Impact of Education on Indian Agriculture in the Post-Independence Era : A Close-up Study of A Block in Orissa.

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DECLARATION

Certified that the dissertation entitled "IMPACT OF EDUCATION ON INDIAN AGRICULTURE IN THE POST-INDEPENDENCE ERA: A CLOSE-UP STUDY OF A BLOCK IN ORISSA", submitted by Rama Chandra Mishra in partial fulfilment for the award of MASTER OF PHILOSOPHY DEGREE has not been previously submitted for any other degree of this or any other University. To the best of our knowledge this is a bonafide work.

We recommend this dissertation to be placed before the examiners for evaluation.

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A C K N O W L E D G E M E N T

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C O N T E N T S

CHAPTER - I

INTRODUCTION

This is a study to find out the impact of education on Indian agriculture in the post-independence era. It starts with the assumption that the efficient use of more improved agricultural inputs increases the productivity of agriculture.[1] The demonstration plots using improved agricultural inputs and skilled manpower have been showing a better productivity in comparison to the plots using traditional inputs and unskilled manpower.[2]

The development of agriculture depends upon the quality of inputs used and the quality of men who use it. Improvement of the quality of inputs is related to the improvement in the quality of material means of production whereas the improvement in the quality of manpower is related to the enrichment of human capital. The material means of production in agriculture

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1. There may be a few cases when the use of improved agricultural inputs does not give a better yield. For instance, the use of high yielding varieties of paddy seeds by the flood effected farmers of Salepur region of Orissa in 1982 did not give any yield at all. Such type of cases are exceptional. Further, in such cases, we can not say whether the cause of the failure lies in the technology or in its use.

2. Recently the ecologists have found out that the use of more modern agricultural inputs viz. fertiliser, pesticides, High Yielding Varieties etc., in the long-run, degrades the soil and reduces the productivity.

are land, seeds, fertilisers, pesticides, implements and machineries, irrigation etc. The human capital is related to the productive efficiency of man. It is, very often determined by the non-economic factors such as the social, political, ethnic and educational background of the people. To my mind, the improvement of both the quality of material means of production and the quality of manpower is influenced by education.

People from Europe who colonialized North and South America had the same opportunity to develop the countries which they had adopted as their new homes. Both continents had vast land and water resources, plenty of minerals, and a scanty native population. Yet, it was the people who colonialized North America were more successful. Why was it so? It was because of the human element. The colonists from England and other northern European countries who settled in north America were more hardworking than the Spaniards and the Portuguese who colonialized South America.[3]

In India also, as in the rest of the world, the human element has an important role in agricultural development. Kusum Nair, a journalist, travelled all over India from

3. M.S. Randhawa and others, Green Revolution: A case Stuay of Punjab. Delhi, 1974, p.33.

1958 to 1960 to assess the role of human element in rural development. In a number of states she found contentment with the existing miserable conditions. In Punjab alone she saw people who were enterprising and energetic. Even in 1958 she saw humming industries in the towns of Punjab where owners of small workshops were turning out sewing machines, by-cycles and agricultural implements in a constant din of hammers and electric motors. She also noticed that the refugee farmers were more progressive and superior in techniques of cultivation to the farmers of East Punjab.[4]

The above two analyses give more importance to the traditional factors in determining the quality of human element. In India the human element was mostly determined by physical and socio-cultural status of a human being. Thus, the adoptive and innovative capacities of the farmers were determined by his caste, religion, traditions, culture, stature etc. These factors are mostly ascriptive, not achievement-oriented. They still use to have their hold in the human element. In the plan periods efforts have been made to makethe human element more achievement-oriented through education.

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4. Ibid.

This study aims at finding out the contributions of education in improving the human element particularly in the context of agriculture. It also aims at finding out the contributions of education to the development in the quality of inputs. Finally, the study tries to find out whether the education level of a farming household(or family) influences it to have a better farming system and thereby better productivity.

The performance of Indian agriculture in the post-independence era can be judged through productivity approach. Agricultural productivity may be defined as the ratio of the index of total agricultural output to the index of total input used in farm production. Productivity of agriculture has been looked at from different points of view, such as, productivity of land, labour and capital. For a study of agricultural modernization in a country like India, attention may specially be focussed on the productivity of land, because it is the most permanent and fixed among the three conventional categories of inputs(land, labour, capital). Therefore, productivity per unit of land would reasonably indicate the degree of agricultural development. This is particularly important in view of the fact that the land/labour ratio in India is unfavourable due to population explosions and there is a widespread belief that under-employment and disguised employment is prevalent in the agricultural sector of India. Thus our main aim is to find out the production and land productivity in agriculture. Raising the productivity of land, however, does not mean only raising the yields of individual crops. It encompasses the whole output of a farm or country in relation to the total area of farmland, and may be raised by changing the pattern of production toward more intensive systems of cultivation or towards higher value crops. The productivity of land may be increased by raising multiple crops in a year on the same land.

The impact of education on production and productivity has to be judged by defining education clearly in the context of agriculture. Education for agriculture includes all formal education and also informal and non-formal education. Formal education includes all education from primary level to university level. It also includes agricultural research. Informal and non-formal education includes education through agricultural extension services, broadcasting, television, adult education programmes, non-formal schools, Krishi Vigyan Kendras, Development Departments of the Government, private industrial organizations etc.

The economic laws of the production show that in the long-run three types of returns to scale operate. They are, increasing returns to scale when output increases more than proportionately to the increase in inputs, decreasing returns to scale when all inputs are increased by some portion and the output increases less than proportionately, constant returns to scale when output increases by the same proportion as inputs. Externalities influence the different types of returns to scale. Externalities are the products of educational impact.

An observer on Indian agriculture can visualize certain things which create some puzzles in him. It is seen that farmers with large-size holdings, belonging to higher castes, with considerable education, having links with high-ups in administration and politics, participate and get the benefits of agricultural development. It is seen that there is a gap between the potential yield in research farms and realised yield in demonstration plots. There is also a gap between the realised yield in demonstration plots and the actual yield in farmers' field. This may be due to the differences in the use and quality of factor inputs and/or differences in human capital.

In the rural areas some farmers innovate first. They are the leader in learning about improved farm practices and adapting it into their plots. While there are others who follow it after visualizing the result. Who are these leading farmers? Do they have an edge over the others in case of educational attainment? Or is it determined by socio-economic factors other than education?

In Indian agriculture, some pockets or areas of different states are developed as far as their agricultural production and productivity are concerned. In these areas the level of awareness and achievement among the farmers are higher in comparison to the other agricultural regions. Of course there may be exceptions, particularly in case of areas with adverse geo-physical and climatic set-up.

In case of some crops the increase in productivity is high while in others' case it is almost stagnant. In case of crops with increased productivity the research and mechanization is more. While research is a part of education, mechanization is a contribution of research.

With all these above observations one can have a positive attitude towards the role of education in Indian agriculture. Therefore, our hypotheses are:(a) education had an impact on Indian Agriculture in the post independence era, and (b) farmers with education are the early adopters of yield-raising inputs.

"Material planning creates opportunities for economic growth; it is the psychological response of the human factor that determines the utilization of these opportunities and, therefore, the volume and pace of economic growth".[5]
The psychological response of the human factor can be modified or changed through education. According to V.M. Dandekar, education of the farmer would help him in changing his attitude to nature. Once education is used to explain the working of nature and indicates possibilities of modifying and harnessing it in the interests of man, much of his traditional attitudes to nature would get modified automatically. Secondly, education will clarify the distinction between traditional knowledge and modern science wherever it influences production

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5. V.K.R.V. Rao, Education and Human Resource Development, New Delhi, 1966, p.16.

ability. In particular, it will emphasise the fact that modern science is experimental while traditional knowledge is largely authoritative. Lastly, education will emphasise the difference between a traditional and the modern attitude to certain aspects of human life and endeavour. This would explain the existence of relations between man and man in the process of production and how and why these need to be changed in the interest of production efficiency. According to him these three aspects of education would prepare the farmer for a transition from traditional agriculture to modern agriculture.[6]

Methodology

Data have been collected on production, yield rate, improvement in education, consumption of agricultural inputs and improvement in the quality of inputs. The collection of data is mainly from the secondary sources. A close up look at a particular community development block in Orissa is given through a field-study. The field study is conducted through field observation and interview-schedules. Thus, the data collected from the Block is primary in nature. The study did not try to quantify the impact of education on agriculture. Only through tabulation, the study tried to find out whether there is any impact of education on agriculture.

Limitation

The study gives importance to such variables as the different determinants of the prosperity of agriculture viz. education,

6. D.P. Chaudhri, Education, Innovations and Agricultural Development: A Study of North India (1961-72), New Delhi, 1979, p.89.

research, irrigation, fertiliser, high-yielding varieties etc. There are some other factors which can also influence agriculture to some extent. But these are isolated in the study. In case of field study, the respondent's replies in regard to his source of information, level of education, quality of inputs used etc. have been taken as final. As the investigators belong to the area of study and, as the purpose of the investigation was made clear to them in language that they can understand and appreciate, they have been faithful in their replies. In the field study some observations have been made to find out the influence of a few social factors on the agriculture.

Chapterization

The first Chapter of the study introduce a number of observations from the area of study. It indicates the methods by which the study is conducted. It also classifies the limitation on which it stands. Part I of second Chapter gives an elaborate account of the role of education in the overall economic development. While analysing the role of education on the over-all economic development the emphasis is laid on the role of education in the development of agriculture. The problems that occur in the quantitative measurement of the impact of education on economic growth has also been analysed. Part II of this Chapter deals exclusively with agriculture.

It analyses the importance of agriculture in over all economic growth. It gives an account of the relationship between farmers' education and agriculture.

The third Chapter surveys the literature on the subject of the study. A brief note on the studies that tried to find out the impact of education on agriculture is given in this Chapter. Most of the important studies are taken into account. In the end of this Chapter some guidelines for the study are found out.

The first part of the fourth Chapter deals with the agricultural scene of India. After briefing the importance of agriculture in the Indian economy, it tries to find out the changes in the agricultural output during the post-independence period in India. The factors responsible for the change in the agricultural output are also analysed. The second part of this Chapter deals with the growth of agricultural education and its contribution to Indian education.

The fifth Chapter deals with the field study. The Field study tries to find out the impact of education on Indian farmer and his over all agricultural performance.

The sixth Chapter gives a note on the findings of the study. On the basis of the findings, this Chapter gives some suggestions to make the agriculture more productive through education.

CHAPTER - II

EDUCATION AND ECONOMIC DEVELOPMENT
(With Special Emphasis on Agricultural Development)

Section - I

The role of education in the over-all economic development

Agriculture forms the largest sector in the economy of the developing countries, of course, barring a few oil exporting countries. Particularly, in the Asian region the economic development of the countries is highly dependent on their agricultural sectors. The share of agriculture in the Gross Domestic Product of developing countries is very high in comparison to what it(agriculture) shares in the GDP of developed countries(Table 1).

Why do low income countries, even those with relatively good resource endowment, progress at a rate of only 2 to 4 percent, with little gain in per capita income? The answer usually given is -- limitations imposed by the human factor.[1] Education is of vital importance especially where the barriers are of a cultural rather than of a physical (health etc.) kind. The educational product in the context of economic development not only includes the components of education usually distinguished as consumption(i.e. enjoyment of the fuller life permitted by education) and as direct investment

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1. Richard A. Musgrave, "Notes on Educational Investment in Developing Nations", in Financing of Education for Economic Growth, ed. by Lucille Reifman, OECD, Paris, 1966, p. 31.

Table 1: Economic and Educational Development Indicators, by country.

Country	Percentage of Agriculture in GDP	Harbison & Myer's index	Percentage of professional workers in the labour force
United States	4.0	261.3	10.8
Canada	6.1	101.6	10.6
Puerto Rico	12.4	-	7.8
Venezuela	7.2	47.7	-
Colombia	30.5	22.6	3.9
Chile	12.6	51.2	4.9
Mexico	18.0	33.0	3.6
Brazil	27.0	20.9	3.1
Great Britain	3.3	121.6	9.6
Germany	5.0	85.8	7.6
Denmark	12.3	77.1	7.8
Norway	8.2	73.8	8.0
Sweden	6.0	79.2	15.3
Belgium	5.5	123.6	8.0
The Netherlands	8.3	133.7	9.2
Greece	25.6	48.5	3.4
Israel	13.5	84.9	11.4
India	51.3	35.2	1.7
Malaysia	28.3	23.6	3.0
Japan	14.3	111.4	5.5
The Phillippines	32.4	-	3.3
Nigeria	55.6	4.95	2.4
Ghana	33.7	23.15	2.2
Kenya	34.6	4.75	1.2
Uganda	59.4	5.45	1.3
N. Rhodesia	-	2.95	-
New Zealand	-	147.3	10.2

Source: George Psacharopoulos, Returns to Education: An International Comparison, Amsterdam, 1973, p. 189.

(with the gains accruing internally in the form of increased earnings to the educated person), but also education as the investment in the functioning of the economic and social system at large. These latter gains accrue externally, not only to those in whom the educational input is vested, but also to the other member of the community.[2]

Table 1 shows that the countries with low educational development (or low Harbison & Myers index) are suffering from a low economic development. The share of agriculture in the Gross Domestic Product of these countries is high. "The more developed the country, the lower will be the contribution of agriculture to GDP. Therefore, on theoretical ground one would expect a positive relationship between the percentage contribution of agriculture to GDP and the rate of return to investment in education".[3] This table also shows that the percentage of professional workers in the labour force is very less (below 5%) in the less developed countries of the world. The level of educational development is measured first by what is known as the "Harbison and Myers index", and alternatively by the percentage of professional, technical and related workers in a country's labour force. The Harbison and Myers "composite index of human resource development" is based on the educational enrolment rates by level of education in each country.

2. Ibid., pp. 31-32.

3. George Psacharopoulos, Returns to Education: An International Comparison, Amserdam, 1973, pp.187-188.

The highly complex and productive agriculture of Western Europe and North America in the early part of the 19th century would have been hardly distinguishable from what one can observe today in the developing areas of the world, such as South Asia. Except for the United Kingdom, the percentage of population dependent upon agriculture was in the range of 60 to 80 percent throughout Western Europe and North America; this is approximately the situation today in the developing regions. Thus modern agriculture is a recent phenomenon with a period of development of only a little more than a century.

D. Gale Johnson observes:

> if you move back into history a little less than a century the agriculture of the new industrial countries was not all that different from the agriculture of the Indian subcontinent today. The rapid change in agriculture in the industrial countries over the century has not been due primarily to conditions over which farmers had control, but rather to the rapid general development of such economies. Unfortunately the agriculture of the developing countries still depends primarily upon land and labour for their productivity , though the 1960s brought forth some significant changes through new seeds, fertilizer and irrigation.(4)

Table 2 provides a comparison of critical features of the agriculture of the United States, Japan and India as of 1960. There is an amazing difference in the quantities of important inputs(i.e. fertiliser, machinery, agricultural

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4. D. Gale Johnson, World Agriculture in Disarray, London, London, 1973, p.81.

land, education, research and extension) associated with a farm worker among the three countries. The differences in the factors that cooperate with labour and the amount of education of farm workers explain virtually all the differences in output per worker. The workers in United States and Japan work in more affluent conditions in comparison to the workers in India. The affluent condition of the workers depends to some extent on the level of education and the level of research and extension.

Agricultural development is a variable dependent on a number of independent factors influencing it in different ways and degrees. It is very difficult to trace back, identify and point out the contribution of an individual factor to the overall agricultural development. The means of production, the level of technology, the resource potential, capital expenditure, infrastructure facilities such as health services, housing, transport, communication, marketing and storage etc. quality of labour force, population pressures and so many other factors influences agricultural development. These factors are interdependent. They very often, influence each other. Thus it is impossible to contain or partial out the effect of any of these factors and study the influence of the others. Of course, there have been studies which have tried to find out the impact of new technology on production. But even in such studies the non-

Table - 2: Farm Output and Input per Male Worker and Levels of Education and Research and Extension Expenditures, US, Japan and India 1960'.

Countries Output and input	United States	Japan	India
Farm output(wheat units per worker)	96.2	10.7	2.22
Fertiliser(Metric tones per worker)	2.13	0.32	0.0038
Machinery(Horse power per worker)	45.9	1.07	0.0077
Agricultural land (Hectares per workers)	129.7	1.43	1.99
Education(School enrolment ratio)	100.	90	26
Research and Extension (cottage graduates per 10,000 workers)	22.8	14.2	0.40

Source: Yujiro Hayami, American Journal of Agricultural Economics, American Agricultural Economic Association, New York, August 1969.

focussed variables were not controlled. The role of education in the overall development(viz. development of agricultural, industry and other sectors etc.) can be traced to some extent from the following table which gives a comparison of the Gross Domestic Product, per capita Gross Domestic Product and literacy figures for some of the developed and developing countries of the world. The table shows that the developed countries are associated with the high level of literacy.

The examples of countries, if any, where development has taken place or is in process without corresponding high literacy rates are exceptional, and not the rule.[5] There are some researches who have concluded that education will have a negative effect on development.[6] Such types of

Table - 3 : GDP, GDP per capita and percentage of Literacy for Selected Developing and Developed Countries of the World

Name of the country	GDP in million $	GDP capita in $	% of literacy
United States	1060318	5121	100.0
United Kingdom	136392	2454	100.0
Japan	229809	2196	100.0
France	162697	3175	100.0
India	57320	104	31.0
Indonesia	13957	118	39.0
Pakistan	11186	204	19.0
Burma	2135	79	58.0
Srilanka	2233	176	75.0
Thailand	6988	198	68.0
Brazil	32169	349	76.7
Chile	6124	640	76.7
Nigeria	5310	99	26.3
Ghana	1887	221	26.3

1971 data at current prices

Source: Educationaand Rural Development by A.S. Seetharamu, New Delhi, 1980, p.8

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5. A.S. Seetharamu, Education and Rural Development, New Delhi, 1980, p.9.

6. B. Odeke, "Crop Production in Orurgo, Teso District, Uganda, "Special Project(unpublished manuscript) (Makerere: Faculty of Agriculture 1971) quoted by E. Ronald Wetts: Educational Needs of Farmers in Developing Countries' in Education and Rural Development, World Year Book of Education, Evans Bros Ltd., London, 1974, p.150

conclusions are of course few. Most of the researchers have found out either a zero impact or a positive impact of education on economic development.

To be sure, "not just any kind of education will promote economic growth". Education is a source of economic growth only if it is anti-traditional to the extent that it liberates and stimulates as well as informs the individual and teaches him how and why to make demands upon himself."[7]

Accordingly, a proper educational strategy would manifest itself in four "growth producing capacities". The first is the development of a "general milieu favourable to economic progress. The reference is to social mobility, a general increase in literacy necessary for improved communication, and "record keeping and deposit banking".[8]

The second capacity emphasises the development of "complimentary resources for factors which are relatively plentiful and substitutes for comparatively scarce factors".[9] Education provides managerial talents that can exploit resources more effectively. At the same time education may provide

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7. William L. Miller, "Education as a Source of Economic Growth", Journal of Economic Issues(December, 1967) (280-296), p.281.

8. Ibid.

9. Ibid.

techniques to overcome the scarcity of some resources by substituting a plentiful resource for the scrarce one. Without education, people would be far less adaptable to varying production needs.[10]

The third capacity underscores the durability of educational investment. Miller argues that education has greater durability than most forms of non-human reproducible capital, particularly in countries with a long life expectancy at birth. Further, Miller contends that depreciation and obsolescence of human capital occurs at a much slower rate than that of physical capital on the grounds that usually only specialized training of the lowest sort becomes completely obsolete. Therefore Miller asserts that a given investment in education tends to be more productive, other things being equal, than the same outlay on non-human capital.[11]

Finally, education is an alternative to consumption, private investment in non-human capital, private investment in non-human capital, or government outlay for other than educational ends. It may be argued that expenditures on education are made mostly at the expense of consumption (not savings).[12] Since investment in physical capital is

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10. Elchanan Cohn, The Economics of Education, Lexington, 1972.

11. Miller, op.cit., p. 283.

12. Edward F. Denison, The Sources of Economic Growth in the United States and the Alternatives Before Us (New York: Committee For Economic Development, 1962), pp. 77-78 Quoted in Cohn, op. cit. p.49.

conditioned upon the availability of savings, within limits, additional expenditures upon education can make a net contribution to growth even if the internal rate of return is lower in education than material capital, for it transfers to round about production the resources that would otherwise be consumed.[13]

Agricultural production depends on the combination of different factors of production viz. land, labour, capital and entrepreneurship. To be more specific, increases in agricultural production may be due to

1. The use of more labour;
2. the use of more physical capital;
3. the use of more land;
4. the use of better labour;
5. the use of better machines; and
6. the more efficient allocation and use of labour, land (materials) and machines.

The use of more labour is dependent on a number of factors viz. availability of land, level of technology, duration of the working period(the length of the work week), growth rate of population, age composition of the population, labour-force-participation rate, employment rate, etc. Education may have some influence, positive or negative, on these factors. Think for example, of the effects of compulsory

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13. Miller, op. cit.

schooling upon the relative numbers of children and women in the labour force-fewer working children but more working mothers -- or of the effects of improved education upon labour mobility and thereby upon the employment rate. In advanced countries education has a positive effect on the labour force participation rate, because the percentage of people in the labour force increases with the number of years of schooling completed. The level of techonology depends on the level of research and innovation. The availability of land is more or less constant. Education may influence it to certain extent. The 'Land utilisation scheme' may renovate certain fallow lands for agricultural use. But it can not increase it after certain point because of the limitation of the geographical area. This scheme can also influence the quality of the land.

The use of more physical capital to a large extent depends on the saving habits and investment propensities of the people. Education may have influence on both saving and investment, but the influence may be either positive or negative. The influence is quite subtle and slow-working.

Education can play a really significant role with regard to the improvement in the quality of labour. Positive effects may be expected on five scores:[14]

a. better working habits and discipline, increased labour efforts, and greater reliability;

b. better health through more wholesome and sanitary ways of living;

14. Fritz Machlup, Education and Economic Growth, Lincoln, 1970, pp. 7-8.

c. improved skills, better comprehension of working requirements, and increased efficiency;

d. prompter adaptability to monetary changes, especially in jobs which require quick evaluation of new information and, in general, fast reactions; and

e. increased capability to move into more productive occupations when opportunities arise.

All levels of education may contribute to improving the quality of labour.

To the use of better machines, education can contribute in at least two ways:[15]

a. by making people more interested in improved equipment, more alert to its availability, and more capable of using it; and

b. by training people in science and technology and expanding their capacity for the research and development work needed to invent, develop, adapt, and instal new machines.

More efficient allocation and use of labour, materials, and machines may be the result of developments that have nothing to do with education(for example, economies of scale) but also of some that can be significantly prompted by education. We may list the following avenues of approach.[16]

a. technical progress not embodied in machines, but engineered by trained people;

b. abolition of restrictive measures by government or private groups (though one must admit that the educated people have voted for the introduction of counter productive restrictions as often as for their abolition);

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15. Ibid., p. 8.

16. Ibid.

c. improved organization and management; and

d. greater adaptability and mobility of labour, without which more efficient allocation would not be possible.

Concern for education by economists started about twenty five years ago when empirical investigations in the United States revealed that output was growing much faster than inputs as conventionally measured. The part of the growth of output unaccounted for by conventional inputs came to be known as the 'residual' or the 'coefficient of our ignorance'. This led researches to try to open the black box of technical change and reduce the unexplained residual. The main initial development was the quantification of the increase in the quality of labour inputs and this led to the creation of a new field in economics known as the 'economics of human capital', or more narrowly, the 'economics of education'.[17] In fact it was a rediscovery, since people as far back as Adam Smith and as recent as Marshall had already written about the economic consequences of education.

Education influences social and economic development by inducing change in technology through the systematic application of scientific and other knowledge in skills and specialized knowledge for specialized tasks as a consequence of their division and differentiation, and in values and

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17. Psacharopoulos ,op. cit., p.1

attitudes to provide the necessary incentives for increasing productive efficiency. The net change in growth is the result of the productivity of the new technology and skills, assisted by changes in values and attitudes and reduced by dysfunctionality that is caused by obsolescence in both technology and skills.[18]

Public awareness of the economic value of education appears to be rather dim and unclear. There is, of course, a general notion that education also prepares a person, in some manner, for earning a livelihood, and in the absence of proper studies, professional, technical, and vocational branches of education have been identified as concrete instances of economic value of education. Such a narrow and vague view of relationship of education to economic growth can create an agonizing problem in the developing countries where education has to compete with other sectors of national development for its share from the national pool of limited resources.[19]

The economic value of education _ though always taken for granted by educators and other social scientists - has received very little attention from the developing countries as a field of research. Some studies have focussed attention on education's vital role in creating human capital, an essential factor for economic development. They have helped

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18. Muhammad Shamsul Huq, Education , Manpower and Development in South and Southeast Asia, New Delhi, 1976, pp. 52-53

19. Muhammad Samsul Huq, Education and Development Strategy in South and Southeast Asia, Honolulu, 1965, pp. 66-67.

in bringing educators and economists nearer to one another in more realistic development planning. As a result, some serious falacies in the prevailing concepts of development planning have been exposed by outstanding economists. Professor John Kenneth Galbraith sounded this note of caution:

> In the early stages of development, plan creation is not properly a matter of economic planning at all; rather it is to build basic administrative organs, to develop the educational and basic cultural structure, and to get a viable and progressive social system. In Western Europe and the United States these steps following the French and American revolutions laid the foundation for economic advance. In developing its Central Asian republics, as the visitor learns, the Soviets gave high priority to developing an effective system of provincial administration, to education, to providing a transportation system, and to getting the nomards into a settled system of agriculture. These steps were clearly regarded as pre-requisites for further agricultural and industrial development.(20)

In another lecture , Professor Galbraith dispels the general misconception about the economic value of education:

> More specifically, we think of economic development as the investment of present resources for increased future production-the investment of savings for growth. We regularly measure the development effort of a country by the volume of its investment-what it saves from its own consumption, and what it is borrowing from consumers , abroad, to invest in future increases in output. And here is the problem, for education is both a form of consumption and a kind of investment. Like bread, it is something we use or consume. But like a dam or canal, it is something in which we invest to produce more in the future(21).

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20 John Kenneth Galbraith, Economic Development in Perspective Cambridge, 1962, p. 37.

21. Ibid., pp. 47-48

> The fact is that education is of high importance both as an object of immediate consumption and as a form of investment for future production.... To look at education as a form of consumption, given the importance that the developing country attaches to investment, is to risk assigning it an unduly low priority. Some new countries have almost certainly done so. They have regarded their steel mills, dams, and fertilisers factories as the tangible manifestation of such development. Aswan, Volta, or Bhakra-Nangal are development. They get the discussion, the money, the visitors, the glow of pride. Well-trained teachers may provide a greater promise of increased production. But they are not such tangible monuments to progress.(22)

As Professor Galbraith emphatically concludes: But when we consider education as an investment, we must consider it as purposefully as any other form of capital outlay. This the older and more developed countries do not necessarily do or need to do. Their traditions are different; wealth has made it possible for them to be much more easy going. The new country can not be so permissive toward those in whom it invests. (23)

Economic growth, i.e. the raising of future output, would require either some addition to productive resources or some more effective method of utilising given resources. Of the three categories of available resources , land is fixed in quantity, while if the growth objective is defined more precisely as raising output(income) per head, then

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22. Ibid, pp. 51-52

23. Ibid., p.58.

an increase in the quantity of labour would not help. Here the change in the quantity of labour is desired. Besides the quality and quantity of the third factor, capital, can be increased. It is generally believed that the increased investment, by increasing the quantity of capital, can raise the growth rate. Various statistical estimates aimed at establising the impact of investment on growth rates have been undertaken in recent years. The general outcome of these has been to show that while investment undoubtedly played an important part, it was by no means as dominant an element as many economists had earlier thought. A typical illustration of these statistical results is given by the following data.[24]

Table-4: Estimated Contribution of Inputs to Growth in Output: Selected countries. Annual Averages(%)

Countries	a. Contribution of Labour and Capital ECE 1949/59	NIESR 1950/60	b. 'Residual' ECE	NIESR
Germany	2.9	3.75	4.5	4.05
France	1.1	1.45	3.4	2.95
Norway	1.6	2.05	1.8	1.15
USA		1.9		1.2
UK	1.3	1.15	1.1	1.2

Source: The British Economy in 1975 (Ed. W.Beckerman), National Institute for Economic and Social Research, London 1964. Given in 'Economic Dimensions in Education' (Martin O' Donoghue), p.105.

24. Martin O'Donoghue, Economic Dimensions in Education Dublin, 1971, pp. 104-105.

The interpretation of these data is that of the estimated annual growth in output of 7.8 per cent for Germany in the 1950s, increases in the amounts of capital and labour can be used to account for a 3.75 per cent increase, leaving the remaining 4 per cent unexplained. This residual is the increased 'productivity' per unit of input employed, and it may be noted that the absolute size of this residual is greater, the larger the growth rate concerned.[25]

While the size of the 'residual' element may have been a surprise, the existence of some long-run influences, other than quantity changes in labour and capital, had long been recognized. The most obvious of these was 'technological progress'(which through the introduction of new production techniques and new products would raise the output of any given factors). The determinants of such progress were in turn taken to be the products of invention and innovation.[26] The invention and innovation are due to the research and development activities.

It is quickly recognized that research and development (R&D) activities, as they are now described, had many links with education. While applied research with commerical orientations might be mainly the concern of business organisations, much of the basic or fundamental research

25. Ibid., p. 105.

26. Ibid., pp. 105-106.

on which it was based was the product of universities and related institutions. Apart from this direct role of providing a flow of research results, universities were also of relevance as the suppliers of the highly-skilled personnel needed for R & D activities.[27]

The role of research and development in generating economic growth is not very clear. There is no such direct link between a country's level of spending on research and development and its growth rate. Even countries which spend relatively large proportions of their national income in this way, such as the US and UK have had lower growth rates than others with smaller spending, such as Japan, Germany and France. There are many factors which can be advanced for this differential effects viz. the proportion of defence activities in the research and development, the extent to which 'know how' is bought from abroad etc. Thus, no comprehensive assessment of the link between R & D and growth is yet available.

