms, we look into the (i) per capita individual commodity expenditures and total consumption, (ii) relative shares of those commodities and (iii) shares of own produce in the expenditures across the farm-size groups. Further, it is proposed to analyse the inequalities in the individual commodity and total consumption expenditures and also to estimate the expenditure elasticities for different commodities from the Engel's functions.

Before going into the details. it is thought necessary to mention the limitations of the consumption data. In respect of the durable goods, the information has not been specific from most of the respondents and as such, this item has been included in the miscellaneous expenditure where some reporting occurred. In addition to this, the miscellaneous expenditure includes expenditure on soap, powder, paste etc. and also expenditure on marriages and other ceremonies. As regards fuel and light, the firewood from personal collection could not be evaluated with a reasonable degree of accuracy and had, therefore, to be left out of our analysis. In other words, only the purchased firewood has been taken into account. Further, in respect of own cereals and pulses, the evaluation has been made at the sale prices of the grain in the post-harvest season, prevalent in the villages; whereas milk has been evaluated at village level prices, prevalent at the end of the reference year (1984-85).

(i) Per Capita Expenditure - Individual Commodities and Total Consumption

Table 8.6 gives the details of per capita expenditure on 15 individual commodities and total consumption for both the regions.

In R-I, the level of per capita total expenditure is higher both at farm-size and overall level than in R-II. Thus, in R-I, at overall level it is higher by 72 per cent and in respect of the large farms it is 125 per cent higher, whereas in respect of the small farms it is only 30 per cent higher respectively than in R-II. However, in both the regions, the per capita total expenditure maintains a positive association with the farm-size. In R-II, the variation between the small and medium farms is negligible, but the large farms have 21 per cent higher level than the small farms. In R-I, the inter-farm size variations are glaring. Here, the total per capita expenditure of the large farms is 108 per cent higher and of the medium farms 50 per cent higher respectively than that of the small farms.

A general glance at Table 8.6 reveals a few important features in the individual commodity per capita expenditures. The individual per capita expenditure on(i) cereals and (ii) tobacco and intoxicants etc. are higher both at farm-size and overall levels in R-II than in R-I. The higher per capita

Table 8.6: Per Capita Expenditure on Individual Commodities and Total Consumption (Rupees)

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Cereals	390.52	405.15	409.32	398.98	440.50	461.36	471.85	456.99
2. Pulses	80.69	99.25	133.27	99.26	49.14	47.92	51.19	49.40
3. Milk and Milk Products	253.27	332.63	389.69	308.60	87.90	95.16	124.09	101.62
4. Edible Oils	94.43	111.60	135.16	109.45	75.90	74.89	85.11	78.49
5. Vegetables	82.24	85.13	112.74	91.21	51.61	47.23	46.81	48.71
6. Spices and Salt	122.42	155.00	203.37	151.92	58.85	54.26	59.15	57.49
7. Meat, Fish, Egg etc.	97.21	120.45	168.63	121.98	79.11	102.77	111.92	96.94
8. Sugar and Tea	98.53	128.75	148.11	118.95	58.51	54.04	69.15	60.46
9. Tobacco and Intoxicants	70.99	70.58	83.68	74.35	104.93	141.55	165.35	135.57
10. Fuel and Light	34.89	45.09	63.02	44.88	22.99	18.03	21.81	21.05
11. Cloth, Footwear etc.	269.83	360.00	610.74	383.00	200.28	177.24	275.96	216.90
12. Medicines	78.97	89.25	281.68	136.50	69.61	46.10	61.70	59.69
13. Conveyance and Cinema	70.07	125.25	169.58	109.12	76.69	64.58	88.51	76.60
14. Education	54.37	217.88	336.95	168.77	26.37	54.40	37.52	38.74
15. Miscellaneous Expenditure	175.02	587.52	859.84	455.99	113.03	81.79	156.89	117.02
Total	1973.45	2930.53	4105.78	2773.26	1515.42	1521.32	1827.01	1615.67

expenditure on cereals in R-II may be attributed to the fact that cereals in R-I are mostly from home produce and they have been evaluated at harvest prices. Perhaps, there is an underestimation of the value of cereals in R-I. In R-II, the own cereals account for only 56 per cent of the total cereal consumption. The remaining 44 per cent cereals have been purchased in the market. As such, there is the possibility of overvaluing the cereals. To this may be added the over-reporting and higher prices of cereals in R-II.

As regards per capita expenditure on tobacco and intoxicants, in R-I, the consumption of intoxicants (liquors and wines) is comparatively lower among the farmers, whereas in R-II, it is fairly open and widespread. This has some historical background. In the pre-independence period, R-I was under the direct British government, whereas R-II was under the Nizam's feudal government. In the post-independence period, though R-I and R-II came under the same government, there had been a regime of prohibition for several years (from early 50's to late 60's) in R-I. As such, there has been a degree response among the villagers towards alcoholic addiction in R-I. Added to this, there may be under-reporting in R-I. On the contrary, in R-II, the alcoholic addiction has been rampant, as there had been no prohibition for the period when it was in R-I. This may also be attributed to the traditional behaviour among the villagers in R-II.

Except on these two commodities, per capita consumption is higher in R-I than in R-II on almost all other commodities both at the individual farm-size and overall levels (with the exception of the small farms in respect of conveyance and cinema).

In R-I, in respect of all the commodities, per capita expenditures maintain a positive association with farm-size. Despite the fact that along the farm-size ladder, the medium and large farms are faring better in their consumption, glaring variations are seen in respect of the items (i) education and (ii) other miscellaneous expenditure. In respect of (a) medicines and (b) clothing, footwear etc., large farms have quite higher levels of consumption expenditures. Thus, in the human capital formation (through medical and educational services) on the one hand and in the consumption of luxuries on the other, the medium and large farms are clearly quite ahead of the small farms.

However, in R-II, the pattern of consumption is somewhat different, with no systematic behaviour with farm-size. But, in most of the commodities, the large farms show higher values than the small and medium ones. Here, in respect of some commodities, the small farms show an edge over the medium farms, viz. (i) edible oils, (ii) vegetables, (iii) sugar and tea, (iv) fuel and light, (v) conveyance and cinema, (vi) cloth and footwear,(vii) medicines, and (viii) miscellaneous expenditure. In respect of medicines and vegetables only, the small farms have higher per capita expenditures than even the large farms.

On thorough examination of the data, the explanation for this unique result may be offered as follows. In R-II, some of the households among the small farms have non-agricultural working members who are somehow better placed (TABLE 8.3) and so the improved consumption of such households would generally reflect itself in higher per capita consumption of the small farms. Further, in respect of the items (i) cereals, (ii) milk, (iii) meat, fish etc. and (iv) tobacco and intoxicants, there is a positive association with farm-size. Interestingly, the per capita expenditure on education is higher on the medium farms than on the small and large farms. The large farms have lower per capita expenditures on both medicines and education and thus they are less conscious about human capital formation.

(ii) <u>Relative Shares of Individual Commodity Expenditures in the Total Consumption</u>

Table 8.7 gives the shares of commodity expenditures in the total consumption in the three farm-sizes for the two regions.

At overall level, cereals has the highest share (28.3 per cent) in R-II, whereas in R-I, it has the second top position with 14.4 per cent. Interestingly, it is only half the percentage of what it is in R-II. Thus, in R-II, a large share is allocated for the staple food in the bundle of consumption compared to R-I. This is also a symptom of developing region. In R-I, the highest share (16.4 per cent) has gone in favour of miscellaneous expenditure which

Table 8.7: Individual Commodity Expenditures in the Total Consumption (percentage terms)

Item	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Cereals	19.79	13.83	9.97	14.39	29.07	30.33	25.83	28.29
2. Pulses	4.08	3.39	3.25	3.58	3.24	3.15	2.80	3.06
3. Milk and Milk products	12.83	11.35	9.49	11.13	5.80	6.26	6.69	6.29
4. Edible Oils	4.79	3.81	3.29	3.95	5.01	4.92	4.66	4.86
5. Vegetables	4.17	2.90	2.75	3.29	3.41	3.10	2.56	3.02
6. Spices and Salt	6.20	5.29	4.95	5.48	3.88	3.57	3.24	3.56
7. Meat, Fish, Eggs etc.	4.92	4.11	4.11	4.40	5.22	6.76	6.13	6.00
8. Sugar and Tea	4.99	4.39	3.60	4.29	3.86	3.55	3.78	3.74
9. Tobacco and Intoxicants	3.60	2.41	2.04	2.68	6.92	9.30	9.05	8.39
10. Fuel and Light	1.77	1.54	1.53	1.62	1.52	1.19	1.19	1.30
11. Cloth, Footwear etc.	13.67	12.28	14.88	13.81	13.22	11.65	15.11	13.42
12. Medicines	4.00	3.05	6.86	4.92	4.59	3.03	3.38	3.69
13. Conveyance and Cinema	3.55	4.17	4.13	3.93	5.06	4.24	4.84	4.74
14. Education	2.75	7.43	8.21	6.09	1.74	3.57	2.05	2.40
15. Misc. Expdr.	8.89	20.05	20.94	16.44	7.46	5.38	8.59	7.24
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

includes luxurious goods and social ceremonies. On the one hand, allocation of less share in favour of staple food (cereals) and on the other, allocation of the highest share in favour of miscellaneous expenditure clearly suggest the characteristics of developed scenario. In R-II, however this item (miscellaneous expenditure) accounts for only 7.2 per cent (i.e. nearly 1/4th of cereals share), whereas in R-I, the share of this item exceeds the share of the cereals by 2 per cent. Further, the share of essential food items (cereals + pulses + edible oils + salt and spices) is as high as 40 per cent in R-II, whereas it is only 27 per cent in R-I. Interestingly, in both the regions, cloth and footwear occupies almost the equal share, 13 to 14 per cent.

