New Technology and Income Distribution in Agriculture : A Case Study of Two Villages in Haryana

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Dedicated to my Father and Late Mother

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DECLARATION

We certify that the dissertation entitled " NEW TECHNOLOGY AND INCOME DISTRIBUTION IN AGRICULTURE - A CASE STUDY OF TWO VILLAGES IN HARYANA", submitted by PARMOD KUMAR, in fulfilment of six credits out of total requirements of twenty four credits for the Degree of MASTER OF PHILOSOPHY (M.Phil.) of the University is his original work to the best of our knowledge and has not been previously submitted for any degree of this or any other University and therefore be placed before the examiners for evaluation.

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Needless to say, the conclusions drawn and any error or omissions which may remain, are entirely my own responsibility.

Pkumar

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CHAPTER-I

Agriculture in India

1.1. Introduction:

The pre-eminence of agriculture in the Indian economy is brought out by the fact that it accounted for 36.7 percent of its national income and employed 66.7 percent of the total labour force in the country during 1985-86. The development of agriculture, therefore, holds the key to the growth of the economy and decides the lot of the vast section of population dependent on it.

Indian agriculture was in a completely stagnant position before independence. The long period of British rule had resulted in the creation of tenurial system which inhibited progress and caused exploitation of the tiller of the soil by a large group of revenue and rent intermediaries, money lenders and grain dealers.[1] Available agricultural statistics for pre-Independence period indicate that during the first half of this century, agricultural production rose only marginally, as compared to the growth of population. According to J.P. Bhattacharjee, India's population rose by 38 percent between 1901 and 1946, but the area of cultivated land rose only by 18 percent, the average productivity of all crops rose by 13 percent and of foodcrops by only 1 percent.[2] The increase in population had thus overtaken increase in food production by a considerable extent.

Table- 1.1.

Growth Rates (Percent Per annum)

Pre-Independence and Post-Independence Period.

Item	Pre-Independence *	Post-Independence*
Food grains		
Area	0.3	0.7
Production	0.1	2.6
Yield	-0.2	1.6
Non Food grains		
Area	0.4	1.2
Production	1.3	2.6
Yield	0.9	1.0
All crops		
Area	0.4	0.8
Production	0.4	2.6
Yield	Neg.	1.4

* Pre Independence Period - 1891 - 1947.
Post Independence Period- 1949-50 to 1983-84.

Source : 1. Pre Independence Period - George Blyn - "Agriculture trends in India 1891-1947, output availability and Productivity", University of Pennsylvania Press 1966.

2. Post Independence Period - Ministry of Agrl., Agriculture Situation in India March, 1985, pp. 901.

Table 1.1. presents the growth rate of area, per hectare yield and aggregate output in the pre and Post Independence periods. The trend in the growth rates of output of food grains and non food grains during the pre-Independence period points out the obvious stagnancy of agriculture during the British period. There was some positive growth in the area under all crops but yield improvement did not take place at all. Food grain yields appear to have had a negative trend. Thus agrarian set up in the pre-Independence period clearly brings out the sluggishness of the socio economic and technological environment prevailing then.[3]

In the Pre-Independence period almost all of the Indian farmers were using the traditional methods of cultivation. Traditional inputs like, cowdung manure, traditional seeds and age old agricultural implements as bullocks, Persian wheels were used. They depended largely upon rain water due to the lack of additional sources of assured water supply. Under such a system of production, farm productivity per unit of land was very low. However not only was the farm productivity low but the labour productivity on land was also extremely low.

The other main reasons for the stagnation of Indian agriculture during the colonial period were the existence and perpetuation of outmoded land relations,

deliberate integration of the Indian economy into the colonial economy and inadequate investment in irrigation and other infrastructure. The earlier leaders of Indian National Congress during independence focussed attention on prevailing land relations in India. Later emphasis shifted from economic to political aspects of the struggle. However leaders of the Indian National Congress Stood Committed to abolition of Zamindari and other exploitative elements in farming and introduction of a more egalitarian agrarian structure on attainment of independence.

This commitment of egalitarianism was perceived in the country's constitution. The Directive principles embodied in article 39 of our constitution lays down that the ownership and control of material resources of the community are to be distributed as best to serve the common good and prevent concentration of wealth and means of production in a few hands to the detriment of the community. The successive five year plans attempted to translate this general constitutional directive into concrete measure of policy and action.

The first plan recognized that the pattern of land ownership and cultivation was a fundamental issue in national development and set out a broad outline of the policy to be followed by the state governments. The policy was further elaborated in the second plan.

The main objectives aimed at were:

a) To remove such impediments in the way of agricultural production as it arose from the character of the agrarian structure and to create conditions for evolving as speedily as possible an agrarian economy with high levels of efficiency and productivity and

b) To establish an egalitarian society and eliminate social inequalities.

To achieve this twin objective, the policy measures recomended were :

a) Abolition of intermediary tenures.

b) Tenancy reforms including regulation of rents, security of tenure and enabling the tenant to get ownership of his holding.

c) Ceilings on land holdings.

d) Consolidation of holdings and

e) Agrarian reorganisation.

The third plan laid emphasis on a more vigorous implementation of the policy laid down in the second plan and embodied in the legislation on various aspects of land reforms undertaken by states in pursuance of accepted policies. The fourth plan called for a reorientation of land policy, having regard to the technological developments in agriculture and social requirements of the time and for a review of the provisions

in the existing legislation and measures for their expeditious implementation.

By and large, all intermediary tenures have been abolished and over two crore farmers were brought into direct relationship with the state. Some of these tenures were of great antiquity and their abolition represents a remarkable transition to a modern structure. Almost all states have legislations restricting the size of holdings. The ceiling legislations were revised on the basis of guidelines formulated in 1972. Prior to the revision about 11.86 lakh hectares of land were declared surplus of which 9.96 lakh hectares were distributed among poorer peasants.[4] The allotees of these land are being provided with financial assistance for investment in productive agriculture. Various steps have been taken to improve the lot of cultivating tenants. They have been granted protection against rack-renting and eviction and have also had ownership rights conferred over the lands cultivated by them as tenants. Legislative measures for the consolidation of holdings have been undertaken in the most of the states, especially in the command areas of major irrigation projects. Nearly 4.5 crore hectares have been consolidated and the process is completed in Punjab, Haryana and western Uttar Pradesh.

One of the significant achievements of the land reform legislations passed during the fifties was the

abolition of absentee land lordism in large parts of India. However on the plea to resume land for personal cultivation, many intermediaries evicted the tenants and some others retained considerable portions of land dividing it among their family members. So intermediary tenures have not been fully abolished and a few still exist in one form or the other. From this point of view, the communist government in Kerala (in 1959) and West Bengal (in 1967) have intervened decisively in favour of tenants. In other states, however, the government adopted a policy of reconciliation with Zamindars and large landowners.[5]

Reforms were half hearted with regard to the imposition of ceilings and security of tenure. Consequently the skewness of land distribution was not reduced in any significant manner. Despite these limitations, land reforms brought about a significant change in land relations in so far as self cultivation rather than absentee landlordism became a predominant mode of production in Indian agriculture.

Looking at the Post-Independence agricultural trends, the depressing long term agricultural scenario prevailing prior to the independence should be kept in mind. Table 1.1. clearly shows a break with the past, after independence, with the introduction of economic planning in 1950-51 and with the special emphasis on

agricultural development, the previous trend of stagnant agriculture was reversed:

a) There was a steady increase in area under cultivation;

b) There was a steady rise in the average yield per hectare i.e. agricultural productivity;

c) As a result of the increase in area as well as increase in yield per hectare, total production of all crops recorded a rising trend.

Thus because of very high priority given to the agricultural sector by the national government in the post Independence period, one finds a growth rate of agricultural and foodgrains output ahead of the population growth rate of a little over 2 percent per annum. These growth rates are creditable achievements compared with the historical experiences of the developed countries in their initial phase of growth and the recent growth experiences of the third world developing countries.

It is important to note that of the three percent per annum increase in agricultural output during fifties and early sixties (see table 1.2), 70 percent was due to area increase and only 30 percent was due to increase in yield rate.[6] However the acceleration in agricultural output achieved during the fifties could not be sustained beyond a decade. During the period of First Plan and Second Plan i.e. 1950-51 to 1960-61, the agricultural Production increased at a growth rate of 4.2 percent per annum (triennium ending

1952-53 =100). However during the Third Plan period, the Annual Plan periods and the Fourth Plan period i.e. 1960-61 to 1973-74, the production rose at a rate of 2.6 percent per annum only (triennium ending 1962-63 = 100).[7] Thus by the beginning of the sixties domestic output of foodgrains had started stagnating and the country had to resort to large scale import of food. This prompted significant changes in the plan strategy. The emphasis shifted to finding methods of increasing land yield through the use of modern inputs and improved methods of production. Therefore, during the closing years of the second plan, the Intensive Agricultural District Programme (IADP) was formulated, which envisaged concentration of resources and efforts in specially endowed areas to achieve a quick break through in production. In the beginning it was introduced on an experimental basis, particularly in the areas where there was assured water supply and more fertile land. In 1964-65 a modified version of the same programme was introduced in many districts of various other states of India. This was named as Intensive Agricultural Area Programme (IAAP).

To begin with, this programme did not show any encouraging results. However this intensive area approach acquired new potency with the emergence of exotic high yielding varieties of cereal crops and technological

improvements. These were incorporated in the High Yielding Varieties Programme (HYVP) which became the kingpin of the new strategy of agricultural development launched in 1966-67. The new strategy generally termed as 'Green Revolution' has had a profound impact on raising agriculture yields and thus increasing the foodgrains output in India. This strategy has led India to make rapid strides in the use of various modern inputs, such as HYV's of seeds, Chemical fertilizers, Plant protection chemicals and modern agriculture implements, particularly that of tractors and tubewells. Green Revolution thus, has contributed to the transformation of rural peasantry in some areas (where it has been successful) into a dynamic agrarian entrepreneurial class.

Table 1.2

Growth rates (Percent per Annum)

Pre & Post Green Revolution (in India)

Item		Pre Green* Revolution	Post Green* Revolution
Food grains			
	Area	1.0	0.4
	Production	2.5	2.6
	Yield	1.5	1.8
Non Food grains			
	Area	2.3	0.8
	Production	4.0	2.5
	Yield	1.7	1.3
All Crops			
	Area	1.2	0.5
	Production	3.0	2.6
	Yield	1.8	1.7

* Pre G.R. - 1952-53 to 1964-65
Post G.R.- 1967-68 to 1983-84.

Source : V.M. Rao & R.S. Deshpande, "Agriculture Production rate and Pattern of growth, as quoted in Brahmananda, P.R. and Panchamukhi (eds) ,"The Development Process of the Indian economy" Himalaya Publishing House, 1987.

Table 1.2 presents the growth rates by the two sub periods formed by the cut off point of the mid sixties which witnessed the beginning of the accelerated growth in the wheat output. It is clear from the table that the increase in area as a source of output during pre-green revolution period, has dwindled in its importance during post-green revolution period. Moreover, foodgrains show a modest increase in the growth rate of yield but there appears to have been a deterioration in the growth rate of non-foodgrain yields.

The period of new strategy in Indian agriculture can be divided into two phases. The first phase consists of period 1966-67 to 1970-71 during which a very widespread use of HYV's seeds and a very rapid rate of growth of output especially of wheat took place. The second phase consists of period 1971-72 onwards and is characterised by fluctuations in its growth rate. The total area under the five HYV crops - rice, wheat, maize, sorghum and millet increased from 1.89 million hectares in 1966-67 to 15.39 million hectares in 1970-71.[8] As a result of an increased use of HYV seeds, yield per hectare of wheat increased from 830 kgs. in 1965-66 to 1310 kgs. in 1970-71.[9] Aggregate output of wheat was around 10.39 million tonnes at the year of inception of HYV's i.e. 1965-66 and it more than doubled (23.83 million tonnes) within such a short span of time of first phase.

Over the same period, the yield per hectare of rice

increased from 860 kg. in 1965-66 to 1120 kg. in 1970-71. Similarly aggregate rice production increased from 30.60 million tonnes to 42.23 million tonnes for the time period mentioned above. The overall food production (as a result of high rate of increase in these two cereals) increased from 72.35 million tonnes in 1965-66 to 95.05 million tonnes in 1967-68 and to 108.42 million tonnes in 1970-71.