Like the change in the quality of capital, there could have been a change in the quality of labour. This development of human resources could be the product of many things such as improved health, better nutrition and living conditions, more training on the job and also more education.

Another significant discussion of current interest on the relation between education and development is about the rate of return from different levels of education to development.

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27. Ibid., p.106.

A number of studies on the rates of private and social returns from educational levels have been reported. Though the earlier studies focussed on the private benefits in terms of higher individual income, economists, of late, recognise the social benefits from education. As Schultz puts it: "In accounting for the benefits from education, it is not sufficient to look only at the higher earnings associated with more education. There are many social benefits too."

One of them is associated with the decoding and interpreting of new technical and economic information pertaining to production and consumption.[28] The social benefits from education lie in providing an overall perspective of the details of development and the attitudes for consequent action. Such a perspective is highly necessary in developing countries.[29] Perhaps the most important aspect of the external benefits of education lies in the change in the social and cultural climate, incident to the widening of horizons, which education entails. As has been pointed out many times, such a change is an essential condition of success for many developing nations".[30]

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28. Theodore Schultz, "The Education of Farm People: An Economic Perspective" in Education and Rural Development, 1974, p.60.

29. Seetharamu, op.cit., p.10.

30. Richard A. Musgrave , op.cit., pp.31-37.

The social change that education brings about has been described variously as the 'diffusion', 'filtration' or 'neighbourhood' effect. Lord Robbins prefers to call it 'neighbourhood' effect. As he puts it: "A community in which there is a rapid communication of ideas due to common habits of understanding and high potential mobility, due to widespread training of general intelligence, is likely to be more productive absolutely and more capable of development than a community otherwise similarly situated , in which such standards do not prevail. There are the so-called neighbourhood effects of educational investment; and although they are obviously much more difficult to identify and to measure than the private effects thereof, it is to miss an important part of the picture to ignore their existence."31 Though the contributions of education to the process of development have been widely recognised, the degree of return from different levels of education is still a matter of debate. "Since educational outlays compete for resources that have an alternative use in directly productive investment, it is essential to determine what proportion of national income should be devoted to education. And within the educational system itself it is necessary to establish priorities for the various possible forms of education and training".[32]

31. Lord Robbins, "The Theory of Economic Developments" (in The History of Economic Thought) New York, 1968, pp.76-77.

32. M. Gerald Meier, "Role of Education in the Development Process" editorial note in Leading Issues in Economic Development, 1970, p.601.

Some scholars have tried to find out the social rates of return from different levels of education. G.Psacharopoulos and K. Hinchcliffe conclude that the first years of elementary schooling generally yield the highest returns and the additional years of education yield progressively lower rates of return.[33] Mark Blaug, in one of his recent studies about Thailand concludes that 'A government faced with the problem of allocating a given budget for education among the different levels of the system, so as to maximise the contribution of education to national income, should in their circumstances direct expenditure from the higher to the lower stages of education.[34] Schultz found a quite different picture while observing the modernization of agriculture in United States. "Clearly in the US, as modernization continue at this rapid pace where farm people have in general high levels of income, the economic value of education is such that the optimum level is not attained by elementary schooling....Farm people with 12 years of schooling are winning out in competition with those who have 8 and less years of schooling. Furthermore, those with 16 years of education have been gaining relative to other levels of over-time.[35] But Schultz's observation about a developed country like the US may or may not hold good in the case of developing countries.

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33. Seetharamu, op.cit., p.11.

34. Ibid.

35. T.W. Schultz, op.cit., p.57.

Frederic Harbison and Charles Myers correlated the GNP of 75 nations with enrolment at different levels of schooling and came out with mixed results. As per their study, among 75 nations, GNP per capita is correlated 0.67 with primary school enrolment, 0.82 with secondary school, and 0.74 with third level enrolment. But enrolment in school can not be assumed to reflect the literacy or educational levels of the people in a country, as drop out and also retention rates have to be taken into account; they are usually high in developing countries.[36]

However, though the evidence on the value of education in the development process is positive, the problem of estimating the quantitative magnitudes of education's contribution to economic growth remains to be solved. Since many 'intangibles' are involved in such analysis , any such attempt will certainly be quite rudimentary.

A number of scholars have tried to measure the economic value of education as an investment in human capital. Notable among them in the United States are Theodore Schultz, Gary S. Becker, Jacob Mincer, Edward F. Denison, Simon Kuznets, W. Arthur Lewis, C. Arnold Anderson, Fritz Machlup, Nicholas

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36. Seetharamu, op.cit., p.12.

Dewitt, Frederick Harbison and Charles Myers. In United Kingdom, John Vaizey has made a significant contribution to the study of economics of education. In Soviet Russia the most pioneering work in this field was undertaken by Stanislav G. Strumilin.

All the above scholars found out that the rate of increase in output was more than the rate of increase in input, leaving quite a substantial portion of the increased output as 'unexplained', or 'residue'. A large part of this is a return on investment in skill and related abilities. All these studies also bring into sharp focus the limitation of the traditional concept of capital which left out human capital. "A concept restricted to structures, producer equipment, and inventories is all too narrow for studying either the growth that is being measured(national income) or what is more important, all gains in well being from economic progress which would also include the satisfactions that people derive from more leisure, from the growing stock of consumer durables, and from satisfactions that come to people from better health and more education -- all of which, as a rule, are omitted in estimates of national income."[37]

This important fact is also recognized by Kuznets when he stresses that for "the study of economic growth over long

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37. Theodore Schultz, "Reflections on Investment in Man," Journal of Political Economy, LXX, Suppl.(October, 1963), Chicago, p.5.

periods and among widely different societies... the concept of capital and capital formation should be broaden to include investment in health, education and training of the population itself, that is, investment in human beings. From this point of view, the concept of capital formation followed here is too narrow."[38]

There are several limitations of the studies by the above scholars. The most important limitation in applying the methods of economic analysis to education is the difficulty of isolating the consumption components of education from what strictly may be considered as investment components. Another assumption that may be questioned is that schooling for some economists means only formal schooling. Schultz's estimate excluded education in the home, church, and community and also on-the-job training. Some economists object to the inclusion of 'earnings forgone' in the cost of education in estimating the stock of capital.[39] If earnings foregone were excluded from cost, the result is a reduction in the estimated stock of educational capital, but a corresponding increase in the rate of return to the investment in education.[40]

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38. Simon Kuznet and Elizabeth Jenks, Capital in the American Economy: Its formation and Financing, Princeton, 1961, p.340.

39. See for example, John Vaizey, Economics of Education, London 1962, p.51.

40. Huq Education and Development Strategy in South and Southeast Asia , op. cit., p.81.

Schultz's estimate left out the contribution of research to growth. Denison adopted an indirect method of allocating to "advance knowledge" the residual that he had left after accounting for all the elements identified and measured by him. The weakness of the residual method adopted by Denison is that it can not be regarded as a positive measure.

It is difficult to measure the economic value of education as an instrument of creating various kinds of skills for productive use. It seems fair to say that the assumptions and limitations underlaying the studies of the formation of capital through education are inevitable because the capital in question is human in character, not capable of analysis precisely as is physical capital.[41]

Whatever viewpoint is adopted, the contribution which education makes to economic growth is not something which can be clearly identified and measured. For present purposes the question is not so much one of precise calculation, but rather whether or not education is a significant factor in economic growth. On this issue a wider degree of agreement seems possible. The 'Denison measurements' suggest that the relative importance of education in this context has varied widely between countries. The role of education is one which varies both with time and place. The almost universal conclusion, however, is

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41. Ibid.

that it is one which should not be ignored.[42]

It should be stressed that in addition to the vital role it plays in capital formation, education has certain unique features which distinguish it from other kinds of producer goods. These lie in the potential of education to discover new talents, new goods, new technologies, and new instruments of social policy. Those who perform these functions constitute a new class of rapidly growing importance in the advanced countries, as distinct from the other three classes of producers, namely, primary, secondary and tertiary. Furthermore, though all of these functions of education have not been brought within the scope of economic analysis -- which, for good reason, has been confined to the study of education as a process of creating human capital -- there value to the economic and social progress of a nation is too great to be overlooked.[43]

Section - II

Influence of Education on Agriculture

The role of agriculture in promoting economic growth has been sufficiently underlined in recent economic

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42. O'Donoghue, op.cit., pp. 116-117.

43. Huq, Education and Development Strategy in South and Southeast Asia, op.cit., p.82.

literature.[44] The potential contributions of agriculture are (a) to provide food and fibre for an expanding population, (b) to provide capital, including foreign exchange, for the economic transformation, and (3) to provide a direct increase in the rural welfare. Additional contributions to development from the agricultural sector are the labour force for the expanding industrial sector and a market for the output of consumer goods and production supplies from the industrial sector. All these objectives and contributions are closely associated with increased income in the agricultural sector.[45]

Other things being equal, the level of farm incomes is determined largely by the efficiency with which farmers are able to utilize the resources at their command by allocating them among alternative production activities. If farmers are inefficient in the use of their scarce resources, there certainly exists an unexploited potential for increasing farm incomes and generating surpluses which can serve as an inexpensive source of economic growth. Thus resource-use and allocative efficiency on farms in low-income countries becomes an important issue in determining the existing opportunities in agriculture for economic growth and welfare of the farm families.

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44. See for instance W.A, Lewis, "Economic Development with Unlimited supplies of labour, R.Nurkse, "Problems of Capital Formation in Under Developed Countries", Simon Kuzents, 'Economic Growth and the Contribution of Agriculture'.

45. John W. Mellor, The Economics of Agricultural Development, New York, 1967, p.141.

The impact of education on agricultural production as well as on the agricultural sector as a whole is multifarious. The education of the farmers can help in increasing the agricultural output and productivity, either by a better choice of inputs or by a more effective use of labour. The growth in agricultural production is generated not only by real capital in the form of tools and machinery, but also by men. Some farmers are able to produce more from a given set of inputs or perform the same agricultural operations, using their labour, yielding higher output, they will be employing their own abilities to a fuller extent and they will be using their own, their family's and hired labour more effectively. In this sense they might be reducing 'Slack' in the use of human resources. The amount of labour employed increases or decreases depends on the level of technology and the rate of substitution between capital and labour. Further, the rate of substitution depends on the relative prices of input factors. There are some progressive farmers who decide to innovate and experiment while others wait till the economic profitability of these innovations is established and technological change becomes less risky. Progressiveness is probably due to a superior information field and a better access to the resources required to innovate.

Farmers can acquire economically useful information in many ways. In the situation of traditional agriculture, as defined by Schultz(1964), where there are no additional economic overheads, no additional research results becoming available and no institutional changes being introduced by development planners, farmers find themselves in a state of long-run equilibrium. The two sources of disturbances are (a) natural factors, and (b) market factors. The farmers by historical experience learn to provide self-insurance by choosing a cropping pattern which will not necessarily give them maximum yield in any particular year but will assure stable yield every year. An example of this is the mixture of wheat and gram sown by farmers in North India. Diversification of the cropping pattern, even on very small farms is also a kind of self-insurance which farmers learn to provide by long experience of dealing with nature. The second source of uncertainty, the market factors, creates different responses among farmers. The small farmers probably tend to become subsistence farmers producing mainly for consumption and using mostly home produced inputs, while the large farmers tend to produce for the market and try to stabilise their incomes by maintaining a diverse cropping pattern. These farmers also find learning to decode market information economically useful. Thus economic dualism as described by Sen (1966) emerges. We get a set of subsistence farmers, economically rational but having a different objective function(maximisation of utility and set of market oriented farmers maximising profits.[46]

Once agents of change appear on the scene in the form of state authorities wanting to change agricultural institutions, regulate markets and disseminate agricultural research information, the knowledge acquired by historical experience ceases to be adequate and it becomes necessary for individual cultivators to decode the new information and distinguish the economically useful from the economically useless. This ability to decode new information may come to the farmers in various ways.[47]

(a) The farmers might learn to critically examine it as 'learning by doing'. This, as explained by Arrow(1962) would provide greater ability to those who already have the experience and who have already been decoding this kind of information and would be less useful to those who are being initiated into the use of new techniques embodied in capital.[48]

(b) The state can devise an elaborate extension system, such as demonstration plots to inform farmers of the new information on inputs, techniques etc. This can be done by personal

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46. D.P. Chaudhri, Education, Innovation and Agricultural Development. A Study of North India (1961-72), New Delhi, 1979, pp.2-3

47. Ibid., p.3.

48. Ibid.

contacts of the extension agents or through the use of mass media like radio, television.[49]

(c) In close-knit village communities there is a lot of personal, family and social interaction among farmers with different types of information field. This interaction can also contribute to an expansion of the information field of the farmers.[50]

(d) Besides, reading about the economically useful information in journals, books and extension agencies propaganda leaflets can help in broadening the information field of the farmer.

It is hypothesised that farmers with formal education of a general type are the early adopters of yield raising inputs. This is probably due to the fact that their information field is broader, their capacity to evaluate the information is more accurate, and their ability to read and write is more. This ability to evaluate economically useful information more quickly and more accurately reflects itself in the use of yield raising inputs and in the value of agricultural produce per unit of land or labour. A change in yield per hectare over time would reflect the growth of productivity reasonably well. This change would come about only through changes in the quality of inputs used and substitution of inferior quality inputs by superior quality inputs. Economists study this phenomenon as 'technical

49. Ibid.

50. Ibid.

change'. Sociologists have tried to find out the way by which different technologies have been adopted by different socio-cultural groups.[51]

Clive Bell (1972) points out that there appear to be three fundamental questions beyond the reach of the economists.[52]

First , what are the various decision rules followed, and which type of farmers are guided by them?

Second, what causes one farmer to innovate when another of identical status, kin, power, etc., does not?

Third, granted that a farmer in a community attempts to innovate, what kind of social pressures are brought to bear to prevent his doing so? And if he succeeds, what social and political obstacles are placed in way of others, possibly less privileged and less powerful, attempting to follow his example?

Thus, besides economic factors, there are certain social factors that determine the level of agricultural productivity and the prosperity of the agricultural sector as a whole. Any study to find out the impact of education on agriculture particularly in the Indian context will have to take into account both social and economic factors.

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51. For example, see Rogers and Shoemaker <u>Diffusion of Innovation</u>, New York(1971)

52. For example, see Clive Bell, "Acquisition of Agricultural Technology: Its Determinants and Effects", <u>Journal of Development Studies</u>(Oct. 1972).

CHAPTER - III

SURVEY OF THE LITERATURE

The first study to find out the impact of education on agricultural productivity goes back to the early 1960s. Since then a number of economies all over the world have been studied by different scholars to find out the contribution of education to agricultural productivity. However, studies of the economics of education in the agricultural sector have been based largely on aggregate data from developed countries. Studies in developing countries have focussed on the non-agricultural sector, while the agricultural sector has been almost entirely neglected with a few exceptions(such as Mexico, India, Colombia, Philippiness, Brazil, Taiwan).

The first related work on the subject is done by Max. F. Millikan. This work tried to find out the role of education in innovation and in the development process of the developing countries. After that a number of works have been done by scholars like Grilliches(1964), Khaldi(1964), Nelson and Phelps(1966), Chaudhri(1968), Adamski(1969), Adelman(1969), Elstrand(1969), Welch(1970), Adito-Barleta(1971), Castilo(1971), Harker(1971), Haller(1972), Huffman(1972), Evenson(1973), Fane(1974), Schultz(1975), Wu(1977) etc. The latest work on the subject is by Som P. Pudasaini based on the agriculture of Nepal. Particularly, in the Indian context quite a few works have been done by D.P. Chaudhri, (1968, 1971, 1974), Robert Evenson(1973) , Bruce Roger Harker(1973) and Rati Ram (1976).

We can briefly summarise some of the important works of the above scholars in order to find out a guideline for our present study.

MAX F. MILLIKAN in his article 'Education for Innovation in Restless Nations: A study of World Tensions and Development' (1962) explores in some detail the role of education in innovation and the need to develop more economical educational methods which are specially geared to encourage innovations. This is the first detailed attempt in explaining what education is required to do in the development process of the less developed countries.

The work of ZVI GRILLICHES(1964) on US agriculture is the first attempt at estimating an agricultural production function which specified education as an explicit explanatory variable. An unrestricted Cobb-Douglas production function was used. Apart from the conventional input variables, a combined variable of education research and extension is used. The estimates are presented both with education, research and extension variables and without these variables. It is shown that the explanatory power of the function improves when the education, research and extension variables are included in the function.

NABIL KHALDI , in his PhD thesis 'The Productive value of Education in US Agriculture'(1964), attempts to examine the productive value of education of the farmers in the context of two effects: one, the 'worker effect' and two, the 'allocative effect'. The 'worker effect' is the increased output for unit change in education keeping other factors constant. The 'allocative effect' is the enhancement of farmers' ability to acquire and decode information about production, as well as costs of factor inputs. An agricultural production function with education and research variables in addition to other inputs(land, labour, capital etc.) indicates that the elasticity of education is positive, in the estimated production function providing the evidence that the worker effect and the allocative effect are positive.

R.R.NELSON and E.PHELPS(1966) suggest that in a technologically progressive or dynamic economy production management is a function requiring adaptation to change and the more educated a manager is the quicker will be to introduce new techniques of production. According to them education will have a higher pay-off in a technologically dynamic economy where there is scope for the exercise of discretionary abilities, adaptability and decision making faculties. The PhD thesis of ROBERT EVENSON(1968) found out that research and extension had yielded high rates of return in US agriculture.

I.ADAMSKI, Z.MALANICZ, R.MANTEUFEL and J.ZUCK (1969) studied the Polish agriculture from different angles. Adamski found that the adoption of improved methods is quicker among farmers who are subscribing to a paper or a journal or those who read books on agricultural production in comparison to those who do not do so. His study considers education as a means of dissemination of information. Malanicz in his first paper, statistically explored that(i) a rise in the level of education of the farmer increases the efficiency of work (ii) the increase in production per hectare of agricultural land took place with a decrease of the labour force on all farms but the rate of decrease of the labour force was higher among more educated farmers. Another paper of Malanicz concludes that the educational level of the farmers is significantly related to the level of investment per hectare. The fixed and circulating capital for fertilisers, seeds and purchased fodder increased more quickly among the farmers with education. R. Manteuffel and J.Zuck studied 125 State farms from Polish agriculture and found that the educational level of the farm managers is a significant factor in determining output per acre, productivity per worker and index of profitability.

The study of H. SCHIMERLING(1969) relates to agricultural co-operatives in czechoslovakia. It is found that agricultural co-operatives which do not have graduates on their management have poor economic performance as compared to those who have persons with college education in managerial positions. The personal incomes of workers, and the production and output per worker are higher in co-operatives with educated managers.

The study of Dutch farmers by A.W. VAN DEN BAN (1969) reveals that education influences the adoption rate probably via information which the farmers get from the mass media. Before adopting a new practice farmers invariably have a personal discussion with somebody they consider competent. The local extension officers usually consider educated farmers well informed and thus willingly offer their time for discussion. Usually such farmers have more resources and higher status in their communities than those who adopt these practices later.

IRMA ADELMAN and FREDERICK L.COLLADAY(1969) studied the relationship of education to political, social and economic development on the basis of the data collected from US and Morocco. Using linear programming they came to the conclusion that the role of education is crucial in promoting the growth of the agricultural sector and the national economy.

C.BARBARIS(1969) studied Nurra region land reform project in Italy. Various characteristics of the farmers like their age, education, size of holding, type of farming activity and regional characteristics were examined. He came to the conclusion that the education of a farmer is significantly related to his performance in his economic enterprise.

E.ELSTRAND in his study, 'Norwegian Experience from Extension work in Farm Management'(1969) reports the relative earnings among family workers according to farm size and level of education. He came to the conclusion that farmers educated at the agricultural schools consistently have higher earnings than those without education. The differential is lowest where farm size is less than 10 hectares and is highest where farm size is over 30 hectares.

F.WELCH in his paper 'Education in Production'(1970) examines the reason for the expansion in the supply of skill labour in the agricultural sector of the United States. The study concludes that the rates of return to investment in schooling has remained high which probably explains the reasons why the pressure of rapidly rising average educational level has continued. The innovative effect and allocative effect of education is found to be significant and present in US agriculture.

N.ARDITO-BARLETA's study on an agricultural project in Mexico (1971) reveals that the project has had a very high pay off due to (a) greater attention to the extension of research and (b) the increased level of training and education to the farmers. It indicates a complementary relation between research and extension, and research and education.

GELIA CASTILO's paper, 'Education for Agriculture' (1971) is devoted to the Phillipine agriculture. The author surveys agricultural education in the Philippines in terms of the number of institutions, students, educational expenditure within the agricultural sectors and the utilisation of skilled people trained in these institutions. The study concludes by suggesting some new approaches to education for agriculture such as relating to applied research and agricultural demonstration plots to educational institutions and emphasizing the need for special training for agricultural extension agents.

BRUCE ROGERS HARKER's study(1971) relates to the Japanese farmers. He examines inter-household and inter-community data with a view to specify and test an analytical model of the relationship between education, communication behaviour, agricultural innovations and agricultural production. He concludes that the number of times a farmer consults an agricultural extension agent in a year is related positively to his educational attainments and that of his father.

THOMAS ELMER HALLER's Ph.D. thesis 'Education and Rural Development in Columbia'(1972) attempts to evaluate the effectiveness of the primary school system as it exists in rural columbia and to analyse the way in which the schooling contributes to farm-family's income. The rate of return, is significant and high in one of the four regions, the region with the highest rate of change in the agricultural sector. For the remaining three regions, the innovative and allocative effects of education appear to be insignificant. The study concludes that in a situation of long-term equilibrium in traditional agriculture, education's role is not very significant while in a dynamic agriculture education's contribution is positive and significant.

The Ph.D thesis of WALLACE E. HUFFMAN 'The Contribution of Education and Extension to Differential Rates of change' (1972) concludes that farmers with more education are clearly aware of a wider range of information sources than those with less education, and the more educated farmers are assumed to be more efficient at processing information and reaching decisions. When the extension service is a major source of technical information to educated groups, farmers with more education benefit more than the less educated ones from the extension service. Yet in another paper "Decision Making: The role of Education"(1974) Huffman found that in a dynamic environment with imperfect information, education contributes to production as an allocative effect arising from increased ability to acquire and process information efficiently. He found that the rate of adjustment of mid_western US(Illinois, Indiana, Iowa, Minnesota and Ohio) farmers to the changing optimum quantity of nitrogen fertiliser in corn production is positively related to education of farmers, availability of information (agricultural extension), and scale incentive to be informed (acres of corn). Education and extension are substitute sources of allocative efficiency.

GEORGE F. PATRICK and EARL W.KEHRBERG(1973) tried to find out the cost and returns of education in five agricultural areas of eastern Brazil. They found that schooling returns are negative or low, but increased with modernization level. In areas of more traditional agriculture, the number of alternative techniques available may be limited, giving farmers little opportunity to use the increased decision-making and managerial capacity developed by schooling. They also found that extension returns are generally high for individuals, but cover social cost in only two geographic areas. Farmers assisted by extension may become early adopters of a new technique and become the recipients of the benefits of early adoption. Seeing the result, other farmers will adopt this new technology and society will benefit through having either greater output at the same cost or the same output at lower cost. The result suggests that returns to extension activities are higher in less modernized areas, while schooling has higher returns in areas of more modernized agriculture. The short-term investments in extension may well serve to facilitate agricultural modernization, but the long-term investment in schooling may have high returns for the next generation of farmers of agriculture is modernized.

The PhD thesis of GEORGE FANE (1974) attempts to measure the productive value of education in US agriculture. The results show that education significantly helps farmers to reduce excess costs. The estimated marginal value of an extra year of education in reducing excess costs in one limited context is about US $ 100 in each subsequent year worked.

NABIL KHALDI in his paper 'Education and Allocative Efficiency in US Agriculture' (1975) provides strong support for the basic hypothesis that education enhances allocative efficiency and weak support for the hypothesis that the pace of technological change and marginal efficiency are inversely related. The allocative phenomenon relies heavily on the relationship between the technical change and the value of information. Therefore, a large share of the returns to education are tied up with these processes. The economic growth is increasingly dependent on technical change. With the change in technology, the quest for optimal combination of resources will have to be met by the factors complementary to learning.

T.W. SCHULTZ, one of the leading experts on the role of education in agricultural modernization, in his paper 'The value of the Ability to deal with Disequilibria'(1975) tries to explore how education and experience influence the efficiency of human beings to perceive, to interpret correctly, and to undertake action that will appropriately reallocate their resources. In this paper he summarises various studies completed in US and other developed countries as well as in the developing countries. The relationship of education in production, consumption and fertility decisions within the household are discussed. He came to the conclusion that education provides ability to deal successfully with economic disequilibria.

CLAUD L. SCROGGS(1975) tried to find out the relevance of university research and extension activities in agricultural economics to agribusiness firms. He came to the conclusion that the university research and extension activities improve the knowledge of agricultural producers thereby help the agribusiness firms directly and indirectly. Though the extension economists are providing the most relevant services to agribusiness firms, the campus research of agricultural economists, especially that reported in the journal, does not offer a major input to decision making by agribusiness firms. CRAIG C. WU studied the agriculture of Taiwan(1977) to find out the role of education in production. The study suggests that in a densely populated agriculture where production is typically carried out by small farms, education of farmers of a moderate level(about six years of schooling on the average) is able to contribute to production when rapid development is in progress. The study found a strong indication of the over all scale effect. In comparison to American agriculture the worker effect is very high and the allocative effect is small in Taiwanese agriculture. This suggests that the way by which the education contributes to production is quite different for a small scale, labour-intensive farming. Unlike in US agriculture, the contribution of worker effect surpasses that of allocative and scale effects suggesting that the relative importance of these may vary with farm size and with the average level of education.

TODD E. PETZEL in this paper 'The role of Education in the Dynamics of Supply' (1978) offers a synthesis of Nerlovian Supply dynamics and the recent work on the role of education in entrepreneurial decision making. The model is tested by looking at the dynamics of Soyabean Supply for US counties. It was found that several economic variables, including education of the decision maker, made an impressive impact on the rate of adjustment, providing more empirical support for education's role in allocative efficiency.

SOM P. PUDASAINI in his paper 'The contribution of Education to Allocative and Technical Efficiency in Sugarcane Production in Nepal' (1978) shows that education has a significant allocative effect, even on a single output farm. Farmers facing imperfect information and technologically changing agriculture may make allocative errors in the sense of not being able to equate the marginal value product of variable inputs to their respective opportunity costs even if they produce a single crop. The presence of disequilibrium arising from changing technology may create incentive for farmers to learn about inputs and adjust their actual resource employment toward an optimum level. Education may enhance farmers' ability to acquire and analyse technical and market information about inputs and enable them to adjust quickly to disequilibria in input use. Consequently education may have a much stronger impact on output through its allocative effect than through its worker effect. He found that profit function is more suitable than the production function to find out the allocative efficiency of education. The conclusions of his paper are that (i) farmers' education contributes to output most significantly through its worker effect even in a single output(sugarcane) farm characterised by changing technology, and (ii) the profit function approach catpures the allocative effect of education more clearly than the production function model.

Studies on Indian Agriculture

Besides the above studies on different economies of the world, some studies have been done on Indian economy. The paper by V.M. DANDEKAR 'Planning in Indian Agriculture' (1967) based on his presidential address delivered on the occasion of the 26th annual conference of the Indian Society of Agricultural Economics, analyses the reasons for failure of planning in the field of agriculture and gives some remedial suggestions. The suggestions are in the following lines:

(a) to educate and improve the farmer as a farmer;

(b) to recognise the production apparatus in agriculture so as to enable the farmer to take better care of his land and inputs like water resources; and

(c) to create appropriate institution in order to improve decision making in agriculture.

According to the author education is considered to be a major bottleneck in the agricultural growth. Education of the farmer helps him in modifying his traditional attitudes to nature in favour of the modern techniques. Education prepares the farmers psychologically and scientifically, for a transition from traditional agriculture to modern agriculture.

The most important work on Indian agriculture in this field goes to the credit of D.P. CHAUDHRI. His Ph.D. thesis 'Education and Agricultural Productivity in India (1968) Provided the first clear-cut distinction between the allocative effect and the worker effect of education among farm workers in the agricultural sector. He used a production function at various levels of aggregation to internalise the externality of education. After examining the cross section of data viz. interhousehold, intervillage, interdistrict and interstate, the study concludes that the level of agricultural productivity is significantly related to the level of education in Indian agriculture.

ROBERT W. HERDT(1971) compared the work of D.P. Chaudhri on Indian agriculture with the work of Grilliches on US agriculture. He came to the conclusion that the effect of education on agricultural production in India is small but positive while in the United States the effect of education is larger than that in India. This is because the study of D.P. Chaudhri (1968) is based on the pre-green Revolution period did not have many innovation possibilities available to the farming families.

Another paper by D.P. Chaudhri 'Education in Production in Modernising agriculture in Asian Underdeveloped Countries' deals with the role of education in pursuing different strategies of agricultural development in the Asian region. The author argues that the strategy of agricultural development in different countries of Asia, without a proper rural education policy, will lead to increased rural inequality. He compared his earlier work on Indian agriculture with those obtained from other countries of Asia. The paper concludes that education is one of the crucial inputs in creating a dynamic agricultural sector. Chaudhri also published a paper in International Year Book of Education(1974) in which he examines various components of educational impact in the agricultural sector and goes into the details of the effects of the farmers education on his ability for innovation and allocation.

Robert Evenson's study 'Technology generation and agriculture' (1973) relates to the significance of research and extension in Indian agriculture. The study is based on State level data and estimates a production function relating total factor productivity to research, extension, weather, time and region, and concludes that the rate of return on research in Indian agriculture is high.