Thus, the priorities in R-I and R-II at overall level are different. In R-II, the priorities are in the order - (i) cereals, (ii) cloth and footwear, (iii) tobacco and intoxicants, (iv) miscellaneous expenditure, and (v) milk. These items together account for nearly 64 per cent in the total consumption. In R-I, the priorities are in the order - (1) miscellaneous expenditure, (2) cereals, (3) cloth and footwear, (4) milk and (5) education. They together occupy nearly 62 per cent of the total consumption. In R-I, tobacco and intoxicants occupies last but one position, whereas in R-II, it is so important, it occupies third position (after cereals and clothing). Moreover, this expenditure is on country liquors, but not on modern wines. It represents a traditional behaviour of the households in R-II. In R-I, the miscellaneous expenditure assumes the topmost rank in the priorities, whereas in R-II it has fourth position after food (cereals), clothing and tobacco plus intoxicants. Further, in R-I, education assumes fifth position, whereas in R-II, it goes to last but one position. Thus, towards human capital formation, R-I is undoubtedly showing the effects of a developed area with consumption patterns responding well to the changing requirements of modern living.

Now looking into the variations at farm-size level, the following important points need to be underlined.

In R-I, the priorities of the medium farms remain just the same as at the overall level, whereas in respect of the large farms, clothing shifts to second top position, throwing cereals to the third position. Interestingly, for the small farms, the share of cereals assumes the first position (with 20 per cent). That is, the small farms allocate the highest share of their budget for the staple food, throwing other items to low priority areas, i.e. food is first, other items only after food! The miscellaneous expenditure which assumes first priority for the medium/large farms has been thrown to the fourth position in the priorities of the small farms (after cereals, clothing and milk). Further, education which assumes the fifth position for the medium/large farms has gone to the last but one position in respect of the small farms. Thus, there is a clear distinction in the allocation of the budget in the households of the small and the medium/large farms in R-I.

In R-II, the large farms have the same priorities just as that at the overall level. In respect of all farm-sizes and at overall level, cereals and clothing occupy the first and the second positions. This is clearly in consonance with any developing scenario. In respect of the small and medium farms, though there is some change in the positions for tobacco plus intoxicants, miscellaneous expenditure and milk; they stay between the third to the fifth positions. Interestingly, the small farms have miscellaneous expenditure in the third position whereas it is in the fourth and the fifth positions for the large and medium farms respectively. To some extent, the influence of non-agricultural working members seems to have reflected itself in such behaviour of the small farms.

In R-I, the shares of the expenditures maintain an inverse relation with the farm-size, in respect of the commodities, viz. cereals, pulses, milk, edible oils, vegetables, spice and salt, meat, sugar and tea, tobacco plus intoxicants and fuel and light. From this, it can be inferred that shares of such commodities decrease with increase in the farm-size. Interestingly, all these commodities are only the consumables and thus of elemental importance to life. Conversely, for other commodities, the shares should increase with farm-size. Those are cloth and footwear, medicines, conveyance and cinema, education and miscellaneous expenditure. The absolute per capita expenditures for all commodities have maintained positive association with farm-size, as was witnessed in the preceding part of this section. In such a case, the differences in absolute per capita values over farm-size ladder should be higher in the latter set of commodities than in the former set.

In R-II, in respect of the commodities, viz. milk, meat and fish, tobacco plus intoxicants and education, the medium and large farms show higher shares. In regard to clothing and miscellaneous expenditure, the small farms have higher shares than the medium farms. This can be attributed to the influence of non-agricultural working members. In respect of all other commodities, of which most are consumables, the shares seem to maintain an inverse relation with farm-size.

(iii) Own and Purchased Commodities

Generally, there is a possibility of reporting own commodities (from home produce) in respect of cereals, pulses and milk. The incidence of own produce from edible oils, vegetables etc. was extremely low. Hence, we better concentrate on this aspect only in respect of cereals, pulses and milk.

Table 8.8 gives the shares of the own portion in the consumption of cereals, pulses and milk, and also the shares of home produce of these commodities in their total consumption.

In respect of cereals, 98.2 per cent of the

Table 8.8: Shares of Own Produce in Cereals,Pulses, Milk and Total Consumption

Item	Percentage of Own Produce in Total Consumtion							
	REGION I				REGION II			
	S	M	L	T	S	M	L	T
1. Cereals	96.20	100.00	100.00	98.15	41.37	49.78	77.97	55.98
2. Pulses	...	...	...	...	36.97	56.12	55.03	48.75
3. Milk	94.89	94.25	100.00	96.49	90.25	93.29	97.94	94.12
4. Total Consumption	31.22	24.52	19.46	24.86	18.46	22.70	28.33	23.25

consumption is from home produce at overall level in R-I, whereas it is only 56.o per cent in R-II. In R-I, the consumption of cereals by almost each cultivating household goes by own production. In R-I, it is so possible because the staple food, i.e. paddy alone is grown there. Further, only 3.8 per cent of cereals (rice) is purchased from the market in respect of the small farms. Thus, it is clear that even the small farms in R-I are in a position to keep aside their produce for self-consumption without involving in the compulsive market relations as pointed out by Krishna Bharadwaj and others. As R-I is a developed scenario, where green revolution has set in, it may also be possible that the small farms have, to some extent, reaped the gains of green revolution. However, in R-II which is a developing scenario, the shares of home produce increase with the farm-size. This shows that the small farms depend more on the market for the cereals (58.6 per cent cereals have been purchased by the small farms, whereas this percentage in respect of the large farms is only 22.03).

In respect of pulses, R-I has to depend entirely on the market as no pulses are grown there. In R-II, at overall level nearly 50 per cent of the pulses are home produced. However, the small farms have this as 37 per cent, whereas the medium and large farms have just more than 55 per cent.

In respect of milk, in both the regions (R-I and R-II), the percentage of home produce varies between 90 to 100 per cent both at the overall level and across the farm-size continuum. Thus, the variation in shares of home produce is negligible across farm-size ladder.

In the total consumption expenditure, the share of the home produce at the overall level in both the regions is just less than 1/4th. Interestingly, the percentages of home-produce maintain an inverse relation in R-I and a positive relation in R-II with farm-size. That is, in R-I, the households involve relatively more in monetary transactions over the farm-size ladder, whereas the contrary is the case in R-II.

(iv) Distribution of Consumption Expenditure and Inequalities

In this section an analysis of the distribution of consumption expenditure among the households is taken up. Following Bhalla and Chadha, the households have been rearranged into decile groups in ascending order of their net operated area rather than in ascending order of their total household expenditure, and the percentage share of each decile in total as well as individual commodity expenditure has been worked out.

Table 8.9 gives commodity-wise distribution of consumption expenditure for both the regions for 15 individual commodities and for total consumption expenditure.

In R-I, except in respect of the commodities cereals, and tobacco plus intoxicants, for all other commodities, for as many as the first seven deciles, the percentage of expenditure is less than their respective share of consumers.

Table 8.9: Distribution of Consumption Expenditures by Decile Groups

Decile Group	Percentage of Consumers	Cereals	Pulses	Milk and Milk Products	Edible Oils	Vegetables	Spice and Salt	Meat, Fish, Eggs etc.	Sugar and Tea	Tobacco Intoxicants	Fuel and light	Cloth, Foot wear etc.	Medicines	Conveyance and Cinema	Education	Misc. Expenditure	Total Expenditure
		PERCENTAGE SHARE OF CONSUMPTION EXPENDITURE															
REGION I:																	
0 10	7.88	7.28	5.20	4.87	5.61	6.88	5.55	4.85	6.06	2.31	8.63	4.37	3.46	4.57	0.81	3.31	4.75
10 20	8.45	8.30	7.19	6.82	7.26	7.64	7.41	8.82	6.87	12.37	6.14	5.40	4.85	5.23	5.96	3.20	6.35
20 30	8.31	8.68	6.67	8.08	8.65	9.52	7.64	7.38	9.39	10.87	7.02	6.98	3.97	6.30	1.33	3.72	6.69
30 40	10.17	10.38	8.14	7.72	7.85	8.01	7.36	5.71	7.42	14.57	6.39	7.13	9.32	5.36	1.61	3.50	7.01
40 50	10.17	9.98	9.53	9.08	9.75	8.48	9.17	8.81	8.31	5.29	7.25	7.29	4.41	7.88	1.58	3.79	7.21
50 60	10.17	9.74	9.18	9.36	10.07	8.86	9.05	7.98	7.08	5.55	6.64	7.60	4.41	5.75	15.40	5.47	8.20
60 70	8.60	9.08	9.41	9.66	8.80	8.20	8.56	8.60	10.28	9.39	7.58	9.29	5.85	6.77	6.79	5.96	8.23
70 80	11.18	11.18	10.22	13.04	10.90	13.10	11.88	12.76	12.72	15.03	13.66	10.99	11.08	18.67	12.84	20.78	13.66
80 90	12.18	12.30	14.90	14.43	12.49	13.57	13.35	10.36	11.56	9.71	11.91	16.19	5.92	10.79	23.53	16.35	14.06
90 100	12.89	13.08	19.56	16.94	18.62	15.74	20.03	24.73	20.31	14.91	24.78	24.76	46.73	28.68	30.15	33.92	23.84
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Gini Coefficient		0.0073	0.1262	0.1120	0.0893	0.0605	0.119	0.1494	0.1072	0.017	0.149	0.2103	0.3590	0.2453	0.4011	0.3901	0.1890
REGION II																	
0 10	7.84	6.72	6.42	5.16	6.76	7.59	7.44	6.78	6.11	7.36	7.16	5.70	13.25	6.01	4.83	8.52	6.86
10 20	8.17	9.32	12.19	6.48	9.13	10.20	11.10	7.21	9.87	4.69	10.36	10.32	10.24	16.49	5.35	10.66	9.34
20 30	10.53	9.88	9.38	7.74	10.58	10.76	8.88	7.90	9.02	7.96	14.11	9.42	8.89	8.51	11.56	9.61	9.36
30 40	8.18	7.95	6.75	10.11	7.45	8.00	8.18	6.45	8.54	7.42	7.18	6.66	9.12	4.65	2.47	5.25	7.30
40 50	7.73	7.60	9.09	9.12	7.36	8.83	8.18	9.50	6.56	8.72	6.39	5.64	5.82	5.53	3.93	5.58	7.28
50 60	9.74	9.87	8.91	9.59	9.80	8.14	8.88	10.81	7.89	9.74	8.56	8.55	9.90	7.54	13.24	7.92	9.34
60 70	10.97	10.48	8.53	7.14	8.87	9.52	9.47	9.91	8.89	11.35	9.13	7.25	7.32	10.13	16.65	6.49	9.32
70 80	11.87	12.02	11.45	13.04	12.40	11.86	11.80	12.54	13.78	12.47	10.30	12.05	8.22	10.26	13.04	8.22	11.71
80 90	13.44	12.99	13.27	13.29	14.26	12.00	12.04	15.18	13.78	15.83	12.00	14.52	13.39	13.69	14.36	17.82	14.04
90 100	11.53	13.17	14.01	18.33	13.39	13.10	14.03	13.72	15.56	14.46	14.81	19.89	13.85	17.19	14.57	19.93	15.45
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Gini Coefficient		0.018	0.0075	0.101	0.0265	0.012	0.001	0.0657	0.056	0.0904	0.0123	0.0969	0.0549	0.293	0.1182	0.0787	0.0468