In contrast the growth rate has been inconsistent in the second phase from 1971-72 onwards. The overall food production which reached 108 millian tonnes in 1970 -71 declined to 105.17 million tonnes and 97.03 million tonnes in the successive two years.[10] But it reached 121 million tonns in 1975-76. This figure remained almost stable upto 1980-81 (129 million tonnes). However total foodgrains recorded a steep rise to 145.5 million tonnes in 1984-85 and 150 million tonnes in 1985-86.[11] One of the main reasons of fluctuating production of foodgrains is the year to year variations in the level of rainfall and weather conditions which effect the total output to a very great extent.

Area under HYV's seeds programme have continued to register a success. At the end of the first phase of green revolution (1970-71) the overall acreage under HYV's was 15.29 million hectares which increased to 38 million hectares in 1977-78 and 56 million hectares in 1986-87. An interesting feature of the second phase is

the fast increase in the area under HYV's of rice, Particularly in areas which were conventionally non rice producing areas, like Punjab, Haryana and Western Uttar Pradesh.

In India, as a part of overall planned development, agricultural technology was sought to be updated through huge investment in irrigation and other infrastructure alongwith land reforms. That the immediate pay off of these policies was extremely high is clear from the fact (as discussed above) that it brought about technological break through i.e. Green Revolution in Indian agriculture, generating the process of modernisation in agriculture. The introduction of new biological and mechanical technology around 1966, initiated the phase of transformation of farm economy from subsistence level to commercial farming. However the pace of modernisation in Indian agriculture is not uniform and smooth. At the farm level, the rate of adoption of new strategy shows a differential response. One possible reason is that while the new technology (strategy) is scale neutral, it is in fact, also capital intensive. Therefore it might be equally productive on farms large or small (not so sure), but its adoption by small farmers is constrained by inadequate supply of finance own or borrowed, to meet the requirements of capital using new technology. Consequently, the impact of new technology exhibits

perceptible changes in the pattern of income distributions, savings and decisions of reinvestments on farms among different categories of farming community.

There is a vast literature on the question of the impact of new farm technology on farm income distribution. But conflicting results have been drawn by different scholars. The impact of new technology upon the ralative efficiency and pfofitability of small and large farmers have continued to be a subject of controversy amongst researchers.

Tirath Singh[12] in his study on Punjab during 1985 has observed, that as a result of adoption of the new farm techology, the absolute inequality in income has increased, while, the relative inequality has declined. According to Singh, the new technology has established successfully, the complementarity between growth and equitable distribution. Moreover he concludes that the small farmers gained proportionally more than the large farmers due to their lower base and scale neutrality of improved farm technique.

Suryakant Shah[13] in his study of green revolution and income distribution has concluded that overall impact of green revolution is favourable for all classes of people (rural as well as urban). In terms of the comparative advantage, both poorest of rural and poorest of urban have gained more than their richer counterparts, and it is the poorest of rural, who have gained more

than the poorest of urban from green revolution from 1960-81. In many other studies it is pointed out that the small farmers are more efficient in the production process as compared to their counterpart large farmers and they have enjoyed more the relative gains of new technology as compared to the large farmers who enjoy more absolute gains.[14]

In some studies the generally held view that the proportion of adopters is positively related to holding size has been refuted by some economists. According to them the rate of participation should not be mixed up with the proportion of area sown to HYV's. The later has been reported to be higher on small farms in comparison with large farms in some parts of the country.[15] Another view expressed by a group of economists was that as a result of the failure of redistribution of land and the inception of new strategy in agriculture, inequality the distribution of income among rural peasants has widen. The new agriculture strategy relying upon massive infusion of modern inputs, has helped more positively the achievement of the goal of increasing productivity while the social objective of distributional justice has been paid the least regard.

H.R. Sharma, T.V. Moorti & Kamlesh Singh in their study on Himachal Pradesh during 1983-84 have concluded that agriculture development has more skewed the distribution

of income. According to their view, in spite of concerted efforts being made by centre as well as state government, the gains of development have been unequally distributed making the rich persons more rich and the poor people more poor.[16] Suhas L. Ketkar[17] in his study using cost data on 60 dug wells from the Karjat taluka of Ahmed Nagar district in Maharashtra has concluded that the cost impediments and infrastructure increases with the increase in size of holdings but at a decreasing rate and as given the scale neutrality of new technology, large farmers having more facilities of irrigation will thereby increase their share in income and so will further accentuate income inequalities in the rural areas. Some other studies as made by G.R. Saini, P.K. Bhardhan, B.K. Choudhary, B.S. Minhas, A.K. Sen, M.S. Stanislaus etc. have stated explicitly that the new strategy with emphasis on massive infussion of new factors and techniques has a built in bias towards the promotion of inequalities.[18]

Yet there is another set of studies which points out that some have gained more than others but all have benefited from the new technology.[19] An empirical study of rendom sampling of 91 farmers cultivating HYV's in both Kharif and Rabi for the period of 1977-78 was drawn for the village of Seyyampalayam in Coimbatore district Tamil Nadu by K. Kalirajan. Utilizing the main technique of Lorenz Curve and Gini Concentration ratio he had established that the gains from the HYV programmes were

not enjoyed by large farmers alone but by farmers of all size groups. Furthermore, it is the land ownership pattern which determines the pattern of distribution of profit and is the main cause of presence of inequality.[20]

The debate is still not over. Hence a systematic investigation on this problem will shed useful information on the nature and extent of the problem. With this aim in view we propose to look into the farm size, production function and income levels of cultivating households in Karnal district in Haryana. Since Karnal happens to be an important agricultural area of Haryana which along with Punjab has been in the forefront in the adoption of new technology. We have chosen this area and a study is done on two villages namely Sandhir and Butana which are nearly hundred percent irrigated. The main hypotheses which we want to test in this study are as given below.

1) The new technology has resulted in increasing returns to scale in agriculture.

2. With the spread of new technology in agriculture, the inverse farm size productivity relationship tends to disappear.

3) Inequality in the size of operational land holdings is the main cause of unequal distribution in farm income.

This study is divided into six chapters. In chapter 1, we have presented introductory notes and set out the hypotheses to be tested. Data base, concepts and definitions used in our study are also presented in this chapter. A brief review is given in the last section of this chapter about our questionnaire which presents the information sought from the respondents.

Chapter 2 gives a broad introduction to the Haryana economy and the rapid strides made by its agriculture. Chapter begins with a brief discussion of General Physical set up of Haryana state. The cropping pattern and the composition of growth of area, production and yield from 1960-61 to 1986-87 have been attempted in the next section. The subsequent sections of this chapter deal with the growth of agricultural inputs during the above said period.

In chapter 3 output and cost structure of different farm size groups were analysed. The main aspects covered in relation to five farm size categories were cropping pattern, household composition, output per farm, per acre and per crop, cost composition such as, seed, manure , fertilizer, pesticide , irrigation etc. And lastly output input ratio is discussed.

Chapter 4 deals with returns to scale in agriculture and that of farm size productivity relation ship prevailing in the region, we examine the first two hypotheses proposed above in this chapter.

In chapter 5 we have put forward, household income and consumption. Separately farm income distribution and Non farm income distribution is given in this chapter. An attempt is made to point out the main sources of non farm income. Hypothesis 3 is tested in this Chapter.

Finally, in Chapter 6, we have put forward the main conclusion of the study.

1.2. Data Base:

The data used in this study are both primary as well as secondary. The secondary data are used mainly in Chapter 2nd, which are taken from the published report, "Statistical Abstract of Haryana" of various years. The data used for the rest of the study are primary one and were collected keeping in mind the problems and objectives of the study. The schedule was prepared for an interview with the selected households. The questions to the respondents were put in their own dialects and in order to seek correct information, counter questions were made where necessary. After collection of data, it was tabulated. The data relates to the agriculture year 1989-90.

1.3. Selection of household:

Our study consists of two villages based on stratified sampling, namely Sandhir and Butana in Karnal district of Haryana. We selected 150 households out of which 100 are from the village Sandhir and 50 from Butana.

A list of all cultivators in each village and the total operated area was prepared and arranged in an ascending order of cultivated area. Cultivating households were further sub-divided into four categories according to their size of net operational holdings as :

1) Marginal farmers with operational holdings upto 2.50 acres.

2) Small farmers with operational holdings from 2.51 acres to 5.00 acres.

3) Medium farmers with operational holdings from 5.01 acres to 10.00 acres.

4) Large farmers with operational holdings from 10.01 acres onwards.

The total number of cultivators in each of these four categories were listed. Out of the total cultivators in each category, 30 households (20 from the village Sandhir and 10 from Butana) from each category were selected. The method of selection used was stratified sampling.

For example, the number of households in village Sandhir in the category of small farmers were 121. Dividing this number by the total number of households that are to be selected (20), we found the figure of interval i.e. 121/20 = 6.05. We started by any random number supposed number 2. So the first household selected is at the Sr. No. 2. The next households selected, will be -

2+6=8, 8+6=14, 14+6=20 and so on. However, if a household can not be surveyed due to any reason then it is substituted by the household with the next sampling Sr.No.

Similarly we have selected 30 households consisting of agriculture labour. In this category also we collected

observations on 20 households from Sandhir village and rest 10 from Butana. The prodedure of selection was similar as discussed above.

1.4 Other Aspects of Methodology:

The present study is a cross section study of cultivators and agriculture labour households. The two villages from which data was collected are not significantly different from each other. In fact villages are in the vicinity of each other. Therefore, the basic structure of cultivation is almost uniform. Moreover as our sample size is small we have pooled together the households in each category and do not study separately on each village. Thus, our study on each category consists of 30 households. However, for making a better understanding on farm structure we have sub-categorised the last category of large farmers in chapter 3rd and 5th. Those households which are operating more than 20 acres are classified as very large farmers and rest farmers operating between 10.00 acres and 20.01 acres are called simply large farmers. The main procedure adopted in the study are discussed in the chapters wherever necessary.

An important limitation of the data collected is that only one agriculture year has been taken into account. However the reference year was a normal year in terms of monsoon and other natural hazards.

Generally the responses of the farmers were based on memory. As such data can not be treated as very accurate. However it was tried to check these data (by cross questions) so that we can draw some conclusions without loosing accuracy.

Sample size is small and is confined to only a single region.

1.5. Concepts & definitions:

It is essential to mention something about the concepts and definitions of the terms used in our analysis. A brief description is given below :

(i) The New Technology:

The new farm technology is defined by the use of bio-chemical and mechanical innovations. Bio chemical innovations include use of HYV' seeds, chemical fertilizers, Pesticides and insecticides and artificial irrigation sources. Mechanical innovations include tractor, thresher, seed drill and harvesters etc. our field data gives us a clear impression that almost all cultivators are using these innovations in varying degree.

(ii) Size of Operational Holding:

By size of operational holding we mean net land operated by a household. It comprises of total land owned plus land leased in minus land leased out. We

also subtract land mortgaged out and add land mortgaged in for the operational holdings. Addition or subtraction must be during the year of the survey.

(iii) Household:

Household is a unit in which all the members of the family are under joint operation for their livelihood. Some members may be in cultivating activities and others in Non farming activities but there is a single decision making body for the houshold. In some cases the members of the family are jointly operating their farm and Non farm activities but have separate kitchen. In our study we have taken such cases as single household.

(iv) Gross Output :

It includes the value of gross output from all the crops plus their by-products in the form of Straw, stalks etc. By-products are converted into value after multiplying their respective prices prevailing in the village at time of threshing. Similarly main products are converted into value terms by their respective prices in the market at the time of grain plucking. Imputed value of grain kept for home consumption was also calculated and included in the Gross Output.

(v) Material Cost:

Material costs consist of expenditure on fertilizer and manure, seed, insecticides and pesticides, canal

water charge, operational cost of tubewells and tractor, hire charges for machinary including tractor, hiring or maintainance cost of Bullocks, repair of implements and mechinary, hired threshing charges and transport charges actually paid. The imputed value of home produced inputs such as manure and seeds has been included at the respective prices that prevailed in the village or market at the time of survey.

(vi) Total Cost :

Total cost includes all material cost mentioned above plus rent paid out for land leased in and paid out labour costs, which include wages paid to permanent workers and casual workers. However in some cases wages are also paid in the form of grain, by products or other perquisites such as bread etc, particularly in case of attached labour. Value of all these form of wages are calculated at the prevailing prices in the village at time of work done. In estimating total cost we have not included imputed costs of family labour, owned land and capital assets. Depreciation of assets has also not been deduced due to the lack of reliable data on the value of capital assets and their expected life. So thereis some under consideration of total cost.