Bruce Rogers Harker's study(1973) examines the role of extension and education in Indian agriculture and compares it with that of Japan. It concludes that (i) education contributes to the agricultural modernization by developing the literacy and general communication skills,(ii) mass media and agricultural extension services also equally contribute to the modernization. The author feels that the schooling of the farmers and extension services are mutually supporting but are also capable of independently providing a stimulus to agricultural change.

The Ph.D. thesis of RATI RAM 'Education as a Quasi Factor of Production: The case of India's Agriculture' (1976) suggests that schooling lowers the marginal costs of information and raises its marginal benefits and thus provides an incentive to the more educated producers to acquire a greater amount of information. Such reduction in costs, rise in benefits and the consequent increase in information are the major sources of efficiency of more educated persons. Schooling has mainly an indirect impact on productivity and therefore, it may be regarded as a quasi factor of production.

The Guidelines from the above Studies

The most important point of agreement in the above studies is that the education, by influencing the human capital , exercises a positive role in determining the agricultural productivity of an economy.

One way of conceptualising the role of educational activities (schooling or extension) in agricultural production is to consider education's impact on production of a firm. Welch has attributed the value of education to a "worker effect" and an "allocative effect" which are directly related to the labour and managerial input components of the human factor. The worker effect arises because increased education may improve the quality of the labour component and can be defined as the ability to produce more, given the same resources. Increased education may also improve the decision making functions of the managerial component by increasing the farmers ability to acquire, interpret and evaluate information, giving rise to the allocative effect.[1]

1. In part this includes the "innovative" effect discussed by Nelson and Phelps(1966).

The allocative effect has two aspects. The first refers to the allocation of resources, in the case of a multi-product firm, among competing products. In a market-oriented agricultural environment with changing product and/or factor prices there is typically continued need for adjustment in resource allocation, although production techniques and types of inputs may be constant. More nearly optimum allocations of resources among products by farmers with more education would be reflected by greater output, other factors being constant. (Increased education may also improve a farmer's ability to predict seasonal price variations). Determination of the types and quantities of resources to be used in production is the second part of the allocative effect. Farmers with more education may adjust production plans according to changes in input prices and may be able to identify and utilize properly "new" inputs. In the short run the types and quantities of purchased inputs can be changed, while the types and quantities of firm-supplied resources can be charged in the long-run.[2]

With the transformation or modernization of agriculture, alternative production techniques and new inputs are devebped. Farmers must continually evaluate alternative production techniques, resource and product combinations. If education aids farmers in allocative decisions, returns to education hypothetically will be higher in areas with more modernized

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2. George F. Patrick and Earl W. Kehrberg, 'Costs and Returns of Education in Five Agricultural Areas of Eastern Brazil in <u>American Journal of Agricultural</u> Economics, 1973, p.145.

agriculture.[3]

In U.S. agriculture, the allocative effect is more important than worker effect(Huffman). The findings of Craig C. Wu in the context of the Taiwanese agriculture are just to the contrary. The contribution of worker effect (in Taiwarnese agriculture) in crop production is three times as large as the (over all) allocative effect. The possible explanation is that, with a higher average education for U.S. farmers, they may all possess the basic skills in using modern agricultural inputs, and hence they do not differ to a large extent in technical efficiency. As a result, the worker effect in U.S. agriculture is relatively small. This further suggests that the relative importance of worker effect may decrease with the average level of education.

When education has a worker effect it normally raises the marginal productivity and hence the profitability of national inputs. A minimum level of education is necessary for farmers to learn effective use of modern agricultural inputs (Craig C. Wu, Wharton 1965). If modern inputs are introduced in a less-developed agriculture without an accompanying increase in education of farmers, it may result in a large degree of ineffective use.

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3. Ibid., p.146.

To summarise, we can think of the impact of education, if any, as comprising the following conceptual components:[4]

(i) The innovative effect-this would consist of (a), (b) and (c) as given below:

(a) the ability to decode new information-know what, why, where, when and how;

(b) the ability to evaluate costs and benefits of alternative sources of economically useful information;

(c) the ability to quickly establish access to newly available , economically useful information.

(ii) The allocative effect would consist of the ability to choose optimum combination of crops, new inputs and agricultural practices quickly. This can be seen to consist of two parts, (i) Business activity, and (ii) Production Activity.

(iii) The worker effect - the quality of labour e.g. ploughing skill , harvesting skill.

(iv) An externality - neighbouring and other producers in the vicinity who are in direct contact with educated farmers will be able to consult the educated farmers without paying and would be able to copy(without paying) his sources of information, crop and input combinations and related production and business technique of provers success.

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4. D.P. Chaudhri, Education, Innovations and Agricultural Development: A Study of North India (1961-72), New Delhi, 1979, p.18.

CHAPTER - IV

THE SCENE OF INDIAN AGRICULTURE AND AGRICULTURAL EDUCATION IN THE POST -INDEPENDENCE ERA : IMPACT OF EDUCATION ON AGRICULTURE

I. Importance of Agriculture in the Indian Economy

In India, agriculture is the largest sector of economic activity. It contributes nearly 40 per cent of the net national produce, provides livelihood to about 60 per cent of total working force and accounts for nearly 35 per cent of total value of country's exports. It supplies the bulk of the wage goods required by the non-agricultural sector and raw materials for a large section of industry. Transport, marketing, processing and other aspects of agricultural production and utilisation also have a strong bearing on the tertiary sector of the economy.[1] It being the dominant sector, the improvement or change in the national output depends on the output in agriculture. It has to provide the capital required for its own development and make available surpluses for national economic development. The economic history of the now developed economies amply demonstrates that improvement in agriculture preceded and paved the way for rapid strides in industry, transport and other non-agricultural activities.

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1. See India 1985, New Delhi, 1986, p.279.

Agricultural Development in the Post-Independence Period

While agriculture held an important place in the national economy, its efficiency remained at a low level. Before independence it was stagnant over a long period and was imoverished. It became subsistence farming and a way of life but not an enterprise. During the post independence period, although the agricultural sector received much more attention, over vast areas in the country crop production has continued to remain traditional in character. Conditions of static technology and cultural practices established over generations pervade the scene. The technology used is labour intensive and production is largely conditioned by the amount of labour the cultivator is in a position, and is prepared, to put in. Crop production is restricted to a few months in a year and is dependent on the vagaries of weather. A good proportion of inputs is farm produced and the quantity of purchased inputs is small. The seeds used are locally produced; the use of chemical fertilisers is minimum while green and farmyard manures are used to the extent available. Cultivators lack knowledge about soil and water conservation and the land management practices are inefficient. Lack of knowledge and lack of capital have resulted in the inefficient use of production resources and in low yield. Poor cultural practices resulting in low yields have limited income and the capacity to invest, throwing the economy of the cultivator into a self perpetuating cycle of low investment and low returns.

A modern sector has also been developing in recent years although on a very limited scale. In the areas placed favourably with respect to controlled irrigation, a new technology based on proper combinations of seed, water, fertilizers and pesticides have made farming more dynamic. Crop production on these modern lines has been possible as a result of the discovery of new varieties and hybrids which are more responsive to purchased inputs like fertilisers and give very high yields. The adoption of efficient farming methods developed through research has paid good dividends in the areas where modernization has taken roots. The increases in crop production in the sixties are the result more of improvement in yield than of extension in area, as contrasted with the situation in the previous decade which witnessed increases more from extension of area. The results of a breakthrough in technology are most spectacular in the case of irrigated wheat. Also in the case of maize, the improvement in yield has been substantial if not so spectacular. In respect of rice, jowar and cotton, improved varieties and better agronomic practices have led to increased productivity. While in the first decade of planning the basic approach to agricultural development was to implement individual schemes, in the sixties the package approach was developed. By 1965, a number of fertilizers responsive varieties of wheat and rice and hybrids of maize, jowar and bajra became available. Immediately after the crop failures of mid-sixties, the 'New Strategy' for agricultural development was initiated with emphasis on high yielding varieties and multiple cropping programmes.

The compound growth rate in the agricultural production during the period 1949-50 to 1983-84 exceeds 2.60 per cent per annum. During the same period, production of foodgrains has almost trebbled from 54.9 million tonnes to 152.9 million tonnes to 152.4 million tonnes(see appendix Table 1.3). The cropping pattern is more diversified and cultivation of commercial crops has received a new impetus in line with domestic demands and export requirements.

Table 1.2 shows that land productivity has been steadily improving in India, more particularly after 1961-65 as a result of the impact of the green revolution. Under the impact of the new technology, increase in yield per hectare in almost all crops had taken place. The productivity of cereals has increased more significantly in comparison to other foodgrains and non-foodgrains. The spectacular rise in productivity in the plan period has been in the case of wheat, bajra and maize. Potato, Rubber and Coffee have also been showing significant improvement in production and productivity.

In case of other crops the increase in productivity is not that significant. There has been a slow growth in case of pulses and oilseeds.

While agricultural production rose gradually since 1950-51, it received a severe jolt during 1965-66 and 1966-67 because of severe drought over vast areas of the country. The upward trend was renewed in 1967-68. Between 1969-70 and 1983-84 production of foodgrains had increased by 60 per cent while production of non-foodgrains had increased by 47 per cent; the production of all crops had gone up by 56 per cent.[2] This increase in agricultural production has never been smooth but been highly fluctuating. The increase in agricultural production is partly brought about by increase in area under cultivation and partly by rise in productivity(yield).

Table 1.5(appendix) shows that the increase in agricultural production is primarily due to the increase in productivity. Increase in area is also important in some crops. There has been a distinct acceleration in the production of most crops brought about mainly by improvement in yields during 1976 to 1984 as compared to the early years of Green Revolution(1967 to 1976). The overall growth rate during 1976-84 increased from 2.3 percent to 3.0 per cent partly as a result of (a) a step-up in the yield rate from 1.3 percent to 2.3 per cent

2. Ruddar Dutt and K.P.M. Sundharam, Indian Economy, New Delhi, 1965, pp. 378-379.

per annum, and (b) slower pace of increase in area under cultivation of 0.3 per cent as compared to 0.5 per cent in the first period. The area under cereals has been increasing at a low rate during both the periods, but yield rate had increased by 1.9 per cent during the early years of green revolution but by 2.9 per cent during the subsequent period. As a result, the compound growth rate in the production of cereals is quite impressive -- by 2.2 and 3.2 per cent per year in the two periods respectively.

An analysis of the long-term growth trend of Indian agriculture during the fifteen-year period 1967-68 - 1981-82 which coincides with the period of green revolution in the country, reveals that the agricultural production curve has been moving consistently upward, except during the years marked by acute weather aberrations(Fig. 1.1 appendix). Agricultural production has, over the years, steadily acquired strength and resilience, pointing to the gradual strengthening of its technological base.

Foodgrains constitute the important fraction in the over-all agricultural production. In Table 1.3 the triennial averages, i.e., three-year moving averages of food-grain production were computed for the series covering the years from 1949-50 to 1984-85. A few periods of stagnancy can be seen in the table viz. 1954-55 to 1955-57, 1960-61 to 1966-67, 1977-78 to 1980-81. The average of latest triennium in 1983-84 is 142.7 million tonnes. This jump is quite high in comparison to the triennium in 1950-51 (57.13 million tonnes). This indicates the significant improvement in the production of food grains.

The growth rates of production of major foodgrain and non-foodgrain crops, computed for the post-independence period, are shown in Table 1.6(appendix). For all the three decades together, the combined growth rates of food-grain worked out to be 2.51 per cent per annum. The decade wise estimates of growth rates are 3.32 per cent per annum for the first decade (1950-51 to 1960-61), 2.52 for the second (1960-61 to 1970-71) and 2.41 for the third. This indicates a steady decline in the growth rate over the past periods. The estimates of growth rate for the entire post-green revolution period (2.24 per cent per annum) was found to be again much less than that for the fifties(3.32 per cent) and also for the sixties(2.52 per cent). If we break up the post-green revolution period into two viz. 1968-69 to 1975-76 and 1975-76 to 1980-81 , then it is seen that the growth rate of foodgrain production in the earlier period is 1.45 per cent per annum, whereas in the latter period it is 1.90. An obvious implication derived from this is that there was relative acceleration in the process of growth after 1975-76.

Increase in the growth rate of agriculture in the post-independence era is mainly due to the increase in the land productivity and the increase in area. But in the post-green revolution period the increase in area has been negligible whereas the average levels of productivity has been considerably higher for a number of major crops excluding ground nut, jute, gram and tur. Particularly in case of wheat, jowar and maize productivity has increased significantly(see table 1.6 in appendix). The output of pulses and oil-seeds has tended to show secular stagnation. For the last two years there has been an improvement in the production of these two crops.

Despite the continued impressive performance of agriculture, there are signs of emerging imbalances in the cropping pattern. The output of certain crops grew at a faster rate than , and sometimes at the expense of, other crops. An indicator of the emerging imbalance in the supply of different crops is the short fall in domestic production of edible oilseeds and sugarcanes necessitating substantial imports of edible oils and sugar, while at the same time stocks of wheat, rice and jute rise about the desired levels. In any attempt to redress cropping pattern imbalances, regional differences in yields and costs of production need to be taken into consideration. A state level study of cropping pattern does not match the States' comparative advantage in yields. Crops for which the conditions are most suitable are under-produced and there is over-production of crops which are not suitable. While a number of agronomic factors exist which prevent the substitution of one crop for another and several other factors, besides yields need to be taken into account in deciding on an appropriate cropping pattern, nevertheless it is clear that serious regional distortions have emerged . These distortions have developed over a period of time and will require a phased programme to encourage improvements in the supply-demand position at the national level for major crops and shifts towards more optimal cropping pattern at the regional level.[3]

The productivity of land in India also shows marked regional variations. Productivity of land is dependent on the quality of soil, extent of irrigation facilities, favourable natural factors like rainfall, climate etc. and improvement in inputs and infrastructure. Differences in natural endowments can be narrowed down by human factor (development in human effort and human capital). Punjab, Haryana and Western U.P. are the most developed areas of Orissa, Rajasthan, Bihar, Madhya Pradesh, North-Eastern regions are among the low productive regions.

Agricultural productivity in India is below the world average in all the crops. Further, it is very low in comparison to the productivity in the developed countries viz. France, USA, USSR, Germany, Japan etc. In case of rice, productivity per hectare was only about 31 per cent of that of Japan during 1976-78. In case of wheat, average annual yield per hectare in India was 14 quintals during 1976-78 while it was 43 quintals per hectare in France and 45 quintals per hectare in Germany.[4]

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3. See, Economic Survey 1985-86, Govt. of India, New Delhi, pp.10-11.

4. See Production Year Book , published by FAO of the United Nations.

Different factors are responsible for the low productivity in Indian agriculture. These are (a) over crowded of agriculture which causes fragmentation of holdings and low land per-capita, (b) poor techniques of production (c) inadequate irrigation facilities (d) improper implementation of land-reform policy (e) inadequate non-farm services such as credit, marketing etc., and (f) the discouraging rural atmosphere. The Indian farmers are illiterate, ignorant, superstitious, conservative and bound by social customs and institutions such as the caste system and joint family. Superstitions and social attachments have made the farmers fully satisfied with their primitive system of cultivation. For example the system of shifting cultivation and the system of attachment to fragmented parental lands are the result of superstitions which check the implementation of improved technology and consolidation of holding respectively.

These above factors are improving fast in the recent decade thereby facilitating the growth of agricultural production. There has been an improvement in the rate of production and productivity over the post-independence period. But an imbalance in the pattern of growth of agricultural production has emerged. There is imbalance between the crops, for example, the growth rate of foodgrains production is high in comparison to the non-foodgrains. Further, among the foodgrains wheat and jowar indicate a high growth rate in comparison to rice and gram(see table 1.6 in appendix). There are also inter-regional and intra-regional imbalances in the agricultural production. These imbalances and disparities are mainly due to the differences in the natural endowments, level of technology, level of education and research, and the quality of manpower.

The basic aim of the study is to find out the impact of education on agricultural production in India. Education includes both formal and informal education. It includes research and extension. First, we will try to find out the factors that are responsible for the development of agriculture. Then we will try to find out the contribution of education, research and extension to these factors and to the overall development of agriculture.

Factors of Change in Crop Output

Provision of increased irrigation facilities, introduction of high-yielding varieties of cereals and cotton, increased use of fertilizers and provision of plant protection facilities were the main factors responsible for the growth in agricultural output. Measures such as land reclamation during the earlier plan periods and multiple cropping during the later plans also partly contributed to the growth, through increase in cropped area. Other supporting measures such as soil conservation and land development, consolidation of holdings, agricultural credit, agricultural marketing, research and education, and price incentives also directly or indirectly influenced agricultural growth. A broad picture of the developments in respect of some of the above factors since the beginning of the planning era is indicated below:

(i) Irrigation is the basic to the adoption of other improved practices such as HYV, fertiliser application and plant protection measures. According to the report of national commission on agriculture, every hectare of extra irrigation normally gives 0.5 tonnes of extra foodgrains output. Fertilisers are expected to add 100tonnes for every tonne of plant nutrient applied. The composite effect of irrigation, fertilisers and HYV are known to be higher than the sum of the effect of the individual factors. Since the beginning of the planning era expansion of irrigation facilities to ensure timely and adequate water supply has been the kingpin in the country's programme of agricultural development. The potential of irrigation facilities have increased from 22.6 million hectares in 1950-51 to 68 million hectares in 1984-85. Cumulative utilisation of irrigated area has increased from 20.9 million hectares to 60.5 million hectares, 25.3 million hectares are through major and medium irrigation schemes and 35.2 million hectares are through minor irrigation scheme. Command Area Development Programme (CADP) was taken up with a view to narrowing the gap between the potential created through the major/medium irrigation projects and its ground-level utilisation.[5] In addition to the responsibility for distribution of water within their jurisdiction, these co-operatives may take up the responsibilities of providing inputs and of marketing facilities for output.

(ii) The rapid expansion of the HYV seeds is the mainstay of the green revolution and the programme continues to be an important plank of the country's agricultural strategy. Table 1.7 in the appendix shows that 15.38 million hectares of land were under the High Yielding Programmes(HYP) in 1970-71. In 1984-85, 55.42 million hectares of land were under the HYP. In 1970-71, 6.48 million hectares of wheat producing land were under the HYP whereas 5.59 million hectares of rice producing land were under the HYP. This amount increased to 19.58 million hectares in case of rice in 1984-85. Percentage wise 60.4 per cent of the paddy growing areas and 83.1 per cent of the wheat growing areas were under the HYV area in 1984-85(see Economic Survey 1985-86). There has been a record increase in the distribution of certified seeds during the past five years. In 1979-80, only 14 lakhs quintals of certified seeds were distributed . It touched a level of 42 lakh quintals in 1982-83(see Table 1.8 in appendix). Further

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5. See Economic Survey 1985-86, op.cit., p.12.

the estimated distribution during 1984-85 is of the order of 70.44 lakh quintals.[6]

(iii) Along with the adoption of HYV seeds, the consumption of chemical fertilizers has also increased impressively. Consumption of chemical fertilizers(Nitrogenous, Phosphatic and Potassic) increased from 0.69 tonnes in 1950-51 to 61 lakh tonnes in 1982-83(see Table 1.8 in appendix). Economic Survey 1985-86 reveals a more prosperous picture for 1982-83. It finds that the consumption of chemical fertilizer was 63.9 lakh tonnes in 1982-83, 77.1 lakh tonnes in 1983-84 and 82.1 lakh tonnes in 1984-85(see table 1.7 in appendix). Consistent efforts to introduce fertilizer use through trials, demonstrations and propaganda constituted an integral part of agricultural developments during the post-independence period. High priority was given to production of fertilizer in the country. Production of fertilizer increased from 2983 thousand tonnes in 1979-80 to 5181 thousand tonnes in 1984-85.[7] Fertilizer consumption per hectare has also increased from 2 Kgs in 1960-61 to 45 Kgs. in 1983-84(see table 1.9 in appendix).

(iv) As an integral part of the agricultural development programme, plant protection measures, such as seed treatment,

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6. See India 1985, op.cit., p.285

7 See Economic Survey 1985-86, op.cit., p.13

prophylactic spraying, weed control, rat control, locust control, control of epidemics, etc. received increasing attention. With the introduction of HYV, adoption of plant protection measures assumed added importance. Timely detection of pests and diseases through surveillance and judicious use of pesticides in conjunction with other agricultural practices like use of biological, cultural and genetic engineering, are some of the methods through which this is achieved. Table 1.8 in appendix reveals that the consumption of pesticides has increased from 2.35 thousand tonnes in 1950-51 to 61 thousand tonnes in 1982-83. Further a major portion of the current requirements of pesticides and plant protection equipment are being met from indigenous production.

(v) Improved farm implements and tools to meet the needs of scientific agriculture received adequate attention only during the Third plan period. In the context of emphasis on intensive cultivation especially during the sixties, use of tractors for farm operation and use of oil engines and electric pump sets for irrigation started gaining popularity. From about a thousand tractors in use in 1951, there number rose to 54 thousand in 1966 and to 170 thousand in 1972.[8] In order to spread the benefit of mechanization to a larger

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8. See Report of the National Commission on Agriculture, Part II, Govt of India, New Delhi, pp. 287-288.

number of farmers, particularly those who are not able to afford costly machinery, agro-industries corporations were set up in all States for distributing tractors and other agricultural machinery on cash as well as on hire-purchase basis, and also to provide repair and servicing facilities to the farmers. In 1983-84 a thrust was given to the programme of popularisation of improved animal drawn agricultural implements and hand tools. The programme envisaged providing a suitable technology to the farmers in the dry land areas. About 3.5 lakh agricultural implements and hand tools were distributed by the State governments. Emphasis was laid on the adoption and use of seed-cum-fertiliser drills. With a view to take the latest technology to the farmers a central level Agricultural Implement Review and Release Committee has been constituted. Between 1966 and 1978, the use of modern agricultural inputs has increased at a compound rate of 10 per cent per annum -- in contrast to the traditional inputs rising at the rate of only one per cent per annum during the same period. The share of modern inputs in the total value of all inputs used had increased from 10 per cent in 1955-56 to over 60 per cent in 1976-77.[9] Selective mechanisation of agriculture and increased use of

9. Dutt and Sundharam, op.cit., p.501.

farm power has contributed in a significant manner to the increased production of food, fodder and fibre crops during the last two decades.

(vi) Agricultural development largely depends on efficient use of land and water resources so as to get optimum production from them, preserving them from deterioration and improving their utility in future. To achieve this end various soil conservation measures were undertaken during the plan periods. Table 1.9 in the appendix shows that in 1960-61, 1.6 million hectares of agricultural lands were treated with soil and water conservation measures. This amount increased to 27.9 million hectares in 1983-84. Different centrally sponsored and state sponsored schemes for watershed management were launched during the plan periods. Integrated approach to improve the producitivity of the resource base of soil and ensure better moisture conditions received greater attention during the recent years, both in the Central and State Sector Programmes for watershed management.

(vii) Inspite of massive investments in the development of irrigation in the country during the past three and half decades, dryland/rainfed agriculture is still being practised. The development of dryland farming has been included in the 20 Point Programme. Dryland farming is being practised in over 102 million hectares out of 143 million hectares of the total cropped land in the country.[10] Development of watershed has been accepted as a national approach and strategy for development of dryland areas.

(viii) Besides , strict measures have been taken to implement the land reform policy. A crop insurance scheme has been introduced from the 1985 Kharif Season.[11] Provisions have been made to provide adequate institutional credits and marketing facilities to the farmers. To give an incentive to the primary producers, the Government of India had been following a policy of price support since 1957.

The above factors of change in the agricultural output are linked to the factors of education, research and extension. Education, research and extension help in the modernization of traditional inputs and production of more modern agricultural inputs. The degree of adoption of a new technology by the farmers is also influenced by education. In the remaining portion of this chapter we will analyse the development of education, research and extension and the impact of these on various agricultural inputs.

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10. See, India 1985, op.cit., p.291.

11. See Economic Survey, 1985-86, op. cit., p.14.

I. Research, Education and Extension in Agriculture During the Plan Periods: Impact on Agricultural Production

Research

In recent years there has been a growing recognition of the fact that agricultural research has to be the foundation stone on which any programme for increased agricultural production could be based. It is only as a systematic application of improved agricultural technology to crop production that we are able to witness in many parts of the world what is popularly known as the Green Revolution.[12]

Talking about the Green Revolution in his Nobel Peace Lecture, Dr. Norman E. Borlaug had the following comments to make: "The Green Revolution in India and Pakistan which is still largely the result of a breakthrough in wheat production is neither a stroke of luck nor an accident of nature. Its success is based on sound research, the importance of which is not self-evident at first glance. For, behind the scenes, halfway around the world in Mexico, were two decades of aggressive research on wheat which not only enabled Mexico to became self-sufficient in respect of wheat production but also paved the way to rapid increase in its production in other countries."[13]

In the Constitution of India, which came into effect on January 26,1950 , both the Union and the States could

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12. K.P.A. Menon, Indian Agriculture: Administrative and Organizational Constraints, New Delhi, 1985, p.106.

13. Ibid.

assume a share of the responsibilities for ensuring progress in the agricultural research. So far the Central Government has been taking better initiative in agricultural research. Certain State governments had set up very good agricultural research stations and educational institutions. But in many other states research was badly neglected. Support for research was provided by the government of India, Ministry of Food and Agriculture, through a number of Central Research Institutes , Commodity Committees and Directorates.

Science and technology as applied to agriculture during the Colonial rule were harnessed for serving essentially the interest of the rulers rather than the ruled. The concomitant benefits included an awareness amongst the educated of the importance of science and technology in the overall development of the country. However, the establishment of the Indian Council of Agricultural Research(ICAR) was a significant landmark. After independence, the awareness took more concrete shape, and the massive growth of science and technology in the country has been the result. The widespread influence which the various research organisations exert on the growth, direction and development of agriculture in general and of agricultural research in particular in the country demands that their activities and performance are carefully reviewed.[14]

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14. Report of the National Commission on Agriculture, 1976, Part XI, Govt. of India, New Delhi, p.2

The Department of Agricultural Research and Education, set up in 1973, in the Ministry of Agriculture , is responsible for coordinating research and educational activities in the fields of agriculture, animal husbandry and fisheries. Besides it helps to bring about inter-institutional and intra-institutional collaboration both with national and international agencies engaged in the same and allied fields. The Department provides Government linkage to the Indian Council of Agricultural Research (ICAR).

The ICAR, set up in 1929 as a registered society, is the apex body for formulating plans and co-ordinating agricultural research and their application at field-level through the medium of extension agencies under the Central and State Governments and also through the agricultural universities. The ICAR performs its functions in an integrated manner through the national grid of co-operative research in which central institutes, state agricultural universities and other educational and scientific institutions participate. It has a well-knit network comprising 39 central research institutes, 11 national research centres, 71 all-India co-ordinated research projects, 22 agricultural universities and 530 ad hoc schemes.[15] All the major states have atleast one agricultural university. These universities

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15. India 1985, op.cit., p.305.

act at the State level, performing the triple functions of research , education and extension. The Indian Agricultural Research Institute(IARI) has the deemed university status and impart post-graduate level education and confers Master's degrees and Doctorates in various disciplines of agricultural sciences.

To make a fair estimate of the significant scientific contributions of the research institutes from the beginning to date is a difficult task. However, some idea may be obtained from published accounts and achievement audit committees' reports, where available, which highlight the scientific achievements of the laboratories. Some of these are presented below:

(i) The Indian Agricultural Research Institute (IARI) has a long record of achievement. Particularly in the field of plant breeding , soil science, pests and diseases. Its contributions in the evolution of improved varieties of wheat, hybrid maize, hybrid sorghum and techniques of water management and multiple cropping are pioneering. Its training programmes have earned reputation throughout the country. The researches initiated in this institute on sugarcane, tobacco, potato ultimately led to the establishment of fulfledged institutes in various parts of the country. Work on newer and more improved varieties of crops of varied kinds together with agronomy, pest and disease problems etc. occupies a prominent place in the research programmes of the institute.

(ii) The Sugarcane Breeding Institute has helped in production of 'Co' varities of sugar cane which are known throughout the world.

(iii) The Jute Technological Research Laboratory (JTRL) is concerned with the physical and chemical properties of jute and other fibres including their processing and spinning. It has contributed to the development of quality fibres and diversified products.

(iv) The Central Rice Research Institute has evolved a number of improved and high yielding varieties of rice of superior qualities. It has also evolved a few short duration and disease resistant varieties of rice.

(v) Breeding work on coconut and arecanut at Central Plantation Crops Research Institute(CPCRI) has resulted in high yielding varieties. A dwarfing gene in arecanut has been spotted. The root disease of coconut is under active study from various angles.

(vi) The Central Tobacoo Research Institute (CTRI) is engaged in the breeding of tobacco leading to improved and disease resistant strains. It is engaged in involving improved techniques for flue-curing.

(vii) Introduction of new and improved varieties of jute and development of suitable agronomic practices for them occupy a large part of the research work of the Jute Agricultural Research Institutes(JARI): Work on establishment of potentialities of ramil as a textile fibre and standardisation of a sisal cultivation are some of its other important research activities.

(viii) The Central Potato Research Institute's (CPRI) main interest is in the breeding of disease-resistant and high yielding varieties and hybrids of potato. It has developed the 'seed plot technique' to avoid attack of potato by aphids and to produce healthy seeds. A method of screening potato against early blight has also been developed by the Institute.

(ix) The Indian Institute of Sugarcane Research(IISR) is engaged in improved agronomy of sugar cane and economics of companion cropping with wheat, potato, berseem, etc. It has developed techniques of screening sugarcane against smut. It has also developed techniques of moderate heat treatment to kill scale insects and mealy bug. A bullock drawn semi-automatic sugarcane planting machine has been designed and fabricated, which does a number of operations simultaneously.

(x) The Central Arid Zone Research Institute (CAZRI) is unique in its programme of research which deals primarily with agriculture under rigorous constraint of soil moisture and high temperature and consequent desertic condition. Its main interest lies in the volution of varieties of crops and grasses and trees which would survive such conditions. The major thrust is on plant and animal physiology and agronomy aimed at water economy, geomorphology of deserts, stabilisation of sand dunes and solar energy utilization.