This clearly indicates that the last 3 deciles have higher shares in almost all the commodities, thereby leading to skewed distribution. In other words, the top 30 per cent households, who also command an extremely high share in net operated area, usurp a lion's share in the consumption expenditure. This is, however, not to deny that in respect of almost all the commodities (except education), the households from lower deciles do also have their shares in the consumption albeit small ones. As seen from Gini coefficient values, the lowest inequalities are noticed in respect of cereals, tobacco plus intoxicants, vegetables, and edible oils (ranging from 0.0073 to 0.0893). The highest inequalities are observed in respect of education, miscellaneous expenditure and medicines (0.4011, 0.3901 and 0.3590 respectively). In respect of conveyance plus cinema and clothing plus footwear also, the inequalities are fairly high (0.2453 and 0.2103 respectively). For meat and fish, fuel and light, pulses, spices and salt, milk and sugar plus tea, the inequalities are of a moderate degree, the Gini coefficient values ranging between 0.1072 and 0.1494. From this, it is clear that the inequalities are high in non-food items particularly in medical and education services and luxuries plus social ceremonies. Thus, the pattern of consumption in respect of the individual commodities has its counterpart in inequality in the total consumption; Gini ratio at the level of total consumption expenditure is 0.19. Finally, it may be said that the distribution of consumption expenditures in individual commodities and total consumption in R-I, is inegalitarian, of course in relative terms, compared to R-II.

In R-II, the households, in the lower deciles also get more or less the same share as that of consumers in almost all the commodities, which indicates that the distribution of consumption expenditures in respect of almost all the commodities is more egalitarian here than in R-I. As regards inequalities, the Gini coefficient exceeds 0.1 in respect of two commodities only, viz., milk and education. The Gini coefficient lies between 0.05 and 0.10 in respect of meat and fish, tobacco plus intoxicants, clothing plus footwear, medicines, and miscellaneous expenditure. Thus, except in respect of milk, and meat and fish, for all other food items, the distribution is less inequitable in this region. However, in respect of all other purchased non-food items, the inequalities are relatively of a higher order. The inequality in respect of total consumption is fairly low. Gini Ratio is 0.05.

Comparing R-I with R-II, it is seen that there is more equitable distribution in R-II than in R-I, for individual as well as total consumption expenditure. The Gini coefficient values are quite low in R-II compared to those in R-I, showing that there are low inequalities in R-II. This is in consonance with Kuznets proposition that inequalities in the distribution of income and hence consumption get accentuated in the developed region relatively more than in a developing region. In the latter case, the total cake is small but it is more equitably shared.

(v) Expenditure Elasticities

In this part of the section, expenditure elasticities for all the commodity groups have been estimated. For this purpose, Engel's functions have been fitted with per capita commodity expenditure (y) as the dependent variable and per capita total expenditure (x) as an independent variable.

Some adjustments have been made in the data for estimating Engel's functions. The cultivating households have been divided into sixteen (16) groups, on the basis of net operated area and then the mean levels of per capita total as well as individual commodity expenditures have been computed in each of the groups. Thus, there are sixteen pairs of observations on x and y. Then, the weighted regressions have been run, the number of households behind each group being the weight. Generally, the groups are made on the basis of total expenditure size-classes. But in this study, it is opted to make groups on the basis of net operated area as:[12]

> The main advantage of the above procedure is that the household classification based on operated area is intertwined with that based on total consumption expenditure and consequently, inferences derived from the analysis of the latter would have, *mutatis mutandis*, their counterpart in the former.

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12. G.S.Bhalla and G.K. Chadha, op. cit., p.136

As regards the mathematical forms of Engel's functions, the following are used:[13]

1. Linear $y = a + bx$
2. Quadratic $y = a + bx + cx^2$
3. Hyperbolic $y = a + b(- {}^1/_x)$
4. Semilog $y = a + b \log_e x$
5. Log inverse $\text{Log}_e y = a + b\,(- {}^1/_x)$
6. Log log inverse $\text{Log}_e y = a + b \log_e x + c\,(- {}^1/_x)$
7. Loglinear $\text{Log}_e y = a + b \log_e x$
8. Log quadratic $\text{Log}_e y = a + b \log_e x + (- (\log_e x)^2)$

Now the problem is to settle whether some or all of those functions are to be used. For this purpose, an exercise is conducted in the following manner.

1. As long as the dependent variable is the same, the functions may be compared even if the number of independent variables is not the same and their definitions are also not the same, by looking R^2. But in the case of the given functions, in the set of first four equations, the dependent variable is in non-logarithmic terms, whereas in the set of other four functions it is in logarithmic terms. As per Box and Cox transformation only, the functions with the same number of independent variables in these two sets are comparable.[14] On applying Box and Cox transformation, it

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13. B.D. Gupta, Consumption Patterns in India, Tata Mc Graw Hill Publishing Co Ltd., Bombay, 1973, p.37.

14. P. Rao and R.L. Miller, Applied Econometrics, Prentice Hall of India, Private Ltd., New Delhi, 1971, pp.13-21 and 107-111.

has been found that the comparable functions are empirically different for our data.

2. After fitting all the functions it has been found that the functions with three parameters have suffered from multi-collinearity problem, due to which betas are insignificant, despite their R^2s are significant.

In the light of the above exercise, the five functions with a single independent variable (i.e. with two parameters) have been chosen and the results have been shown in Table 8.10 for the fifteen commodity groups and both the regions. From the Table, the following points are of interest.

Generally, R^2 values of all the five functions in each of the commodity groups have been almost invariant with the functional forms in both the regions. In R-I, the R^2 values are higher in respect of all the commodities (except cereals) than in R-II. In R-I, R^2 values are quite higher in respect of the commodity groups - milk, cloth and footwear, conveyance and cinema, and miscellaneous expenditure; and fairly high in respect of oils, spices and salt, meat and fish, sugar and tea, and education. In R-II, R^2 is quite high for clothing and footwear; and it is fairly high in respect of edible oils, spices and salt, and sugar and tea.

In both R-I and R-II, the slope (beta) is significant in respect of commodities, viz. pulses, milk, oils, spices and salt, sugar and tea, fuel and light, cloth and footwear, conveyance and cinema, and miscellaneous expenditure. Thus,

Table 8.10: Engel's Functions for Individual Commodities

Commodity	Function Type	REGION-I					REGION-II				
		Intercept(a)	Slope(b)	t(b)	R	e	Intercept(a)	Slope(b)	t(b)	R	e
1. Cereals	Linear	374.7420	0.0092	1.2390	0.0900	0.0614	290.3130	0.1027	3.4810 *	0.4260	0.3614
	Hyperbolic	436.1760	88006.0390	1.2860	0.1040	0.0829	638.1460	287853.9090	3.2580 *	0.3870	0.3957
	Semilog	164.2490	69.1230	1.2380	0.0940	0.0752	-842.6360	405.4480	3.4130 *	0.4130	0.3873
	Log inverse	2.6400	94.7540	1.2780	0.1030	0.0820	2.8290	271.5370	3.1380 *	0.3700	0.3908
	Log linear	2.3480	0.0741	1.2240	0.0920	0.0741	1.4354	0.3815	3.2690 *	0.3920	0.3815
2. Pulses	Linear	58.2930	0.0144	3.4580 *	0.4340	0.3965	8.1730	0.0259	3.8230 *	0.4720	0.8358
	Hyperbolic	159.7910	149942.2650	4.5430 *	0.5930	0.5834	99.7360	78671.7700	4.1410 *	0.5050	0.9918
	Semilog	-303.9530	117.8990	4.1130 *	0.5330	0.5302	-290.3890	106.2540	4.0310 *	0.4950	0.9308
	Log inverse	2.2510	661.3190	4.6120 *	0.6000	0.5722	2.1249	685.3630	4.2420 *	0.5170	0.9864
	Log linear	0.2264	0.5139	4.0640 *	0.5270	0.5139	-1.2577	0.9207	4.0830 *	0.5020	0.9207
3. Milk and Milk Prods.	Linear	145.2940	0.0591	6.5980 *	0.7360	0.5199	-30.4930	0.0816	3.2880 *	0.3980	1.3059
	Hyperbolic	537.6100	557643.7950	8.1660 *	0.8240	0.6927	249.8310	230542.7390	3.2290 *	0.3830	1.4694
	Semilog	-1253.2120	457.9400	7.9200 *	0.8090	0.6574	-940.3730	325.1530	3.2810 *	0.3940	1.4124
	Log inverse	2.8073	806.5650	7.7170 *	0.8080	0.6979	2.6540	1061.6710	3.1780 *	0.3760	1.5279
	Log linear	0.2830	0.6430	6.6070 *	0.7460	0.6430	-2.6290	1.4396	3.2270 *	0.3710	1.4396
4. Edible oil	Linear	47.5500	0.0226	7.3830 *	0.7780	0.5592	26.9250	0.0321	5.1220 *	0.6160	0.6561
	Hyperbolic	181.3080	174935.0790	4.5040 *	0.5880	0.6111	141.5050	99165.5250	5.9880 *	0.6810	0.7918
	Semilog	-427.3330	157.4490	5.7890 *	0.6930	0.6357	-345.3890	132.4150	5.5780 *	0.6530	0.7346
	Log inverse	2.2830	623.7080	4.9240 *	0.6310	0.5397	2.2440	555.4270	5.6930 *	0.6590	0.7993
	Log linear	0.1776	0.5423	5.7960 *	0.6940	0.5423	-0.4652	0.7361	5.2170 *	0.6220	0.7361
5. Vegetables	Linear	61.5130	0.0108	3.6230 *	0.4570	0.3184	28.6880	0.0130	1.6050	0.1360	0.4207
	Hyperbolic	127.8780	89204.8930	3.0220 *	0.3910	0.3713	77.4660	43950.2810	1.9260	0.1810	0.5556
	Semilog	-176.0640	78.3980	3.4130 *	0.4400	0.3772	-130.5480	56.2550	1.7720	0.1590	0.4941
	Log Inverse	2.1130	389.3720	2.9860 *	0.3860	0.3369	1.9541	418.1520	2.1070	0.2090	0.6018
	Log linear	0.7891	0.3413	3.3530 *	0.4310	0.3413	-0.0294	0.5366	1.9390	0.1850	0.5366