(vii) Gross Value Added:

Gross value added is derived by subtracting the value

of total material cost from value of gross output (as defined above).

(viii) Farm Business Income :

FBI is net surplus from cultivation. It can be calculated by deducing total costs from gross value of output. Farm Business income is a composite return to family as for family efforts and a return for management provided in fact.

(ix) Total Household Income:

Total Household income is sum total of FBI and Net income from Non farming activities (list of sources of non farm income is discussed in detail in 5th Chapter). Income received from sources such as dowry, gifts and selling of land or other farm assets is excluded from Non farm income.

1.6 Questionnaire :

The following is a condensed list of items on which information had been collected from the respondents:-

1) Particulars of family members:

Name, relation to head, age, sex, Martial status, education, Economic status (earner or not), major occupation and subsidiary occupation of each family member.

(ii) Land area owned, leased in area, leased out area, net operated area by each household.

(iii) Cropwise information regarding:

Total area sown,number of watering, total output (Quantity & value), value of by products, use of seeds, manure, fertilizer, Pesticides (insecticides) in value terms, hired charges of water; bullock, tractor and other equipment; wages paid for hired labour for sowing, transplanting and harvesting & threshing in terms of cash, kind and perquisite, no of days of hired labour, and number and days of family workers used, charges paid for threshing and transporting of grain into market.

(iv) Disbursemnt:

Land revenue, bullock maintenance cost, repair own implements, electric charges of tubewell,oil charges for owned tractor and engine,canal irrigation charges, rent of land leased and other charges to be paid.

(v) Household income:

Permanent and casual labour: Name, nature of work (Permanent or casual), type of wage employment (agriculture or non agriculture), wages paid in cash, kind perquisite and total.

(vi) Income:

From leasing outland, Dairying, Livestock poultry etc; Income from property and financial assets, salaries and pension, agro industries

remittancesfrom outside, wages received as labour, retail tradeshop, income from craftship and income from hiring out of agriculture implements.

Respective expenditure incurred on all these items and net incomefrom these sources.

(vii) Consumption expenditure in terms of goods purchased and home produced:

Wheat, rice, other cereals, Gram, Pulses, Milk, Milk Products, Edible oil or Ghee, Meat, Eggs & Fish, Vegetables, Fruits & Nuts, Sugar and Gur, Salt & Spices, Beverages, Pan tobaco, Fuel & Light including home consumed electricity and miscellaneous goods & services (excluding durable goods).

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CHAPTER-2

Agricultural Economic Set Up of Haryana During 1960-61 to 1987-88.

2.1 General Physical Set Up:

Haryana as a state was carved out from the composite Punjab state on 1st November, 1966. With an area of 44,222 Square Km. Haryana is located in the northern part of India, adjoining Delhi. On its east is situated the state of Uttar Pradesh while Himachal Pradesh is on its north - east. Punjab and Rajasthan bound it from north west and south and sourth west respectively. Geographically the boundaries of Haryana are made by river Ghaggar in north west, Shiwalik hills in north east, river Yamuna in east and Aravalli hills in the sou-th and thar desert in the south west.

Greater part of Haryana forms the part of Indo - Gangetic plain of the sub-continent. Excepting outer Shiwalik ranges in Ambala district (north east) and Aravalli ranges in Mahendragarh and Gurgaon districts (south), the entire Haryana is a broad level plain. The Shiwalik ranges render a slope towards south and southwest, whereas the Aravallisprovide a gradient towards north. The plain can be sub divided on the basis of aridity as - Eastern and Western regions. The western plain with a higher degree of aridity mainly covers Hissar and

Mahendragarh districts. This plain has a dry climate, steppe vegetation and sand dunes of various shapes and sizes. The eastern plain which has a fertile, light and loamy soils, extends west of Yamuna river. As being a flat and very fertile area, it produces the largest part of state's agricultural production.

In the north, the Haryana Plain is bordered by low hills of Shiwalik ranges. A large number of rainfed torrents flow down the outer slopes of the Shiwaliks. The only perennial river flowing not excatly through Haryana but along its eastern border is Yamuna. Yamuna originates from Yamnotri near Garhwal and below Paonta Giri it follows a southern course and works as a boundary between Uttar Pradesh and Haryana. About 20 kilometers south of Paonta are located Tajewala and Khare where from western and eastern Yamuna canals have been taken out. The western Yamuna canal irrigates a large acreage in the districts of Karnal, Kurukushetra, Rohtak and Hissar. In the South of Delhi, Yamuna leaves the Haryana boundary at Hassanpur (Gurgaon) and completely becomes a river of Utter Pradesh. Ghaggar, Markanda, Saraswati, Sahibi, Rakshi, Dohan and Kasauli are other notable streams of Haryana. These streams are seasonal and look like streaks of water only during summer and very often become formidable bodies of water during rainy season.

The climate of Haryana, with pronounced continental character is of Semiarid monsoontype. Deficiency of

rainfall over a wide area, high summer temperature, high rate of evaporation and markedly cold winters are its chief characteristics. The three usual seasons of winter, summer and rains are experienced here also. The two well marked rainy seasons in the state are -

(1) The monsoon period lasting from the middle of June till September on which autumn crops and spring sowing depend and

(2) The winter rains which occur from December to February and although often insignificant in quantity yet they prove to be bonanza for rabi crops. Rainfall is scanty, particularly in Bhiwani, Mahendragarh and Hissar districts.

The flora of this plain bears resemblance to those of Iran, Arabia and North Africa, the largest truly indigenous trees are the Shisham (Dalbera Latifolia) and the kikar (Acacia Arabia). The scrub jungle consists mostly of juljund and Coral flowered leafless Karir (caper). The soil of the region is mostly alluvial loamy. But in some places we find loamy soil, light loamy soil, sandy loamy soil and sandy rocky soil. The soils of Haryana as a whole are fertile. This type of soil has played a vital role in development of Haryana agriculture. In general we can say the physical set up of the state is helpful in accelerating the pace of agricultural development.

2.2. Land Utilisation:

Table 2.1 shows land use pattern in Haryana. The total geographical area shown in the table is as recorded in the revenue papers of the state. A slight increment or fall in total area is on account of rechecking of revenue records. During 1986-87 Only 3.8 percent of the area was under forests in the state and 13.7 percent area was not available for cultivation. However the area under forests has seen a slight increase from 1960-61 to 1986-87. Land not available for cultivation, other uncultivable land and fallow land all have undergone a tremendous decline. The proportion of area of these three items has declined from 21.05 Percent of total area in 1960-61 to 13.66 Percent in 1986-87. Thus as a result of a slight increase in forest area and a tremendous fall in the land not available for cultivation, land area availabe for cultivation has increased. The Table shows that during 1960-61, only 77 Percent of net area was under cultivation while it increased to 82 Percent during 1986-87. With India entering the green revolution period, multicropping as well as more and more area has been brought under cultivation in Haryana. Thus as a result, there is a continuous rise in gross cropped area as well as cropping intensity.

Table - 2.1

(area in 000 hectares)

Land use Pattern in Haryana

Years	1960-61	1970-71	1975-76	1980-81	1986-87
Particulars					
1	2	3	4	5	6
Area according to village papers	4389 (100)	4402 (100)	4404 (100)	4405 (100)	4391 (100)
Area under forests	64 (1.46)	99 (2.25)	104 (2.36)	132 (3.0)	169 (3.85)
Land not available for cultivation	516 (11.76)	490 (11.13)	473 (10.74)	434 (9.85)	390 (8.88)
Other uncultivable land (Excluding fallow land)	221 (5.03)	98 (2.23)	78 (1.77)	60 1.36)	52 (1.18)
Fallow land	187 (4.26)	150 (3.41)	125 (2.84)	177 (4.02)	158 (3.60)
Net area sown	3401 (77.49)	3565 (80.99)	3624 (82.29)	3602 (81.77)	3622 (82.49)
Gross cropped area	4584	4957	5451	5462	5662
Gropping intensity	135	1.39	1.50	1.52	1.56

Source : Various statistical abstracts of Haryana.

(Figures in parentheses are percentage to total area)

2.3 Crop Diversities and Cropping Pattern:

Table 2.2. gives an idea of change in cropping pattern in the state over 1960-61. The extent of shift in the cropping pattern in crops like rice, wheat and cotton is very high. Among foodgrains wheat and rice experienced a favourable shift and coarse grains like jowar, bajra, maize, barley as well as pulses a negative shift during this period. A major favourable shift took place in cotton and total oilseeds during the time period under consideration. Introduction of HYV's of seeds, which led to Green Revolution in the state disturbed the previous cropping pattern and so one observes marked change in the percentage area under different crops which is still continuous. A sharp shift has taken place particularly in the case of wheat, which occupied only 13 percent of GCA during 1960-61 and increased to 31.5 percent of GCA, the highest area occupied by any single crop during 1986-87. A major breakthrough has also taken place in case of rice, the percentage area to gross cropped area of which has increased around four times in the period of 26 years. However the gain in area by superior cereals has been largely at the cost of pulses and coarse grains. Alone gram occupied 33 percent of GCA during 1960-61 which is reduced to 10.8 percent in 1986-87, bringing down the area devoted to total pulses from 35 percent to 12 percent during the above mentioned period. Due to this fall in the area of pulses, the total area under foodgrains has gone down from 81 percent in 1960-61 to 73 percent in 1986-87. However favourable changes have taken

Table 2.2.

(Area in '000 hectares)

Changes in cropping pattern during 1960-61 to 1986-87.

Name of the crop	Area 1960-61	Area 1986-87	Percentage change
1	2	3	4
Rice	155 (3.38)	628 (11.09)	305.2
Jowar	308 (6.72)	151.4 (2.67)	-50.0
Bajra	802 (17.50)	774.2 (13.67)	-3.50
Maize	106 (2.31)	54.3 (0.96)	-48.8
Wheat	628 (13.70)	1782.4 (31.48)	183.8
Barley	111 (2.42)	69.3 (1.22)	-37.6
Total Cereals	2115 (46.14)	3460.6 (61.12)	63.6
Gram	1543 (33.66)	610.9 (10.79)	-60.4
Total Pulses	1606 (35.03)	679.2 (12.0)	-57.7
Total Foodgrains	3721 (81.17)	4139.8 (73.12)	11.3
Total oilseeds	160 (3.49)	297.1 (5.25)	85.7
Cotton	103 (2.25)	380.7 (6.72)	269.6
Sugarcane	130 (2.84)	125.5 (2.22)	-3.5
Gross cropped area	4584 (100)	5662 (100)	23.5

(Figures in Parentheses are percentage to GCA)

Source : Various Statistical Abstracts of Haryana.

place in the case of non food crops and particularly in the area under oilseeds and cotton.

Looking towards cropping pattern during 1986-87 reveals that though a large variety of food and non food crops are grown in Haryana, the cropping pattern in the state remains largely foodgrain oriented which accounted for over 70 percent of GCA during 1986-87. The most important crops in the category of foodgrains were wheat, rice and bajra, which together accounted about 56 percent of GCA during the period 1986-87 in which wheat alone accounted for about 31.0 percent. However the proportion of pulses in the total foodgrains is quite low as compared to other cereal crops. Total pulses accounted for 12 percent of GCA whereas total cereals accounted about 61 percent of GCA during the time period mentioned above. Among nonfood-grains cotton and oilseeds are important.

2.4. Growth Performance of agriculture:

The major dynamic element in the rural economy of Haryana, is the growth of output of various crops. The growth in crop output is the end result of a number of changes underway in technology, institutions, supporting services etc. in the rural economy and in its own turn leads to further changes in agriculture as well as other sectors of the economy.

Here we will examine the growth rates of area, output and yield of major crops in Haryana state. During 1960-61 to

1986-87. The compound growth rates are worked out by fitting the following semilog function to time series data.

$$Y = A\ B^t$$

where Y = Area or Production or Yield

t = Time Period

A& B = are constants

By taking log of both sides we get

log Y= log A + t log B

The rate of growth then can be obtained as -

r=(Antilog (logB)-1) x 100

The time series data was divided into three phases as 1960-61 to 1966-67, 1966-67 to 1975-76, 1975-76to 1986-87 and finally 1960-61 to 1986-87. The first phase represents the growth rate during pre-green revolution and in our regression equation is taken as T_1.
The rest two phases represent the period of post-green revolution and are represented as T_2 and T_3 respectively. The time period 1960-61 to 1986-87 represents the whole time period of pre and post-green revolution and is represented by T_4. The rates of growth for these four time periods for area production and yield are given in table 2.3.