(xi) The Institute of Agricultural Research Statistics carried out researches which are mainly directed to methodologies of estimation of crop yield and cost of production/assessment of production programmes, design of experiments and evolving a national index of field experiments.

(xii) Breeding high yielding and disease resistant varieties of tuber crops such as cassava, sweet potato, yam etc. is an important research activity of the Central Tuber Crops Research Institute(CTCRI). This is backed by necessary agronomic studies for optimizing yield.

(xiii) The Indian Institute of Horticultural Research (IIHR) has so far introduced a large number of grape varieties, some pineapples, banana, guava and strawberry. Ethrel treatment has been found to induce uniform flowering. New varieties of several vegetables have been developed. A pumpkin variety resistant to fruitfly has been bred.

(xiv) A satisfactory method of reclaiming saline sodic soils on a large scale by means of gypsum treatment has been developed by the Central Soil Salinity Research Institute (CSSRI) and good yields of paddy, wheat and barley have been obtained.

All-India Coordinated Research Projects(AICRP) work under the guidance of ICAR. Systematic efforts were put in around 1965 and in course of 2 to 3 years as many as 70 AICRPs were launched to carry out research on different crops, soils, agronomy and agricultural engineering(see table 1.11 in appendix) and to transfer the results of research to the field. Under ICAR's guidance agro-economic research centres were established to undertake problem oriented studies and to carry out continuous study of change in the rural economy. In 1967 there were 9 agro-economic research centres. It increased to 13 in 1982(see Indian Agriculture in Brief).

Table 1.12 in the appendix shows that the ICAR till 1975 administered and financed 30 research institutes. Nine of the institutes were concerned with specific crops, three with animal sciences, two with fishery and three with soils; five were of general type; four were interested in crop and fish technology and one each in agricultural statistics and agricultural engineering.

The ICAR publishes books, technical bulletins, reports and proceedings of important seminars and symposia both in English and Hindi. Table 1.15 shows that the publication and Information Division brought out 29 publications in 1981, 16 in English and 13 in Hindi. Another 18 titles, 11 in English and 7 in Hindi were expected to be released by March 1982.

The concept of an integrated approach to research, teaching and extension education has been accepted as the keynote of agricultural universities. Most of the Universities have tried to follow the Model Act framed by the ICAR in a broad sense, so that a more or less uniform pattern has emerged. The guidance of ICAR is often replaced by direction and regimentation. Since research is intimately connected with extension and field application, and since agriculture is state responsibility, directed research may not be appreciated. The agricultural universities institutionally and through their scientists have taken upon themselves the task of organising basic research relevant to agriculture.

The State Departments to certain extent carry out the work of adaptive research and extension.

Agricultural Universities, ICAR research institutes and State Departments of Agriculture are the recognised centres of agricultural research. The general universities also do take part in the agricultural research. Table 1.14 in the appendix mentions the name of the organisations (other than agricultural universities and ICAR institutes) that participate in the agricultrual research. Most of their research work is on problem basic to agriculture and the main financial source is either the ICAR, CSIR or UGC ad hoc grants on scheme basis. Some of the institutes mentioned in table 1.14 in the appendix do not depend upon any outside financial assistance but their own. It is expected that research work sponsored by them is more gainfully utilized.[16]

16. See Report of the National Commission on Agriculture, 1976 Part XI, op.cit., pp. 71-72.

The production, improvement and marketing of the four commodity crops, namely, rubber, coffee, tea and cardamon are managed by boards. Tea Board's performance in maintaining an upward trend in production and yield of tea reflects its capability of benefiting from its own sponsored research work as well as from those done by other institutions. Rubber Board's performance an upward progress in production as well as yield per hectare.

The International collaboration in agricultural research has also been going on. It takes various forms, viz., bilateral agreement or protocol, cultural exchange of programmes, Colombo Plan, International Technical and Economic Cooperation programme, World Bank Assistance, Ford Foundation, Grants Rockfeller Foundation, PL-480 programmes and International Institutes.

Education

Education for agriculture broadly covers all formal education in the subject from the school to the university level and also informal and non-formal education. Essentially, the worth of agricultural education has to be judged by its effectiveness as an instrument of national development. It should aim at fostering a sense of enquiry in every recipient regarding problems of agriculture and a desire to solve them. In other words, the goal is service to the farming community through integration of teaching, research and extension.

Pre-degree Level Education

Table 1.19 in the appendix shows the literacy rates for different states and for India as a whole in different decades after independence. The all-India literacy rate increased from 16.6 percent in 1951 to 36.23 in 1981. At the primary school level, agriculture has been introduced as one of the compulsory crafts in the junior and senior basic schools especially in rural areas. In a few general high/higher secondary schools in some states courses in agriculture are offered either to fulfill the requirements of introducing a rural crafts or as one of the elective subjects to meet the requirements for matriculation.

Onthe recommendations of the Commission on Secondary Education set up by the Government of India in 1952, 503 multi-purpose high/higher secondary schools were established during 1955-57 on experimental basis in many states. By the end of 1960-61 there number increased to 2115. In these schools agriculture was offered as one of the streams in many states.

Till 1972 the vocational education in agriculture was imparted in 74 agricultural schools, 6 rural institutes and a few verterinary and diary science and craft training centres. The vocational or agricultural schools admit students after primary education and offer one to two years' certificate/diploma course.

Agricultural education at the pre-university level is much less developed than at the university level. While there were 10,000 seats available for admission to the degree level education, hardly 2000 or so were there at the lower i.e. diploma/certificate level in 74 agricultural schools in 1972.

The scheme of Krishi Vigyan Kendra (KVK) was set up with five KVKs during the Fourth Five Year Plan. The KVKs are the first line grass root level vocational training institutions for imparting need based skill training to the practising farmers, farm women and school drop-outs who wish to be self-employed. The method of training is 'learning by doing' and 'teaching by doing'. The Trainers' Training Centres (TTCs) are the institutions established in the specialized areas of dryland agriculture, horticulture, farm machinery and agricultural engineering, home science and hill agriculture located mainly at ICAR institutes. By the end of the Sixth Five Year Plan, 89 KVKs and 8 TTCs, have been established throughout the country. The TTCs impart training to the KVKs and other such training institutions to keep them in line with the latest knowhow in technology as well as pedagogy. During the year 1985, 5155 training courses of both long and short durations were organized and 125,901 trainees including 28,961 farm women, were trained in crop production, horticulture, fisheries, agricultural engineering, home science and home crafts. The TTCs organized 101 specialized courses and imparted training to 1681 teachers of the KVKs, other training centres and extension staff of the states and union territories. The KVKs also implemented the lab-to-land programme in their respective areas. Special emphasis was laid on organising training courses on the production of oil seed and pulses in the dry lands under the 20-point programme.[17]

Higher Education in Agriculture

Higher agricultural education is imparted through the agricultural universities. By the end of 1975, the country had 22 agricultural universities(see table 1.13 in the appendix). The growth of agricultural universities between 1960 and 1975 is represented in the Fig. 1.2 in the appendix. It shows a gradual increase in the number of universities since 1960. Recently, the two newly established Sher-e-Kashmir University of Agricultural Science and Technology, Srinagar, and the Birsa Agricultural University, Ranchi, were provisionally cleared by the UGC. In addition to the agricultural universities, the Indian Agricultural Research Institute(IARI) also imparts university level agricultural education. A number of research institutes under the control of the ICAR also have M.Sc. and Ph.D. courses.

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17. See Annual Report 1985-86, Part I, ICAR, New Delhi, p.137.

The growth of colleges of agriculture and agricultural engineering as well as of student population at different levels is graphically represented in Fig. 1.3 and 1.4 in the appendix. The figures show that the number of colleges has increased rapidly between 1950-57 and 1972-73. By the end of 1973 there were some 73 colleges offering degree courses in agriculture. There number in 1951-52 was 19 with an annual intake of 1060. By the end of 1965-66 the number of such colleges was 70 with an intake of 10,049. The intake in 1972-73 came down. The number of post-graduate colleges in agriculture in 1951-52 was 4 which increased to 49 in 1972-73. The annual intake of 6 colleges in 1955-56 was 223 but it went upto 2002 in 1972-73.

The review of ('Indian Agriculture in Brief; a Ministry of Agriculture publication, from 1953-54 to 1983-84 reveals that there were only 22 agricultural colleges in 1953 offering degree courses in agriculture. The number of students admitted into these colleges was 1254 and the output was 792. In 1969-70 the number of colleges increased to 73, the number of students admitted increased to 8049 and the output increased to 6346. In 1977-78 , the data available only from 56 colleges show that the number of students admitted was 5029 and the output was 4259. The number of students admitted into post graduate courses 2002 in 1972-73 to 2613 in 1979-80. The output of post-graduate colleges was 978 students in 1972-73. It increased to 1489 in 1977-78. Further, 'Indian Agriculture in Brief' 1982-83 shows that upto 1979-80 Ph.D. education in agriculture was provided by 17 colleges. The data available from 13 such colleges show that upto 1979-80 they admitted 506 students into this programme and had an output of 272.

In case of agricultural engineering, till 1961 there were only 2 institutes offering degree courses in it. The annual intake varied from 50 in 1958-59 to 65 in 1961-62. In 1966-67 the number of agricultural engineering colleges and annual intake were 6 and 329 respectively. By the end of 1972-73, the number increased to 10 with an annual intake of 399.[18] Table 1.18 in the appendix shows that the annual intake of 10 colleges for degree in agricultural engineering showed a gradual decline over the years between 1973-74 and 1979-80. This decline was from 424 students in 1973-74 to 377 students in 1979-80. The output also showed a decline from 303 in 1973-74 to 233 in 1979-80. Table 1.18 also shows the number of colleges providing post-graduate degree in agricultural engineering, their admission capacities and the output between 1973-74 and 1979-80. Over the years, though the number of colleges remained the same at 4, the admission capacity and the output declined gradually.

A few general universities also offer post graduate programmes in biological sciences which have bearing on

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18. See Report of the National Commissionon Agriculture, 1976, Part XI, op.cit., p.136.

agriculture, such as agricultural botany, agricultural zoology, agricultural chemistry etc. Courses in agricultural engineering at the undergraduate and post-graduate levels are offered by seven agricultural universities, the Indian Institute of Technology(IIT) , Kharaqpur and the Agricultural Institute affiliated to Allahabad University. In the area of of teachers training Punjab Agricultural University, Ludhiana has set up a department of agricultural education. Four schools of management outside the agricultural universities are conducting post graduate diploma training in business management and administration as applied to agriculture.[19]

The centres of advanced **studies** on different aspects of agriculture have been developed. The UNDP continued to provide assistance through the ICAR to different agricultural universities and research institutes for strengthening post-graduate teaching and research in selected disciplines under the project on Post-Graduate Agricultural Education and Research of the United Nations Development Programmes. Its aim is to enhance the competence of professional staff and augment facilities for high quality research for tackling problems coming in the way of increased agricultural production in the country. In the present phase the agricultural disciplines covered under the project are: Agricultural Microbiology , Tropical Horticulture, Temperate Horticulture, Plant Physiology, Agricultural Communication, Energy Management, Agricultural Statistics and Computer Applications, Plant Virology and Post-Harvest Technology. The project, with the continued support from the ICAR and the UNDP

19. Ibid, p.137.

(UNESCO/FAO), had interaction with leading overseas institutions through visits of consultants. This has resulted in the building-up of a cadre of highly competent professional scientists. All the institutions under the project collaborated in organizing all-India workshops, seminars and conferences.

The ICAR is implementing the National Agricultural Research Project (NARP) to strengthen regional research capabilities of the agricultural universities for conducting need-based research. The project came into effect in January 1979, and phase I of the NARP terminated on 30 September 1985. The agro-climatic zones of different states have been identified. This information is being utilized to decide the investment proposal for strengthening the research programmes of the state. The mechanism of organizing zonal workshops twice a a year in each agro-climatic zone became effective under this programme and its scope was widened to discuss simultaneously the programmes of transfer of technology of the ICAR-funded projects and the programmes of agricultural extension of the State department of agriculture in the zone. Phase II of the NARP became effective from 1 October 1985. It was accepted for 7 years. All the agricultural universities would be eligible for this assistance subject to a few conditions. This project is a joint exercise of ICAR, Ministry of Agriculture and the World Bank in consultation with the agricultural universities and the directorates of agriculture.

To promote the development of trained manpower in agriculture and allied sciences the ICAR continued to operate a number of scholarships and fellowships schemes. It organizes Summer Institutes to discuss on various agricultural development and effective teaching methods and techniques. It provides a scheme of Professorial Chair. This scheme was enabled the ICAR to attract outstanding scientists to areas of fundamental research in agriculture. The ICAR-UNICEF project on Education in Food and Nutrition has been in operation with UNICEF assistance. The programme was under operation in 20 agricultural universities. Its objective is to improve the nutrition of rural families, particularly of women and children. The All-India Coordinated Research Project in Home Science was initiated in 3 disciplines - Food and Nutrition, Child Development, and Home and Farm Management - and was implemented at 6 centres. A scheme was introduced to provide financial assistance to teachers and scientists writing university-level text books. The ICAR also instituted 'Best Author' and 'Best Teacher' awards to provide incentives to authors and teachers engaged in the field of agriculture and allied sciences.

The need for having suitable arrangements for training scientists and technicians working in agriculture and allied fields to update their knowledge has been well recognised. The Directorate of Extension of the Union Ministry of Agriculture and Irrigation in collaboration with the State Governments took up refresher training of VLWs by adding special wings to the existing extension training centres. Till March 1974, 43,255 VLWs or gramsevaks have been trained at 67 gramsevak training centres.[20] There are also Gramsevika training centres to provide training to Gramsevikas and Mukhyasevikas. For training the instructional staff of the Gramsevak, Gramsevika and farmers' training centres and agricultural schools in extension methods and techniques, three extension education institutes have been set up on regional basis at Nilokheri(Haryana), Rejednra Nagar(Hyderabad) and Anand (Gujarat). A scheme for imparting refresher courses to Extension Officers, Agricultural Inspectors, Agricultural Inspectors, Agricultural Assistants and Assistant Development Officers etc. was started as selected agricultural colleges as early as 1954-55. For the senior officers at the divisional and higher levels short-term courses are being organised by the Directorate of Extension at research institutes and agricultural universities.

20. Ibid. p.157.

Extension

Extension and extension education relate to the process of conveying the technology of scientific agriculture to the farmer in order to make him competent to utilize the knowledge for better agriculture. This consists of provisions for non-formal educational facilities through organised extension services, introduction of agricultural education in schools and education through non-degree institutional programmes (KVKs etc.) to impart vocational skills to the farmers for improving their productive activities. The National Extension Service is the base for our extension work. The term extension refers to an informal out-of-school education and services for the members of the farm family and others directly or indirectly engaged in farm production, to enable them to adopt improved practices in crop production. Agricultural extension not only imparting knowledge and securing adoption of a particular improved practice but also aims at changing the outlook of the farmer to the point where he will be receptive to, and on his own initiative, continously seek means of improving his farm occupation home and family life in totality.[21]

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21. Ibid, p.232.

The first major effort to spread the work of extension on an area basis with the Grow More Food(GMF) Programme. Field demonstrations and contact with the farmers to introduce the improved techniques and the initiation of a dialogue with the villagers were the main lines of approach. The next important stage was the introduction of National Extension Service(NES) with its complex of Village Level Workers (VLWs) and Agricultural Extension Officers (AEOs) in each block under the Community Development Programme (CDPs). The technical support to NES was from the existing State Departments. The work of NES was organised more systematically with the introduction of Panchayati Raj and Intensive Agricultural District Programme (IADP). In order to establish a direct link between the scientists and the field, in 1965 a programme of National Demonstrations was introduced. Now the extension service is provided tothe farmers through audio-visual aids like magic lantern and cinematographs, radio broadcasting, televsion programmes etc. The provision of extension through dialogue or through man-to-man transfer by extension officers. VLOWs is also going on side-by-side.

The ICAR implemented 6 transfer-of-technology projects for agricultural extension, viz. National Demonstrations, Krishi Vigyan Kendras, Lab-to-Land Programme, Tribal Area Operational Research and Socio-Economic Upliftment of Scheduled Castes and Backward Communities. These projects aim at (i) demonstrating the latest technologies to the farmers as well as the extension workers; (ii) testing and verifying the technologies in the socio-economic conditions of the farmers; and (iii) getting a first-hand feed-back for making changes in research, education and training system.[22] Out of the 6 transfer-of-technology projects the function of KVKs has already been discussed under the heading of 'EDUCATION'. The function of the other 5 are as follows:

The All-India co-ordinated Research Project on National Demonstration, in 1985, was under operation in 48 districts spread over 23 states and Union Territories.[23] The demonstrations dealt with multiple cropping, reclamation of alkali and acid soils and cultivation of better crops on rained lands. The project helped in the dissemination of modern technology by organising training programmes for farmers. It helped in popularizing several crop rotations. In the traditional rice-growing areas, rice-rice-rice, rice-rice and rice-groundnut rotations proved very successful. In new rice growing areas, rice-wheat and rice-wheat-greengram rotations were found to be very promising. Rabi maize, short-duration pigeonpea and high yielding varieties of cereals, pulses and oilseeds were successfully grown in farmers' fields under this project. The average yield of the demonstration plots were much more in comparison to the other plots. It has proved more profitable, after deducting

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22. Annual Report ICAR, op.cit., p.135

23. Ibid.

the cost of modern inputs.

The lab-to-land programme was launched in 1979, for transferring relevant low-cost technology to small and marginal farmers and landless agricultural labourers, who had not benefitted much from the modern technologies. About 50,000 farm families were covered in the first phase and 75,000 farm families in the second. In the third phase, which started from June 1984, over 75,000 farm families were adopted by 115 transfer-of-technology centres covering 34 ICAR institutes, 23 agricultural universities, 13 agricultural colleges and 47 voluntary organizations. While adopting the farm families preference was given to the backward classes, scheduled castes and scheduled tribes.[24]

The Operational Research Project(ORP) aimed at testing the suitability of new agricultural technology on a large scale. The technology was introduced by the scientists in a group of 4 or 5 villages or in a watershed. The projects were implemented at 85 centres by agricultural universities, ICAR institutes and state departments of agriculture. The ICAR selected 47 watersheds in 16 states. Of these, 38 were in operation in different states during 1985. Under an integrated approach , the land and water resources were reinforced, production system of crops, pastures and agro-foresting were super-imposed, and people's participation was envisaged. Under this programme 35320 hectares were under development for crops, pastures and agro-foresting

24. Ibid, p.137.

under different soil classes. Crop demonstrations were taken up, with special emphasis on pulses and oilseeds. The high yielding and disease resistant crop varieties were popularized in the ORP. With the adoption improved agronomic practices, the incidence of pests and diseases decreased considerably in the areas covered by the ORP. The net income of farmers was 59.65 percent more in the ORP villages than in the non-ORP villages.[25] The results obtained at the JARI, West Bengal, indicated that crop and fish production could go side by side in regions having adequate amount of water.[26] The yield and income from different crops in the ORP villages supervised by the JARI, Barrackpore shows that in about 80 0ercent of the farm families covered by the ORP, the yield of the crops increased considerably.

The ICAR operated the Tribal Area Operational Research Project through 26 centres covering 9 states to help tribal farmers increase their income through agriculture and allied technologies . Special attention was paid to examine the relevance of the modern technologies in the socio-economic conditions of the tribal farmers, and popularise those which are appropriate and productive in their conditions. Besides, under the All-India Coördinated Project on Scheduled Castes and Backward Communities, 19 Centres were established in 16 states to develop integrated models to improve the socio-economic conditions of scheduled castes and other backward

25. Ibid, p.139

26. Ibid. p.140.

communities. In these projects the aspect of crop production, health-hygiene and nutrition and homestead vocations(driving, repairing and maintenance of oil-engines and electric motors and plant protection equipments etc.) are taken into account. Central Agricultural Research Institute for Andaman and Nicobar Group Islands, Port Blair and ICAR Research Complex for the North-Eastern Hills Region were established to take up special agricultural problems of the areas.

The agricultural universities are playing important roles in the system of education, research and extension programmes of the States and the ICAR. The farmers are also getting benefits from general education system. M.S. Randhawa found that the Schools in the rural areas in Punjab have helped in preparing the yough to take up farming as a profession and also to go in for higher education in agriculture. With greater stress on the introduction of agriculture as a subject in high and higher secondary schools, more and more farmers' sons are getting interested in farming. The boys studying agriculture in schools transmit their knowledge to their parents. The school teacher, being in contact with the farmers, enjoys their confidence and promotes the adoption of new technology.[27] The programme of adult education also makes the farmers aware of the improved agriculture practices. The Development Departments of the State Governments have been trying to popularise improved

27. M.S. Randhawa, Green Revolution: A Case Study of Punjab, Delhi, 1974, p. 58.

agricultural practices through their extension workers viz. Agricultural Inspectors, Block Development Officers, Panchayat Officers, District Agricultural Officers, Deputy Directors, District Development Officers, Agricultural Extension Officers, VLWs etc. Many private companies engaged in the manufacture of pesticides, insecticides, fertilizers, weedicides and agricultural machinery also popularize their use. Such companies have field agencies which educate the farmers in the appropriate use of their products. Frequent method-and-result demonstrations are conducted by them. Some organizations are even advancing loans to the farmers to help improve farm techniques and also provide fellowships to research scholars.[28]

<u>A Brief account of the Impact of Research, Education and Extension on India's Agricultural Production</u>

In part I of this chapter, the factors contributing to the growth of agricultural production have been analysed. These are mainly the improvement in the factor inputs, the improvement in the organisational and socio-cultural aspects of production. Research, which is a part of formal education, has helped in the improvement of technology. The result of

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28. Ibid, pp. 58-59

research in the plan-period are (i) the production of high-yielding and disease resistant varieties of seeds, (ii) effective plant protection measures (iii) better qualities of agricultural implements and machineries for different geo-physical and climatic zones ,(iv) new techniques for soil and water management ,(v) development of different varieties of fertilizers and pesticides for different crops, (vi) development of different cropping systems viz. inter-cropping, mixed farming, crop rotation, dryland farming etc., and (vii) new measures for the effectivness of the systems of agricultural price policy, agricultural credit and agricultural co-operation.

The increase in the consumption of different factor inputs of better quality is analysed in part I of this chapter. This increase is due to a better awareness among the farmers in the post-independence period. This awareness has come through different methods of formal and informal education. Education has increased the allocative and innovative capacity of the farmers. This aspect of education is taken up more systematically in the next chapter. In this chapter it is found out that in the post independence period the production and productivity of agriculture has increased. The increase is significant in some crops and is not significant in case of others. It is also found out that the increase in production and productivity is due to the efficient use of more agricultural inputs of better quality. The change in the quality of inputs is the result of continuous research. The efficient use of these inputs has come in a round-about way through general education, agricultural education and extension education. The functions and roles of agricultural education and extension education have already been analysed. The next chapter will show the way farmers are influenced through education. To conclude this chapter, a brief account of the recent contribution of research has to be given.

During 1985-86 stress was laid on evolving disease-resistant and pest resistant varieties of crops , with accent on pulses and oil seeds; development of varieties that could withstand drought, cold climate and salinity; and demonstration of watershed management. As a result, a fair measure of success was achieved in stablizing foodgrains despite aberrations of weather in different parts of the country. During 1984, 94 new varieties of foodcrops(13 of paddy, 7 of wheat, 5 of maize, 27 of millets, 16 of pulses, 5 of oilseeds, 43 horticultural crops, 1 of cotton and 2 of sugar cane) were released.

The high yielding varieties and associated technologies developed by ICAR, have opened up new vistas in the field of agriculture. In most of the crops the scientists have developed a large number of high yielding disease and pest resistant varieties, suitable for cultivation in every climatic zones.

In the field of cotton, India is the first country to evolve cotton hybrid. Several new varieties have been developed which produce superior quality cotton and are of short-duration, high yielding and disease resistant. India is again a pioneer in the field of sugarcane research. More than 3000 varieties of sugarcane have been evolved, which are of short duration with higher sucrose contents. A number of new jute varieties with higher yield potential, producing superior quality fibre have been developed, which can withstand water logging in the fields.[29]

The growing of pulses with other crops was introduced. At several places, intercropping of pigeonpea and chickpea with cereals-millets and oilseed crops could increase the production, effect a saving on inputs and reduce the cost of cultivation. A new variety of summer groundnut was introduced. At some places summer groundnut gave twice as much yield as kharif groundnut. In 1985 other oilseed varieties released included 5 varieties of rapeseed, mustard, 2 hyrbids of sunflower,

29. India 1985, op. cit., 1986, p.306.

2 varieties each of sesamum and niger, 7 of linseed and 1 of castor. Proposals were finalised to have a technology mission for increasing the production of oil seeds in 180 districts.

In collaboration with the Department of Space, remote-sensing and satellite data were made use of to survey and classify the soil and water resources of different regions. The information would be of great use in formulating long-term agricultural strategies.

For allthe major agro-climatic zones of the country promising crop rotations were identified both in terms of economic returns and agricultural productivity. The information was disseminated through the KVKs, operational research projects, national demonstrations and lab-to-land programmes. To reduce our dependence on chemical fertilizers research was intensified on biological nitrogen fixation and recycling of agricultural and animal wastes. Stress was laid on developing suitable technologies for stablising crop production from drylands. In case of plant protection research was intensified on seed borne diseases, epiculture and the beneficial roles of birds.

Research in the field of agricultural engineering was directed towards the development of improved manual, animal drawn and power-operated tools, implements and machinery, their prototype production and feasibility testing; development of efficient post-harvest technology and equipment for minimizing post harvest losses; production of value added products and utilizationof wastes and by-products; development of renewable energy operated gadgets and establishment of energy requirement in different cro-machine-power source combinations; development of techniques and equipment for improving the efficiency of wells and pumps; and design of suitable drainage plans for selected watersheds.

Agricultural Research and Education in the Seventh Plan aims specifically at reducing the gap between potential and actual experimental yields through relevant basic and applied research in all major farming systems and development of suitable area-specific and crop-specific packages of practices, particularly of dry-land and rented farming areas. Stabilizing the yield potential of improved varieties/strains through an integrated approach; exploitation of genetic resources and conservation of the final produce efficient energy and input management and ensuring the renewable nature of agricultural wealth through appropriate steps for ecological security are further areas for intensified research and development and education.[30]

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30. Government of India Planning Commission: The Approach to the Seventh Five Year Plan, 1985-90, New Delhi, 1985, p.12

CHAPTER - V

A STUDY OF ANANADAPUR BLOCK IN ORISSA

This chapter is a report on the field study conducted in Orissa. The field study is conducted in a few villages of Anandapur block to find out the influence of education on farmers.

Agricultural Scene in Orissa

Agriculture is the main occupation of the majority of the people in Orissa. Over 76 per cent of the people are dependent on agriculture. Out of the gross cropped area of 87.46 lakh hectares, 18.99 lakh hectares are irrigated.[1] Thus, irrigated land constitutes only 21.9 per cent of the total cropped area. To a large extent agriculture in Orissa means the growing of paddy which occupies an area of 43.72 lakh hectares constituting about 65 per cent of the total area under food crops. The other major food crops are pulses, ragi, small millets and wheat.[2]

The economy of Orissa is heavily dependent on rice production, but the production has not shown any appreciable rising trend. The production has been constant over the last decade. The yield rate of paddy remained stagnant at about 900 kg per hectare during the sixties and the seventies while the all-India average moved from 1000 kg. to 1130 kg. Only

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1. India 1985, Govt. of India, New Delhi, 1986.

2. B. Mishra, "Deceleration of Rates of Agricultural Growth in Orissa: Trends and Explanatory factors," Indian Journal of Agricultural Economics, Vol. XXXVIII, Oct-Dec. Bombay, 1983, p. 591.

the summer rice has shown some improvement due to increase in the area under irrigation and high yielding varieties.[3]

Table 2.1 in the appendix shows that the productivity per hectare in rupees in Orissa has decreased from Rs. 2,088 in 1970-73 to Rs. 2022 in 1977-80. Except a few districts viz. Bolangir, Cuttack, Koraput, Mayurbhanj and Sundargarh, all others shared a decrease in productivity.

Table 2.2 shows the literacy rate of different districts. It shows the over-all literacy, male and female literacy, and rural and urban literacy. As far as over-all literacy is concerned only three districts are having literacy rate more than 40 per cent. These districts are Puri, Cuttack, Balasore. In case of rural literacy, there are five districts having more than 30 per cent literacy rate. These are Cuttack, Puri, Balasore, Dhenkanal and Sambalpur. Some of these districts show a decrease in productivity in 1977-80(over the year 1970-73). Inspite of this, the districts of Balasore, Cuttack, Sambalpur, Dhenkanal and Puri continue as the agriculturally advanced districts of Orissa. These districts are having not only a good literacy rate but also a higher over-all education level. The number of colleges and Schools in these districts are much more in comparison to the number

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3. Ibid.

of schools and colleges in other districts of Orissa. Particularly the enrolment of students from rural background into Secondary Schools and colleges in these districts is very high. The output rate of these students is also high. From this we can make out that there is a close relationship between the development of education and the development of agriculture. But before analysing the data collected from the Block we can not say whether education influences agricultural development or agricultural development influences education. There is also the possibility of their mutual dependence.

From Table 2.1 in the appendix we found out that the land productivity in 1977-80 decreased in comparison to the productivity in 1970-73. Table 2.3 in the appendix divided the agricultural output into foodgrains and non-foodgrains. Foodgrains covered cereals and pulses whereas non-foodgrains included oil seeds, fibres and other miscellaneous crops. The table shows that the index number of area under foodgrains increased from 103.1 in 1969-70 to 123.9 in 1980-81 whereas the index number of yield increased from 102.6 in 1969-70 to 147.4 in 1980-81. This shows a decline in the land productivity in case of non-foodgrains.