Table 8.10 continued

6. Spices & Salt	Linear	51.9390	0.0363	8.3160 *	0.8160	0.6507	20.4520	0.0233	3.9880 *	0.4930	0.6461
	Hyperbolic	272.0490	293185.1860	5.3740 *	0.6710	0.7421	102.1070	69644.5470	4.1890 *	0.5110	0.7543
	Semilog	-732.3860	259.2800	6.9040 *	0.7630	0.7585	-245.8990	94.8890	4.1500 *	0.5100	0.7142
	Log inverse	2.4800	768.0750	5.7600 *	0.7000	0.6646	2.0760	499.4710	4.0760 *	0.4970	0.7188
	Log linear	-0.0770	0.6573	6.5980 *	0.7460	0.6573	-0.4202	0.6805	4.0380 *	0.4960	0.6805
7. Meat, Fish, Eggs etc.	Linear	27.5300	0.0340	7.0480 *	0.7610	0.7669	20.5330	0.0475	1.9050	0.1820	0.7876
	Hyperbolic	232.0850	270658.7080	4.6800 *	0.6070	0.8620	181.1420	132764.7210	1.8190	0.1650	0.8599
	Semilog	-698.3970	240.3060	5.2823 *	0.6960	0.8846	-501.1420	186.7870	1.8750	0.1750	0.8407
	Log inverse	2.4230	885.3330	5.2390 *	0.6590	0.7660	2.3010	527.3270	1.3770	0.1020	0.7589
	Log linear	-0.4978	0.7498	5.7160 *	0.6880	0.7498	-0.4288	0.7481	1.4290	0.1100	0.7481
8. Sugar and Tea	Linear	56.3030	0.0229	5.3250 *	0.6450	0.5204	-25.3100	0.0530	4.3330 *	0.5350	1.4256
	Hyperbolic	205.3930	209428.7160	5.5110 *	0.6810	0.6720	157.6030	153897.9050	4.2830 *	0.5220	1.6170
	Semilog	-474.0370	174.0060	5.6700 *	0.6840	0.6453	-618.7210	211.9670	4.3410 *	0.5320	1.5476
	Log inverse	2.3760	763.2860	5.3560 *	0.6690	0.6604	2.4480	1087.7680	3.8800 *	0.4730	1.5655
	Log linear	-0.0475	0.6185	5.1230 *	0.6390	0.6185	-2.9380	1.4667	3.7700 *	0.4620	1.4667
9. Tobacco and Intoxicants	Linear	57.6830	0.0063	0.6480	0.0260	0.2236	39.1320	0.0590	1.6660	0.1450	0.7070
	Hyperbolic	120.9110	110604.5600	1.2310	0.1040	0.5595	250.4590	183419.3990	1.8050	0.1630	0.8586
	Semilog	-162.0890	69.5780	0.9700	0.0600	0.4068	-646.7020	243.8520	1.7380	0.1540	0.7932
	Log inverse	2.2110	958.0420	2.1200	0.2410	0.8289	2.4470	534.9710	1.4470	0.1110	0.7699
	Log linear	-0.4212	0.6560	1.7060	0.1640	0.6560	-0.1405	0.7022	1.3770	0.1030	0.7022
10. Fuel and light	Linear	5.8230	0.0142	7.1220 *	0.7650	0.8679	2.7600	0.0115	2.5200 **	0.2800	0.8727
	Hyperbolic	87.0490	103198.5280	3.8420 *	0.5100	0.8906	41.5780	32144.7230	2.3990 **	0.2550	0.9529
	Semilog	-287.2060	97.3580	5.3640 *	0.6600	0.9710	-122.8680	44.9910	2.4670 **	0.2690	0.9268
	Log inverse	1.9770	870.9710	3.5680 *	0.4730	0.7536	1.6914	595.5430	2.3370 **	0.2460	0.8571
	Log linear	-1.1161	0.8023	4.5580 *	0.5830	0.8023	-1.3354	0.8273	2.3780 **	0.2550	0.8273

Table 8.10 continued

11.Clothing, Bedding Footwear etc.	Linear	37.8060	0.1237	8.0200 *	0.8050	0.8971	-205.0500	0.2605	9.9521 *	0.8580	1.9683
	Hyperbolic	828.0510	1086007.0000	7.3340 *	0.7910	1.1121	688.4890	747757.5300	8.7144 *	0.8190	2.2071
	Semilog	-2792.5920	930.0340	8.5740 *	0.8320	1.1007	-3107.4180	1037.3790	9.5770 *	0.8470	2.1277
	Log inverse	3.0360	1192.2770	8.4110 *	0.8320	1.0316	3.1830	1376.2900	7.8790 *	0.7870	1.9807
	Log linear	-0.7996	0.9811	8.2290 *	0.8220	0.9811	-3.7040	1.8784	7.8430 *	0.7880	1.8784
12.Medicines	Linear	19.3200	0.0381	1.4130	0.1140	0.8406	20.0130	0.0255	0.9430	0.0520	0.6712
	Hyperbolic	302.2810	430921.6500	1.7820	0.1830	1.3425	113.3740	82372.3030	1.0560	0.0620	0.8460
	Semilog	-1008.7890	332.4480	1.6700	0.1580	1.1970	-282.6060	107.3470	0.9990	0.0570	0.7661
	Log inverse	2.4593	1165.0622	2.3360 **	0.2780	1.0080	2.2700	822.8050	1.6940	0.1460	1.1841
	Log linear	-1.2269	0.9405	2.3020 **	0.2630	0.9405	-1.6902	1.0740	1.5980	0.1340	1.0739
13.Conveyance and Cinema	Linear	-44.1870	0.0554	9.9660 *	0.8640	1.4299	-83.8320	0.0992	4.2250 *	0.5220	2.1183
	Hyperbolic	286.4800	434969.5210	5.3832 *	0.6710	1.5852	254.5230	281691.5899	3.9940 *	0.4870	2.3497
	Semilog	-1228.8020	392.0560	7.5380 *	0.7930	1.6513	-1184.8680	393.7390	4.1640 *	0.5120	2.2821
	Log inverse	2.5890	1506.4880	6.7090 *	0.7600	1.3035	2.7190	1380.2800	3.8720 *	0.4720	1.9864
	Log linear	-2.4500	1.2963	8.8187 *	0.8190	1.2963	-4.3150	1.9233	4.0070 *	0.4920	1.9233
14.Education	Linear	-209.5380	0.1361	8.4660 *	0.8210	2.3733	2.3800	0.0221	1.1110	0.0700	0.9366
	Hyperbolic	609.5610	1076254.0000	5.1920 *	0.6550	2.6500	82.9470	70886.1920	1.2380	0.0840	1.1735
	Semilog	-3129.8430	966.2110	6.8000 *	0.7570	2.7496	-257.8930	92.4020	1.1700	0.0760	1.0630
	Log inverse	3.3340	3314.3520	5.7540 *	0.7000	2.8677	2.3320	1307.4310	1.7350	0.1520	1.8816
	Log linear	-7.2110	2.6920	5.5100 *	0.6720	2.6924	-3.8637	1.6760	1.6020	0.1340	1.6758
15.Miscell-aneous Expendi-ture	Linear	-690.0840	0.4174	9.9320 *	0.8640	2.6412	-114.6890	0.1432	4.2170 *	0.5210	2.0012
	Hyperbolic	1736.6730	3099830.4000	4.6870 *	0.6070	2.7696	359.7020	384608.5360	3.5960 *	0.4350	2.0996
	Semilog	-9396.8970	2889.8320	6.7990 *	0.7570	2.9841	-1649.4810	551.3160	3.9130 *	0.4800	2.0913
	Log inverse	3.4260	2310.5570	5.8230 *	0.7050	1.9992	2.7720	1167.4970	3.2500 *	0.3860	1.6802
	Log linear	-4.4600	2.0344	7.5790 *	0.7950	2.0344	-3.2520	1.6501	3.4240 *	0.4150	1.6501

* = Significant at 0.01 level ** = Significant at 0.05 level

for all these commodities their per capita expenditure is influenced by the per capita total expenditure. It is important to observe that most of these commodities are food items. Further, the significant relation in respect of cloth and footwear, conveyance and cinema, and miscellaneous expenditure in R-II, gives an inference that developing region of our study is also experiencing a change in the consumption pattern of its cultivating households. Further, in R-II, the slope is significant in respect of cereals also, while it is not so in R-I. That is, R-I being a developed scenario has reached a fairly high level in cereal consumption,[15] as the per capita total expenditure does not influence per capita cereal consumption; whereas R-II being a developing scenario has not yet reached saturation, as is revealed by the significant relation.

In R-I, the slope is also significant in respect of the commodities - meat and fish, vegetables, and education; and further in respect of medicines, the slope is significant for the log-inverse and log linear functions. From these

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15. The cereal consumption(average) is not high in R-I, counted in monetary terms, as the evaluation of own produce is done at the harvest prices. But, the cultivating households that spend 98.2 per cent of the total cereals from the own produce may not be constrained to enjoy this upto saturation limit. Further, the saturation limit for cereals is sufficiently lower in R-I as would be seen from Table 8.11, showing only a smaller gap between the saturation limit arrived at and actual average (being Rs.436.02 and 398.98 respectively).

results, it can be said that (i) the developed region (R-I) is experiencing a qualitative change in consumption of food items, as the per capita expenditure on meat and vegetables does respond effectively to changes in per capita total expenditure, (ii) R-I is also conscious about human capital formation, as is revealed by the significant relation in respect of education and medicines. That is, the insignificant results in respect of these commodities in R-II indicate that the income levels (proxied here by expenditure levels) have not risen to the extent of diverting expenditure towards either qualitative food or towards medical and educational services.