Let us see first growth rate of area, production and yield for the whole time period under our analysis,

i.e. 1960-61 to 1986-87. The rate of growth of area is fairly high in case of rice and wheat, but other inferior food crops namely jowar, maize, barley gram and pulses experienced a negative growth rate in the area. Among non foodgrains, only Potatoes have grown significantly in area by 7 percent per annum. However groundnuts and oilseeds also experienced a moderate positive growth rate in area.

One encouraging point to note about Haryana's agriculture is that except pulses (gram) and groundnuts, all crops have shown a positive increase in yield rate. There are however considerable inter crop variations in growth rates of average yields, which show growth rates relatively high in case of rice, wheat, moong and barley, moderate in case of jowar, bajra, mash, total oilseeds and sugarcane and negative in case of gram, total pulses and groundnuts. A notable thing is that except wheat rice and potatoes, the growth rate of yield is higher than the growth rate of area of all other crops.

As a result of increase in area as well as yield, the output of rice and wheat has undergone a tremendous change. Both rice and wheat have experienced a very high growth rate of 10 percent and 7.9 percent per annum, respectively. As a result total foodgrains output increased by around 5 percent per annum and that of total cereals increased by 6.8 percent per annum. However as both area as well as yield of pulses have undergone a negative change, total

Table - 2.3

Compound growth rates of different crops During 1960-61 to 1966-67, 1966-67 to 1975-76, 1975-76 to 1986-87 and 1960-61 to 1986-87.

Years	1960-61 to 1966-67			1966-67 to 1975-76		
Crops	A	Y	P	A	Y	P
1	2	3	4	5	6	7
Rice	3.95	0.718	4.69	4.74	5.02	9.99
Jowar	-3.17	-0.70	-3.67	-5.86	4.77	-1.34
Bajra	1.60	2.06	3.68	1.03	1.18	2.44
Maize	-2.71	4.93	2.09	3.84	1.59	5.49
Wheat	2.42	0.91	3.35	5.32	1.24	6.64
Barley	6.33	11.69	17.77	-1.70	-0.86	-2.60
Total cereals	1.47	2.93	4.45	2.24	3.28	5.59
Gram	-7.42	-7.81	-14.65	-0.04	-3.45	-3.85
Mash	-8.96	1.19	-7.84	1.60	3.74	5.41
Moong	-12.49	1.30	-11.29	-4.18	6.81	2.30
Massar	3.20	-8.23	-5.35	-2.86	1.80	-1.05
Total Pulses	-6.99	-7.73	-14.20	-0.61	-3.04	-3.63
Total Foodgrains	-1.75	-0.26	-1.99	1.39	2.28	3.69
Groundnuts	22.33	4.50	27.67	-4.08	0.38	-3.67
Total oilseeds	-0.23	-3.37	-3.60	0.72	0.73	1.46
Sugarcane	3.99	0.86	4.89	0.56	0.82	1.41
Potato	8.63	0.09	8.98	15.80	3.80	19.89

Source, Various statistical Abstracts of Haryana.

1975-76 to 1986-87			1960-61 to 1986-87		
A	Y	P	A	Y	P
8	9	10	11	12	13
6.10	1.12	7.22	5.87	3.95	10.02
-2.17	3.17	0.90	-3.77	1.62	-2.24
-2.69	1.60	-1.30	0.02	1.86	1.89
-8.07	2.47	-5.95	-2.32	0.76	-1.66
3.29	3.57	6.98	4.48	3.31	7.94
-5.17	1.92	-3.29	-1.54	2.25	0.60
1.17	4.52	5.67	2.11	4.56	6.84
-5.39	-3.33	-8.55	-2.88	-0.57	-3.43
-5.89	1.02	-5.14	-2.19	2.36	0.05
-7.19	0.36	-6.83	-6.27	3.57	-2.92
-2.28	1.74	-0.59	-1.50	0.002	-1.49
-5.02	-2.93	-7.80	-2.69	-0.40	-3.08
-0.24	4.35	4.10	0.74	4.19	4.97
-2.35	-3.85	-6.12	1.29	-0.03	1.44
8.86	3.83	13.03	1.32	1.50	2.85
-3.94	1.44	-2.57	- 0.24	0.51	0.21
-2.00	-0.86	-3.11	7.10	0.48	7.65

output of Pulses has declined at rate of 3 percent Per annum during this period. Inferior cereals as bajra and barley have experienced a low but positive growth of production while jowar and maize have undergone a negative growth rate. All cash crops (nonfoodgrains) experienced a positive growth rate of production with Potatoes being the highest (7 percent Per annum).

We now see the pattern of agriculture growth during Pre and Post-green revolution period. During the sixties agriculture growth was led by barley among foodgrains and groundnuts among cash crops. In the first phase of post-green revolution period (1967-68 to 1975-76) rate of growth of rice output has taken a major position among foodgrains and Potato among cash crops. The growth rate of output of barlay and groundnuts which had a high rate of growth during Pre green revolution period recorded negative growth rate during first phase of green revolution. The position remained almost same for foodcrops during second phase of the green revolution i.e. rice and wheat remained dominant crops in terms of the growth rate. In the cash crops, major position is occupied by total oilseeds while Potatoes recorded a negative growth rate. A down-ward trend in output of Pulses has taken place after the advent of green revolution in the state.

Trends in the rate of growth of area under major crops also reflect a similar Pattern. The rate of growth

of area of rice and wheat has slightly changed among foodgrans. There is a sharp decline in growth rate of area under barley and jowar from pre-green revolution to 1st phase of Post green revolution period. Growth rate of Pulses remained negative. Among cash crops, the rate of growth of area under groundnuts has declined tremendously while that of Potatoes has increased tremendously. During the 2nd Phase only growth rate of rice, wheat and total oilseeds is Positive. It seems that during the 2nd Phase of green revolution, the area under the crops like wheat, rice and oilseeds expanded at the cost of Pulses and other inferior cereals.

It is discouraging to note that the rate of growth of yield of all foodgrains except rice and some Pulses show a decline in the first Phase of green revolution. In the second phase also yield rate of foodgrains, except wheat and barley has undergone a decline. However growth rate of yield of cash crops particularly oilseeds has shown only slight improvement.

To find out the sources of growth of Production of various crops in Pre and Post-Green Revolution, a de-composition of growth rates has been done. In the Pre green revolution period, the growth rate of production of crops except bajra, maize, barley,mash and moong was coming from growth of area. Growth of yield was mainly contributing in the Production of maize and barley. However in the case of barlay, the growth of area was also very high and

so this crop had experienced a very high growth of production. In the first Phase ofPost-Green Revolution, the position was completely reversed. During this period except maize, wheat and Potato, the growth of production in all other crops had its source in growth of yield rate. Rice had experienced a high growth of yield as well as area and so the growth rate of Production Stands to be very high in this case. The growth rate of area during first Phase points out that rice and wheat which were covered by high yielding variety technology, have undertaken area sown of other crops. In the second phase of green revolution, the area growth rate has completely paralysed and except rice and oilseeds, growth of production is coming completely from growth of yield. During the second phase, growth rate of area in most crops is negative.

2.5 Agriculture inputs

With the introduction of new technology the farmers have adopted the improved seeds-irrigation fertilizer-pesticides technology. So the importance of these inputs has increased as they have a direct effect on crop yield.

2.5.1 Irrigation :

The Percentage of irrigated area under the selected crops in the state is presented in table 2.4. The total irrigated area in the state has increased more than three times during the period of two and a half decades starting from the 1960's to mid 1980's.

Table -2.4

Percentage of irrigated Area under relected crops in figure 1960-61 to 1986-87.

Year	(000Hectare) Gross Irrigated Area	% age Rice	% age Wheat	% age Total Cereals	% age Total Pulses	% age Sugar-cane	% age Cotten	% age GIA as a % of GCA
1	2	3	4	5	6	7	8	9
1960-61	1206	7.96	24.79	46.19	21.23	8.46	7.13	26.3
1961-62	1261	7.93	25.06	44.81	22.20	8.41	7.61	28.0
1962-63	1360	8.23	25.22	46.25	20.00	7.43	8.01	29.6
1963-64	1431	7.34	25.23	43.60	18.66	6.43	11.39	32.1
1964-65	1428	7.63	27.31	43.35	19.61	8.19	11.76	31.2
1965-66	1463	9.23	29.39	48.32	14.56	10.25	12.99	35.9
1966-67	1736	7.95	29.49	50.92	16.59	7.32	10.20	37.7
1967-68	1780	9.10	28.76	50.28	16.97	5.73	13.09	34.6
1968-69	1864	9.50	35.73	57.72	12.71	7.51	11.05	46.0
1969-70	2158	9.55	36.98	58.29	13.44	6.90	8.85	43.7
1970-71	2230	10.54	40.99	61.93	11.35	5.96	8.47	45.0
1971-72	2325	10.88	41.99	61.07	12.34	4.09	10.19	46.1
1972-73	2477	10.62	42.83	62.70	9.77	4.28	10.25	47.7
1973-74	2584	9.58	39.32	60.10	11.84	5.14	9.60	50.2
1974-75	2596	9.90	38.17	61.59	9.70	5.55	9.40	53.9
1975-76	2732	10.03	39.68	60.80	11.90	5.16	8.82	50.1
1976-77	2698	11.30	44.62	63.57	10.23	5.63	8.89	51.1
1977-78	2776	12.50	43.51	61.85	9.65	6.20	9.40	51.1
1978-79	2976	14.31	44.35	63.84	9.68	5.64	9.41	53.9
1979-80	3131	15.27	44.59	66.05	8.85	3.67	9.77	64.4
1980-81	3309	14.17	41.64	62.89	10.09	3.11	9.40	60.6
1981-82	3455	13.98	42.03	63.13	10.30	3.76	9.35	59.3
1982-83	3554	13.51	45.55	65.66	6.49	3.82	10.87	67.1
1983-84	3595	14.16	46.90	67.31	5.48	3.36	10.88	63.2
1984-85	3504	15.64	46.52	67.66	4.51	3.05	8.22	63.6
1985-86	3679	15.68	44.11	65.26	6.20	2.69	9.27	65.7
1986-87	3912	15.85	43.89	65.80	6.11	3.07	9.66	59.6

Source, Various Statistical abstracts of Haryana.

Highest irrigated area has been under wheat which has remained a very important crop not only during the eighties, but also during seventies and sixties. Similarly rice has also improved its position from sixties to eightes. Since both these crops are covered by the new agriculture strategy consisting of HYV's seeds and use of fertilizer and high level of irrigation they have been successful in Haryana, their high percentage in irrigated area is but natural. Percentage of irrigated area under Pulses has fallen which are not covered by green revolution. Cotton however, has improved its position. Table points out that gross irrigated area as a percentage to gross cropped area has been continuously increasing except for a slight decline in between the years till eighties. But during the eighties we find more fluctuations in the percentage area irrigated to GCA. One thing to be noted down here is that the state of Haryana is now more and more dependent upon artificial sources of irrigation with the increase in proportion of irrigated area to GCA. Table. 2.5 gives the sources of irrigation. The Table shows that NIA as a Percentage to NSA has increased from 30 Percent in 1960-61 to 64.8 Percent in 1986-87. The importance of wells and other sources of irrigation has decreased and these sources are replaced by other sources as tubewells and canals .

The irrigation by tubewells is becoming very popular in the state. It is evident from the table as during 1970-71, that no area was irrigated by tubewells. However during

Table- 2.5

Net irrigated area (Percentage) By source of irrigation

Sources of irrigation / Years	1960-61	1965-66	1970-71	1975-76	1980-81	1986-87
1	2	3	4	5	6	7
Govt. canals	81.73	78.30	62.14	59.06	54.4	51.23
Wells	16.48	18.27	37.47	1.77	1.22	0.60
Tubewells	-	-	-	38.88	44.10	47.96
Tanks and others	1.79	1.06	0.39	0.28	0.28	0.21
Total(Net irrigated area 000 Hectares)	100 (1007)	100 (1226)	100 (1532)	100 (1754)	100 (2134)	100 (2348)
Percentage to Net area sown (NIA / NSA x 100)	30	37	43	48.4	59.2	64.8

Source : Various statistical Abstracts of Haryana.