In case of agricultural production the growth rate is positive. Both foodgrains and non-foodgrains show an increase over the years(1969-70 to 1980-81). The index of foodgrains production increased from 104.5 in 1969-70 to 128.7 in 1980-81 whereas the index of non-foodgrains production increased from 102.6 in 1969-70 to 147.9 in 1980-81 (see table 2.3 in the appendix). In case of foodgrains the increase in production is mostly due to the increase in area under cultivation. In case of non-foodgrains the increase in production is entirely due to the increase in area under production.

The possible reasons for slow growth rate of foodgrains and non-foodgrains production in the state may be either bio-physical constraints(i.e., lack of improved seeds and other inputs, inefficient cultural practices, deteriorating soils, weeds, diseases and insects, etc.) or socio-economic constraints(i.e., lack of knowledge, non-availability of inputs, inadequate marketing and credit facilities, lack of profitability, tradition, risk aversion, etc.)[4]

In Orissa, floods, droughts and cyclones occur almost in every alternative year in a severe form, causing substantial loss in production. Due to frequent natural calamities, agricultural production in the state does not show any favourable trend. B. Mishra(1983) tried to find out the abnormal years between 1964-65 to 1980-81. Out of the 17 years, he found that 11 years were considered to be

4. Ibid.

abnormal. During those years, there had been crop loss due to natural calamities(viz. drought, flood, cyclone etc.).

Erratic monsoon is the cause of flood, cyclone, and drought. The problem of erratic monsoon can be solved through improvement in the irrigation facilities. The irrigation facilities in the state are inadequate. The irrigation potential in the state has been estimated at 40 lakh hectares. By the end of 1977-78, the state achieved a potential of 20 lakh hectares. Of this only 14 lakh hectares of land received irrigation which accounted for about 70 per cent of the total irrigation potential created in the state. This shows that there is great scope for improvement in irrigation.[5]

Besides, cimatological factors, there are also socio-economic factors which obstruct technological change. These factors are very strong in Orissa. The rural scene is pervaded by illitracy, superstition, poverty etc. The technological change is hindered by illiteracy, superstition, poverty , fragmentation of holdings, share-croppings, shifting cultivation etc. In Orissa, the scheduled tribes and castes account for about 40 per cent of the population. They are socially and economically backward. Most of them use to live in the rural areas. The literacy rates among them, according to the 1981 census

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5. Ibid. pp. 603-6-4

are 22.41 in case of scheduled castes and 13.96 in case of scheduled tribes. The rural people, particularly the illiterates and the people with very low education, use to have a conflict between tradition and modernity and have a judgement in favour of the former unless influenced by the state machinery. There is a great attachment of the rural people to their parental lands. Most of them are reluctant to exchange these lands for other lands. Thus they don't have a favourable opinion towards consolidation of holdings. Likewise, tribals have almost a devotional attitude towards shifting cultivation. They do not want more mechanisation in it. Yet another example, the Brahmins in Orissa do not till the land by themselves through plough. This has been a tradition. Even the educated Brahmins do not try to break it. A number of such social factors operate in the socio-economic set-up of Orissa, which hinder the agricultural development in the state.

Area of Field Study

Anandapur Block is a Block in the Keonjhar district of Orissa. The agricultural productivity of the district was in the medium category in 1970-73. This further decreased in 1977-80, and placed the district in the lower productivity category(See Fig 5 and Fig. 6 in the appendix). The literacy rate of the district is less than the average literacy of the state. In 1981 the literacy rate of the state was 34.23 per cent whereas the literacy rate of the district was 29.89. The rural literacy rate of the district was only 27.77. The literacy rate of Anandapur Tahasil was quite impressive. The over-all literacy rate and the rural literacy rate of Anandapur were 38.22 and 37.19 respectively(see table 2.2 in the appendix). Table 2.1 in the appendix shows that there is a little fluctuation in the land productivity in the district between the periods 1970-73 and 1977-80. In 1970-73 the productivity per hectare in rupees was 1984. It decreased marginally to 1874 in 1977-80.

Anandapur Block is situated in the flood plains of river Baitarani and Kushei. The main crops grown in the Block are rice, pulses, jute and vegetables. Recently oil seed has been introduced in the area. A few other crops like mesta, sugarcane etc. have also been grown by a new farmers in the Block. There are no large-scale irrigation facilities in the Block. A few public ponds are there for the purpose of irrigation. These are mainly to save the Kharif crop from the monsoon failure. These are dried up in the summer. Sometimes, farmers co-operate to set up some lift-irrigation points from the river Baitarani to irrigate the summer crop. But this is casual.

Thus, a major portion of the lands is single cropped. Besides, private efforts have been going on to irrigate the land for double cropping and multiple cropping. Some farmers have been successful in irrigating a portion of their land for double cropping and multiple cropping. In summer they mainly grow high yielding varieties of paddy, summer moong and vegetables.

The agricultural labourers of the Block are mostly from the scheduled castes and other lower castes. The agricultural practices are done by the hired labourers and the family labourers. In case of the higher castes such as Brahmin and Karana the agricultural practices are done mostly by the hired labourers. But in case of castes like Khandayat and scheduled castes the agricultural practices are done mostly by the family labourers. Of course, hired labourers are employed to some extent.The hired labourers are mostly illiterate.

Barring a few gradation on the basis of low and high, the lands of the Block are mostly of the same quality. The lands of the farmers are mostly fragmented.

PROFILE OF THE SAMPLE

The data are collected from 130 farmers of seven villages of the Block. The samples(farmers) are selected in such a way that the cases of extremes such as very small farmers and very big farmers are eliminated. For, in case of these farmers, poverty and richness, the size and quality of holdings etc. determine the access of the farmers to modern technology and better farm practices. The samples well represent farmers of different educational background caste, size of holdings etc. The data are collected from those farmers who are the decision makers of their farming households.

Education of the Respondents

It may be observed from table 2.4 in the appendix that the level of education of the respondent farmers vary from illiteracy to matriculation and above. Out of 130 respondents 23 are illiterates, 53 are with the education level from Class I to class VII, 39 with class VIII to class X. and 15 are with either matriculation or above.

Size of Holdings of the Respondents

Table 2.4 in the appendix shows that out of the 130 respondents 56 are small farmers with land holdings between 1 and 5 acres, 53 are medium farmers with land holdings between 5 and 15 acres, and rest 21 are big farmers with land holdings between 15 to 50 acres. As we indicated earlier, in order to avoid the problem of extremes we have excluded the marginal farmers with less than one acre of land holdings and large farmers with more than 50 acres of land holdings. The percentage of small, medium and big farmers, in the samples are 43, 41 and 16 respectively. 69.6 per cent of the illiterate farmers belong to the category of big farmers and 4 per cent belong to the category of big farmers. Out of the 21 big farmers 14 belong to the educational level of VIII to X.

Structure of Family of the Respondents

Table 2.5 in the appendix shows that 41.5 per cent of the respondents are having nuclear family. The nuclear family consists of wife, husband, the unmarried childrens and in some cases one or both of the parents of the husband. Another 58.5 per cent of the respondents live in the joint family set-up. Joint family consists of the families of the married brothers, unmarried brothers and sisters, and their common parents. More than 50 per cent of the illiterate respondents live in the nuclear family whereas in case of other respondents the percentage is less than 50.

Respondents by Caste

As table 2.6 in the appendix shows, the distribution of the respondents is skewed in favour of the agricultural castes(Khandayats). They constitute 38.4 per cent of the total samples. The percentage of scheduled castes and other lower castes among the illiterate farmers is 56.5 per cent. Share as the percentage of Brahmins and Karanas are 4 and

8.7 respectively. Brahmins constitute 46.6 per cent of the farmers with education matriculation and above whereas the percentage of Karanas and Khandayats are 40 and 13.4 respectively. In the category of farmers with education matriculation above, no scheduled caste farmer is available.

Education Level of the Family members of the respondents

Table 2.7 in the appendix shows the education level of the family members of the respondents. In case of 4 illiterate respondents' families, there is one member with education matriculation or above. In case of another one respondent, there are two or more members with matriculation or above education. The families of 18(78%) illiterate respondents do not have a single matriculate. Out of the families of 130 respondents, in 44 families there is not a single matriculate. In 32 per cent of the families of the respondents with education I to VII, there is not a single matriculate. This percentage is 23 per cent in case of respondents with education VIII to X.

Respondents by the profession of their family members

Table 2.8 in the appendix shows that in the families of 40 per cent respondents not a single person is in service(Government, Public or Private). In case of the families of the illiterate respondents, in 69.6 per cent families there is not a single person in service. This percentage is 35.8 in case of respondents with education I to VII, 41 per cent in case of respondents with education XI and above. In the families of 46.1(39.2 + 6.9) per cent respondents atleast one person is in Government service.

INTERPRETATION OF DATA

Data obtained by analysing the schedules used for field work are presented and interpreted in the form of simple percentages. For example, the sources of information of farmers, the utilization of credit facilities, the use of modern inputs, the innovation in the area etc. by the respondent farmers are presented in the form of simple percentages. The production performances of the respondent farmers in the year 1984-85 are also presented in the form of percentages.

Acquaintance of farmers with the sources of agricultural information

The sources of information among the farmers of the Block are newspaper, radio, television , VLWs, fellow villagers and outsiders. A few farmers also contact Block level extension officers for information on certain agricultural practices. Informations through ICAR implemented extension services viz. National Demonstration, Operational Research Projects, Krishi Vigyan Kendras and the Lab-to-Land Programmes have not spread into the area.

Table 2.9 in the appendix shows the acquaintance of respondent farmers with the sources of agricultural information. The data show that the farmers with increased educational level have more access to newspaper as a source of information. Considering the educational background of the farmers the table divides the respondents into 4 categories. First, the illiterate; second, the respondents with education Class I to Class VII; third, the respondents with education Class VIII to class X; and fourth, the respondents with education Class XI and above. While not a single illiterate respondent is acquainted with newspaper reading, 18.9 per cent of the respondent farmers of the second category, 41 per cent of the third category and 100 per cent of the fourth category are acquainted with newspaper as a source of information. Information through VLWs is the major source of information in the villages. 77.7 per cent of the respondent farmers said that they consult the VLWs for agricultural information. In this case also the table shows that the more the level of education the more the farmers consult the VLWs. 60.8 per cent of the illiterate respondent farmers consult the VLWs whereas 100 per cent of the respondent farmers with education matriculation and above consult the VLWs. The second major source of information in the area is radio. 53.8 per cent of the total respondents listen to radio as a source of information. The percentage of respondents who listen to radio among different categories is also skewed in favour of the educated. In the first category 39.1 per cent, in the second 32 per cent, in the third 24.3 per cent and in the fourth 100 per cent of the respondents listen to radio. Very few respondents use. T.V. as a source of information. Out of the total respondents only 8.5 per cent use TV. It is mostly used by the educated farmers. The fellow villagers are the major source of information for the illiterate farmers. With the increase in education, the fellow villagers as a source of information decline in importance. Information through outsiders is also a source of information. 40.8 per cent of the rrespondents said that they gather information from outsiders. Sometimes, educated farmers and farmers with political influence also contact the extension officer of the Block for information. There is a Government Demonstration Farm in the adjacent Ghasipura Block. Very often, a few educated farmers visit to that farm to gather information.

The above analyses of the table indicate that the educated farmers are most acquainted with the new and improved sources of agricultural information viz. newspaper, radio, T.V. VLWs etc. The illiterates and less educated farmers mostly use the traditional sources of information viz. villagers, outsiders etc. The VLWs as a source of information, are also important for all the categories of farmers. Besides, the educated farmers have more access to the national extension services in comparison to the illiterate ones.

Education level of the farmers and the use of improved qualities of inputs during 1984-85

Table 2.10 in the appendix shows that 27.7 per cent of the respondents irrigate their lands partially by individual efforts. This effort is high in case of educated farmers. But the less educated respondents behave in the same way as the illiterates. 37.7 per cent of the respondents use high yielding varieties, 52.3 per cent use fertiliser, 16.2 per cent use plant protection measures and 11.5 per cent use improved agricultural implements. The use of improved agricultural inputs is more in case of the educated farmers such as the farmers in the third and fourth categories of education(VIII to X and XI and above). Whereas 21.7 per cent of the illiterate respondents and 26.4 per cent of the respondents with education I to VII use improved seeds, 41 per cent of the respondents with education VIII to X and 93.3 per cent of the respondents with education XI and above use improved seeds.

From the analysis of the table 2.10 in the appendix, it is clear that the educated farmers are more accustomed to improved qualities of inputs. The illiterate farmers and the farmers with primary education are less accustomed to it.

Effective utilisation of agricultural credit by the farmers

For the development of agriculture , agricultural credit is provided to the farmers by different agencies. Table 2.11 in the appendix shows that in the year 1984-85, 37.7 per cent of the respondents availed of credit facilities. 30.4 per cent of the illiterate respondents, 28.3 per cent of the respondents with education I to VII, 35.9 per cent of the respondents with education VIII to X and 86.7 per cent of the farmers with education XI and above availed of the credit facilities. 51 per cent of the respondent farmers who availed of the credit facilities used it effectively. 42.9 per cent of the illiterate farmers that availed of the credit used it effectively. In case of the second category of farmers who availed of the credit, 40 per cent used it effectively. This effective utilisation rate stood at 50 per cent for the third category and 69.2 per cent for the fourth category. Thus it is clear from the table that the educated farmers have more access to the developmental credit provided for the agricultural purposes. Further, it is clear that the effective utilisation rate is high in case of the educated farmers(particularly farmers with secondary education and above).

<u>Performance of different farmers in the crop production in 1984-85</u>

In 1984-85, the monsoon was average in the Block. It was not upto the level of 1983-84 which had a very favourable monsoon. Table 2.12 in the appendix shows that 49.2 per cent of the respondent farmers had an average performance, whereas 8.5 per cent had very low performance, 26.9 had low performance, 10 per cent had high performance and 5.4 per cent had very high performance. Not a single illiterate farmer had a very high crop production. 1.9 per cent of the farmers in the second category, 7.7 per cent farmers of the third category and 20 per cent farmers of the fourth category had a very high performance. It is clear from the table that the percentages of illiterate and less educated farmers(education I to VII) in 'very low' and 'low' categories of crop production are high in comparison to the educated farmers. This trend is just the reverse in case of 'high and 'very high' categories of crop production. In these categories the percentage of educated farmers is high in comparison to the percentage of illiterate and less educated farmers. Thus, the educated farmers performed well in comparison to the other farmers in 1984-85.

Innovation by the Farmers in the Area

Innovations have been going on in the area. Farmers have been trying to introduce new crops, new inputs and new farm practices into the area. Table 2.13 in the appendix shows that, between 1982 and 1985, out of the 130 respondent farmers 41 helped in the process of innovation, by innovating something or the other. 17.4 per cent of the illiterate respondents innovated, 20.8 per cent of the farmers with education I to VII innovated, 46.2 per cent of the farmers with education I to VII innovated, 46.2 per cent of the farmers with education VII to X innovated and 53.3 per cent of the farmers with education XI and above innovated. The success rate of the respondent farmers who innovated is 60.9. The success rate of illiterate respondent farmers who innovated is 25 per cent. This rate is, 27.3 per cent in case of respondent farmers with education I to VII , 72.2 per cent in case of respondent farmers with education

VIII to X, and 87.5 per cent in case of respondent farmers with education XI and above. We could make out two things from this table. First, educated farmers are in a better position to innovate. The rate of innovation among them is high in comparison to the others. Second, the educated farmers are better adapted to make the innovation a success.

Besides the above findings, we have observed the operation of certain factors which, some way or the other, influence the performance of agriculture on the area.

(i) The education of the family members exerts certain influence on the performance of the farmers. We found some respondents of the Khandayat Caste with primary education and who live in a joint family. We found differences in the performance of these farmers. Their source of information, level of awareness and degree of absorption of modern agricultural inputs also differ. Among the respondents, the respondents with education, family members are more aware of different schemes for agricultural development. They use more modern inputs and better farm practices. Thus, they are likely to have a better performance in the crop production.

(ii) The profession of the family members also had some influence. On the level of awareness, use of modern inputs and overall performance of the respondents. Other things(viz. cattle, education level, size and nature of holding, family structure) remaining the same, the respondents in whose family atleast one member is in Government service performed well in the farming practices. Their level of awareness and their access to modern inputs and developmental schemes for agriculture are also higher in comparison to the respondents in whose family there is not a single Government employee.

(iii) There is also a difference in the performance of two farmers with similar backgrounds(viz. education level, size of holdings, education level of the family members etc.) but with different caste. We found three respondent farmers of Khandayat caste and two respondent farmers of Brahmin caste with equal level of education. They were similar in their family structure and size and nature of land holdings. They were also in the similar situation with regard to the education and profession of their family members. Though the level of awareness and the use of modern inputs were almost similar in case of these five farmers, the Khandayat farmers performed better in crop production. That might be due to the operation of worker effect. The Brahmin farmers use mainly the hired labourers for the cultivation of land. These hired labourers are mostly illiterate. Besides, the Brahmin farmers do not work in the field as a labourer. Therefore, the hired labourers sometimes do not work sincerely due to the payment of low wages. The Khandayat farmers , even if educated, directly practicipate in the process of cultivation.

(iv) The structure of family also sometimes influences the farmers. Particularly, in the absence of any Government and co-operative effort to protect the crop from cattle and men, the structure of joint family acts as a co-operative to save the crop production from artificial calamities. Other factors viz. caste, education level etc. remaining constant the respondent farmers with joint family background performed better in the crop production in 1984-85 in comparison to the respondent farmers with nuclear family structure. As the holdings of the farmers in the Block are scattered, it needed more loyal persons to watch the growth of the crop and its harvesting.

(v) We observed in the Block that most of the farmers who use modern agricultural inputs get a better yield in comparison to the farmers who use traditional inputs. The profitability of the farmers using modern agricultural inputs is higher in comparison to others, particularly, in case of normal or average monsoon. In case of a monsoon failure, without any alternative irrigation facilities, the loss of these farmers is more in comparison to the farmers using traditional inputs.

A brief note on the findings of the field study:

It is found out from the field study that education has a positive impact on the activities pertaining to agricultural development. The formal education of the farmers made them better suited to receive informal education (viz. education through radio, T.V., newspaper, VLWs etc.) and thereby helped them in acquiring more agricultural informatior Then both the forms of education combined and made the farmers more innovative and more capable of allocating the resources among the different agricultural inputs. This also increased the worker's efficienty, particularly in case of those farmers who engaged themselves directly in the process of cultivation. The formal education of the family members of the farmers provided a positive externality to the farmers by making them aware of modern inputs and developmental schemes for agriculture. It also influenced the farmers in decision making.

The social factors such as caste, structure of family etc had some influence in determining the prosperity of the individual farmer in the Block. Another point to be noted from the study is that the most important sources of agricultural information of the farmers are the agents of informal education (such as radio, T.V., VLOWs, demonstration plots, newspaper). The most important point in the study is related to the monsoon. Irrespective of the educational level and socio-economic background of the farmers, their overall prosperity is dependent on the monsoon. In the year 1984-85 most of the farmers had an average yield (see table 2.12 in the appendix). This happended because the farmers had an average monsoon in that year.

CHAPTER - VI

CONCLUSION

During the post-independence era a new trend has emerged in agriculture which indicates the future prosperity of Indian agriculture. The major factor accountable for this new trend is education. In the course of our study we have found that education through research, has succeeded in modernizing the agricultural inputs and the overall technology. It has played an important role in the increased (technology) absorption capacity of the farmers. It has helped in decreasing the dependency rate in agriculture, particularly, by making people more capable of shifting into other sectors. Moreover, education has influenced all the factors of agricultural production, viz. land, labour, capital and organisation(entrepreneurship).

Some Findings

The impact of education on Indian agriculture in the post-independence era has been positive, though not significant. The various factors of agricultural production have been modernised through improved education and research. The achievements of the agricultural research are:(a) production of more high yielding varieties of seeds for different crops, (b) development of different plant protection measures,(c) development in the management of soil and water viz. soil conservation watershed management etc., (d) production of different improved agricultural implements, (e) production of alternatives to chemical fertilisers viz. biological nitrogen fixation and recycling of agricultural and animal wastes, (f) development of dryland/rainfed farming, and (g) development of different cropping systems for different agro-climatic regions. These products of the research have proved successful in most of the cases.

The development of general education in the post-independence era has increased the percentage of literates and educated in the rural areas. This has enabled rural people to get greater access to different sources of agricultural information.

There has been an improvement in the level of agricultural education in the country. But the improvement has been very slow. The increase in the number of agricultrual colleges and agricultural universities has increased the scope of agricultural research and education. The output of the students of different courses has not increased significantly, particularly, in the seventies. Different centres of advanced studies and agricultural research centres have increased the number of skilled persons to operate different agricultural projects and research institutes.

There has also been an improvement in the nature of extension service. The extension services have been spreading up through out the country, thereby facilitating the transfer of technology. Though there has been an increase in the coverage of extension services, it is yet to reach the grass-root level.

The production and productivity in the post-independence era have increased. But there have been imbalances between the growth of different crops. The crops, in case of which more research have been done, have improved more significantly in terms of production and producitivity. The increase in crop production is mainly due to the increase in the consumption of more improved agricultural inputs. Whereas the production of the improved agricultural inputs is the direct result of the improvement in the education, the absorption of these inputs is dependent on several factors including education.

With other socio-economic factors, education influences the farmers to make them more innovative, allocative and effective. It works as a positive externality to the farmers. The impact of education is more clearly felt with increased level of technology. In India the level of technology and infrastructural facilities are not well developed. Therefore, the impact of education is not felt very clearly. In case the monsoon fails, the educated and uneducated farmers suffer equally.

It is seen that the agricultural production and productivity have improved haphazardly in case of different crops and different regions. Further, the prosperity of agriculture has been dependent more on monsoon than on other factors. All these indicate that there are many more things to be done to distribute the prosperity more or less equally among the different crops and the different regions.

Some Suggestions

In spite of the improvement in technology and infrastructural facilities, the growth rates of agricultural production and productivity have not been very significant in the post-independance period. The importance of agriculture in the Indian economy demands a better performance from it (agriculture). Education alone can not improve the performance of the agriculture. It has to be backed by other socio-economic and political factors. Education has to be geared-up to be more effective and result oriented. It has to work with political and socio-economic factors to find out a better and viable agricultural sector. We have a few suggestions for this:

(i) Area approach has to be given to the agricultural research. All regions and all crops have to be covered in it. The research achievements have to be published in all the regional languages. More research will have to be done on infrastructural facilities to agriculture viz. irrigation, power etc.

(ii) In case of primary education, courses on agricultural activities have to be included in the curricula considering the need of the area. More courses on agriculture have to be added into the text books right from the primary education. Education has to be universalised upto secondary level.

(iii) More informal and non formal education of vocational nature have to be developed for different areas considering the special needs of the areas. Different regional radio and T.V. Centres have to be created to impart agricultural education considering the needs of the area.

(iv) The network of extension education has to be spread all over India. There should be some demonstration plots in every village. More extension workers and officers have to be employed with the latest knowledge regarding the appropriate technology for the area.

(v) The number of agricultural universities and colleges has to be increased covering each micro agro-climatic area. The intake capacity of the universities and colleges has also to be increased significantly with special preference to the students from rural areas.

(vi) Besides, land reforms have to be completed with the assistance of the State, and credit facilities have to be provided.

If all these above suggestions are materialised, then the saying that human factor is an impediment to the agricultural development in India will be a myth. The quality of the human capital will be improved. This improved human capital along with improved technology can make agriculture in India viable and prosperous.

A P P E N D I X

Statistical Tables

Table 1.1 : PERCENTAGE CONTRIBUTION OF AGRICULTURE, FORESTRY AND FISHING TO NET DOMESTIC PRODUCT

Year	Percentage contribution of agriculture, forestry and fishing to NDP
1950-51	56.1
1955-56	54.3
1960-61	51.2
1964-65	46.9
1965-66	42.6
1966-67	41.4
1969-70	43.4
1970-71*	44.7
1971-72*	43.3
1972-73*	40.5
1973-74**	41.7

* Provisional ; ** Quick estimates.

Source: Report of the National Commission on Agriculture, 1976, Part II.

Table 1.2: AREA, PRODUCTION AND YIELD OF PRINCIPAL CROPS
Year relates to crop years (July -June)

Crops		1950-51	1960-61	1970-71	1980-81	1982-83	1983-84
Rice	A	308.10	341.28	375.92	401.52	382.62	409.90
	P	205.76	345.74	422.25	536.31	471.16	597.68
	Y	668	1,013	1,123	1,336	1,231	1,458
Wheat	A	97.46	129.27	182.41	222.79	235.67	243.95
	P	64.62	109.97	238.32	363.13	427.94	451.48
	Y	663	851	1,307	1,630	1,816	1,851
Jowar	A	155.71	184.12	173.74	158.09	163.76	162.63
	P	54.95	98.14	81.05	104.31	107.53	119.34
	Y	353	533	466	660	657	734
Bajra	A	90.23	114.69	129.13	116.57	109.42	118.10
	P	25.95	32.83	80.29	53.43	51.31	76.24
	Y	288	286	622	458	469	646
Maize	A	31.59	44.07	58.52	60.05	57.20	58.88
	P	17.29	40.80	74.86	69.57	65.49	79.24
	Y	547	926	1,279	1,159	1,145	1,346
Cereals (Total)	A	782.30	920.18	1,017.82	1,042.10	1,022.62	1,069.36
	P	424.14	693.14	966.04	1,189.62	1,176.62	1,388.88
	Y	542	753	949	1,142	1,151	1,299
Gram	A	75.70	92.76	78.39	65.84	73.99	73.08
	P	36.51	62.50	51.99	43.28	52.90	47.55
	Y	482	674	663	657	715	651
Pulses (Total)	A	190.91	235.63	225.34	224.57	228.33	234.12
	P	84.11	127.04	118.18	106.27	118.57	126.55
	Y	441	539	524	473	519	541
Foodgrains (Total)	A	973.21	1,155.81	1,243.16	1,266.67	1,250.95	1,303.48
	P	508.25	820.18	1,084.22	1,295.89	1,295.19	1,515.43
	Y	522	710	872	1,023	1,035	1,163
Groundnut	A	44.94	64.63	73.26	68.01	72.15	76.41
	P	34.81	48.12	61.11	50.05	52.82	72.84
	Y	775	745	834	736	732	953
Rapeseed and Mustard	A	20.71	28.83	33.23	41.13	38.27	38.93
	P	7.62	13.47	19.76	23.04	22.07	25.66
	Y	368	467	594	560	577	659
Oilseeds (Total)	A	107.27[1]	137.70[1]	166.44	176.03	177.55	186.95
	P	51.58[1]	69.82[1]	96.30	93.72	99.95	128.14
	Y	481[1]	507[1]	579	532	563	685
Sugarcane	A	17.07	24.15	26.15	26.67	33.58	31.67
	P	570.51	1,100.01	1,263.68	1,542.48	1,895.06	1,770.20
	Y	33,422	45,549	48,322	57,844	56,441	55,904
Cotton (Lint)[2]	A	58.82	76.10	76.05	78.23	78.71	77.65
	P	30.44	56.04	47.63	70.10	75.34	65.82
	Y	88	125	106	152	163	144
Jute[3]	A	5.71	6.29	7.49	9.41	7.34	7.41
	P	33.09	41.34	49.38	65.08	59.46	60.57
	Y	1,043	1,183	1,186	1,245	1,458	1,470
Mesta[4]	A	Not	2.74	3.31	3.59	2.86	2.87
	P	Available	11.29	12.55	16.52	12.25	13.58
	Y		742	684	828	771	850

1. Five major oilseeds; 2. Lakh bales of 170 kg each;
3. Lakh bales of 180 kg each; 4. 1950-51 data relate to jute crop only.
A — Area in lakh hectares; P — Production in lakh tonnes; Y -- Yield in kg per hectare

Source: India 1985, Publication Division, Govt. of India

Table 1.3 : ALL INDIA FOODGRAINS PRODUCTION

(million tonnes)

Year	Production	Triennial averages of foodgrains production*
1949-50	60.8	-
1950-51	55.0	57.13
1951-52	55.6	57.47
1952-53	61.8	63.23
1953-54	72.3	68.27
1954-55	70.7	70.77
1955-56	69.3	70.83
1956-57	72.5	69.47
1957-58	66.6	72.63
1958-59	78.8	74.17
1959-60	77.1	79.40
1960-61	82.3	80.60
1961-62	82.4	81.63
1962-63	80.2	81.17
1963-64	80.6	83.38
1964-65	89.4	80.78
1965-66	72.3	78.64
1966-67	74.2	80.54
1967-68	95.1	87.77
1968-69	94.0	96.19
1969-70	99.5	100.65
1970-71	108.4	104.36
1971-72	105.2	103.54
1972-73	97.0	102.29
1973-74	104.7	100.51
1974-75	99.8	108.51
1975-76	121.0	110.68

Table 1.3 cont...

Year	Production	Triennial averages of foodgrains production*
1976-77	111.2	119.54
1977-78	126.4	123.16
1978-79	131.9	122.67
1979-80	109.7	123.82
1980-81	129.9	123.93
1981-82	133.1	130.80
1982-83	129.5	136.30
1983-84	152.4	142.70
1984-85	146.2	-

* Three-year moving averages.

Source: Indian Journal of Agricultural Economics, 1983, p.476.