Another interesting feature is that in both R-I and R-II, the slope in respect of tobacco and intoxicants has turned out to be insignificant. In R-I, this expenditure occupies only last but one position as per the shares of individual commodities in the total consumption and so its per capita expenditure may not depend on the per capita total expenditure (as a matter of fact it is so in the tastes of the consumers of R-I). But in R-II, this item occupies the third position at overall level as per the shares. Yet, it is not significantly influenced by per capita total expenditure.

As regards expenditure elasticities, they are higher in respect of all the commodities (except education) in R-II than in R-I. If it is considered for the commodities for which the significant slope values are there, most of them are food items. However, in respect of non-food items, viz. cloth and footwear, and conveyance and cinema; and elasticities are higher in R-II than in R-I. The pattern of consumption in R-II is in consonance with an underdeveloped economic regime, where the propensity to consume is higher till it reaches take-off.

In R-I, the elasticities are higher (with being just equal to 2 or more) in respect of education and miscellaneous expenditure, whereas in R-II, they are so in respect of clothing and footwear, conveyance and cinema, and miscellaneous expenditure. Further, the elasticities are greater than unity in R-I for conveyance and cinema, cloth and footwear, and medicines; whereas in R-II this is so for such commodities as milk, and sugar and tea. Thus, the elasticities are greater than unity in respect of only non-food items in R-I. Interestingly, in R-II, the food items - milk, and sugar and tea, also have the elasticity greater than unity.

Now it may be looked into the saturation limits of commodity expenditures, as presented in Table 8.11. Taking the log-inverse function, the saturation limit for commodity expenditure, i.e. value of y when x tends to infinity has been obtained (as in anti-log of a). From the semilog function, the minimum level of total per capita expenditure below which no expenditure is incurred on the commodity, i.e. the value of x when y = 0 has been found (as an anti-log of -a/b).

Table 8.11: Saturation Limits as per Selected Engel's Functions
(Rupees)

Item	Value of y, when x = ∞ in Log inverse function		Value of x, when y = 0 in Semilog function	
	REGION I	REGION II	REGION I	REGION II
1. Cereals	436.02 (398.98)	674.81 (456.99)	0.004	119.75
2. Pulses	178.24 (99.26)	133.32 (49.40)	378.51	540.72
3. Milk and Milk products	641.65 (308.60)	450.49 (101.62)	545.29	780.00
4. Edible Oils	191.86 (109.45)	175.43 (78.49)	517.73	405.87
5. Vegetables	129.59 (91.21)	89.96 (46.71)	176.11	209.24
6. Spices and Salt	301.88 (151.92)	119.93 (57.49)	667.87	390.34
7. Meat, Fish, Egg etc.	264.74 (121.98)	199.93 (96.94)	805.89	481.90
8. Sugar and Tea	237.39 (118.95)	280.80 (60.46)	529.98	829.74
9. Tobacco and Intoxicants	162.68 (74.35)	280.05 (135.57)	213.61	448.78
10. Fuel and Light	94.75 (44.88)	49.13 (21.05)	891.23	538.22
11. Cloth, Foot wear etc.	1086.63 (383.00)	1524.20 (216.90)	1006.18	989.58
12. Medicines	287.96 (136.50)	186.37 (59.69)	1082.51	429.19
13. Conveyance and Cinema	388.02 (109.12)	523.70 (76.60)	1362.23	1021.57
14. Education	2125.68 (168.77)	214.68 (38.74)	1734.99	618.02
15. Misc. Expdr.	2665.57 (455.99)	591.32 (117.02)	1785.30	981.52

Note: Figures in parentheses are average actual per capita Commodity expenditures from Table 8.6

In both R-I and R-II, for all the commodities, the saturation limit is greater than the actual average per capita commodity expenditures. The saturation limit is higher in R-II than in R-I for such commodities as clothing and footwear, cereals, conveyance and cinema, tobacco and intoxicants, and sugar and tea. The gap is alarmingly high in R-I for miscellaneous expenditure, education, clothing and footwear, and somewhat high for conveyance and cinema, and milk. However, in R-I, for cereals the gap is quite low. As was made clear in the previous paragraphs, the cereal consumption has reached fairly high limits in R-I. In R-II, the gap is very large for clothing and footwear, whereas it is moderately high for miscellaneous expenditure, conveyance and cinema, milk and education. For all these commodities, their per capita expenditure will go on increasing with future increases in the per capita total expenditure.

As regards the minimum per capita total expenditure, it can be seen from the Table that in R-I, only the cereal consumption starts at almost zero level of per capita expenditure. That is, x and y always move together from the initial stages till the saturation limit reaches. Further, the consumption of the commodities, viz. miscellaneous expenditure, education, conveyance and cinema, medicines, cloth and footwear start only at relatively very higher levels of per capita total expenditure. It is of interest to note that all these commodities are non-food items. That is, all food items start generally at relatively lower levels of per capita total expenditure. In R-II, also the non-food items, viz. conveyance and cinema, clothing and footwear, and miscellaneous expenditure start only at relatively higher levels of per capita total expenditure. One important inference can be drawn from the above results that the levels of per capita total expenditure being different in the two regions (72 per cent higher in R-I than in R-II), it is possible that in R-I, education and medical expenditure also start at relatively higher levels of per capita total expenditure. Further, in R-II, it is seen interestingly that even the food items - sugar and tea, and milk, also start at relatively higher levels of per capita total expenditure (these levels being even higher than in R-I)

Summary

Agricultural employment and income are substantially higher in R-I than in R-II, whereas mandays of non-agricultural employment and non-agricultural income are higher in R-II. In R-I, farm business income (FBI) makes a very high proportion in net household income (NHI). As a result, the NHI (including or excluding miscellaneous receipts) is higher in R-I, though total days of employment are higher in R-II. Really, this is the effect of the difference in the technology levels between two regions.

In R-I, agricultural employment is dominant in the total employment on all farm-size groups. Each component of agricultural employment and as a result, total agricultural employment maintains a negative relation with farm-size. Due to the sheer weight of agricultural employment, the total household employment also has a negative relationship with farm-size. In R-II, own-farm employment shows a positive relationship with farm-size. Although, in total agricultural as well as non-agricultural employment by FFWs, the medium farms show higher values, yet the level of total employment shows a negative relationship with farm-size.

As regards total household income (NHI), there is a positive relationship with farm-size in both the regions, following a more or less similar pattern by income from most of the sources.

Though FBI is highly skewed in both the regions, R-II shows somewhat less inequitable distribution of income from sources other then self farming (NFI), thereby showing lower inequality in the distribution of NHI. As NFI shows a more skewed distribution in R-I than in R-II, NHI also shows a fairly skewed distribution.

Given the more remunerative employment sources in R-I, per capita income levels are higher than in R-II. On the contrary, per capita surplus is negative among most of the farming households in R-II, giving a wide scope for higher incidence of poverty. In R-I, deficit households are no more than 20 per cent compared with as high as 70 per cent in R-II. Similarly, the incidence of poverty is low and discernible only among the small farms in R-I. By Bardhan's criterion, 26 per cent of the farmers in general and nearly 40 per cent of those among small farming households are poor in R-II. In brief, the technologically advanced agriculture of R-I guarantees the minimum standard of living, although the skewness in income distribution is somewhat higher compared with that in R-II.

The incidence of consumption from home produce is high in respect of cereals, pulses and milk. The proportion of home produce in the total expenditure maintains an inverse relation with farm-size in R-I, and positive relation in R-II. In a broad sense, this indicates a higher and higher degree of monetization as we climb up the farm-size ladder in R-I than in R-II.

Consistent with the better income position of R-I over R-II, per capita total expenditure is also higher in R-I than in R-II, both at the individual farm-size and overall levels. In both the regions it maintains a positive relation with farm-size. In R-I, per capita expenditure for all individual commodities maintains a positive association with farm-size. In R-II, there is no such systematic pattern. However, in most of the commodities large farms show higher values than other farm-size groups. The small farms have an edge over the medium farms in most of the non-food items and also food items like edible oils, vegetables and sugar plus tea. The small farms show higher expenditure on medicines even than the large farms, and the medium farms show the highest per capita expenditure on education. Thus, the large farms in the backward region (R-II) do not seem to be very much concerned about the need for human capital formation, compared with their counterparts in R-I.

As regards the shares of individual commodity expenditure in the total consumption, at the overall level, it is cereals that dominate in the entire expenditure in R-II, whereas it is miscellaneous expenditure (inclusive of luxuries) that assumes top position in R-I. The items - tobacco and intoxicants, which occupies third top position in R-II, assumes last but one position in R-I. Education which occupies the fifth position in R-I, gets last but one position in R-II. Clothing plus footwear occupy a nearly equal place of importance in both the regions.

When we look at the distribution of consumption expenditure, it is found that in R-I, there are higher inequalities compared to that in R-II. This follows the pattern observed earlier for net household income.

From Engel's functions, it is observed that in R-I the per capita total expenditure has its influence over all individual commodities except cereals, whereas in R-II, there is no such influence on qualitative foods, viz. meat and fish, and vegetables; and in respect of services of human capital formation (i.e. education and medicines). The expenditure elasticities are generally higher in R-II than in R-I. In a broad sense, R-II is clearly reflective of an underdeveloped area. In R-I, the elasticity is greater than unity mostly for non-food items, while in R-II, it is so even in respect of food items, viz. (a) sugar and tea, and (b) milk.

In total, R-I is a region of more remunerative employment, largely under the impact of more progressive agriculture. More remunerative employment generates higher per capita earnings, higher per capita consumption expenditure, a better pattern of consumption, especially from the point of view of important non-food items, a low incidence of poverty and so on. The other region, characterized by a general backwardness of its agriculture, offers sharp contrasts in almost all aspects of employment, income and consumption.