1986-87 around 47 Percent of total irrigation was by the source of tubewells. In addition to rainfall only canal and tubewells are now the main source of irrigation in the state of Haryana.

2.5.2 Chemical Fertilizers & Pesticides :

It is an undisputed fact that the HYV's Programme was successful due to assured irrigation and use of chemical fertilizers and Pesticides besides the use of improved varieties of seeds. In the chemical fertilizers, the use of Nitrogenous, Phosphatic and Potasic is Prevalant in the state.

The use of fertilizers gained momentumafter mid seventies and trend is continuous till toady. In 1988-89, the index of fertilizer rose to 3814.9 showing thereby an increase of 3714.9 percent in the fertilizer consumption in the state as compared to 1966-67. In fact there is a continuous rise in consumption of fertilizer with the exception of 1974-75 and 1987-88 when there was only a slight decline in use of fertilizer. Such a gigantic growth in the chemical fertilizer in the state shows its extent of effectiveness in increasing the Productivity per hectare of land. In fact use of fertilizers and pesticides run together. The table shows the increasing use of pesticides in the state. Pesticides use has increased from 273 tonnes in 1966-67 to 4407 tonnes in 1988-89. Moreover more and more land is being brought under the use of Pesticides. In 1966-67 only 19.17 Percent of total area was covered by the use of Pesticides. It has increased three fold in 23 years. In 1988-89 about 60 Percent of area was brought under the use of various types of Pesticides which has further helped in increasing the productivity of land.

Table - 2.6

Fertilizer and Pesticides consumption in Haryana (1966-67 to 1988-89)

Year	Fertilizer Consumption (Tonnes)			Total	Index of Fertilizer 1966-67=100	Fertilizer Consumption per Hectare (Kg.)	Pesticides Consumption	
	N	P	K				Quantity (in tonnes)	Area Covered
1	2	3	4	5	6	7	8	9
1966-67	12626	574	147	13347	100.0	3.9	273	19.17
1967-68	30227	1726	521	32474	243.3	9.2	293	17.64
1968-69	40325	5513	1186	47024	352.3	14.4	327	20.62
1969-70	47000	5120	1800	53920	404.0	15.2	363	22.17
1970-71	60972	6860	2228	70060	524.9	19.7	412	32.06
1971-72	73432	6305	2397	82134	615.4	23.0	482	22.35
1972-73	83106	8175	2611	93892	703.5	26.4	485	29.45
1973-74	94060	16473	4464	114997	861.6	32.2	1525	35.20
1974-75	66081	7117	2279	75477	565.5	21.4	1335	32.03
1975-76	86308	8322	2285	96915	726.1	26.7	1400	37.33
1976-77	115503	15661	5981	137145	1027.5	37.6	1600	45.33
1977-78	150195	28654	9262	188111	1409.4	51.6	1600	49.02
1978-79	161933	31833	10301	204067	1528.9	55.9	2000	48.63
1979-80	174539	30242	10657	215438	1614.1	60.6	2100	54.55
1980-81	187385	31340	12098	230823	1729.4	64.1	2150	50.58
1981-82	208726	32047	10801	251574	1884.9	68.7	2250	49.08
1982-83	216175	37337	9717	263229	1972.2	73.2	2641	52.02
1983-84	259543	53028	13679	326250	2444.4	90.6	2753	59.85
1984-85	272745	56246	7629	336620	2522.1	93.1	1313	64.62
1985-86	296394	69639	6154	372187	2788.5	103.0	3608	70.20
1986-87	327037	81957	5843	414837	3108.1	114.5	3995	75.50
1987-88	300695	88319	4889	393903	2951.2	121.8	3700.11	67.76
1988-89	383610	119618	5944	509172	3814.9	-	4407	59.49

Source: Various Statistical Abstracts of Haryana.

2.5.3 High Yielding Variety Seeds:

A major break through has been brought about by the increased use of chemical fertilizers along with the use of high yielding of seeds in the state's agriculture. The table 2.7 presents the area under high yielding varieties of rice maize, bajra and wheat in the state since their adoption i.e. from 1967-68.

Table- 2.7

Area under HYV Crops in Haryana 1966-67 to 1986-87

(Area '000 Hectares)

Crop	Rice		Maize		Bagra		Wheat	
Year	Area	%age to total	Area	%age to total	Area	%age to total	Area	%age to total
1966-67	-	-	-	-	-	-	-	-
1967-68	4	1.8	3	2.6	34	3.8	100	11.9
1968-69	10	4.4	8	9.1	51	5.8	256	28.5
1969-70	20	8.3	11	10.0	131	14.1	440	43.3
1970-71	30	11.1	14	12.2	240	27.3	630	55.8
1971-72	70	24.1	14	12.3	214	24.3	796	67.6
1972-73	92	31.6	14	12.5	219	24.2	1000	78.7
1973-74	125	42.9	13	11.0	240	25.1	1018	86.5
1974-75	145	52.7	14	11.3	300	32.6	990	88.6
1975-76	169	55.7	17	12.3	250	24.9	1087	88.7
1976-77	190	57.6	20	16.3	250	25.7	1200	89.0
1977-78	252	67.9	20	20.9	250	28.2	1224	90.0
1978-79	330	72.0	25	28.2	300	34.4	1340	90.4
1979-80	416	81.7	25	32.5	322	39.5	1346	91.1
1980-81	414	85.6	28	39.3	335	38.5	1360	92.0
1981-82	441	87.4	25	35.7	485	56.9	1437	92.0
1982-83	430	87.8	20	38.3	515	66.1	1584	91.9
1983-84	435	77.6	25	46.3	520	61.9	1675	93.4
1984-85	470	84.3	25	40.7	460	61.5	1610	94.4
1985-86	495	84.8	20	39.2	410	63.5	1612	94.8
1986-87	480	76.4	20	37.7	490	63.3	1710	95.9

Source: Various Statistical Abstracts of Haryana.

The table shows that there is continuous rise in area under HYV for all these four crops with a few exceptions. However a very sharp increase in area under HYV has taken place in wheat and rice. During 1967-68 i.e. the year of advent of green revolution only 11.9 percent of area of wheat was under HYV. Nearly whole of wheat area was under HYV during 1986-87. Rice has also gone through a very sharp increase from 1.8 percent in 1967-68 to 76.4 percent in 1986-87. During 1986-87 63.3 percent of area under Bajra was captured by H.Y.V. The area of maize under HYV was however quite low of 37.7 percent.

After the whole discussion we can say that the agriculture of Haryana is growing with a rapid rate. New technique of production is taking place with adoption of HYV seeds, Pesticides, insecticides, fertilizers and with the availability of facilities of irrigation by tubewells and canals, and this has helped in increasing the agriculture production and income of farming families.

CHAPTER-3

Farm Size, Output Structurs and Cost of Farming

Farm structure and organisation constitute the ground work of Production efficiency on the farms. The size and disposition of a holding, soil fertility and the man-made improvements on it can serve as objective basis for differentiating one farm from another, in terms of their potential for higher production. Gross output per acre is a crude general index of farm level efficiency in resource use. In juxtaposition with per acre cost, it provides a rough indication of profitability of farm business. However, a general descriptive analysis of costs and returns is no substitute for a regorous production function analysis, which serves better as an indicator of the efficiency of factor proportions in production. Nevertheless, a study of output (returns) and costs throws useful light on aspects which need careful scrutiny in a rigorous analysis. With this in view, we examine in this chapter output structure and cost of cultivation. The first section of this chapter puts forward the characteristics of households and land holdings. In the second section cropping pattern has been undertaken. In the next section a detailed study is made on output and input structure and of costs. In the last section we have tried to find out output-input ratio for the region under our study.

3.1 Household Characteristics:

Our present study is based on the observations of 150 households (as covered by the field survey). Of this 120 consists of households which are operating some land either owned by them or taken on lease. Rest of the households are those comprising of agricultural laborers having no operational land. A further break down of cultivating holdings into five categories is done which have already been discussed in the first chapter.

Since family is a basic social unit, the extent of its size gives us an idia about the working force available, consumption expenditure and the capacity of family to re-invest in the farming enterprise.

Table- 3.1 clearly shows that household size increases with the farm size. In other words, there is a direct relationship between farm size and family size. The reason for such a relationship seems to be that the large farmers have mostly joint family system with a common kitchen, whereas small and marginal farmers are individual or separate families having separate kitchen and therefore, smaller number of members in the family. With a bigger family size, large farmers should have more number of earners in the family as compared to small farmers. It is evident from Table-3.1. The number of earners is more in the case of large farmers (3.8) as compared to small farmers (1.8). However, the percentage of earners is high in the marginal

farmers group as compared to very large farmers. In the former category it comes about 33 percent while in the latter it is about 31 percent. In the later chapters, we shall analyse the percentage of earnings of households from different cultivating and non-cultivating activities.

3.2 Household and Land holdings:

One important fact to be noted from Table-3.2 is the unequal distribution of holdings among cultivators. Out of the total operational area in sampled households around 59 percent is being operated by the category of large and very large farmers. On the other hand, the marginal farmers operated only 5.8 percent of total operational area. Thus there is a large difference between the land area operated by these two categories of farmers whereas their proportion in the total number of households is the same.

The intensity of cropping reflects the intensive use of land. It is generally considered that assured water supply permits the use of modern agricultural inputs and intensive use of land and hence higher cropping intensity. This is true in the present case also. As this study is on the area which is under green revolution belt and with 100 percent irrigation, the cropping intensity is higher, 2.07 as compared to the over all figure for Haryana[1] 1.56, during 1986-87 (Haryana as a whole is far behind 100 percent irrigation). Nevertheless we find an inverse relationship between farm size and cropping intensity with

the confirmation of earlier studies.[2] As farm size increases cropping intensity decreases. Cropping intensity for the category of marginal farmers is calculated as 2.43, it decreases to 1.96 as we increase the farm size to very large farmers. The main reason for this observed fact of inverse relationship seems to be that by holding a smaller area, the marginal farmers and the small farmers try to produce as much output as large farmers do by the method of multiple cropping.

3.3. Cropping Pattern:

There are two main crop seasons in the villages surveyed, namely Kharif and Rabi. Only two worth mentioning crops besides fodder crops in these two seasons were paddy and Wheat respectively in Kharif and Rabi seasons. The prevailing cropping pattern in the region under study is given in table- 3.3. The crops grown in the season of rabi are wheat, gram, mustard and, Barseem & Jawi (fodder crops). The crops of Kharif season are rice (paddy), maize, pulses (massar, moong, Urd) and fodder crops like jowar, bajra, maize etc.

The Table reveals that although there are eight or nine crops grown, however, clearly the emphasis is on wheat and rice. These two crops alone constitute 82.5 percent of gross cropped area of the region. The next most important crop is fodder. The sum total contribution of rabi and kharif fodder crops in gross croped area is, a little more than 16 percent. Thus remaining little more than one percent is contributed by the four crops of maize, gram, mustard and pulses. Besides above mentioned crops, some more crops like

potato, sugarcane and some seasonal vegetables are also grown for personal consumption but the area devoted to them is insignificant and so is not included in the analysis.

The Table shows that more land is devoted to fodder crops by small cultivators than by largecultivators. Both in Rabi as well as in Kharif season, Very large farmers devote about 7.7 percent of gross cropped area to fodder whereas marginal farmers devote around 35.6 percent. However this difference in percentage of area is due to unequal distribution of total cropped land between small and large farmers, whereas both devote near about equal area (in absolute terms) to fodder.

One more striking difference in the cropping pattern between small and large farmers is that large and medium farmers are found to be growing some subsistence crops like maize,gram, mustard and some pulses (although the area devoted to these is a very nominal) small and marginal farmers concentrated on three main crops of rice, wheat and fodder crops.

With the arrival of green revolution, there has been a great change in the production conditions and cropping Pattern in Haryana and particularly in the regions where there are ample irrigation facilities. During our field survey, we particularly inquired about the difference that has taken place in cropping pattern since sixties.