Table 1.4 : INDEX NUMBERS OF PRODUCTION AND YIELD OF FOOD-GRAINS NON-FOODGRAINS AND ALL CROPS (1949-50 to 1980-81)
(Base: Triennium ending 1969-70)

Year	Index of Agrl.Prodn.			Index of Yield		
	Food grains	Non-food grains	All Crops	Foodgrains	Non-food grains	All Crop
1	2	3	4	5	6	7
1949-50	63.4	58.8	62.2	79.4	91.7	82.2
1950-51	57.1	62.0	58.5	72.4	87.2	76.0
1951-52	57.7	69.2	59.4	74.2	83.3	76.6
1952-53	63.7	60.6	62.9	79.4	82.4	80.2
1953-54	74.1	62.0	71.6	88.2	89.9	88.6
1954-55	72.5	71.4	72.2	85.4	93.0	87.3
1955-56	72.6	70.1	71.0	82.9	86.7	83.9
1956-57	75.9	77.2	76.2	85.0	91.1	86.5
1957-58	68.8	76.1	70.8	78.8	90.9	81.7
1958-59	82.1	82.5	82.2	89.9	96.7	91.6
959-60	80.4	79.6	80.1	86.2	90.2	87.4
960-61	86.1	88.1	86.7	93.1	97.3	94.4
961-62	86.8	86.9	86.8	92.1	92.3	92.2
962-63	83.8	88.6	85.3	87.5	94.8	89.8
963-64	85.3	91.3	87.2	89.4	96.5	91.6
964-65	94.3	102.5	96.9	98.1	103.4	99.8
965-66	75.8	91.3	80.8	81.4	90.0	84.3
966-67	77.1	88.5	80.7	82.6	91.0	85.3
967-68	98.7	99.0	98.9	99.9	101.4	100.4
968-69	97.3	97.4	97.3	98.2	98.4	98.3
969-70	104.0	103.6	103.8	101.9	100.4	101.6
970-71	112.9	108.6	111.5	109.9	105.1	108.4
971-72	111.4	110.9	111.2	107.8	107.0	107.6
972-73	102.3	102.1	102.2	101.4	100.1	101.0

Table Cont..

Table 1.4 cont...

1	2	3	4	5	6	7
1973-74	110.3	117.0	112.4	105.0	109.2	106.3
1974-75	104.3	118.3	108.8	102.2	109.5	104.6
1975-76	127.2	119.8	124.8	117.2	112.0	115.6
1976-77	115.7	117.8	116.4	109.1	109.3	109.2
1977-78	133.6	130.9	132.7	122.1	114.5	119.6
1978-79	139.3	134.5	137.8	125.5	115.4	122.2
1979-80	114.8	122.3	117.2	106.2	110.6	107.6
1980-81	137.6	130.1	135.2	127.0	116.2	123.5

Source: Indian Agriculture in Brief, Government of India.

Table 1.5 : COMPOUND GROWTH RATES OF AGRICULTURAL PRODUCTION

I Period : 1967-68 to 1975-77
II Period : 1976-77 to 1983-84

(percent per annum)

Items	Area		Productivity		Production	
	I	II	I	II	I	II
All crops	0.5	0.3	1.3	2.3	2.3	3.0
All cereals	0.3	0.4	1.9	2.9	2.2	3.2
Rice	0.7	0.3	1.0	2.3	2.0	2.6
Wheat	3.2	1.8	2.5	4.1	5.8	6.0
All pulses	0.8	Neg.	-1.3	0.9	0.5	0.9
All oilseeds	0.6	1.6	2.3	2.9	2.9	4.5
Sugarcane	2.8	1.3	0.5	1.2	3.4	2.5
Cotton	-0.6	0.9	3.0	0.2	2.3	1.1
Jute	-1.9	-0.5	1.4	2.5	0.1	1.9

Source: Economic Survey, 1984-85, p.12.

Table 1.6 Compound Growth Rates of Production of Major Foodgrain and Non-Foodgrain Crops: All-India

Crops	Periods of triennial averages with central years from							
	1950-51 to 1960-61	1960-61 to 1970-71	1970-71 to 1980-81	1950-51 to 1980-81	1968-69 to 1980-81	1968-69 to 1975-76	1970-71 to 1975-76	1975-76 to 1980-81
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rice	3·71*	1·75*	2·34*	2·46*	2·12*	1·20*	1·00	2·31*
Jowar	2·83*	0·14	4·26*	1·27	2·70*	0·71	5·00*	1·93
Bajra	2·22*	5·29*	—1·82*	2·19*	—0·97	—0·82	—3·86*	—1·29
Maize	3·90*	4·36*	0·37	2·87*	0·12	0·42	0·67	—0·46
Wheat	4·81*	9·92*	4·70*	6·03*	5·02*	4·46*	2·12	5·16*
Gram	5·34*	—1·25	0·78	—0·13	—0·89	—1·59	—1·18	—5·45*
Tur	—0·83	0·96	0·94	0·008	0·60	—0·10	0·49	0·39
Total foodgrains	3·32*	2·52*	2·41*	2·51*	2·24*	1·45*	1·19	1·90*
Groundnut	5·11*	0·88	0·88	2·05*	1·06*	1·01	0·27	0·28
Cotton	4·48*	0·85	2·86	2·43*	2·86*	2·71*	2·24*	4·35*
Jute	1·99*	1·09	1·87*	1·20*	1·90*	0·26	—0·02	6·69*
Sugarcane (*gur*)	4·87*	2·49*	2·64*	3·15*	2·35*	2·72*	3·83*	—0·07

*Statistically significant at 5 per cent level.

Source: Indian Journal of Agricultural Economics, 1983, p.479.

Table 1.7: PROGRESS OF SELECTED PHYSICAL AGRICULTURAL DEVELOPMENT PROGRAMMES

Programme	Unit	1970-71	1975-76	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86 (Target)
1	2	3	4	5	6	7	8	9	10	11	12	13
High Yielding Varieties												
Paddy	Million hectares	5.59	12.44	16.12	16.88	15.99	18.23	19.69	18.84	21.74	23.44	26.50
Wheat	,,	6.48	13.46	15.80	15.89	15.03	16.10	16.75	17.84	19.39	19.58	19.50
Maize	,,	0.46	1.13	1.24	1.35	1.35	1.60	1.60	1.72	1.91	2.06	2.20
Jowar	,,	0.80	1.96	3.14	3.07	3.05	3.50	3.88	4.37	5.28	5.09	5.30
Bajra	,,	2.05	2.90	2.63	2.94	2.96	3.64	4.57	4.71	5.42	5.25	5.30
Total HYP . . .	,,	15.38	31.89	38.93	40.13	38.38	43.07	46.49	47.48	53.74	55.42	58.80
Irrigated Area . . . (cumulative utilisation)	,,	38.0	45.3	48.5	50.6	52.6	54.1	56.0	58.1	58.6	60.5	62.2
Through Major & Medium . . .	,,	17.3	20.1	21.2	22.0	22.6	22.7	23.2	24.0	24.6	25.3	25.9
Minor*	,,	20.7	25.2	27.3	28.6	30.0	31.4	32.8	34.2	34.0	35.2	36.3
Soil conservation (cumulative level at the end of the year)	,,	12.11	19.96	21.70	22.57	23.40	24.37	25.39	26.52	27.98	29.38	30.48
Consumption of Chemical Fertilisers :												
Nitrogenous . .	Million tonnes	1.49	2.15	2.91	3.42	3.50	3.68	4.07	4.22	5.21	5.49	6.35
Phosphatic . . .	,,	0.46	0.46	0.87	1.11	1.15	1.21	1.32	1.44	1.73	1.88	2.20
Potassic	,,	0.23	0.28	0.51	0.59	0.61	0.62	0.67	0.73	0.77	0.84	1.00
Total NPK . . .	,,	2.18	2.89	4.29	5.12	5.26	5.52	6.06	6.39	7.71	8.21	9.55

*The figures for minor irrigation indicate the net benefit after allowing for seepage.

Source: Economic Survey 1985-86, Government of India

Table 1.8 : PROGRESS IN USE OF AGRICULTURAL INPUTS

Programme	Unit	1950-51	1979-80	1980-81	1981-82	1982-83 Target	1982-83 Ant. Ach.	1983-84 Target	1984-85 Target
I. Consumption of Chemical Fertilizers									
Nitrogenous (N)	Lakh tonnes	0.55	34.98	36.78	40.69	46.7-48.0	42.63	48.0	60.0
Phosphatic (P)	"	0.08	11.51	12.14	13.22	15.3-15.7	14.20	16.0	23.4
Potassic (K)	"	0.06	6.07	6.24	6.73	8.0- 8.3	7.35	8.0-	13.1
Total (N+P+K)	"	0.69	52.56	55.16	60.64	70.0-72.0	64.18	72.0	96.5
II Consumption of Pesticides									
Technical Grade material	'000 tonnes	2.35	60.0	53.3	61.2	72.0	61.0	72.0	80.0
III High Yielding Varieties Programme									
Paddy	Million ha	0.89*	15.99	18.23	19.69	22.50	18.67	22.5	25.0
Wheat	"	0.54*	15.03	16.10	16.75	18.00	18.07	18.2	19.0
Jowar	"	0.19*	3.05	3.50	3.88	4.50	4.75	4.8	5.0
Bajra	"	0.06*	2.96	3.64	4.58	4 00	4.45	4.7	5.0
Maize	"	0.21*	1.35	1.58	1.60	2.00	1.74	1.8	2.0
Total	"	1.89*	38.38	43.05	46.50	51.00	47.68	52.0	56.0
IV. Soil Conservation	Million ha.	—	23.40	24.37	25.41	26.60	26.52	27.56	30.50
V. Distribution of Certified Seeds	Lakh Qtls.	—	14.0	25.0	29.8	—	42.0	—	54.0

*—Relates to 1966-67

Source: Annual Report 1982-83, Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India

Table 1.9 : PROGRESS IN THE USE OF INPUTS

	1960-1961	1970-1971	1980-1981	1983-1984
1. Irrigated area, cumulative utilisation (million hectares)	-	38	55	61
2. Area under High yielding varieties (million hectares)	-	15	43	52
3. Soil conservation (million hectares)	1.6	13.4	24.4	27.9
4. Distribution of quality seed (lakh quintals)			25	58
5. Fertilizer consumption (NPK) Total (million tonnes)	0.3	2.2	5.5	7.7
per hectare (Kgs.)	2	13	32	45
6. Consumption of pesticides (thousand tonnes)	8.6	24.3	45.0	72.0
7. Co-operative credit disbursed (Rs.crores)	214	679	2,112	2,939

Source: Government of India, Ministry of Agriculture, Annual Report (1984-85).

Table 1.10 : Some Key Indicators of Agricultural Progress

Item	*Unit*	*1950-51*	*1960-61*	*1970-71*	*1980-81*	*1983-84*	*1984-85*[1]
I. *Foodgrains Production*							
(*i*) Rice	m. tonnes	20.6	34.6	42.2	53.6	59.8 (Record)	59.5—60.5
(*ii*) Wheat	—do—	6.5	11.0	23.8	36.3	45.1 (Record)	46.0
(*iii*) Total cereals	—do—	42.4	69.3	96.6	119.0	138.9 (Record)	136.0
(*iv*) Pulses	—do—	8.4	12.7	11.8	10.6	12.6	12.5
(*v*) Total Foodgrains	—do—	50.8	82.0	108.4	129.6	151.5 (Record)	148.5—150.5
II. *Non-food crops*							
(*i*) Oil seeds	lakh tonnes	51.6[2]	69.8[2]	96.3	93.7	128.1	130.0
(*ii*) Sugarcane	m. tonnes	57.0	110.0	126.4	154.2	177.2	175.0
(*iii*) Cotton (Lint)	lakh bales	30.4	56.0	47.6	70.1	65.8	78.0
(*iv*) Jute	—do—	33.1	41.3	49.4	65.1	60.6	64.4
III. *Inputs*							
(a) *Seeds*							
(*i*) Production of Certified seed	lakh qtls	—	—	—	21.9	53·8	85.0
(*ii*) Distribution of quality seed	lakh qtls	—	—	—	25.0	57.7	70.4
(*b*) *Fertilizer Consumption (NPK)*							
(*i*) Total	lakh tonnes	0.7	2.9	21.8	55.2	77.1	84.0
(*ii*) Per hectare	kgs	Neg.	1.9	13.1	31.8	44.6	48.4
(*c*) Area under high yielding varieties	m. hectares	—	1.9[3]	15.4	43.1	52.5	56.0

1. Anticipated achievement.
2. Covers five major oilseeds, viz., Groundnut, Rapeseed and Mustard, Castorseed, Sesamum and Linseed.
3. Relates to 1966-67.

SOURCE : Compiled from Ministry of Agriculture, *Annual Report (1984-85)*.

Table 1.11

All India Coordinate Research Projects

(i) food crops
1. rice
2. wheat
3. barley
4. maize
5. sorghum
6. millets
7. pulses
8. forage crops

(ii) commercial crops
1. sugarcane
2. sugarbeet
3. cotton
4. jute
5. oilseeds
6. soyabean
7. tobacco

(iii) horticulture crops
1. fruits
2. tuber crops
3. potato
4. vegetables
5. medicinal and aromatic plants
6. floriculture
7. spices and cashewnut
8. coconut and arecanut

(iv) soils, agronomy and agricultural engineering
1. water management and soil salinity and new cropping pattern
2. use of saline water
3. water management in high rainfall areas and temperate
4. correlation of soil test with crop responses
5. micronutrient research
6. measurement evaluation and improvement of soil structure
7. microbiological decomposition and recycling urban and rural wastes
8. dry farming research
9. agronomic research
10. operational research (including national demonstration and integrated pest control project)
11. research and development of farm machinery, implements, production of prototypes and their evaluation
12. optimisation of ground water utilisation through open wells and pumps
13. energy requirements in IAP Programme
14. post harvest technology

Source: Report of the National Commission on agriculture, 1976, Part XI.

Table 1.12

ICAR Institutes

1. Indian Agricultural Research Institute, New Delhi-12 (1905) (IARI)
2. National Dairy Research Institute, Karnal (1955) (NDRI)
3. Central Inland Fisheries Research Institute, P.O. Barrackpore, (W.B.) (1947) (CIFRI)
4. Central Rice Reseach Institute, Cuttack-6 (Orissa) (1946) (CRRI)
5. Jute Agricultural Research Institute, Barrackpore (W.B.) (1948) (JARI)
6. Indian Institute of Horticultural Research, Bangalore, (Karnataka) (1967) (IIHR)
7. Jute Technological Research Laboratory, Calcutta-40 (W.B.) (1938) (JTRL)
8. Indian Lac Research Institute, Ranchi (Bihar) (1925) (ILRI)
9. Central Sheet & Wool Research Institute, Avikanagar, Malpura (Rajasthan). (1962) (CSWRI)
10. Cotton Technological Research Laboratory, Matunga, Bombay-19 (Maharashtra) (1924) (CTRL)
11. Indian Veterinary Research Institute, Izatnagar (U.P.) (1890) (IVRI)
12. Central Arid Zone Research Institute, Jodhpur (Rajasthan) (1957) (CAZRI)
13. Central Institute of Fisheries-Technology, Cochin-11 (Kerala) (1957) (CIFT)
14. Central Potato Research Institute, Simla (H.P.) (1949) (CPRI)
15. Central Plantation Crops Research Institute, Post Kudlu, Kasargod (Kerala) (1947). (CPCRI)
16. Central Soil Salinity Research Institute, Karnal (Haryana) (1969) (CSSRI)
17. Indian Grassland & Fodder Research Institute, Jhansi (U.P.) (1962) (IGFRI)
18. Central Tuber Crops Research Institute, Trivandrum-10 (Kerala) (1963) (CTCRI)
19. Institute of Agricultural Research Statistics, New Delhi-12 (1959) (IARS)
20. Sugarcane Breeding Institute, Coimbatore-7 (Tamil Nadu) (1912) (SBI)
21. Central Marine Fisheries Research Institute, Jyoti Buildings, Ernakulam, Cochin-11 (Kerala) (CMFRI) (1947)
22. Indian Institute of Sugarcane Research, Rae-Bareli Road, Lucknow (U.P.) (1952). (IISR)
23. Central Tobacco Research Institute, Rajamundry (A.P.) (CTRI) (1947)
24. Vivekananda Laboratory for Hill Agriculture, Almora (U.P.) (VL)
25. Directorate of All India Soil and Land Use Survey, Nagpur (Maharashtra) (AISLUS)
26. Central Soil and Water Conservation Research & Training Institute Dehra Dun (U.P.) (1954) (CSWCRTI).
27. ICAR Research Complex, Shillong (Meghalaya).

New Institutes in the Fifth Plan

28. National Bureau of Plant Introduction.
29. Central Institute for Cotton Research, Nagpur.
30. Central Institute for Agricultural Engineering, Bhopal.

Source: Report of the National Commission on agriculture, 1976, Part XI.

Table 1.13

Agricultural Universities

1. Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (U. P.).
2. Punjab Agricultural University, Ludhiana.
3. University of Udaipur, Udaipur (Rajasthan).
4. Orissa University of Agriculture and Technology, Bhubaneswar (Orissa).
5. Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad.
6. University of Agricultural Sciences, Hebbal, Bangalore-24.
7. Jawaharlal Nehru Krishi Vishwa Vidyalala, Jabalpur.
8. Bidhan Chandra Krishi Vishwa Vidyalaya, Haringhata, Kalyani (West Bengal).
9. Konkan Krishi Vidyapeeth, Dapoli (Maharashtra).
10. Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra).
11. Punjabrao Krishi Vidyapeeth, Akola (Maharashtra).
12. Assam Agricultural University, Jorhat-4.
13. Haryana Agricultural University, Hissar.
14. Rajendra Agricultural University, Dholi, Pusa (Bihar).
15. Kerala Agricultural University, Mannuthy (Kerala).
16. Himachal Pradesh University (Agricultural Complex), Simla.
17. Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu).
18. Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra).
19. Gujarat Agricultural University, Ahmedabad-4.
20. *Indian Agricultural Research Institute, New Delhi-12.
21. Chander Shekar Azad University of Agriculture & Technology, Kanpur (U.P.).
22. Narendra Deva-Avam Prodyogik Vishwa Vidyalaya, Faizabad (U.P.).

Source: Report of the National Commission on agriculture, 1976, Part XI.

Table 1.14

Organisations other than Agricultural Universities and ICAR Institutes engaged in Agricultural Research†

1. Agra University, Agra
2. Aligarh Muslim University, Aligarh
3. Annamalai University, Annamalainagar
4. Delhi University, Delhi
5. Banaras Hindu University, Varanasi
6. Osmania University, Hyderabad
7. Kurukshetra University, Kurukshera
8. Lucknow University, Lucknow
9. Kanpur University, Kanpur
10. Punjab University, Chandigarh
11. Meerut University, Meerut
12. University of Rajasthan, Jaipur
13. Bombay University, Bombay
14. Madras University, Madras
15. Calcutta University, Calcutta
16. Gorakhpur University, Gorakhpur
17. Gujarat University, Ahmedabad
18. Guru Nanak University, Amritsar
19. Shri Venkateswara University, Tirupati
20. Viswa-Bharati University, Santiniketan
21. Burdwan University, Burdwan
22. Sardar Patel University, Vallabh Vidyanagar
23. J. K. University, Srinagar
24. Allahabad University, Allahabad
25. Allahabad Agricultural Institute, Allahabad
26. Saurashtra University; Rajkot
27. Gauhati University, Assam
28. Victoria Jubilee Technical Institute, Matunga
29. Central Leather Research Institute, Madras
30. Haffkine Institute, Bombay
31. Birla Institute of Technology & Science, Pillani
32. Sheila Dhar Institute, Allahabad
33. Bose Institute, Calcutta
34. Indian Institute of Technology, Kharagpur
35. Oil Technological Research Institute, Anantapur
36. Sri Ram Institute of Industrial Research, New Delhi
37. Commonwealth Institute of Biological Control, Bangalore
38. Harcourt Butler Technological Institute, Kanpur
39. S. B. Garda College & B. P. Bria Science Institute, Navsari
40. Kulbhaskar Ashram Degree College, Allahabad
41. Bara Joint Cooperative Society Ltd., Nasirpur
42. Mehsana District Cooperative Milk Producers Union Ltd., Mehsana
43. Maharashtra Association for the Cultivation of Science, Poona.

† The list does not claim to be exhaustive.

Table 1.14(Contd.)

44. Agricultural Institute, American Arcot Mission, Katpadi
45. National Dairy Development Board, Anand
46. Gokhale Institute of Politics & Economics, Poona.
47. Indian Institute of Management, Ahmedabad
48. Indian Statistical Institute, Calcutta
49. Forest Research Institute, Dehra Dun
50. Central Food Technological Research Institute, Mysore.
51. National Botanical Gardens, Lucknow
52. Central Indian Medicinal Plants Organisation, Lucknow
53. Regional Research Laboratory, Jammu
54. Regional Research Laboratory, Jorhat
55. Textile Industries Research Associations, Ahmedabad, Bombay, Coimbatore
56. Silk and Art Silk Mills' Research Association, Bombay
57. Tea Research Association, Calcutta
58. Wool Research Association, Bombay
59. Indian Jute Industries Research Association, Calcutta
60. Fertiliser Corporation of India, Units at Sindri, Trombay, Durgapur
61. Taraporevala Marine Biological Research Station, Bombay
62. Nutrition Research Laboratories, Tarnaka, Hyderabad
63. K. P. Jayaswal Research Institute, Museum Buildings, Patna
64. Agri-Horticultural Society of India, Calcutta
65. Institute of Jute Technology, Calcutta
66. Birbal Sahni Institute of Ralaeobotany, Lucknow

Source: Report of the National Commission on agriculture, 1976, Part XI.

Table 1.15

English

1. Oedogoniales
2. Insect Physiology and Anatomy
3. Annual Report 1980-81, Department of Agricultural Research and Education
4. Annual Report 1979-80 of the ICAR (Part II : Administration and Finance)
5. ICAR Research Highlights 1980
6. Annual Report 1978-79 of the All-India Co-ordinated Project on National Demonstrations
7. Summary of the Annual Report 1978-79 of the All-India Co-ordinated Project on National Demonstrations
8. Management of Agricultural Research
9. Country Report on Plan of Action to Combat Desertification
10. Guidelines for Entire Farming System Demonstration
11. Schedule for Entire Farming System Demonstration
12. Revised General Guidelines for the Formulation, Processing, Scrutiny, Sanction and Implementation of Research Schemes
13. Bacterial Fertilizers
14. Viral and Virus-Like Diseases of Crops and their Control
15. Cotton
16. Proceedings of the Seminar on Agro-Forestry

Hindi

1. DARE Varshik Report 1980-81
2. Baune Gehun ki Kheti
3. Resha Faslon ke Keet
4. Chare ki Faslen aur Beej

5. Jeevanu Urvarak
6. Van aur Manav
7. ICAR Varshik Report 1979-80 (Part II—Administration and Finance)
8. Krishi Anusandhan ke Badhate Charan 1980
9. Murgi Prajanan
10. Mishrit Machhli Palan
11. Paltu Pashu Pakhsion ki Keet Vyadhian
12. Baune Dhan ki Kheti
13. Sag Tarkarion ke Liye Khad

Publications likely to be released by March 1982

English

1. Volvocales
2. Research in Animal Production
3. Fruit Drop and its Control in Mango and Citrus
4. Bee-Keeping in India
5. Cannas
6. Home Gardening
7. A History of Agriculture in India—Volume II
8. Proceedings of International Symposium on Agricultural Research and Education Systems
9. Rinderpest
10. Growth of Agricultural Education
11. Handbook for Summer Institutes—Norms and Operational Guidelines

Hindi

1. Jal Prabandh
2. Tilhan ki Kheti
3. Sankar Makka
4. Aaloo ke Vishanu Rog
5. Pashuon mein Kshaya Rog ka Nidan
6. Gulab
7. Phal Vigyan

Source: Report 1981-82, Government of India Department of Agricultural Research and Education Ministry of Agriculture, New Delhi.

Table 1.16

DISTRICTS HAVING NATIONAL DEMONSTRATION PROJECTS

Implementing Agency	District (1980-1985)
1	2
1. Andhra Pradesh Agricultural University Rajendranagar, Hyderabad, Andhra Pradesh	Vizianagram Cuddapah, Medak
2. Assam Agricultural University, Jorhat, Assam .	Sibsagar
3. Rajendra Agricultural University, Patna, Bihar .	Bhagalpur Ranchi Samastipur
4. Gujarat Agricultural University, Ahmedabad, Gujarat	Banaskantha
5. Haryana Agricultural University Hissar, Haryana.	Jind Bhiwani
6. Himachal Pradesh Krishi Vishwa Vidyalaya, Palampur, Himachal Pradesh . . .	Chamba Sirmur
7. Department of Agriculture, Jammu and Kashmir.	Baramula Rajouri
8. University of Agricultural Sciences, Hebbal, Bangalore, Karnataka	Bellary Bijapur Mangalore
9. Kerala Agricultural University, Mannuthy, Trichur, Kerala	Trichur Palghat
10. Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur, Madhya Pradesh	Chhindwara Balaghat
11. Punjabrao Krishi Vidyapeeth, Akola, Maharashtra	Bhandra Nagpur Chandrapur
12. Marathwada Krishi Vidyapeeth, Parbhani Maharashtra	Bhir
13. Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra	Dhule
14. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra.	Ratnagiri
15. Orissa University of Agriculture and Technology, Bhubaneswar, Orissa	Keonjhar Mayurbhanj
16. Punjab Agricultural University, Ludhiana, Punjab.	Gurdaspur Sangrur
17. Udaipur University Udaipur, Rajasthan	Jaipur Bharatpur Udaipur

Table 1.16 Cont..

1	2
18. Tamil Nadu Agricultural University Coimbatore, Tamil Nadu	North Arcot
19. Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Uttar Pradesh	Kanpur Unnao
20. Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttar Pradesh	Bareilly Budaun
21. Narendra Dev University of Agriculture and Technology Faizabad, Uttar Pradesh	Sultanpur Pratapgarh
22. Bidhan Chandra Krishi Vishwa Vidyalaya Kalyani, West Bengal	Nadia Purulia
23. Department of Agriculture, Goa, Daman and Diu, Panaji	Panjim
24. Department of Agriculture Pondicherry	Pondicherry

Source: Report 1981-82, Government of India Department of Agricultural Research and Education Ministry of Agriculture, New Delhi.

Table 1.17

OPERATIONAL RESEARCH PROJECTS

A. Operated by Agricultural University and State Governments

Name of the Project and Location	Implementing Agency
1	2
1. Operational Research Project (ORP) for reclamation of saline and alkaline soils and demonstrating the effect of drainage in Kapurthala district in Punjab	Punjab Agricultural University, Ludhiana
2. ORP in Puri district in Orissa for stepping up production of groundnut, cereals and pulses in acid soils alongwith animal production	Orissa University of Agriculture and Technology, Bhubaneswar
3. ORP at Chittorgarh district in Rajasthan for stepping up production of oilseeds, cereals and animal husbandry production	University of Udaipur, Udaipur
4. ORP for transforming rural economy through technological changes in Sewagram-paunar area in Wardha district in Maharashtra	Punjabrao Krishi Vidyapeeth, Akola
5. ORP for stepping up production of cotton, cereals, pulses and animal husbandry in Amravati district in Maharashtra	Do.
6. ORP with complete farming system around jowar with special emphasis on areas endemic to white-grubs in Nanded district in Maharashtra	Marathwada Agricultural University, Parbhani
7. ORP on Pulses in Mohindergarh district in Haryana	Haryana Agricultural University, Hissar
8. ORP on Adhaura Area Rohtas district in Bihar	Rajendra Agricultural University, Bihar
9. ORP on integrated Control of cotton pests in Ludhiana district, Punjab	Punjab Agricultural University, Ludhiana
10. ORP on integrated Control of Rice pests in Andhra Pradesh (Bapatla and Warrangal); Kerala (Kuttanad); Madhya Pradesh (Raipur) Maharashtra (Thana and Kolaba); Orissa (Cuttack); and West Bengal (Hooghly)	Andhra Pradesh Agricultural University and Department of Agriculture, Andhra Pradesh; Kerala , Agricultural University and Department of Agriculture, Kerala; Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur and Department of Agriculture, Madhya Pradesh; Mahatma Phule Krishi Vidyapeeth,

Table 1.17 Cont...

1	2
	Dapoli and Department of Agriculture, Maharashtra; Orissa University of Agriculture and Technology, and Department of Agriculture, Orissa; Bidhan Chandra Krishi Vishwa Vidyalaya, Kalyani
11. ORP on Rice in Burdwan district . .	Department of Agriculture, Calcutta, West Bengal
12. ORP in *diara* land, Monghyr district, (Cess Fund)	Rajendra Agricultural University, Bihar
B. Operated by ICAR Institutes	
1. Operational Research Project (ORP) on integrated milk and crop production for increased productivity, employment and farm income in villages around Karnal	National Dairy Research Institute, Karnal
2. ORP for the reclamation of alkali soils .	Central Soil Salinity Research Institute, Karnal
3. ORP for integrated land-use planning for coconut, palm, cashewnut, arecanut and other plantation crops	Central Plantation Crops Research Institute, Kasargod, Kerala
4. ORP in root-wilt-affected area, Krishna Puram, NES Block, Ochira, Quilon district	Central Plantation Crops Research Institute, Kasargod, Kerala.
5. ORP for stepping up production of seed potato and other crops grown in Shillong and Patna	Central Potato Research Institute, Simla
6. ORP on arid-land management . . .	Central Arid Zone Research Institute, Jodhpur
7. ORP on drip and sprinkler method of irrigation in Rajasthan	Central Arid Zone Research Institute, Jodhpur
8. ORP for stepping up production of Jute, mesta, other agricultural crops and fisheries	Jute Agricultural Research Institute, Barrackpore
9. ORP for stepping up crop and fish production in Sunderbans area (West Bengal)	Central Soil Salinity Research Institute, Karnal
10. ORP on Sheep and Wool Development .	Central Sheep and Wool Research Institute, Avikanagar, Malpura

Table 1.17 Cont...