CHAPTER - IX

SUMMARY AND CONCLUSIONS

Since mid-sixties, a great change has taken place in agricultural technology of India. The new agricultural technology consists of bio-chemical and mechanical innovations. As part of bio-chemical technology, there has been increasing adoption of high yielding varieties for five major cereal crops (wheat, rice, maize, jowar and bajra) and use of chemical fertilisers and pesticides. Further, as part of mechanical technology, modern machinery like tractor, harvester, sprayer etc., have been expanding on an increasing scale. The major hallmark of the new agricultural technology is that India could achieve self-reliance in the foodgrain production, overcoming the painful memories of the agrarian crisis of the mid-sixties. Foodgrain production rose substantially since late sixties, enabling India to maintain a fairly comfortable stock of food for running the public distribution system.

The pace of technological transformation of agriculture has not been uniform throughout the country, largely because of institutional, historical and infrastructural variations among the states. For example, Punjab and Haryana have adopted both the bio-chemical and mechanical components of the new agricultural technology far more quickly and comprehensively than the country as a whole and green revolution is a total success in those states. On the other hand, Bihar and Orissa still lag behind in many respects. Similarly, inter-regional and inter-district variations in agricultural modernization within each state are also a reality, partly due to the differences in irrigation, and infrastructural facilities and partly due to lopsided policies for developing their agriculture.

Further, it is also natural that the new agricultural technology has made a differential impact on the different farm-size groups. Such differences are caused due to the differences in the ownership and access of different resources of agricultural production. As is well known, bio-chemical innovations call for a high dose of working capital whereas the mechanical technology needs huge capital investment. For obvious reasons, it is neither financially possible nor economically justified for small farmers to invest in many of the mechanical innovations. Thus, the small farmers are bound to depend mainly on the strength of the bio-chemical technology. For the adoption of bio-chemical component of the new technology, the small farmers need credit on a big scale. Accordingly, if the institutional credit agencies discriminate against them, and; if they have to depend on non-institutional short-term credit for production purposes, the pace of technological change over among them would be rather tardy. On the other hand, endowed with a fairly comfortable resource position of their own, and the technological compulsions to observe timeliness of field crop operations, large farms would tend to adopt mechanical innovations in a big way, in addition to bio-chemical technology. The small farmers can also adopt mechanical technology, provided that hiring-in facility of capital services is available.

Agriculture in Andhra Pradesh too underwent a degree of technological transformation since late sixties, in line with many other states of India. Again, as in most other states, the adoption of the new agricultural technology could not have been uniform in all parts of the state. On a wider plane, from the point of the spread of the new agricultural technology, Andhra Pradesh stands divided into three regions : Coastal Andhra, Rayalasima and Telangana, in that order. It is, therefore, essential to work out the rate of adoption of the new technology in parts of the advanced region and in parts of technologically backward region. Still more important would be to see the benefits of the new production technology accruing to farms of different sizes in advanced areas and the gaps that exist between farmers there and their counterparts in the backward areas. More pointedly, a study to look into the relative advantages and disadvantages of small farmers in backward region compared with their brethren in a technologically progressive region is greatly needed. The present study is a modest attempt in this direction.

Thus, the main objective of the study, would be to examine the farm-size variations and disparities in the production structure of agriculture between the two regions of Andhra Pradesh. More specifically, the study ventures to:

(i) examine the differences in the stock and composition of fixed capital between the two regions and across the three farm-size categories;

(ii) look into the variations in the intensity of resource-use between the regions and across the farm-size ladder;

(iii) analyse farm-efficiency at regional and farm-size levels, in terms of variations in productivity/yield rate, costs and net returns; and

(iv) bring out inter-regional and farm sizewise variations in the household employment, income and consumption levels and bring out the nature and the level of employment, income and consumption variations between the regions and across the farm-size groups, and consequently to assess the incidence of poverty.

Our study is based on primary data, collected through a field survey. The data relate to 1984-85 agricultural year. Data collection was done during September-December 1985. The two regions of Andhra Pradesh chosen for our study differ strikingly from each other in terms of agricultural technology in use; one is coastal Andhra representing a relatively advanced level of agricultural technology and the other is Telangana where technological change on a noticeable scale has yet to take place. One representative district has been chosen from each of the two regions. The chosen districts are West Godavari and Khammam from the developed and the developing regions respectively. West Godavari (hereafter Region-I or simply R-I), with a much higher level of irrigation, mainly through government canals, has fertile lands; while Khamman (hereafter Region-II, or simply R-II), with lower level of irrigation and a dryland crop mix, requiring low resource-use, typically represents a regime of traditional agriculture.

Further, the selection of villages was made on purposive basis. Seven villages were covered from each district, making a total of 14 villages in the survey. In each village, 20 households were randomly selected from among the cultivators. They were divided into three farm size categories in proportion to their respective number in each village. A system of self-weighting was thus observed in our sampling. Drawing a sample of 140 households in each region, we had thus a total of 280 households in the total survey.

For most of our analysis, we use average figures for the two regions on the one hand and among the three farm-size categories within each region, on the other. Wherever necessary, the difference between the averages of farm-size groups has been tested for statistical significance using t-test/Cochran and Cox test. We used disaggregated household level data for estimating regression equations including production function analysis and for computing decile distribution of certain variables. Still further for estimating Engel functions, data have been rearranged into 16 classes, based on farm-size.

Our study has thrown up a large number of results and insights on the changing agrarian realities in Andhra Pradesh agriculture. It is not advisable to repeat all these here. Instead, we give below what in our view, are the more important among them. Further, we consciously avoid giving explanations for the patterns described in this brief concluding chapter.

General Information on Survey Areas.

The number of family farm workers (FFW) per household is higher in R-II than in R-I both at the overall and farm-size levels. The proportion of FFW in family members is lower among large farms in both the regions. As regards FFW per acre of NOA, it bears an inverse relation with farm-size.

The number of permanent workers per household and per acre of net operated area (NOA), and, the percentage of households reporting permanent workers, show an increasing relationship with farm-size in both the regions. In terms of absolute magnitudes, all these values are higher in R-I than in R-II. Thus, the incidence of engaging permanent workers is higher in technologically advanced R-I compared with R-II.

As regards distribution of land, the usual pattern of large farms having a higher share in area compared with their share in the number of holdings, while small farms showing the reverse position, is very much discernible in our study area also. Further, while severe inequalities in the distribution of land exist in both the regions, these are much more severe in R-I than in R-II. Again, while pure tenants are only a marginal category in both the regions in relative terms, their number is higher in R-I than in R-II. Most strikingly, the share of leased-in area to total operated area is nearly twice as much in R-I as in R-II. The share of owner-cum-tenants is also higher in R-I than in R-II.

Important differences are in evidence as regards cropping patterns. The level of cropping intensity is very high in R-I (equal to 2.00) compared with a bare 1.18 in R-II. In R-I, all the three categories enjoy nearly the same level of cropping intensity, while in R-II, it keeps on declining as we go higher on the farm-size ladder. While, R-I is under the regime of mono-crop culture (paddy), R-II has a diverse cropping pattern. In R-II, among the small and medium farms, jowar is important while among the large farms, groundnut figures most prominently. In R-I, the allocation of cropped area under Kharif and Rabi seasons is almost equal both at farm-size and overall levels. In R-II, cropped area in Rabi is slightly higher than in the Kharif season.

In R-I, cent per cent of NOA and gross cropped area (GCA) is irrigated. As such, irrigation intensity is as high as 2.00 for each of the three farm-size categories of this region. In R-II, on the whole, irrigated area in terms of both NOA and GCA is less than 1/4th; among the medium farms, this is even lower. Accordingly, in R-II, irrigation intensity is fairly low for farmers in general. However it goes on rising as we move up the farm-size ladder. Among individual crops, paddy alone is the biggest user of irrigation; it occupies as much as 90.0 per cent of the gross irrigated area.

As regards source-wise irrigation, in R-II, at the overall level, nearly 3/4ths of the irrigated area is under tanks. Across the farm-size continuum, the medium and the small farms depend on tanks to the extent of 7/8ths of their irrigated area, whereas large farms depend on tanks only for 5/8ths of area, since they fill the gap through wells and rivulet channels. In R-I, however, the entire irrigation is through government canals.

Stock and Composition of Capital

Broadly, the stock and composition of capital assets in any region depend *inter alia* on the level of agricultural development of that region. Further at farm-size level, variations in the ownership of capital assets depend on the resource constraints of the different farm-size groups. Endowed with the highest cropping and irrigation intensities (both as high as 2.00), R-I is a developed region by any comparable reckoning. To put it more sharply, the most restrictive bottleneck of irrigation is already overcome, nearly completely, in R-I. It is natural, therefore, to expect that our R-I dominates in the matter of per acre investment in productive capital assets. This is remarkably true.

The total capital assets per holding show higher value in R-I than in R-II and in both the regions, the values maintain a positive relation with farm-size.

On per acre basis, the total of capital assets and implements and machinery have higher values in R-I than in R-II at the overall level. In R-I, the medium farms show the highest values for these two investment indicators, whereas the small farms stand nowhere near the medium and large ones. In contrast to this, in R-II, the small farms show higher value than both the large and medium ones for both the indicators. This contrasting result is due to the fact that, in R-I, these two categories of farm assets consist of modern, costly equipment-tractor. The reverse relation in R-II shows the development gap between the two regions. In other words the traditional capital structure that dominates R-II reflects scale indivisibilities with which small farmers of R-II have still to contend and suffer in net economic terms.

Due to the substitution of mechanical power for draught animals in R-I, investment per acre on draught animals in R-I is substantially less than that in R-II. As against this, investment per acre on milch cattle is quite higher in R-I than in R-II. At farm-level, in R-I, there is a positive association with farm-size as regards investment in draught animals, while it is the opposite in R-II.

However, for per acre investment in milch cattle there is a systematic inverse relationship with farm-size in both the regions.

Looking at the respective priorities in investment, in R-I the highest priority goes in favour of implements and machinery, whereas in R-II, it is in favour of draught animals, though these two items together have equal weightage in the total capital assets (2/3rds) in both the regions. Milch cattle occupy an intermediate position in both the regions. Further, the priorities at farm-size level also remain nearly the same as at the overall level in both the regions. The only exception is the small farms in R-I who give top priority to milch cattle, because their implements and machinery have a smaller share inasmuch no costly equipment is owned by them.

As regards modern equipment, in R-I, it consists of tractor and sprayer, whereas in R-II, it is confined to irrigation structures alone. Further, R-I, dominates in modern equipment, the ownership of which is essentially confined to medium and large farms. In R-II, modern equipment is reported almost exclusively by the large farms.