According to our informants, during the sixties, the cropping Pattern was completely different from what it is now. For instance during Rabi season, sugarcane, gram, jawi and barley were the main crops, whereas, wheat was grown only by a few farmers and that also as a subsistence crop. Similarly rice, which is now a very important Kharif crop had hardly any significance at that time. Maize, Cotton, Sugarcane (crop of whole year) and other pulses and vegetables were the main kharif crops used at that time.

The current cropping pattern makes it evident that the farmers are now producing only a few crops. The two main crops of rice and wheat are now commercial crops and are grown for the market. On the other hand, the previous commercial crops like gram, cotton and sugarcane have now become completely insignificant. Such change has taken place due to assured profitability in the two crops of wheat and rice due to encouraging price and yield rates.

Fodder however has retained its important place in the cropping pattern. Previously fodder was needed for the large number of milch and work animals required for agricultural work. Now tractors have been adopted on a fairly large scale, but the number of bullocks is still quite large.[3] The one main reason for this is that tractor facility is acquired by medium and small farmers

and many of them like to keep bullocks as a standby in case the tractor fails. Moreover bullock ploughing is still preferred for rice plantation. With the increasing prosperity the number of buffaloes being acquired by landowners and that of agricultural labourers might have increased and thereby increasing the total cattle population. This may also be the reason of increasing the importance of fodder in the total cropping. Even now the importance of fodder as a marketable commodity is increasing.

3.4 Leasing in and Leasing out Land:

Some information regarding leasing in and leasing out land per household by different size categories is presented in Table-3.4. Table makes it clear that all categories of farmers tend to increase their operational land holdings by renting land either on cash or on crop-sharing basis. Furthermore leasing in extra land is positively related with farm size. As is apparent from our data cultivators also lease out a part of their land, but only in very small quantities and in special circumstances. Moreover leasing out land is prevalent only among small farmers and that of medium farmers and no large farmer leases out any land.

Most of the leased out land, belongs to small and Marginal cultivators. These cultivators lease out

their land to large farmers due to the lack of modern equipments. For farmers who are unable to afford the modern inputs, renting out has become an attractive proposition for them. Some small and medium holders leased out their land, because they were having jobs in the City and by renting out their land, they are able to supplement their income. However, there are some cases in which - some medium and large land holders have been attached to various other professions and as a result leased out a whole or part of their land.

The large farmers having more than 10 acres of land have a tendency to lease large areas of land e.g. 9.18 acres per household whereas marginal farmers lease in only 0.23 acres per household. Many of the large farmers have already made heavy investments in farm machinary. By adding a few acres to their holdings, they can utilize their equipments to full capacity at a lower production cost. In our case large land owners do not rent out any land, as renting out land has become a prestigious issue. Only poor people and those who have some extra ordinary circumstances rented out land.

3.5 Gross Output:

Gross Farm output is a function of area sown and yield rate per unit of area and these two factors themselves depend upon land availability, methods of cultivation and the composition of inputs used. Table 3.5 shows the value

of gross output of the sample farm - Per Household, per acre of operational holding and per cropped acre, in different size categories. Gross output is perceptibly much more on large farms than on small farms. Similarly percentage share of large farmers in total output as is shown in the Table is quite high as compared to small and marginal farmers. Output per acre of operational holding stands to be the highest in the category of small farmers, the lowest figure is for the very large farmer category. Output per unit of GCA stands highest and lowest for small and medium holdings, respectively. There seems to be no exact relationship between farm size and output per acre. This relationship however will be dealt in detail in the next chapter by means of statistical methods.

3.6 Gross value added:

The value added in the production process can be derived by deducting the value of total material cost from gross value of output. As in our calculations no provision is made for depreciation; Hence all income and its related concepts are in gross terms. Gross value added per acre is invariant over farm size. Value added per farm however increases substantially with increase in farm size on account of higher area operated, which also shows the higher profitability of large farmers in farming activities.

3.7 Cost of Cultivation:

The cost of cultivation has been taken to include all the elements of input costs involved in the production of crops right from the time of preparatory tillage to the final stage of collecting produce in the form of grains and their by-products. The detailed break up of the percentage value of different farm inputs used, per operated acre cost as well as per farm cost by different size groups of farms is given in Table- 3.6, 3.7 and 3.8, respectively.

Taking first the overall position of all farm categories, it is seen from Table- 3.6 that in terms of percentage, the single largest item of cost is human labour. A little more than 27 percent of total cost is paid out for hired labour only. The next to hired labour is the cost of manure and fertilizer. These two inputs of hired labour and manure and fertilizer together account for around 45.7 percent of the total cost. The other major items of inputs being hired tractor or owned tractor (oil) charges, Implement maintenance charges, Irrigation, Seeds, Pesticides and insecticides, respectively according to their percentage contribution except leasing in land, which is third highest contributing item in the total cost.

The total cost as a whole can be divided into material cost and primary cost comprising of paid out labour cost and leasing in cost. Material cost accounted for about

61 percent of total cost and rest 39 percent by primary cost. The least amount of material cost was incurred in threshing and transporting. However, it may be due to that only hire charges of threshing and transportation are included and no imputed cost is included for own thresher or transport resources. The higher proportion of cost contributed by manure and fertilizer charges and by tractor charges points to the increasing importance of bio-technology and mechanicaltechnology in Haryana agriculture. Moreover bio-technology is a step ahead of mechanical technology. However, this new technology has a bearing with the higher use of labour as is due to the availability of surplus labour at cheap rate. There is also an increasing importance of other bio-constituents viz- new seeds, pesticides and insecticides and that of irrigation which are also important contributors in the total cost. Higher percentage of tractor charges as compared to bullocks points out to the increasing tendency of cultivators towards tractor, departing from the traditional technique of bullock ploughing.

The structure of costs differing over farm size is evident from Tables 3.6 to 3.8. Table 3.7 points out that material cost per acre is inversely related to farm size. Contrary to such inverse relation ship one finds no significant difference in total cost per acre incurred by different farm size groups (see Table- 3.7). Such

contradictory result may be due to non inclusion of imputed cost of family labour, which is more utilized by small and marginal farmers, as compared to large farmers.

Paid out labour cost is the single item which has the highest proportion of total cost for all size categories. Table - 3.9 points out that labour days per acre are hired more by large farmers than by small farmers. Despite the large size of their family, the former use more hired labour and latter use more family labour. This suggests that the family members of those farmers who have viable holding are likely to be engaged in activities other than farming.

Let us now see the contribution of the four main components of new agricultural technology viz - Hybrid seeds, manure and fertilizer, pesticides and irrigation - Out of total material cost. A lion's share i.e. around 59 percent is incurred on these four items which is 36 percent of the total cost for all size categories. This indicates the importance of new technology in the agriculture of the region. Moreover this technology is important not only for large farmers but also for small and marginal farmers as well. Around 60 percent of the total material cost by small farmers is incurred on these four items, (almost equal to very large farmers, 62 percent).

Use of bullocks reduces with the farm size. Particularly large and very large farmers have very little use of bullocks with tractors becoming popular. To take adventage of multiple cropping, the small and medium farmers have taken to tractor which they hire from the big farmers. This we can describe as partial farm mechanisation in comparison to complete mechanisation

An examination of the cost structure, therefore, shows that though there is a tendency of using more family labour and less of hired labour as well as using more traditional in puts like bullock ploughing etc. by marginal and small farmers, yet they try to supplement their own stock of productive assets by hiring-in machine services. New technology inputs like Hybrid seeds, Chemical fertilizer, Pesticides and tractor use are equally utilized by all sige of farms showing no significant differences.

3.8 Input-Output analysis:

The economic efficiency of progressive agriculture resources depends largely upon the comparative analysis of cost and income on the farms of different size groups. Output-input ratio is the ratio between output and total cost. A glance on output-input ratio shows the real picture of the farm output at one rupee cost. In order to have a complete picture of output, input relation-ship of different size groups Table-3.10 presents the

value of input costs, output and the net profit or loss per operated acre, per unit gross cropped area and per farm and output-input ratio as a whole. An examination of output-input ratio shows that overall output-input ratio for all size of categories is 2.05. This suggest that output is almost double for one unit of inputs. Medium farmers experienced the lowest output-input ratio while small farmers have largest output-input ratio.

In the light of the above discussion we can conclude that introduction of improved agricultural technology has proved promising. No doubt mechanisation has increased input costs. The increase in output is pro-portionately more than the additional cost incurred. Higher output-input ratio shows that inputs on farms yielded more compared to their cost.

To sum up this whole discussion we can say that there is a direct relationship between farm size and family size. While all size holdings have a tendency to lease in land, large farmers proportionately lease in more land as compared to small and margional farmers. There are mainly two foodcrops grown namely wheat and rice by all size categories. Though gross output per acre is highest on small farms and lowest on very large farms, there appears to be no inverse relationship between farm size and output per acre. There is an encouraging use of constituents of modern technology i.e. manure, fertilizer, pesticides, irrigation and

tractor by all size farm categories. While small and marginal farmers use more traditional inputs like bullock ploughing etc, they try to supplement their own stock of productive assets by hiring in machine services such as tractor, thresher, tubewells etc. Finally gross value added per acre is invarient over farm size.

Table - 3.1

House hold characterstics

House hold category	Total no. of H.H.	H.H. Size	No. of Earners.
1	2	3	4
1. Marginal Farmers	30	6.63	2.20 (33.2)
2. Small Farmers	30	6.25	1.87 (29.9)
3. Medium Farmers	30	8.57	2.80 (32.7)
4. Large Farmers	21	11.67	3.81 (32.6)
5. Very large Farmers	9	11.56	3.56 (30.8)
6. All size (Total)	120	8.26	2.65 (32.0)

Figures in parentheses are percentage of earners to total members of family.

Table - 3.2

Land holding characteristics

Household Category	NOA (Acres)	GCA (Acres)	Cropping Intensity
1	2	3	4
Marginal Farmers	2.00 (5.8)	4.86	2.43
Small Farmers	4.50 (13.1)	9.70	2.16
Medium Farmers	7.48 (21.8)	15.65	2.09
Large Farmers	14.67 (29.8)	30.53	2.08
Very large Farmers	33.78 (29.5)	66.22	1.96
All size	8.6	17.86	2.07

Figure in Parenthesis is percentage to total.

Table- 3.3.

(in Percentage)

Cropping Pattern

Name of Crop	Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	Very Large Farmers	All Size
1	2	3	4	5	6	7
Rice	33.62	39.12	40.42	41.87	43.12	40.97
Wheat	30.70	39.29	39.47	42.11	46.48	41.59
Maize	-	-	0.53	0.39	1.17	0.56
Gram	-	-	-	0.08	0.34	0.12
Mustard	-	-	0.12	0.08	0.67	0.23
Pulses(moong, mash,urd, massar etc.)	-	-	0.21	0.16	0.50	0.23
Barseem	10.81	7.34	7.55	5.26	3.19	5.85
Other fodder crops(jowar bajra,jawi, maize etc).	24.87	14.25	11.70	10.06	4.53	10.45
Total fodder crops	35.68	21.59	19.25	15.32	7.72	16.30
Total crops	100	100	100	100	100	100

Table- 3.4

Leasing in and leasing out land (per House hold)

Farm Size	NOA (acres)	Leasing in (acres)	Leasing out (acres)
1	2	3	4
Marginal Farmers	2.00	0.23	1.00
Small Farmers	4.50	0.13	0.57
Medium Farmers	7.48	0.92	0.17
Large Farmers	14.67	3.07	-
Very large Farmers	33.78	6.11	-
All size	8.6	1.32	0.43

Table - 3.5

Gross Value of output (Rs) (Per household, Per acre and Per crop)

Item	Marginal Farmer	Small Farmer	Medium Farmer	Large Farmer	V.Large Farmer	All size
1	2	3	4	5	6	7
1. Output (per household)	15919	36473	54359	110571	241517	64152
2. Output (per Acre)	7960	8105	7264	7539	7150	7463
3. Outpur (per unit of GCA)	3276	3760	3473	3621	3647	3591
4. Percentage of total output	6.20	14.21	21.18	30.16	28.23	100

Table - 3.6

Break-up of percentage to total value of input cost

Items	Marginal F.	Small F.	Medium F.	Large F.	V.large F	All size
1	2	3	4	5	6	7
Seed	7.80	6.69	6.39	5.15	5.42	5.85
Manure & Fertilizer	19.32	19.72	17.71	18.82	18.47	18.62
Pesticides & Insecticides	4.46	5.25	5.32	5.42	5.50	5.35
Canal & Elect. charges including hired water	10.56	9.98	6.61	4.81	4.34	6.06
Threshing & Transport (only hired)	5.10	5.23	4.12	2.18	2.32	3.20
Hired or owned Tractor	11.42	8.89	10.06	10.70	10.67	10.36
Maint. of Bullocks	10.60	10.56	10.06	3.85	0.47	5.50
Implement Repair	3.34	3.67	4.61	7.80	7.26	6.16
Total Material cost.	72.62	69.99	64.88	58.73	54.44	61.10
Paid out labour cost	19.78	27.70	25.84	27.10	29.34	27.12
Leasing in cost	7.61	2.31	9.28	14.17	16.21	11.78
Total cost	100	100	100	100	100	100

Table- 3.7

Break up of cost per acre operated area (Rs)

Input	Marginal F.	Small F.	Medium F.	Large F.	V.Large F.	All size
1	2	3	4	5	6	7
Seed	282	236	235	194	191	213
Manure & Fertilizer	699	696	652	708	650	677
Pesticides & Insecticides	161	185	196	204	194	194
Irrig. charges	382	352	243	181	153	220
Threshing & Transporting	185	184	152	82	82	116
Hird tractor or owned tractor	413	314	371	403	375	377
Maint. of Bullock	383	373	371	145	16	200
Imp. Repair	127	129	170	294	256	224
Total Material cost.	2626	2469	2390	2210	1917	2221
Paid out Lab. cost.	715	977	952	1020	1033	986
Leasing in cost.	275	81	342	533	571	428
Total cost.	3616	3528	3683	3763	3320	3635
Gross value added	5334	5636	4874	5329	5234	5242

Table- 3.8

Break up of cost per farm (Rs.)