1	2
11. ORP on integrated control of cotton pests in Coimbatore district in Tamil Nadu	Central Institute of Cotton Research, IARI Regional Station, Coimbatore
12. ORP on composite Fish culture . . .	Central Inland Fisheries Research Institute, Barrackpore
13. ORP on livestock and fodder improvement in district Bareilly	Indian Veterinary Research Institute, Izatnagar
14. ORP on rice in Cuttack, Nalgonda . .	Central Rice Research Institute, Cuttack ; All India Co-ordinated Rice Improvement Project, Hyderabad
15. ORP on integrated control of pests in rice in Andhra Pradesh (Warrangal) and Orissa, (Cuttack)	All-India Co-ordinated Rice Improvement Project Hyderabad and Central Rice Research Institute, Cuttack,
16. ORP for maximising lac production in Chhota Nagpur Area (Bihar)	Indian Lac Research Institute, Namkum, Ranchi
17. ORP on mariculture	Central Marine Fisheries Research Institute, Cochin, Kerala
18. ORP on lift irrigation and water management in foot-hills of Nagaland	ICAR Research Complex, Shillong, Indian Agricultural Research Institute, New Delhi

Source: Report 1981-82, Government of India Department of Agricultural Research and Education Ministry of Agriculture, New Delhi.

Table 1.18: Number of collegis, student admission and output in different Agricultural Engineering courses in India during 1973-74, 1979-80.

Year	B.Sc.(Agricultural Engineering) No. of colleges	Admission	Output	M.Sc.(Agricultural Engineering) No. of colleges	Admission	Output
1973-74	10	424	303	4	56	44
1974-75	10	413	299	4	45	33
1975-76	10	423	304	4	105	37
1976-77	10	358	243	4	62	22
1977-78	10	316(8*)	233	4	31(2*)	15
1978-79	10	-	-	4	-	-
1979-80	10	377	233	4	44	13

* Data available for °

Source: Indian Agriculture in Brief, 1973-74 to 1982-83, Ministry of Agriculture, New Delhi.

Table 1.19: Literacy rates

(No. of literates to 1000 persons)

Year / States	1981	1971	1961	1951
Andhra Pradesh	298 (29.94)	246 (24.57)	246	132
Assam	.. (30.63) *	287	330	183
Bihar	260 (26.20)	199 (19.44)	218	122
Gujarat	438 (43.70)	358 (35.79)	362	230
Haryana	358 (36.14)	269 (26.84)	241	...
Himachal Pradesh	419 (42.48)	320 (31.96)	249	77
Jammu & Kashmir	262 (26.67)	186 (18.58)	130	---
Karnataka	384 (38.46)	315 (31.52)	298	193
Kerala	692 (70.42)	604 (60.42)	551	407
Madhya Pradesh	278 (27.87)	221 (22.14)	205	98
Maharashtra	474 (47.18)	392 (39.18)	351	209
Manipur	426 (41.35)	329 (32.91)	360	114
Meghalaya	332 (34.08)	295 (29.49)	-	-
Nagaland	420 (42.57)	274 (27.40)	204	104
Orissa	341 (34.23)	262 (26.18)	252	158
Punjab	407 (40.86)	337 (33.67)	315	152
Rajasthan	240 (24.38)	191 (19.07)	181	89
Sikkim	339 (34.05)	177 (17.74)	142	73
Tamil Nadu	458 (46.76)	395 (39.46)	364	208
Tripura	418 (42.12)	310 (30.98)	243	155
Uttar Pradesh	274 (27.16)	217 (21.70)	207	108
West Bengal	409 (40.94)	332 (33.20)	345	240
<u>Union Territories</u>				
Andaman & Nicobar island	513 (51.56)	436 (43.59)	401	258
Arunachal Pradesh	201 (20.79)	113 (11.29)	479	-

Table Contd...

Table 1.19 cont...

Year States/UTs	1981	1971	1961	1951
Chandigarh	647(64.79)	616(51.56)	551	-
D & N Haveli	266(26.67)	150(14.97)	116	40
Delhi	611(61.54)	566(56.61)	620	384
Goa Daman & Diu	559(56.66)	448(44.75)	349	229
Lakshadweep	547(55.07)	437(43.66)	272	152
Mizoram	595(59.88)	- (53.79)	-	-
Pondicherry	542(55.85)	460(46.02)	437	-
All India	361(36.23)	295(29.5)	283 (28.3)	166(a) (16.6)

Figures in ( ) are percentages

(a) Excluding J & K, D & N Haveli, Goa, D&D, Pondicherry.

Source: Statistical Abstract India 1982.
State Profiles of Literacy and Adult Education Programme, Ministry of Education, Government of India, 1985.

Table:2.1 Agricultural Productivity in Orissa (District Wise)

(Productivity in Rs. at constant price Base 1973)

Name of the Districts	1970-73 Rs./hectare	1977-80 Rs./hectare
Balasore	2738	2108
Bolangir	1787	1935
Cuttack	2065	2462
Dhenkanal	2691	2269
Ganjam	2115	1628
Kalahandi	1746	1680
Keonjhar	1894	1874
Koraput	1571	1918
Mayurbhanj	1879	2220
Phulbani	2374	1956
Puri	2235	1683
Sambalpur	2383	2359
Sundargarh	1657	1900
ORISSA	2088	2022

Source: The table is computed from the data available in Statistical Abstract of Orissa 1970 to 1981, Govt. of Orissa, Bhubaneswar & Weekly Price Bulletin, Food and Civil Supplies, Cuttack, Orissa.

Table : 2.2 Literacy rate in Different Districts and Anandapur Tahsil in Orissa. Rural and Urban Literacy of Different Districts and Anandapur Tahasil. Male and Female Literacy in Different Districts and Anandapur Tahasil.

Name of the District and the Tahasil	Over all Literacy	Male Lite-acy	Famale Literacy	Rural Literacy	Urban Literacy
Balasore	41.84	55.07	28.32	41.19	49.12
Bolangir	25.78	39.92	11.54	23.45	48.91
Cuttack	45.33	58.00	32.30	43.58	60.53
Dhenkanal	36.70	51.40	21.39	34.95	57.26
Ganjam	30.78	45.15	16.87	27.29	51.69
Kalahandi	19.35	31.18	7.65	17.65	45.65
Keonjhar	29.89	42.61	19.95	27.77	46.41
Anandapur Tahasil	38.22	50.42	25.81	37.19	49.64
Koraput	15.33	23.17	8.44	11.94	44.22
Mayurbhanj	25.47	37.01	13.82	23.52	57.61
Phulbani	26.61	41.96	11.26	24.86	58.36
Puri	45.71	59.48	31.38	42.62	63.47
Sambalpur	34.02	47.98	19.67	30.95	50.72
Sundargarh	36.17	47.34	24.19	26.81	57.48
Orissa	34.23	47.10	21.12	-	-

Source: Statistical Abstract of Orissa 1983, Govt. of Orissa Bureau of Statistics and Economics, Bhubaneswar, Table: 2.3 Index number of Area and Yield of Foodgrains and Non-foodgrains in the State (1969-70 to 1980-81)

Year	Foodgrains		Non-foodgrains	
	Index number of area	Index number of yield	Index number of area	Index number of yield
1969-70	103.1	104.5	105.3	102.6
1970-71	103.0	107.7	89.4	99.9
1971-72	106.8	95.7	82.8	96.8
1972-73	106.2	107.2	98.4	106.3
1973-74	111.4	116.4	107.0	110.9
1974-75	107.5	87.1	114.0	164.8
1975-76	116.4	121.8	123.6	116.4
1976-77	108.4	88.4	114.2	98.1
1977-78	117.0	121.6	138.5	117.3
1978-79	119.9	126.2	163.2	169.9
1979-80	115.7	84.9	171.5	109.3
1980-81	123.9	128.7	174.6	147.9

Source: Statistical Abstract of Orissa, 1982, Govt. of Orissa, Bureau of Statistics and Economics, Bhubaneswar.

Table: 2.4 Distrbution of respondent farmers by education and size of holdings

(Education)

Size of Holdings (in Acre)	Illiterate	1 to VII	VII to X	XI and above	Total
1-5 (small)	16 (69.6)	16 (30)	18 (46)	6 (40)	56 (43)
5-15 (medium)	6 (26)	35 (66)	7 (18)	8 (53)	53 (41)
15-50 (big)	1 (4)	2 (4)	14 (46)	1 (7)	21 (16)
Total :	23 (100)	53 (100)	39 (100)	15 (100)	130 (100)

Note: Figures in Parentheses are percentages to total.

Table : 2.5 Distribution of respondent farmers by education and structure of family.

Structure of Family	Education				
	Illiterate	I to VII	VIII to X	XI and above	Total
Nuclear	13	26	9	6	54
	(56.5)	(49)	(23)	(40)	(41.5)
Joint	10	27	30	9	76
	(43.5)	(51)	(77)	(60)	(58.5)
Total :	23	53	39	15	130
	(100)	(100)	(100)	(60)	(100)

Note: Figures in the Parentheses are percentages to total.

Table 2.6: Distribution respondent farmers by caste and education.

Caste	Education				
	Illiterate	I to VII	VIII to X	XI and above	Total
Brahmin	1	12	26	7	47
	(4)	(22.6)	(66.7)	(46.6)	(36)
Karana	2	7	2	6	18
	(87)	(13)	(5)	(40)	(13.8)
Khandayat	7	28	10	2	50
	(30)	(52.8)	(25.6)	(13.4)	(38.4)
Schedule Castes and Other Lower castes	13	6	1	-	20
	(56.5)	(11)	(2.6)		(15)
Total	23	53	39	15	130
	(100)	(100)	(100)	(100)	(100)

Note: Figures in the Parentheses are percentages to total.

Table 2.7: Distribution of Respondent Farmers by their education and the education level of their family members

Education Level of the Family members (excluding the respondent)	Education: Illiterate	I to VII	VIII to X	XI and above	Total
Only 1 member with matriculation or above education	4 (17)	28 (52.8)	18 (46)	4 (46.6)	54 (41.5)
Two or more members with matriculation or above education	1 (4)	8 (15)	12 (30.7)	11 (73.4)	32 (24.6)
No member with matriculation or above education	18 (78)	17 (32)	9 (23)	- -	44 (33.8)
Total	23 (100)	53 (100)	39 (100)	15 (100)	130 (100)

Note: Figures in the parentheses are percentages to total.

Table 2.8: Distribution of farmers by their education and the profession of their family memb

Profession of the family members of the farmers	Education of the farmers				
	Illiterate	I to VII	VIII to X	XI and above	Total
Atleast 1 in Govt. Service But no one in Pvt.Sector or Public Sector Service	2 (8.7)	24 (45.3)	17 (43.6)	8 (53)	51 (39.2)
Atleast 1 in Govt.Service and atleast 1 in Pvt. or public Sector Service	1 (4)	3 (5.7)	2 (5.1)	3 (20)	9 (6.9)
Atleast 1 in Pvt. or Public Sector Service but no one in Govt. Service	4 (17)	7 (13)	4 (10.3)	3 (20)	18 (13.8)
No one is in service	16 (69.6)	19 (35.8)	16 (41)	1 (7)	52 (40)
Total	23 (100)	53 (100)	39 (100)	15 (100)	130 (100)

Note: Figures in the parentheses are percentages to total

Table 2.9 : Distribution of respondent farmers by education and the acquaintance with the sources of agricultural information

Acquaintance with the sources of agricultural information	Education Illiterate Total No. of Respondents-23 (100)	I to VII Total No. of Respondents-53 (100)	VIII to X Total No. of Respondents-39 (100)	XI and Above Total No. of Respondents-15 (100)	Total 130 (100)
Newspaper	-	10	16	15	41
	(0)	(18.9)	(41)	(100)	(31.5)
Radio	9	17	29	15	70
	(39.1)	(32)	(74.3)	(100)	(53.8)
T.V.	-	2	5	4	11
	(o)	(3.8)	(12.8)	(26.7)	(8.5)
VLW	14	40	32	15	101
	(60.8)	(75.5)	(82)	(100)	(77.7)
Villagers	16	27	9	3	55
	(69.6)	(50.9)	(23)	(20)	(42.3)
Others(ont siders)	8	30	11	4	53
	(34.8)	(56.6)	(28)	(26.7)	(40.8)

Note: Figures in the parentheses are percentages to total

Table 2.10: Distribution of respondent farmers by education and use of improved qualities of inputs. in 1984-85.

(Education)

Inputs	Illiterate total No.23 (100)	I to VII total No.53 (100)	VIII to X total No.39 (100)	XI and above total No.15 (100)	Total 130 (100)
Partial irrigation with individual effort	4 (17.4)	8 (15.1)	14 (35.9)	10 (66.7)	36 (27.7)
Improved seeds (HYVs)	5 (21.7)	14 (26.4)	16 (41)	14 (93.3)	49 (37.7)
Fertiliser	4 (17.4)	25 (47.2)	27 (69.2)	12 (80)	68 (52.3)
Plant Protection measures	2 (8.7)	6 (11.3)	4 (10.3)	9 (60)	21 (16.2)
Improved agricultural implements	1 (4)	2 (3.8)	5 (12.8)	7 (46.7)	15 (11.5)

Note:- Figures in the parentheses are percentages to total.

Table 2.11: Distribution of respondent farmers by education and utilisation of credit facilities for agricultural purposes, in 1984-85.

(Education)

Credit facilities and utilisation	Illiterate total no.23 (100)	I to VII total no.53 (100)	VIII to X total no.39 (100)	XI and Above total no.15 (100)	Total 130 (100)
No. availed (1) credit facilities	7 (30.4)	15 (28.3)	14 (35.9)	13 (86.7)	49 (37.7)
(2) Satisfactory Utilisation	3 (42.9)*	6 (40)*	7 (50)*	9 (69.2)	25 (51)*

Note: Figures in the parentheses are percentage to total.

And

Figures in the parentheses with * are percentages of (2) to (1).

Table: 2.12: Distribution of respondent farmers by education and performance of crop production in 1984-85

	(Education)				
Performance	Illiterate	I to VII	VIII to X	XI and Above	Total
very low	2 (8.7)	7 (13.2)	2 (5.1)	-	11 (8.5)
Low	8 (34.8)	18 (33.9)	6 (15.4)	3 (20)	35 (26.9)
Average	11 (47.8)	23 (43.4)	24 (45.3)	6 (40)	64 (49.2)
High	2 (8.7)	4 (7.5)	4 (10.3)	3 (20)	13 (10)
Very High	-	1 (1.9)	3 (7.7)	3 (20)	7 (5.4)
Total	23 (100)	53 (100)	39 (100)	20 (100)	54 (100)

Note: Figures in the parentheses are percentages to total.

Table 2.13: Distribution of respondent farmers by education and innovation into the area and level of success during 1982 and 1985.

Innovation and Success	(Education) Illiterate total no.23 (100)	I to VII total no.53 (100)	VIII to X total no.39 (100)	XI and Above total no.15 (100)	Total 130 (100)
(1)Innovation	4 (17.4)	11 (20.8)	18 (46.2)	8 (53.3)	41 (31.5)
(2)Success	1 (25)*	3 (27.3)*	13 (72.2)*	7 (87.5)*	25 (60.9)*

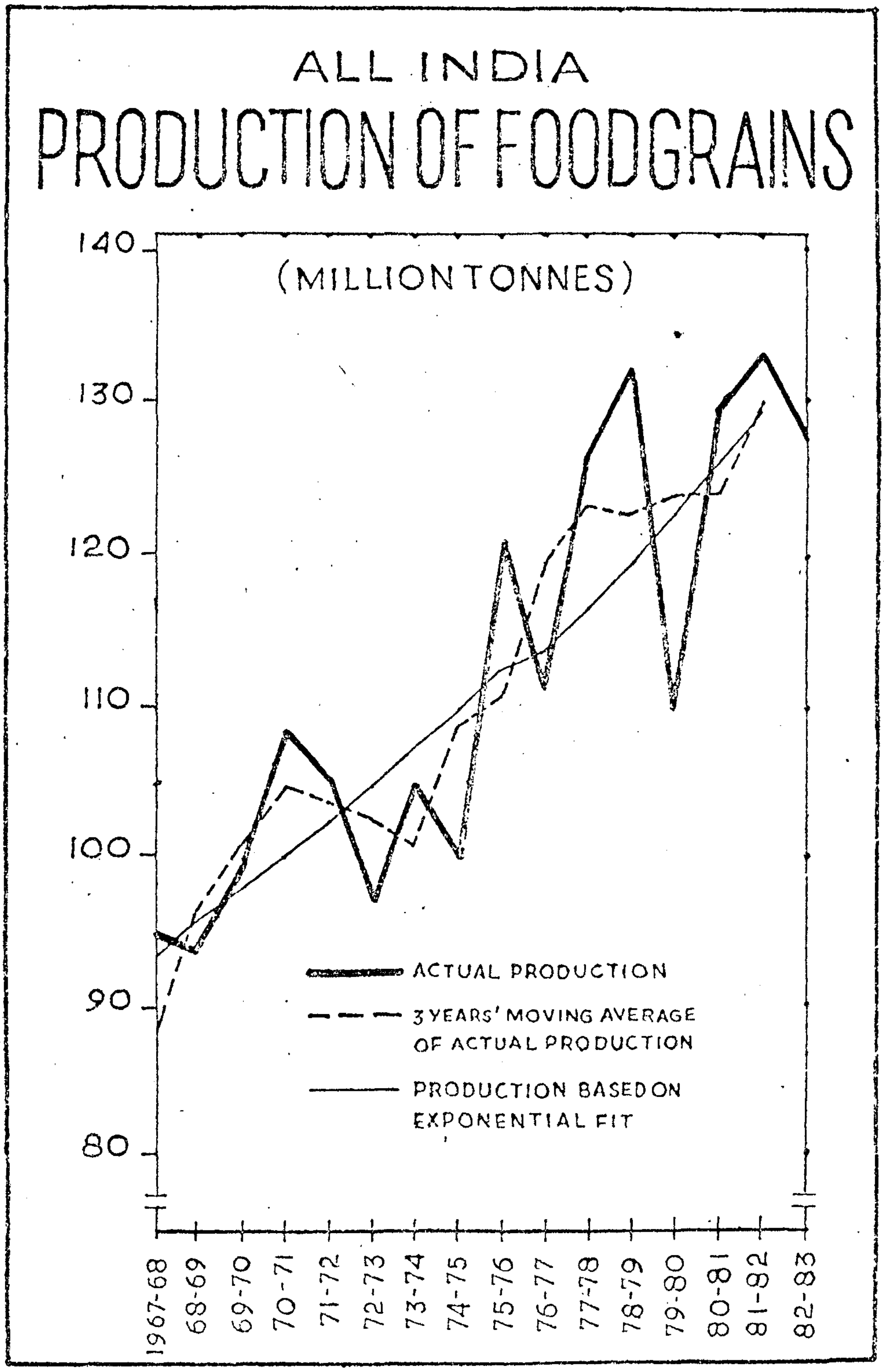
Note: Figures in the parentheses with*are percentages of (2) to (1)

And

Figures in the parentheses are percentages to total.

FIGURE

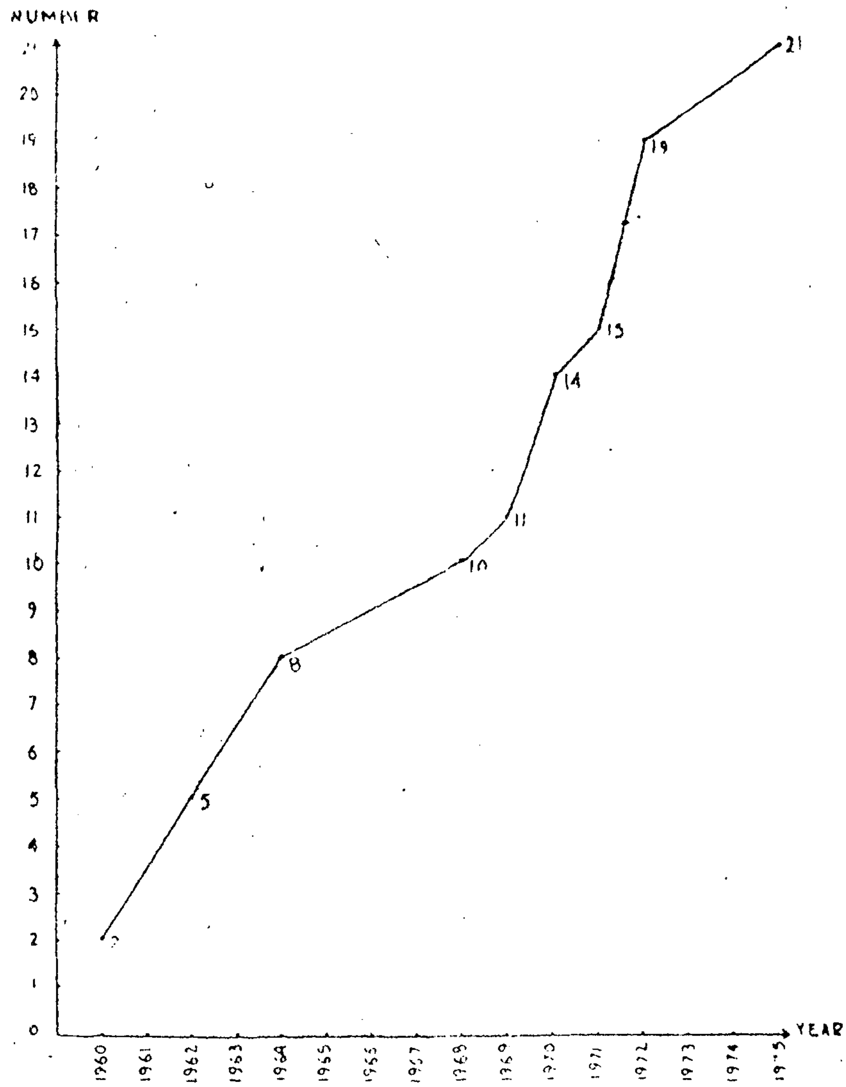
Figure 1.1



Source: Annual Report 1982-83, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi

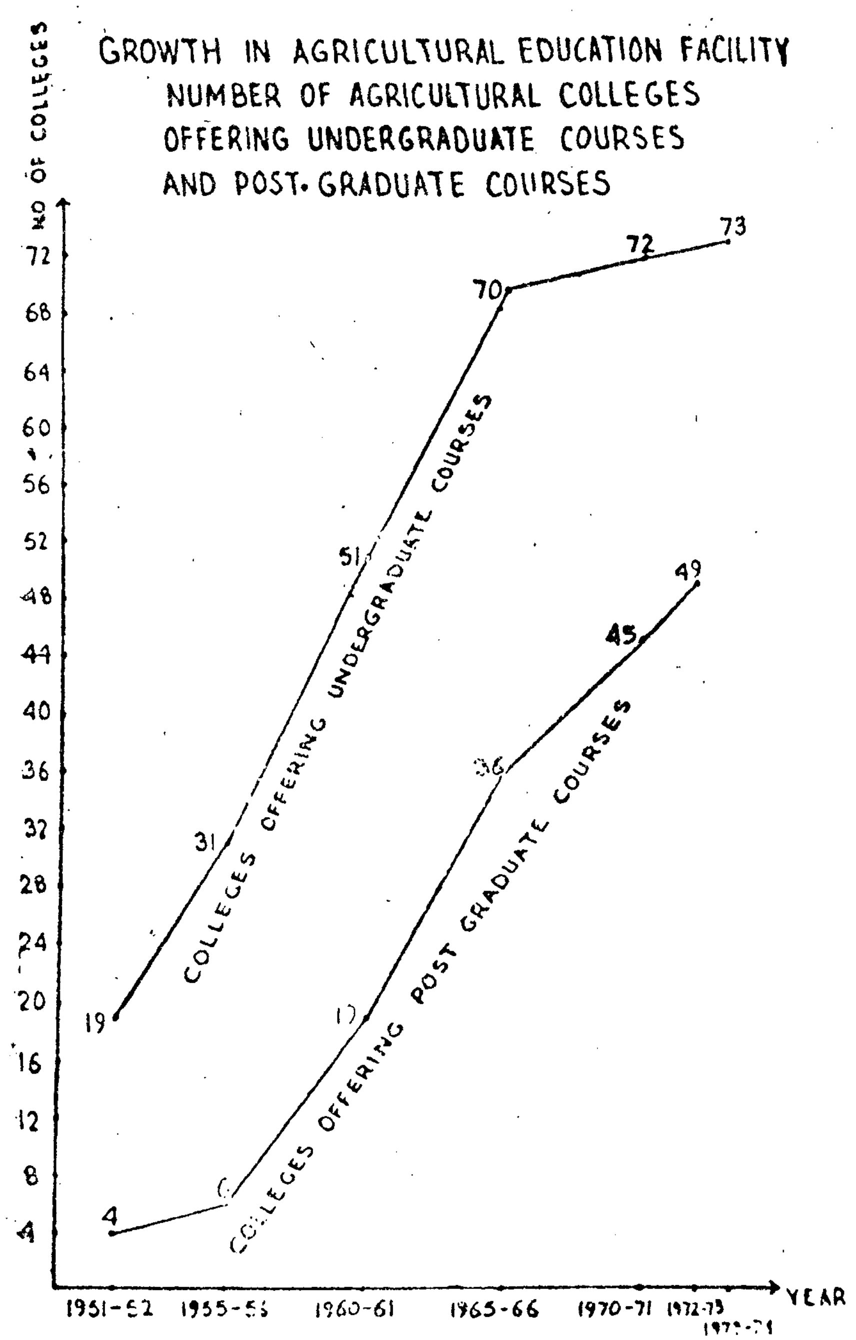
Figure 1.2

GROWTH OF AGRICULTURAL UNIVERSITIES



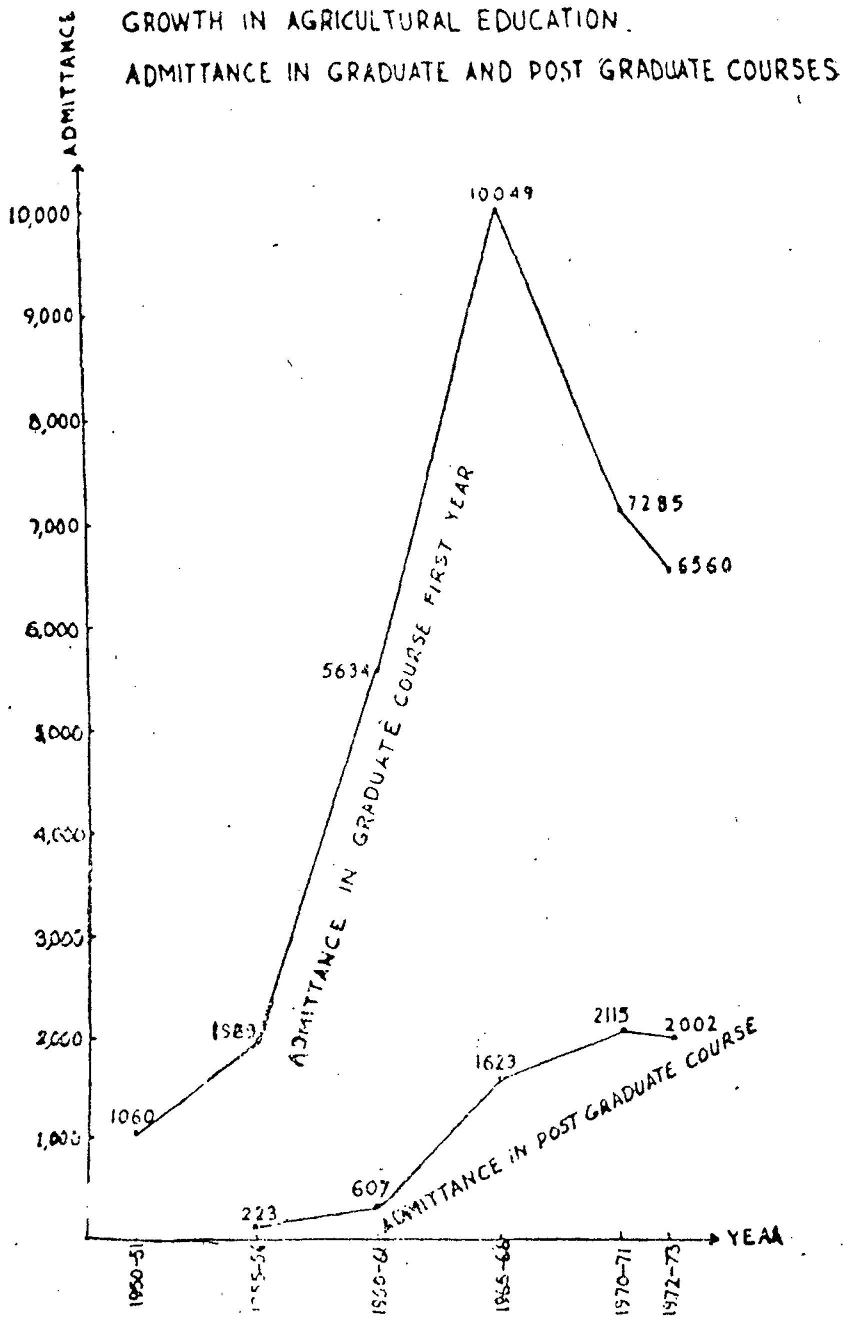
Source: Report of the National Commission on Agriculture, 1976, Part XI, Government of India, New Delhi.

Figure 1.3



Source: Report of the National Commission on Agriculture, 1976, Part XI, Government of India, New Delhi.

Figure 1.4



Source: Report of the National Commission on Agriculture, 1976, Part XI, Government of India, New Delhi.