The lack of ownership of certain components of capital stock by certain categories of farm operators most especially the small farmers does not preclude them from hiring their services from fellow farmers or other agencies. The practice of using hired capital equipment has certain implications of its own, especially in the advanced R-I in contrast to R-II. In R-I, only some of the medium and the large farms own tractor while none of the small farms owns it. Further, sprayer is owned by only a few of the small farms (8 per cent). It is however an extremely significant agrarian development that all the small farms of R-I use tractor services through hiring-in process; also most of them use sprayer as well. In R-II, both ownership and use of tractor and sprayer is negligible. For draught animals, R-II has higher ownership rates than in R-I, both at individual farm-size level as well as at the overall level. All farms in R-II depend on them for traction power.

Gross investment in the reference year is many times higher in R-I than in R-II. In R-I, the medium and large farms dominate in current investment as some among them invested in costly modern equipment mostly tractor. In R-II, the large farms dominate on per holding basis whereas, in terms of per acre, the small farms have higher value than the large farms.

Resource-Use Intensity

The life expectancy of fixed capital assets extends beyond a single production period. It is therefore, the flow of capital services, emanating from those fixed capital assets, that plays a major role in determining the level of production on the farm. In the FMS of the mid-fifties, the small-farm efficiency was attributed *inter alia* to the higher doses of labour and non-labour inputs on those farms. With the changed technological conditions, the farm sizewise differentials in the use of inputs are reported to have undergone big modifications. It is, therefore, of essence to look through the pattern and intensity of resource-use in our sample areas and among the three farm size categories.

In R-I, only paddy is grown in both the cropping seasons. In this region, therefore, whatever we say for total crop output is, *mutatis mutandis*, applicable to paddy. On the other hand, in R-II, among the individual crops, paddy and groundnut occupy dominant position in terms of the use of almost all the inputs.

At the total crop level, per acre use of individual constituents of bio-chemical inputs (except seed), is much higher in R-I than in R-II. For all these inputs, in R-I, there is a systematic positive relation with farm-size. In R-II, the patterns are not very neatly defined. For example whereas there is a positive relation for seed it is negative relation for manure. Again, for other input items, the large farms show higher levels than the small and the medium farms. When we compare the resource-use levels for paddy cultivation, R-I shows higher levels than R-II in all components of bio-chemical inputs (except manure), both at the overall and individual farm-size levels(except small farms). In R-II, the small farms tend to show an edge over the large farms, though the gap is low for most of the individual crops.

Per acre irrigation expenditure at the total crop level is higher in R-I than in R-II. As regards farm groupwise differences, in both the regions, the large farms show higher values in individual crops (paddy and groundnut in R-II and only paddy in R-I).

At total crop level, in R-I, total capital services, improved capital services and hired-in capital services (all exclusive of bullock expenditure) are higher than those in R-II. In R-I bullock labour has been very largely displaced by tractor-use. Naturally, therefore, bullock expenditure is much higher in R-II than in R-I, as the farmers in R-II still depend on draught animals for traction purposes. In both the regions, expenditure on capital services (exclusive as well as inclusive of bullock expenditure) shows an inverse relation with farm-size. Statistically, however the differences between the small and the large farms are not significant in R-I, while they are quite significant in R-II. In R-II, for all the individual crops, the small farms tend to show significantly higher levels, than the large farms. This was so at the total crop level.

Again, at total crop level, total, permanent and casual labour days are higher in R-I than those in R-II, whereas family labour days are higher in R-II. It seems under the changed technological conditions in R-I, dependence on outside labour, has grown relatively more whereas family members still provide the main source of human labour input in R-II. In R-I the small farms show higher total labour days, whereas in R-II, it is the large farms that show higher total labour input. Further, casualization of labour is higher in R-I. Comparing paddy of R-I with that of R-II, the labour days do not differ between the two regions. For individual crops in R-II, family labour maintains an inverse relation with farm-size. As is typical of any traditional agricultural regime, large farms show higher hired-in labour days in R-II.

Bullock labour is the main traction power in R-II, whereas tractor-use figures prominently in R-I, at total as well as individual crop levels. While tractor-hours are invariant to farm-size in R-I, bullock labour days in R-II maintain an inverse relation with farm-size, both at total and individual crop levels.

Finally, a word about the availability of short-term credit. In R-I, the demand for short-term credit measured both in terms of per acre and per holding, is higher than that in R-II. In R-I, commercial banks meet more than half of the demand, while in R-II, co-operative societies occupy a position of eminence. While the overdues are nil in R-I, they are fairly high in R-II. As many as 44 per cent of the borrowers reported overdues in R-II. As regards farm-size level differences, the per holding borrowings maintain a positive association and per acre loans a negative relation with farm-size, both in R-I and R-II. The overdues, both on per acre and per holding basis, maintain an inverse relation with farm-size in R-II, while the proportion of borrowers with overdues is higher among the small farms.

Productivity, Costs and Returns

Having looked into the variations in the input-use between the regions and across the farm-size ladder, we may now like to see the differences in production efficiency between the two regions and across the farm size categories. In other words, we would like to see which category of farms transforms inputs into output more efficiently. To measure efficiency, we bank on productivity/yield rate, total cost and net returns all measured on per acre basis. Further, the production function analysis has been used to throw some light on the contribution of chosen input factors to output. The important findings of these aspects are as follows :

At the level of aggregate crop output, the levels of gross output, total cost and net returns (all expressed on per cropped acre basis) are higher in R-I than those in R-II, thus establishing the technological superiority of the former over the latter. At the farm-level, in R-I, there are negligible differences in respect of gross output per acre. In respect of total cost and net returns, the small farms seem to perform a little more efficiently, as they show lower cost and higher net returns than both the medium and large farms of this region. This efficiency is attributable to the lower cost on hired-in labour (due to higher use of own labour) on the small farms. In R-II, the large farms show efficient production conditions, as they exhibit higher gross output, net returns and total cost (all measured on per cropped acre basis) than the small and the medium farms. Between the small and the medium farms, the small farms fare better.

Thus between the two regions, at the total crop level, the farmers in R-I are more efficient than their counterparts in R-II. However, as regards the farm size wise differences, it is the small farms in R-I and the large farms in R-II who seem to hold an edge over other farm size operators.

We may like to see the differences in productivity levels in terms of net operated area. The operational link between productivity levels measured on per acre of cropped area against per acre of net operated area, is the level of cropping intensity. As seen earlier, cropping intensity is invariant to farm size in R-I while in R-II it goes on declining as we move up on the farm size continuum. The effect of cropping intensity on productivity per acre of net operated area is, therefore, clearly visible in R-II; productivity gaps among farm size groups get reduced when measured on per acre of net operated against those measured on per acre of cropped area. In contrast, in R-I, productivity gaps remain unchanged when we shift to denominator from the gross cropped to net operated area.

At the level of individual crops, paddy in R-I shows the highest levels of yield as well as farm business income for each of the three farm size categories. On the other hand, in R-II, paddy and groundnut dominate in the values of these two performance indicators. Going along the farm size ladder, we discover higher values for yield as well as farm business income with large farms practically for all crops grown in R-II.

As regards the cost-structure, at the total crop level, in both the regions, paid-out labour cost (permanent and casual labour together) dominates. Further, in R-I, chemical fertilizers, rent and pesticides assume importance in that order. In R-II, bullock expenditure gets the second largest share, followed by seed and chemical fertilizers. In R-I, capital services show higher share than in R-II. It, however, needs to be underlined that while their content in R-I is overwhelmingly modern; in R-II, it is very largely traditional. Thus, in R-I, the modern capital services and the new bio-chemical package figure prominently, whereas in R-II, the cost composition, both at the total and individual crop levels, tilts heavily in favour of traditional inputs - local varieties of seed, bullock labour and traditional farm implements, and so on.

We estimated various types (linear, log-linear, U-shaped, etc.) of regression equation to see the relationship between farm size and productivity, overall yield rate, total costs, etc. On the basis of standard statistical criteria, different functional forms were chosen for discussing the underlying relationships. For example, on the basis of linear as well as lon-linear functions, there seems to exist a neutral relationship between farm size and productivity and overall yield rate in the developed region (R-I). Similarly, on the basis of a U-shaped relationship, in R-II, it seems that productivity and overall yield rate keep on declining till we reach a certain size of farm beyond which these performance indicators start rising.

Our production function analysis has not thrown up very neat results. Nevertheless, a few major features could be underlined. Firstly, at the total crop level, in the developed region (R-I), only land turns out to be the big contributor to output, whereas in the backward region (R-II), it is the labour input that has relatively higher impact on the output. Secondly, in R-II, the labour input has a significant impact on the output of all individual crops; and the two dominant crops, paddy and groundnut, show significant and positive elasticity coefficients for labour and capital services. Finally, as regards returns to scale, at total crop level, the evidence points towards constant returns to scale in both the regions. However, in R-II, paddy and groundnut show increasing returns to scale.

Employment, Income and Consumption Pattern

Finally, we have a few important results to report on employment, income and consumption pattern of the sample households. To capture all aspects of employment and earnings (both agricultural and non-agricultural), the analysis has proceeded in terms of household estimates, whereas consumption pattern has been dealt with in per capita terms.

As is to be expected, agricultural employment and income are substantially higher in R-I than in R-II, whereas mandays of non-agricultural employment and non-agricultural income are higher in R-II. In R-I, Farm Business Income (FBI) makes a very high proportion in net household income (NHI). As a result, the NHI (irrespective of whether miscellaneous receipts are included or not) is higher in R-I, though total days of employment are higher in R-II. Really, this is the effect of the difference in the technology levels between two regions.

In R-I, agricultural employment is dominant in the total employment on all farm-size groups. Each component of agricultural employment and as a result, total agricultural employment maintains a negative relation with farm-size. Due to the sheer weight of agricultural employment, the total household employment also has a negative relationship with farm-size. In R-II, own-farm employment shows a positive relationship with farm-size. Although, in total agricultural as well as non-agricultural employment by FFWs, the medium farms show higher values, yet the level of total employment shows a negative relationship with farm-size.

As regards total household income (NHI), there is a positive relationship with farm-size in both the regions, following a more or less similar pattern by income from most of the sources.