Input	Marginal F.	Small F.	Medium F.	Large F.	V.Large F.	All size
1	2	3	4	5	6	7
Seed	564	1061	1760	2843	6451	1828
Manure & Fertilizer	1397	3131	4882	10389	21958	5818
Pericides & Insecticides	322	834	1466	2994	6544	1671
Irrigation charges	764	1584	1821	2654	5161	1894
Threshing & Transporting	369	830	1136	1201	2763	1001
Hired Tractor or owned Tractor	826	1411	2773	5906	12572	3237
Maint.of Bullock	767	1677	2773	2124	556	1717
Imp. Repair	242	582	1270	4304	8633	1924
Total Material cost	5251	11,110	17,882	32,417	64,738	19,089
Paid out Lab. cost	1430	4398	7122	14961	34894	8473
Leasing in cost	550	367	2557	7819	19278	3682
Total cost	7231	15875	27562	55197	118910	31245
Gross value added	10668	25362	36477	78155	176778	45062

Table- 3.9

Total labour days (Hired & Family) (Per Acre)

Farm size	Hired labour days	Family labour days	Total labour days
1	2	3	4
Marginal Farmers	24	122	146
Small Farmers	33	76	109
Medium Farmers	32	76	108
Large Farmers	34	48	82
Very large Farmers	34	25	59
All size	33	55	88

Table- 3.10

Value of input, Output, Net profit, Output - Input ratio by size groups for crop production, per farm, per acre and per crop.

Size group		Input	Output	Net profit+ Net loss -	Out put in put Ratio
1		2	3	4	5
Marginal Farmers	(a)	3616	7960	4344	
	(b)	7231	15919	8688	
	(c)	1486	3276	1790	2.20
Small Farmers	(a)	3528	8105	4577	
	(b)	15875	36473	20598	
	(c)	1637	3760	2123	2.30
Medium Farmers	(a)	3683	7264	3881	
	(b)	27562	54359	26797	
	(c)	1759	3473	1714	1.97
Large Farmers	(a)	3763	7539	3776	
	(b)	55197	110571	55374	
	(c)	1808	3621	1813	2.00
Very large Farmers	(a)	3520	7150	3630	
	(b)	118910	241517	122607	
	(c)	1796	3647	1851	2.03
All size	(a)	3635	7463	3828	
	(b)	31245	64152	32907	
	(c)	1749	3591	1842	2.05

(a) Per operational acre
(b) Per farm (Per H·H)
(c) Per Crop

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3. A.S. Kahlon and S.S. Grewal, Farm Mechanisation in a labour abundent economy", EPW, vol.7, 1972, pp. 991-92. _____ There study has shown that utilization of bullocks on tractorised farms has been reduced by 85 percent but their number has been reduced by only 39.7 percent.

4. Here cost of human labour includes only paid out cost of hired labour. The Inputed cost of family labour has not been included in the total labour cost.

CHAPTER-4

Returns to Scale, Farm Size and Productivity

One of the main objectives of production unit is to utilize resources in such a manner that together they yield highest net returns. If the returns on farm are higher than the costs incurred on the resources in running the farms, there is a surplus that could be put to economic use.[1] Thus a very important role is played by returns on farm in determining the economic status of the rural people. New agricultural strategy has brought about a radical change in the composition of farm inputs and as a result of it, agricultural output has also significantly changed. No doubt the use of high yielding variety seeds, chemical fertilizers, insecticides and pesticides, the use of artificial irrigation activities and introduction of other improved agricultural practices have increased the cost of cultivation, but these activities have also enabled the production on farm to increase manifold. In the present chapter, therefore, an attempt is made to examine the returns to scale prevailing in the region under our study. The controvery of inverse relationship between farm size and productivity is dealt in the last section of this chapter.

4.1 Returns to Scale:

Before starting our study it is essential to know the meaning of returns to scale. By returns to scale we

mean the behaviour of the change of total returns when all the factors of production are changed simultaneously in the same proportion. However it is very difficult to identify all the factors that determine agricultural production. We have uncontrollable factors such as air, sun light and rainfall and such controllable factors as seeds, fertilizer and manures, pesticides, etc. Therefore, in empirical studies economic returns to scale are generally worked out, including only those factors which are under the conrol of entrepreneurs and contribute significantly towards the returns.

4.2 Cobb-Douglas Production Function:

In order to reach the desired results, it is necessary to choose a production function which is appropriate and most reliable for our study of cross section data at a single point of time. By now the use of Cobb-Douglas[2] form has become a convention in production function analysis not only for its ease of manipulation and interpretation but also for its generally being a good fit to the data.[3] The Cobb-Douglas function is a special form of C.E.S. production function. The C.E.S function is general, inter alia, in that the elasticity of factor substitution can take various values ranging from zero to infinity and can, therefore, fit into the requirements of all lines of production. On the other hand, the Cobb-Douglas production function has a unitary elasticity of substitution and is, therefore, appropriate

of production situations where unit elasticity alone operates. In the present study we have opted for Cobb-Douglas production function because some recent empirical studies confirm that the C.E.S production function fitted to agricultural production data at different levels of aggregation gives elasticity of factor substitution not significantly different from unity.[4] Therefore, the Cobb-Douglas production function is thought to be the most common limiting form of the C.E.S function which describes the true underlying production behaviour.

The Cobb-Douglas function is more acceptable from the point of view of farm level cross section data. Phelps Brown[5] in his penetrating appraisal of the fitted Cobb-Douglas function, points out that the empirical fallacy of interpreting the time series Cobb-Douglas fit and the statistical perplexment for the inter industry cross section fit. However, for the cross section fit in respect of a given industry, "there is reason to believe that the differential contributions of broadly inclusive factors such as 'Capital' and 'Labour' may be estimated from the data of a large number of firms or farms ..... when they are making similar products by similar process and in similar environment". The general form (in double logarithmic shape) of Cobb-Douglas production is as follows:

$$\text{Log } Y = \log A + b \log X1 + c \log x2 + d \log x\,3 + \ldots\ldots + z \log xn$$

where Y is dependent variable, X1 through Xn are explanatory variables, A is constant and b through Z are regression coefficients. As is seen, Cobb-Douglas production function is linear in logarithm.

4.3. Some Characteristics of Parameters and advantages of C-D Production Function

Let us consider, only two variables in the production process defined as labour (L) and Capital (K). The form of the function is -

$$Y = AK^{a} L^{b} \qquad a, b > 0$$

where Y is the output, K and L are units of capital and labour respectively and A is constant term while and b are parameters. The first important characteristic of this function is that, the level of output obtained for a specified level of inputs used is determined by the efficiency of technology of that specified production function. Given the degree of returns to scale, capital intensity and elasticity of factor substitution, the technological advancement can enable the production of greater level of output from the same level of inputs or the same level of output from a lower level of inputs.

Returns to scale are defined as the extent to which a proportionate change in inputs generates a proportionate change in output. In other words, it is the response of inputs to output which defines the second most important characteristic of Cobb-Douglas production function that

the sum of the individual output elasticity coefficients is a measure of the returns to scale. In the doble log formulations, the regression coefficients are the elasticities. In our model of two variable viz. labour and capital, a is output elasticity w.r.t. capital and b represents output elasticity of labour. The sum of these two coefficients $(a+b)$ represents returns to scale. Returns to scale are increasing, constant or decreasing respectively as $(a+b)>1$, $(a+b)=1$ and $(a+b)<1$ respectively.

The possibility of substitution of one factor for the other is technically known as the elasticity of factor substitution denoted by σ. Elasticity of substitution for our production function of two inputs is defined as:

$$\sigma = \frac{d(L/K)/(L/K)}{d(MRTS_{LK})/MRTS_{LK}}$$

The third important characteristic of C-D production function is that it always has a unit elasticity of substitution, whatever be the level of returns to scale.

The factor intensity of a production function measures the marginal product of one factor input in relation to others. In Cobb-Douglas production function intensity of factor, say capital is measured by the ratio of output elasticity of capital and labour. If the function is capital intensive, then marginal product of capital is greater than the marginal product of labour and vice versa.

Thus the measurement of factor intensity in Cobb-Douglas function gives us an idea about the relative share of different factors of production.

The most important advantage of Cobb-Douglas production function is that the function makes it possible for the principle of diminishing returns to operate within the scale. Moreover the degree of returns to scale does not vary with the level of output.[6] Another advantage for the widespread use of this production function is that the function can be easily estimated in the double log form by applying ordinary least-square method, the most appropriate in use. This function also economises the degree of freedom as a smaller number of parameters need to be estimated. And the last but not the least, is that this form of production function has been repeatedly testified to fit the farm level data more appropriately than most other functional forms.

4.4. Specification of the Model:

In our present study of production function we have used variables in their value terms rather than using variables in physical terms. It is generally pointed out that we should use variables in their physical terms itself, as it keeps their homogenity intact. But using variables in their homogeneous form creates many problems, as it is then impossible to add two or more variables having different units of measurement. It is also very difficult to go through production function for each crop separately. The main

problem is that some crops have very little representation in the total output as a whole as well as use of different inputs. To overcome this problem we have computed total output function. We have aggregated the value of total output of various crops and their by products. On the same line we have aggregated the value of each input for all crops. As Walters has stated aggregation of firms in the same industry is not open to much criticism.[7] Moreover there are some costs like that of attached labour, electric charges, canal charges etc. which are paid either annually or monthly and not cropwise. Total output production function is also more useful as compared to single crop production function because the latter does not account for the indirect production benefits. To illustrate, the externalities enjoyed by a crop because of the application of intensive inputs of plant nutrients in the preceding crop can only be accounted for in the total output function. Since our purpose is to determine various factors which effect production in agriculture and find out returns to scale in Indian agriculture, it is the aggregate production function rather than crop production function which is more useful to our purpose.

4.5 The Variables

A large number of variables can be identified which effect farm output and so determine the returns to scale of farm. Some important variables are-net operated area,

gross cropped area, seeds, fertilizer and manure, pesticide, irrigation, tractor used and labour used.

It is however, important to note that all the variables are not independent of each other. In fact there is some relationship among all the variables but quite a few of them are causally related in a very strong way. For instance there is a strong positive relationship between net operated area and gross cropped area. Availability of irrigation is a pre-condition for the use of hybrid seeds, pesticides and fertilizers. Similarly charge of repairing of implements increases by manifold for tractor owning farmers as compared to non tractor owners. A correlation matrix for total variables is given in the Appendix. The table shows that the correlation is very high in some cases. As gross cropped area (GCA) and net operated or sown area (NOA) are highly correlated as they are supposed to move in the same direction definitionally. Similarly, seeds, fertilizers and pesticides are highly correlated with each other. Furthermore NOA or GCA and these inputs (mentioned above) are correlated. Own tractor charges and repair implement charges are also correlated. There are some variable, which are actually a part of the same single process, such as charges for canal water used and charges of electricity used for tubewells. We have generated a single variable by adding such variableswhich are a part of single process or are having a very high correlation. In this way there are total 9 generated variables chosen for this study.