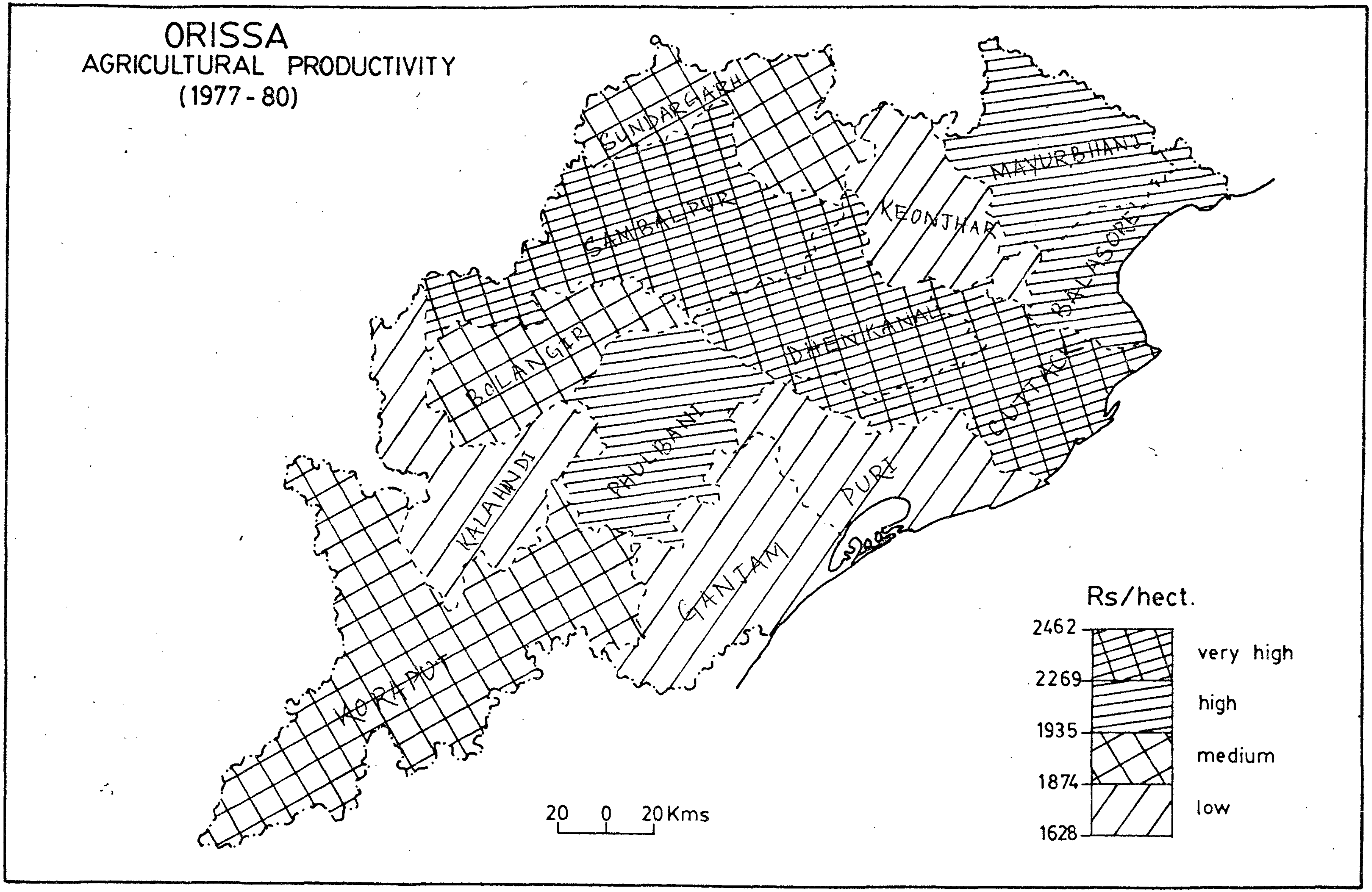

ORISSA
AGRICULTURAL PRODUCTIVITY
(1977-80)
SUNDARGARH
MAYURBHANJ
KEONJHAR
SAMBALPUR
BALASORE
BOLANGIR
DHENKANAL
CUTTACK
PHULBANI
KALAHANDI
PURI
GANJAM
KORAPUT
20 0 20Kms
Rs/hect.
2462
2269
1935
1874
1628
very high
high
medium
low

Fig- 1.6

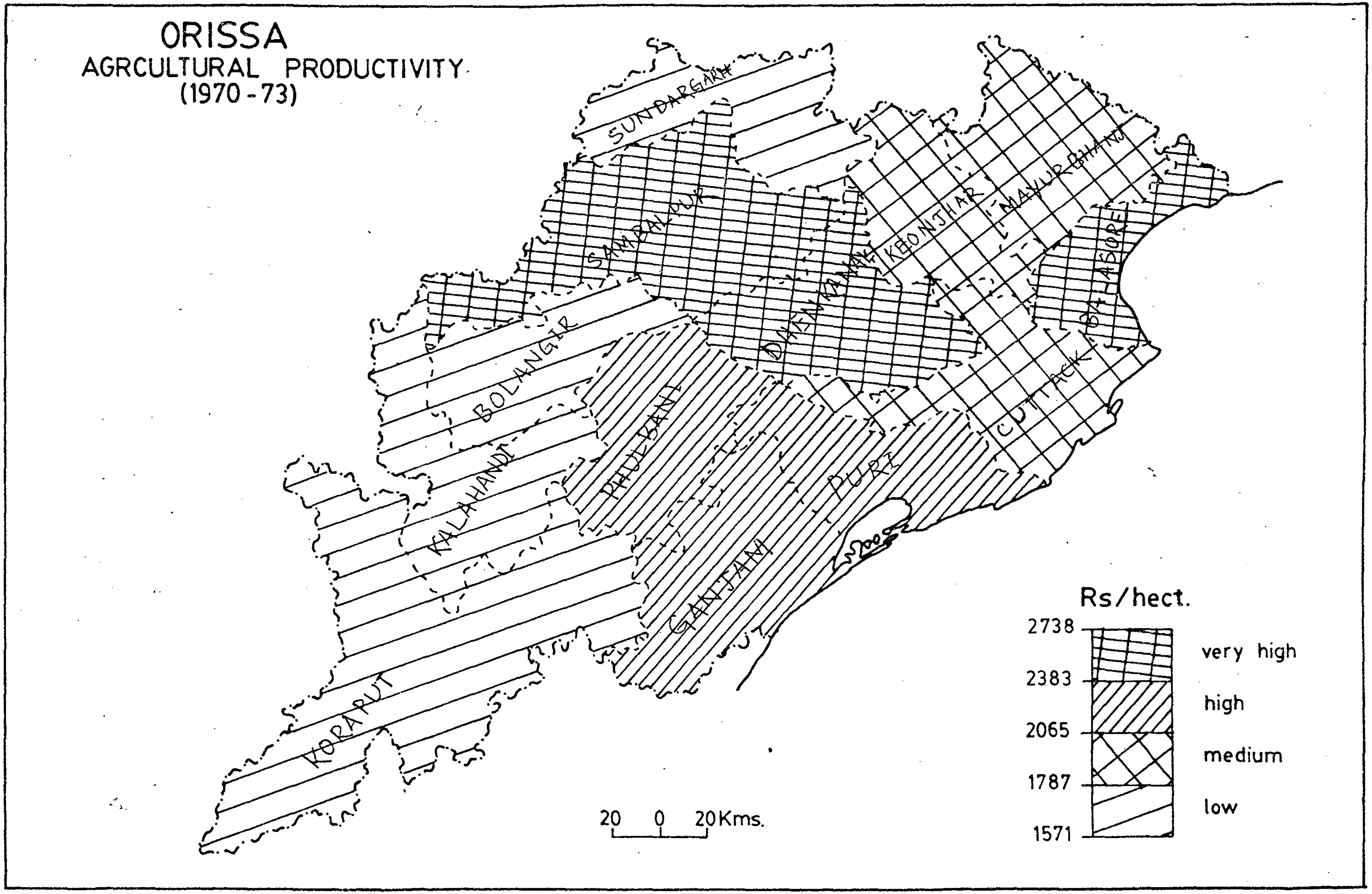

ORISSA
AGRCULTURAL PRODUCTIVITY
(1970-73)
SUNDARGARH
SAMBALPUR
KEONJHAR
MAYURBHANJ
BALASORE
DHENKANAL
BOLANGIR
PHULBANI
CUTTACK
KALAHANDI
PURI
GANJAM
KORAPUT
20 0 20Kms.
Rs/hect.
2738
very high
2383
high
2065
medium
1787
low
1571

Fig- 1.5

BIBLIOGRAPHY

PRIMARY SOURCES

GOVERNMENTAL AND ORGANIZATIONAL SOURCES

Agricultural Situation in India, c1982-83, Govt of India, New Delhi.

Annual Report 1984-85. Ministry of Education, Govt of India, New Delhi

Annual Report 1982-83 , Deptt. of Agriculture and Cooperation, Ministry of Agriculture, Govt of India, New Delhi.

Annual Report 1984-85, Department of Agricultural Research And Education, Ministry of Agriculture and Rural Development, Govt of India, New Delhi.

Annual Report 1985-86 , Part I (Technical), Indian Council of Agricultural Research, ,New Delhi.

Basic Statistics Relating to Indian Economy,- 1950-51 - 1980-81, Central Statistical Organisation, Deptt. of Statistics, Ministry of Planning, Govt of India, New Delhi

Economic Survey of Orissa, 1976, Bureau of Statistics and Economics, Govt of Orissa, Bhubaneswar.

Economic Survey 1985-86, Ministry of Finance, Govt of India, New Delhi.

Education and National Development: Report of the Education Commission, Govt of India, New Delhi, 1966.

Estimates of Area and Production of Principal Crops in India 1978-79, Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India, New Delhi.

India 1985, Publications Division, Ministry of Information and Broadcasting, Govt of India, New Delhi.

Indian Agriculture in Brief, 1950-51 to 1983-84, Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India, New Delhi.

Policy Conference on Economic Growth and Investment in Education(Washington 16th-20th October 1961) OECD, Paris, 1962.

Report 1981-82, Deptt. of Agricultural Research and Education, Ministry of Agriculture, Govt of India, New Delhi.

Report 1979-80, Ministry of Planning, Deptt. of Statistics, Govt of India, New Delhi.

Report of the National Commission on Agriculture(Part I, Part II, Part VI, Part XI, Part XIV), Ministry of Agriculture and Irrigation, Govt of India, New Delhi.

Selected Educational Statistics, 1982-83, Ministry of Education and Culture, Planning, Monitoring and Statistics Division, Govt. of India, New Delhi, 1984.

State Profiles of Literacy and Adult Education Programme, Ministry of Education, Govt of India, New Delhi, 1985.

Statistical Outline of India, 1982, Tata Services Limited, Deptt. of Economics and Statistics, Bombay.

Statistical Pocket Book - India 1983, Central Statistical Organisation, Govt of India, New Delhi.

The Approach to the Seventh Five Year Plan 1985-90, Planning Commission, Govt. of India, New Delhi.

SECONDARY SOURCES

BOOKS AND ARTICLES

Adamski, I, "Improved Peasant Farming as a Result of the Social and Professional Activities of the Farmers", International Journal of Agrarian Affairs, Vol. V, no.4,1969.

Adelman, Irma and Morris, Cynthia, "An Economic Model of Socio-economic and political change in UDCs", American Economic Review, Dec. 1968.

______________ , Society, Politics and Economic Development: A Quantitative Approach, Baltimore: Johns Hopkins Press, 1967.

Araji, A.A. ; Sim, R.J. and Gardner, R.L., "Returns to Agricultural Research and Extension Programmes: An Ex-Ante Approach, American Journal of Agricultural Economics, Vol. 60, No. 5, 1978.

Ardito-Barleta, N., Returns of Agricultural Research in Mexico, Unpublished Ph.D. thesis, University of Chicago, 1971.

Arrow, K.J., "The Economic Implications of Learning by Doing", Review of Economics and Statistics, Vol. 29, 1962.

Bailey, F.G., Caste and Economic Frontier, Manchester: University Press, 1959.

Becker, G.S., Human Capital, Princeton: Princeton University Press, 1964.

________________"Investment in Human Capital: A Theoretical Analysis", Journal of Political Economy, 70, Suppl., Oct. 1962.

Bell, Clive, "Acquisition of Agricultural Technology: Its Determinents and Effects", Journal of Development Studies, Vol. 9, Oct. 1972.

Bessell, J.E., "Measurement of the Human Factor in Farm Management", International Journal of Agrarian Affairs, Vol. V, no. 4, 1969.

Blackie, M.J. and Dent, J.B., Information Systems for Agriculture , London: Applied Science Publishers Ltd., 1979.

Blaug, M, "The Rate of Return on Investment in Education in Thailand", The Journal of Development Studies, Vol. 12, no.2 , Jan 1976.

Bora, A.K., and Saikia, P.D., "Impact of Modern Agricultural Technology on Small Farmers - A case Study in Assam," Indian Journal of Agricultural Economics, Vol. XXIX, no. 3, 1975.

Bowman, M.J., "The Human Investment Revolution in Economic Thought", in Economics of Education, ed.,M. Blaug, Baltimore: Penguin Books, 1968.

_________________, "Human Capital: Concepts and Measures", in Economics of Higher Education, ed., S. Mushkin, Washington, 1962.

Bowles, S., and Gintis, H., "The Problem with Human Capital: A Marxian Critique", American Economic Review, Vol 65, no. 2, 1975.

Bowles, S., Planning Educational Systems for Economic Growth, Cambridge, Mass: Harvard University Press, 1969.

Castillo, Gelia, "Education For Agriculture", The Malayan Economic Review , vol.16, no.2, 1971.

Cartier, Robert, "Non-Economic Factors in the Study of Economic Development", AID Microfitche No. PNAAB-186, 1975.

Chakrabarti, S.B. and others, ed., Agrarian Situation in India, Vol. I and Vol II, Calcutta: Anthropological Survey of India, 1984.

Chadha, G.K., Production Gains of New Agricultural Technology - A Farm Size-wise Analysis of Punjab Experience, Chandigarh: Punjab University Publication Bureau, 1979.

Chaudhri, D.P., "Education and Agricultural Productivity in India", Ph.D. Thesis, University of Delhi, 1968.

__________________, "Education in Production in Modernising Agriculture in Asian Under-developed Countries", Agriculture and Economic Development in Asian Perspective, Tokyo: Japan Economic Research Centre, 1972.

__________________"Rural Education and Agricultural Development. Some Expirical Results from Indian Agriculture", Foster and Shiefield, eds., International Year Book of Education, 1974 - Education for Rural Development, London: Evans Bros. , 1974.

_________, Education, Innovations and Agricultural Development: A Study of North India (1961-72), New Delhi: Vikas Publishing House Pvt. Ltd., 1979.

Clay, Edward J. , "Equity and Productivity Effects of A Package of Technical Innovations and Changes in Social Institutions: Tubewells Tractors and High-Yielding Varieties", Indian Journal of Agricultural Economics, vol. XXX, no. 4, 1975.

Cohn, E., The Economics of Education, Lexington: D.C. Heath & Co., 1972.

Correa, H., The Economics of Human Resources, Amsterdam: North-Holland, 1963.

Curle, A., Educational Strategy for Developing Societies: A Study of Educational and Social Factors in Relation to Economic Growth, London: Tavistock Publications, 1963.

Cosin, B.R. , ed., Education: Structure and Society, Harmingsworth: Penguin Books, 1972.

Dandekar, V.M., "Planning in Indian Agriculture", Indian Journal of Agricultural Economics, vol. 22, no.1, 1961.

Datt, R.and Sundharam, K.P.M., Indian Economy, New Delhi: S. Chand & Co. Ltd., 1985.

Denison, E.F., The Sources of Economic Growth in the United States and the Alternatives before Us , New York: Committee for Economic Development, 1962.

________________"Education, Economic Growth, and Gaps in Information," Journal of Political Economy, 70, Suppl., Oct., 1962.

________________"Measuring the Contribution of Education to Economic Growth", The Residual Factor and Economic Growth, Paris: OECD, 1964.

________________Why Growth Rates Differ: Post-War Experience in Nine Western Countries, Washington D.C. : The Brookings Institution, 1969.

________________"The Contribution of Education to the Quality of Labour: Comment", American Economic Review, 59, Dec. 1969.

Donoghue, M.O', Economic Dimensions in Education, Dublin: Gill and Mac-millan Ltd., 1971.

Eckaus, R.S., "Education and Economic Growth", Economics of Higher Education, ed., Selma J. M., Washington: United States Office of Education, 1962.

______________,"Economic Criteria for Education and Training", Review of Economics and Statistics, Vol. XLVI, no.2, 1964.

Evenson, R., "The Contribution of Agricultural Research", unpublished Ph.D. thesis, University of Chicago, 1968.

________________,"Research Extension and Schooling in Agricultural Development in Evenson and Kislev, Investment in Agricultural Research and Extension, Yale University, London, 1973(mimeograph).

________________"Technology Generation and Agriculture", unpublished paper , Yale University, 1973(mimeograph).

Evenson, R. and Jha, D., "The Contribution of Educational Systems to Agricultural Production in India", Indian Journal of Agricultural Economy, vol. XXVIII , no.4, 1973.

Fane, G., Productive Value of Education in U.S. Agriculture, Ph.D thesis, Deptt. of Economics, Harvard University, 1974.

________________"Education and the Managerial Efficiency of the Farmers" Review of Economics and Statistics, 57, 1975.

Foster, P. and Sheffield ,J.R., eds., World Year Book of Education , London: Evans Bros. Ltd., 1974.

Galbraith, J.K., Economic Development in Perspective, Cambridge, Mass: Harvard University Press, 1962.

Galenson, W. , and Pyatt, G., The Quality of Labour and Economic Development in certain countries, Geneva: International Labour Office, 1964.

Goel, S.C., Education and Economic Growth in India, Delhi:The Macmillan Company of India Ltd., 1975.

Griliches, Z.,"Research Expenditure , Education and the Aggregate Agricultural Production Function", The American Economic Review, vol. IV, no.6, 1964.

________________,"Contribution of Education in Production and Growth Accounting" in Lee Hansen, ed., Education and Income, New York: National Bureau of Economic Research, 1970.

Groves, H.M., Education and Economic Growth, Washington: NEA,1961.

Harberger, A.C. , "Investment in Men Versus Investment in Machines: The Case of India", Education and Economic Development, ed., C.A. Anderson and M.J. Bowman, Chicago: Aldine, 1965.

Harbison, F.H. and Myers, C.A., Education, Manpower and Economic Growth: Strategies of Human Resource Development; New York: Mc Graw-Hill, 1964.

Haller, T.E., 'Education and Rural Development in Columbia', unpublished Ph.D. Thesis, Purdue University, 1972.

Harker, B.R., 'Education, Communication and Agricultural Changes - A Study of Japanese Farmers' unpublished Ph.D. Thesis, University of Chicago, 1971.

______________ "The Contribution of Schooling to Agricultural Modernization: An Expirical Analysis", unpublished paper, University of Chicago, 1973.

Herdt,,R.W., " Resource Productivity in Indian Agriculture", American Journal of Agricultural Economics, vol. 53, no.3,1971.

Holt, J. and Anderson, K.B., "Teaching Decision Making Under Risk and Uncertainty to Farmers", American Journal of Agricultural Economics, vol. 60, no.2, 1978.

Huffman, W.E., 'The Contribution of Education and Extension to Differential Rates of Change', unpublished Ph.D thesis, Deptt.of Economics, University of Chicago, 1972.

______________, "Decision Making: The role of Education", American Journal of Agricultural Economics, Feb. 1974.

______________, "Assessing Returns to Agricultural Extension, American Journal of Agricultural Economics, vol. 60, no.5,1978.

Huffman, W.E. and Maranowski J.A., "An Economic Analysis of Expenditures on Agricultural Experiment Station Research, American Journal of Agricultural Economics, vol. 63, no.1, 1981.

Huq, M.S., Education and Development Strategy in South and Southeast Asia, Honolulu: East-west Center Press, 1965.

______________, Education, Manpower and Development in South and Southeast Asia, New Delhi: Sterling publishers Pvt Ltd., 1976.

Infanger, C.L. , Robbins, L.W. and Debertin, D.L., "Interfacing Research and Extension in Information Delivery System", American Journal of Agricultural Economics, vol. 60, no.5,1978.

Jorgenson, D.W. and Griliches, Z. "The Explanation of Productivity Change", Review of Economic Studies, 34, Sept.1966.

Johnson, D.G., World Agriculture in Disarray, London: Macmillan, 1973.

Kahlon, A.S., "New Farm Technology: Its implications in Agricultural Economics", (Presidential Address , 30th Conference), Indian Journal of Agricultural Economics, vol. XXV, no.4,1969.

Kalirajan, K, "The Economic Efficiency of Farmers Growing High-Yielding , Irrigated Rice in India, American Journal of Agricultural Economics, vol. 63, no.3, 1981.

Khaldi, N.,"The Productive Value of Education in US Agriculture", unpublished Ph.D. thesis, Southern Methodist University,1973.

________________,"Education and Allocative Efficiency in US Agriculture", American Journal of Agricultural Economics, vol.57, no.3, 1975.

Kislev, Y. and Peterson, W. ,"Induced Innovations and Farm Mechanization", American Journal of Agricultural Economics, vol. 63, no.3, 1981.

Kuznets, S. and Jenks, E., Capital in the American Economy: Its Formation and Financing, Princeton: Princeton University Press, 1961.

Leagans, P.J. and Loomis, P.C., eds., "Extension Education and Modernization" in Behavioural Change in Agriculture, London: Cornell University Press, 1971.

Lionberger, F.H., Adoption of New Ideas and Practices, Ames: Iowa State University, 1964.

Machlup, F., Education and Economic Growth, Lincoln: University of Nebraska Press, 1970.

Maddison, A., Economic Progress and Policy in Developing Countries, London: Allen and Unwin, 1970.

Malanicz, Z., "The Influence of Managers' Qualifications Upon the Efficiency of Work of Peasant Farms", International Journal of Agrarian Affairs, vol.V, no.4, 1969.

________________, "The Influence of Managers' Qualifications Upon the Material and Financial Expenditure on Present Farms", International Journal of Agrarian Affairs, vol.V, no.4,1969.

Malassis, L., The Rural World: Education and Development, London: Croom Helm, 1976.

Manteuffel, R. and Zuk, J., "The Influence of the Educational Level of State Farm Managers upon Results of Farming", International Journal of Agrarian Affairs, vol.V, no. 4, 1969.

McClelland, D.C., and Winter, D.G., Motivating Economic Achievement , New York; Free Press, 1971.

Meier, G.M., "Role of Education in the Development Process" editorial note in Leading Issues in Economic Development, (IX B.i Investment in Human Capital), OUP, II Edn., 1970.

Mellor, J.W., The Economics of Agricultural Development, New York: Ornel University Press, Ithaka, 1967.

Menon, K.P.A., Indian Agriculture: Administrative and Organisational Constraints , New Delhi: Arthasashatri Prakashan, 1985.

Millikan, M.F., "Education for Innovation" in Restless Nations: A Study of World Tensions and Development, New York: Dodd, Mead & Co., 1962.

Mishra, B., "Deceleration of Rates of Agricultural Growth in Orissa: Trends and Explanatory Factors", Indian Journal of Agricultural Economics, vol. XXXVIII, no.4, 1983.

Moscardi, E. and Janvry, Alain de, "Attitude Toward Risk Among Peasant: An Econometric Approach", American Journal of Agricultural Economics, vol. 59, no.4, 1977.

Musgrave, R.A., "Notes on Educational Investment in Developing Nations", in Economics of Education, Paris: OECD Study Group, 1966.

Muthayya, B.C. and Vijay Kumar, S., Psycho-Social Dimensions of Agricultural Development: An Analysis, Hyderabad: National Institute of Rural Development, 1980.

Nallagounden, A.M., "Investment in Education in India", Journal of Human Resources(Summer), 1967.

Nandwani, S.C., Education and Economic Development, New Delhi: Cosmopolitan Publishing House, 1973.

National Institute of Community Development, Agricultural Innovation among Indian Farmers, Hyderabad, 1965.

Nelson, A.G. and Harris, T.P., "Designing an Instructional Package: The Use of Probabilities in the Farm Decision Making", American Journal of Agricultural Economics, vol.60, no.5,1978.

Nelson, R.R. and Phelps, E., "Investment in Humans, Technology Diffusion, and Economic Growth", American Economic Review, May, 1966.

Norton, G.W. and Jeffrey, S.D., "Evaluating Returns to Agricultural Research: A Review", American Journal of Agricultural Economics, vol. 63, no.4, 1981.

O'Conner, C.W. and Osterman, D.N., "Innovations in Treating Teaching: An Introduction,"American Journal of Agricultural Economics, vol.60, no.5, 1978.

Parnes, H.S., Forcasting Educational Needs for Economic and Social Development, Paris: OECD, 1962.

Parlman, R., The Economics of Education: Conceptual Problems and Policy Issues, New York: McGraw Hill, 1973.

Petzel, T.E., "The Role of Education in the Dynamics of Supply", American Journal of Agricultural Economics, vol.60, no.3,1978.

Psacharopoulos, G., "Estimating Shadow Rates of Return to Investment in Education", Journal of Human Resources, (Winter), 1970.

________________, Returns to Education: An International Comparison, Amsterdam: Elsevier Scientific Publishing Company, 1973.

Pudasaini, S.P., "The Contribution of Education to Allocative and Technical Efficiency in Sugarcane Production in Nepal", Indian Journal of Agricultural Economics, vol. XXXVIII, no.1, 1983.

Quraishi, M.A., Indian Agriculture and Rural Development: "Then and Now", Delhi: B.R. Publishing Corporation, 1985.

Rahudkar,W.B., "Farmer Characteristics Associated with the Adoption of Diffusion of Improved Farm Practices," Indian Journal of Agricultural Economics", vol. XVII, no.2, 1962.

Ram, Rati, "Education as a Quasi Factor of Production: The Case of India's Agriculture", Ph.D. Thesis, University of Chicago, December 1976.

Randhawa, M.S. and others, Green Revolution: A Case Study of Punjab, Delhi: Vikas Publishing House, 1974.

Randhawa, N.S. and Heady, E.O., "Decision-Making Under Uncertainty with Special Reference to Agriculture (in India)", Indian Journal of Agricultural Economics, vol. XVIII, no.3, 1963.

Rao, V.K.R.V., "Education and Human Resource Development, New Delhi: Allied Publishers, 1966.

Rastogi, R.A., and Mittal, J.P. , "Performance of Some Improved Elements Compared to Conventional Implements", Indian Journal of Agricultural Economics, vol. XXX, no.2,1975.

Ray, A.K.; Atteri,B.R., Sen, A.C. and Mathur, P.N., "Quantitative and Qualitative Impact of Training and Visit System on Different Groups of Farmers - A Case Study of Hoogly District, West Bengal", Indian Journal of Agricultural Economics, vol.XXXIV, no.4, 1979.

Ray, S.K., "An Empirical Investigation of the Nature and Causes for Growth and Instability in Indian Agriculture: 1950-80", Indian Journal of Agricultural Economics, vol.XXXVIII, no.4, 1983.

Reifman, L., ed., Financing of Education For Economic Growth, Paris: OECD, 1966.

Robbins, L.W., Harsh, S.B., and Allen, J.W. "Enhancing Mutual Benefits from Firm-level Research Efforts", American Journal of Agricultural Economics, vol. 59, no.3,1977.

Robinson, E.A.G., and Vaizey, J.E., eds., The Economics of Education, London: Macmillan, 1966.

Rogers, E.M. and Shoemaker, F.F., Diffusion of Innovations, New York: The Free Press of Glencoe, 1971.

Sahota, G.S., "Efficiency of Resource Allocation in Indian Agriculture", American Journal of Agricultural Economics, August 1968.

Saini, G.R., "Resource Use Efficiency in Agriculture", Indian Journal of Agricultural Economics, April-June, 1969.

________________, "Holding size, Productivity and some related Aspects of Indian Agriculture", Economics and Political Weekly - Review of Agriculture, 26 June 1971.

________________ Farm Size, Resource-use Efficiency and Income Distribution, Bombay: Allied Publishers, 1979.

Schimmerling, H., "The work of the Manager in an Agricultural Enterprise", International Journal of Agrarian Affairs, vol.V, no.4, 1969.

Schultz, T.W., "Capital Formation by Education", Journal of Political Economy, vol.LXVIII, 1960.

________________,"Investment in Human Capital", American Economic Review, 51, 1961.

________________, "Reflections on Investment in Man", Journal of Political Economy, 70, Suppl. Oct 1962.

________________, "Rise in the Capital Stock represented by Education in the U.S., 1900-57", in Economics of Higher Education, ed., S. Mushkin, Washington, 1962.

________________, The Economic Value of Education, New York: Columbia University Press, 1963.

______________, Transforming Traditional Agriculture, New Haven: Yale University Press, 1964.

______________, "The Value of the Ability to Deal with Disequilibria", The Journal of Economic Literature,vol. XIII, no.3, 1975.

Sen, A.K., "Economic Approach to Education and Manpower Planning", Indian Economic Review, April ,1966.

Singh, Karam, "Returns to Investment On Agricultural Research in the Punjab", Indian Journal of Agricultural Economics, vol. XXXII, no.3, 1977.

Shingi, P.M., Wadwalker, S. and Kaur, G., Management of Agricultural Extension:Training and Visit System in Rajasthan, Ahmedabad: Indian Institute of Management, 1982.

Singh, R.N., "Characteristics of Farm Innovations Associated with the Rate of Adoption", Indian Journal of Agricultural Economics, vol. XXIV, no.1, 1969.

Stigler, G.J., "The Economics of Information", The Journal of Political Economy, vol.LXIX, no. 3, 1961.

Vaizey, John and others, The political Economy of Education, London: Gerald Duckworth & Co. Ltd., 1972.

Vaizey, John, The Economics of Education, London: Faber, 1962.

Van Den Ban, A.W., "The Human Factor in Farm Management: Some Research Evidence from the Netherlands", International Journal of Agrarian Affairs, vol. V, no.4, 1969.

Weisbrod, B.A., External Benefits of Public Education, Princeton: Princeton University Press, 1964.

Welch, F. ,"Education in Production", Journal of Political Economy, vol. 78 , no.1, 1970.

Wellman, R.H., "Discussion: Research Needed to Increase Production", American Journal of Agricultural Economics, vol. 59, no.5, 1977.

Westermark, Nils, "The Human Factor and Economic Progress", Indian Journal of Agricultural Economics, vol. XVI, no.2,1961.

Worswick, G.D.N., ed., Education and Economic Performance, Aldershot(England): Gower Publishing Company Ltd., 1985.

Wu, Craig C., "Educationin Farm Production: The Case of Taiwan", American Journal of Agricultural Economics, vol.59, no. 4,1977.