FBI is highly skewed in both the regions. FBI is, however, a part (although the most dominant one) of NHI. Happily, R-II shows a somewhat less inequitable distribution of non-self farming income (NFI) which ultimately results in making the distribution of NHI less inequitable in R-II compared with R-I. As a sharp contrast, NFI shows a more skewed distribution in R-I than in R-II, and consequently NHI also shows a fairly skewed distribution. The less unequal distribution of NHI in R-II need not be interpreted to imply a better situation for small farmers here compared with their brethren in R-I. As has been stoutly pointed out, the absolute levels of income are much higher in R-I compared with those in R-II, for any comparable pair of farm size categories.

Given the more remunerative employment sources in R-I, per capita income levels are higher than in R-II. On the contrary, per capita surplus is negative among most of the farming households in R-II, giving a wide scope for higher incidence of poverty. In R-I, deficit households are no more than 20 per cent compared with as high as 70 per cent of them in R-II. Similarly the incidence of poverty is low and discernible only among the small farms in R-I. By Bardhan's criterion, 26 per cent of the farmers in general and nearly 40 per cent of those among small farming households in particular are poor in R-II. In brief, the technologically advanced agriculture supplemented by non-farm earnings in R-I guarantees a minimum standard of living to an overwhelming proportion of their rural households, although the skewness in income distribution is somewhat higher compared with that in R-II.

Finally, we have looked into consumption patterns as well. Consistent with the better income position of R-I over R-II, per capita total expenditure is also higher in R-I than in R-II, both at the individual farm-size and overall levels. In both the regions, it maintains a positive relation with farm-size. In R-I, per capita expenditure for all individual commodities maintains a positive association with farm-size. In R-II, no such systematic pattern is observed. However, for most of the commodities, large farms show higher values than both small and medium farms. The small farms have an edge over the medium farms in most of the non-food items and also food items like edible oils, vegetables, and sugar plus tea. The small farms show higher expenditure on medicines than even the large farms, and the medium farms show the highest per capita expenditure on education. Thus, the large farms in the backward region (R-II) do not seem to be very much concerned about the need for human capital formation, compared with their counterparts in R-I.

As regards the shares of expenditures on individual commodities in the total consumption, at the overall level, it is cereals that dominate in the entire expenditure in R-II, whereas it is miscellaneous expenditure (inclusive of luxuries) that assumes top position in R-I. The item -

tobacco and intoxicants, which occupies third top position in R-II, assumes last but one position in R-I. Education which occupies the fifth position in R-I, gets last but one position in R-II. Clothing plus footwear occupies a nearly equal place of importance in both the regions. When we look at the distribution of consumption expenditure, it is found that in R-I, there are higher inequalities compared to those in R-II. This follows the pattern observed earlier for net household income.

From Engel functions, it is observed that in R-I the per capita total expenditure has its influence over all individual commodities except cereals, whereas in R-II, there is no such influence on qualitative foods, viz. meat and fish, and vegetables; and in respect of services of human capital formation (i.e. education and medicines). The expenditure elasticities are generally higher in R-II than in R-I. In a broad sense, the consumption pattern of R-I is qualitatively much superior to that in R-II; with their greater stress on cereals and other allied commodities, R-II is clearly reflective of an underdeveloped area. In R-I, the elasticity is greater than unity mostly for non-food items, while in R-II, it is so even in respect of food items, viz. (a) sugar and tea, and (b) milk.

superiority of R-I emerges from many counts, e.g. cent per cent irrigation, cent per cent double cropping, cent per cent coverage of cropped area under HYVs and chemical fertilisers and complete displacement of bullock-labour by tractor-use for ploughing and threshing operations.

Our developed region shows higher levels for many performance indicators, in many cases substantially higher, compared with the relatively backward region. In particular, the differences need to be underlined for the following items: Literacy among the cultivators; value of total capital assets and of implements and machinery per acre of net operated area; capital services, improved capital services and hired-in capital services per acre of gross cropped area; gross output, total cost and net returns per acre of both net operated area and gross cropped area; per holding agricultural employment and so on.

Further, the developed region provides a more remunerative employment largely under the impact of progressive agriculture. More remunerative employment generates substantially higher per capita earnings, higher per capita consumption expenditure, a better pattern of consumption, especially from the point of view of important non-food items, a low incidence of poverty.

In the developed region (R-I), the small farms do not suffer from any special production disadvantages compared with the large/medium farms. In fact their production structure reflects lower total cost and higher net returns (in terms of per acre of gross cropped area) which would show them to be slightly better placed as regards the physical efficiency of production. These efficient production conditions of the small farms are largely the result of lower paid out labour cost, accompanied by higher family labour use, as these farms have higher number of farm family workers per acre of net operated area.

An important feature that needs to be underlined is that although none of the small farmers own a tractor, yet each one of them uses tractor-services, thanks to the mechanism of hiring-in capital services. As a result, they show higher value of capital services; more than 90.0 per cent of their capital services expenses are made up of machinery hire charges. Had there been no such market support facilitating adoption of mechanical component of the new technology, not only that the small farmers would have stayed back with the traditional technology but would have also suffered severe diseconomies of indivisibilities through the use of draught animals and ploughset like their brethren continue to do in R-II. The arrival of new technology in R-I has thus conferred double advantage on the small farm sector, and consequently it has not lagged behind the medium/large farm sectors in adopting the new technology and reaping due benefits.

Further, the small farms, in the developed region, show higher averages of total agricultural and total household employment compared with large/medium farms.

Another remarkable aspect is that the small farms in this region get nearly 70 per cent of their net household income from farm-business income, whereas their counterparts in R-II obtain only 20 per cent from self-farming. Again, per household farm business income of the small farms in R-I is substantially higher (nearly 6 times) than their counterparts in R-II. This outrightly, guarantees them a minimum standard of living leading to a much lower incidence of poverty.

The small farm sector in the backward region (R-II) is obliged to maintain substantially higher inventory value per acre of net operated area in respect of total capital assets, implements and machinery and draught animals. This structure of asset position is perfectly in conformity with the production conditions in a traditional agriculture where the ploughset and draught animals have inescapably to be maintained as full technical units on the small farms too. Under-utilisation of those capital assets on small farms compared with the large/medium farms, follows as an unavoidable consequence.

One more glaring disadvantage of the small farms in R-II is lower value of irrigation structures, as also the total of modern component of implements and machinery. As a result, compared with medium/large farms, they show lower irrigation intensity. The higher cropping intensity with them is thus more an expression of distress farming condition including very low levels of land-man ratios rather than a technology-inspired phenomenon.

Still further, in R-II, the small farms show lower production efficiency compared with large ones, as reflected in lower levels of gross output, total cost and net return (all on per acre of gross cropped area basis). Similar is the case in respect of seed, chemical fertilisers and irrigation expenditure (per acre of gross cropped area).

The small farms in this region, affected by backward agricultural conditions show lower agricultural employment and income, with a high degree of dependency on non-agricultural avenues. Fortunately, there are some such non-agricultural avenues, due to industrial development taking place in the region. But for these compensating non-farm avenues of employment and earnings, the absolute level of poverty among the small farms would have been substantially higher than the observed 40.0 per cent.

Policy Implications

Our study offers a few policy implications for developing backward agricultural regions.

The developed region (R-I), with its better irrigation facilities, mainly through government canals, coupled with better institutional structure in the product and credit markets, has undergone technological transformation in its agriculture, leading to higher levels of agricultural employment, production, productivity and net income. Another important feature is that the small farms are also in a position to adopt new agricultural technology nearly as effectively as do the large/medium farms.

As a lesson from the developed region, our backward region (R-II) or such agriculturally backward areas in Telangana need an external stimulus for transforming their traditional agricultural conditions. This is possible by providing irrigation through state-sponsored schemes. In fact, there is a lot of unexplored potential for irrigation expansion in many such areas of Andhra Pradesh as is the backward region in our study. It is no doubt true that known potential for irrigation development does not exist every where, yet the moot question is that wherever such possibilities exist, irrigation potential needs to be exploited to the full extent either by government canals or some other public irrigation system. And in those areas where such irrigation potential is absent, even from the long run point of view, the dry land crop-mix, which is the result of recent agricultural research, should be encouraged as a short-term measure for fostering agricultural growth. The long-run development of agriculture in such areas depends on the possibility of achieving breakthroughs in the dry land agricultural technology.

In areas typified by our backward region (R-II), the small and medium farmers are at a disadvantage not only in respect of irrigation but bio-chemical technology which is supposed to be size-neutral. It is mainly because of lack of own resources as also inadequate support of credit agencies. As a result, the small and medium farms have to rely on dry crops like jowar and green gram on more than half of their cropped areas, as was clearly discernible in R-II of our study area. Only local and low-yielding varieties are available for such crops which affect the total farm profitability. Most ostensibly, these crops require limited number of operations, causing lower levels of labour-use and employment, besides lower production, productivity and net returns. The economic distress, caused by agricultural backwardness in backward areas such as R-II in our study area, is demonstrated by the fact that agriculture (including dairying and wage employment) does not provide more than 1/3rd of total household employment for the small farms here. Ordinarily, a larger share of non-agricultural employment is always interpreted as a better economic outcome since such employment is generally more remunerative and pushes total household earnings upwards. In the present case, it is the low level of employment in backward agriculture which compels people to seek larger employment outside agriculture. It is, thus, the distress caused by agricultural backwardness which generates a distress pattern of non-agricultural employment and income. In sharp contrast, in the region characterised by a high degree of agricultural development, such as R-I in our case, agricultural employment of the small farms also is not only of a very high order, nearly 3/4ths of total household employment, but entails fairly higher level of net earnings. The small farming households here are not under distress to wander about in search of non-agricultural employment like their counterparts who are obliged to do in R-II. The lesson is, therefore, clear. For a more remunerative employment base for small farms, agricultural development is a *sine qua non*.

In case, public irrigation is not a feasible solution, the small and medium farms may be provided with medium or long-term loans for the construction of wells/tubewells. Further, they should be provided with special production credit loans for raising cash crops such as groundnut on a par with the large ones. Thus, the backward areas should be induced by some production incentives, thereby giving scope for technological transformation of their agriculture.

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Abbreviations: EPW = Economic and Political Weekly
IJAE = Indian Journal of Agricultural Economics

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