4.6 Choice of variables : Dependent variable :

Gross value of output:

Our dependent variable is gross value of output of all the individual crops, including their by-products. The measurement of different crops is in different units in physical terms and therefore, we can not add them together. In order to have an aggregate value of all crops and their by products, we measure them in their value terms. The value of output is taken in terms of actual price received by the farmers at the time of harvesting.

Explanatory variables :

The factor inputs have been classified and aggregated in different ways by economists depending on the objective of their research studies. We choose, in our study the following explanatory variables to explain the returns to scale -

Net operated area (NOA) :

In the production function study, area is a crucial explanatory variable. In some studies of such type, land has been used in terms of acres or hectares without any standardization and in some other studies farm holding as a variable is used with standardization. Standardization is done because some times a spacial area in terms of acreage is highly hetrogeneous unit. "To standardize it

by some index of fertility, it is, therefore, assumed that amount of land revenue paid..... could represent land input[8] ". Randhawa[9] has suggested rental value as a measure of standardization while Hopper and Desai have suggested price of land[10] as a measure of standardization. However there are many scholars who have used land as an input without any standardization. Aggarwal and Basak and Chaudhury have used land without any standardization.[11] Saini & Shah[12] have used area under the crops as a measure of land input. These scholars have used land unstandardized as they thought that the above mentioned method of standardization was not unbiased and might influence the estimates.

In this study land input has been measured as an area in terms of acres. It is net area operated by a farmer and is calculated by considering the acres of land owned by the cultivators, plus land leased in minus land leased out in acres. Similarly area mort-gaged in (if any) has been added while that of mort-gaged out has been subtracted to total operated area. We have not standardized this input as there are not much variations in soil texture and fertility in the sample area to vitiate our results.

Gross Cropped area GCA :

We can also measure land in terms of gross croped area. We can use either NOA or GCA. Gross cropped area is calculated

by adding all crops grown on an acre during a year. Because of high correlation between NOA and GCA, we have computed regression coefficients for these two variables by dropping one of these two variables in one equation and the other in other equation.

Cropping in-tensity (CI):

Cropping intensity is another important variable which determines returns to scale. Cropping intensity is calculated by dividing gross cropped area to net sown area and is retained as an explanatory variable in our analysis.

Human Labour (Ld and Lc) :

Human labour as an input is measured in terms of adult man days. A man day consists of eight work hours. However this explanatory variable has been used both in physical units and in value (Rs) terms. Singh, Gongwar and Chhikara have used human labour in value terms.[13] Similarly Naik and Shah have also applied value of human labour used in Rupees and not in directly labour days.[14] On the other hand, Chaudhary, Hanumantha Rao, Raj Krishna and Saini[15] in their studies have used labour inputs in physical terms i.e. in terms of man days. The labour input was recorded in terms of work hours of men, women and children employed for different farm operations during the agriculture year.

In our study we have tried to find out production

function relationship both by human labour in terms of man days (by variable Ld) and in terms of value Rs. (by variable Lc). In terms of man days we have included family labour and permanent and casually hired labour. Most of the casual labour specially during the peak seasons of harvesting sowing and transplanting is hired on the contract basis in our region. Under such contracts amount is paid by per acre for the services of labour. Man days are calculated by dividing the amount paid with average wage rate prevailing in the village during the year which is observed to be same for all different farming activities. Similarly permanent work man days are calculated by dividing the amount paid to permanent workers in terms of rupees or value of perquisites by the average wage rate as above. In case of man days of family workers only permanent family workers are included as there is no fix work period of temporary family labour and might bring inadequacy in the analysis if included. Using human labour in value terms (Lc) i.e. labour charges. We have used only hired labour whereas imputed value of family labour is not included so that we can get difference in the coefficient of total (family + Hired) labour days and that of hired labour (days or charges).

Seed, Manure and Fertilizer and Pesticides (s):

The variable seed is defined as sum of the value of seed used for different crops which is calculated by

multiplying physical quantity of seed with the farmers purchase price. Similarly fertilizers and manures as an input have been used in value terms. The value of fertilizer is used as the value which was prevailing in the market at the time of its purchase and value of manure is calculated by the general prevailing price in the village. Pesticides have become very important with the adoption of HYV seeds. We use pesticides in value terms paid by the farmers. Since all these inputs are part of cost for high productivity and largely dependent upon one another (having high intercorrelation, see Appendix), we have added or clubbed together the value of these three vaiables and made them a single variable denoted by s, so that we are able to reduce the number of explanatory variables and also get rid of the problem of multicolinearity.

Irrigation (I) :

Irrigation is an important input which has a great influence upon value of output. In fact irrigation is prerequisition for the adoption of new technology. Therefore,it is very much important to include irrigation in the explanatory variables. The main problem here is that it is almost impossible to measure the physical quantity of water used for each farm and for each crop. So that we can not go by necessary aggregation. However,one possible way to estimate this variable is price paid by farmers for

electricity used by them by means of their tubewells as well as total amount paid for canal irrigation or for water hired from other sources such as engine etc. As both tubewell and canal water is used simultaneously, we have added the amount paid for tubewells, canal or any other source for the independent variable of irrigation as an input.

Operational Cost (TR) :

This includes expenditure on oil, if one has his own tractor or amount paid for the hiring of Tractor services, Bullock maintenance cost (if own) and paid out cost (charges) for maintenance of all agricultural implements (including Tractor) during the (agricultural) year under study. We denote this variable as TR.

Thus we have total 8 independent variables and one dependent variable. An intercorrelation matrix of all these 9 variables is given (by table-4.2) at the end of this chapter.

Multicolinearity is a serious problem, which may even render the multiple regression analysis meaningless. This problem is serious in some variables in our case. it can be simplified if some of the intercorrelated explanatory variables can be dropped from the analysis. Some other variables which are most important and necessary to be taken in the study as if they are the

Pre-requisition for output e.g. seeds, fertilizers and pesticides, the solution to the problem of multicolinearity can be found (as stated above) by adding such variables to make them a single variable. There are other methods also to reduce the effect of multicolinearity such as principle component analysis, factor analyses. These methods try to make independent variable free from multicolinearity by standardizing the variable. However, such a process takes a lot of time and involves a high level of mathematics. Due to the paucity of both time and computer, we have not tried that process.

We have tried to make the variables orthogonal, by adding two or three variables which are part of a single process and depend upon one another. Similarly from the two alternative variables, only one is chosen such as out of gross cropped area and net operated area, we have chosen one of these in equation as they are highly correlated. By such a procedure, we are able to some extent to deal with multicolinearity.

4.7 The Results:

We have estimated the unrestricted form of the Cobb-Douglas production function. The Regression Coefficients indicate the elasticity of production of inputs and sum of these elasticities indicates the nature of returns to scale. The returns to scale are decreasing, constant or increasing as the sum of regression coefficients

is less than, equal to or greater than unity. As indicated above we have changed the regressors in order to get rid of multicolinearity and to reach the true results. In order to test returns to scale we have applied F test. The value of F test[16] is calculated by statistic as:

$$F^* = \frac{\Sigma e_2^2 - \Sigma e_1^2}{\Sigma e_1^2} \quad (n-k)$$

with V1=1 and V2 = (n-k) degree of freedom

where Σe_1^2 = sum of squared residuals from the unrestricted function

Σe_2^2 = sum of squared residuals from the restricted function.

The restricted from of C-D function is calculated by dividing all the explanatory variables as well as dependent variable by any one explanatory variable. The procedure is given below. Let our Cobb-Douglas production function is given as:

$$Q = A X1^{b1} \times 2^{b2} \ldots\ldots\ldots\ldots X6^{b6}$$

We want to test the Hypothesis

$$HN : b1+b2+b3+b4+b5+b6 = 1$$

against the alternative Hypothesis

$$HA : b1+b2+b3+b4+b5+b6 \neq 1$$

We perform the regression with the restriction

$$b1+b2+b3+b4+b5+b6 = 1$$

From this restriction we obtain

$$b1 = 1-b2-b3-b4-b5-b6$$

so that by substitution in the production function we get.

$$Q = AX1^{1-b2-b3-b4-b5-b6} \; X2^{b2} \; X3^{b3} \; \ldots\ldots X6^{b6}.$$

By rearranging we get

$$\frac{Q}{X1} = A \left(\frac{X2}{XI}\right)^{b2} \left(\frac{X3}{XI}\right)^{b3} \ldots\ldots \left(\frac{X6}{X1}\right)^{b6}$$

Fitting a regression to this restricted form gives us value of sum of squared residuals from the restricted function i.e. Σe_2^2 . The observed F* value is compared with the theoretical (tabular) value of F with given degrees of freedom. For rejection of null Hypothesis observed F* must be greater than tabular value of F Table- 4.1 gives the sum of regression coefficients. In equation 1 and 5 we get increasing returns to scale while rest of equations point constant returns to scale, their significance is tested by using F statistic at 95 percent level of confidence.

There is a high correlation between S and NOA is evident from equation fifth. As we drop the variable S in this equation taking all other variables as in equation

Table- 4.1

Dependent variable - log value of output

Coefficients of Cobb-Douglas Production Function

No of Observation = 120

Constant intercept	Net operated Area (acres) LNOA	Gross cropped Area (acres) LGCA	Cropping intensity LCI	Seed+ manure & Fert. + Pest. (Rs) LS	Irrigation (Rs) LI	Operational cost (Rs) LTR	Labour days Ld	Labour charges (value Rs) Lc	Sum of elasticities	Deviation from unity	F	Returns to scale (By F test) ✓	$\bar{R}^2$
4.5	0.467** (0.102)	-	0.391*** (0.216)	0.469** (0.087)	0.181** (0.040)	-0.023 (0.029)	-0.034 (0.052)	-	1.451	0.451	3.97	I	0.961
4.8	-	0.489** (0.104)	-	0.409** (0.089)	0.153** (0.044)	-0.043 (0.027)	-	0.043* (0.017)	1.051	0.051	3.72	C	0.962
4.9	0.509** (0.108)	-	0.446*** (0.232)	0.539** (0.092)	-	-	-0.041 (0.055)	-	1.452	0.452	3.47	C	0.955
4.4	0.369** (0.088)	-	-	0.511** (0.084)	0.185** (0.041)	-0.021 (0.029)	0.001 (0.049)	-	1.043	0.043	2.88	C	0.960
7.3	0.918** (0.066)	-	0.702** (0.232)	-	0.219** (0.044)	-0.020 (0.033)	-0.025 (0.058)	-	1.794	0.794	10.73	I	0.951
4.4.	0.369** (0.085)	-	-	0.510** (0.083)	0.185** (0.040)	-0.021 (0.029)	-	-	1.043	0.043	3.74	C	0.960
4.5	0.456** (0.101)	-	0.384*** (0.215)	0.467** (0.087)	0.172** (0.039)	-	-0.042 (0.051)	-	1.438	0.438	3.78	C	0.961

(Figures in Parentheses show the standard errors of coefficients)

* Significant at 5% level
** Significant at 1% level
*** Significant at 10% level

✓ = Returns to scale at 5% level of Significance.

first we find increase in value of coefficient of NOA more than twice as compared to first equation while all other coefficients remain almost same, except CI, which also has captured some effect of S. In equation second in place of net operated area, (NOA), GCA and in place of labour days hired (Ld), labour charges (Lc) is taken. As a consequence coefficient of Lc becomes significant and its sign changes from negative to positive. The contribution of operational cost again is insignificant. In the third equation both irrigation and operational cost are excluded from the analysis. In this equation except labour days all other variables are significantly contributing in production function. As irrigation is significant variable which we have dropped, value of $\bar{R}^2$ declines from 0.961 to 0.954. In fourth equation, ctopping intensity is dropped taking other variables as in equation first. As a consequence there is a slight decline in the output elasticity of NOA and a slight increment in the elasticity of seed, fertilizer and pesticides (S) in the comparison of first equation. As a result of exclusion of both cropping intensity and labour days, in equation sixth, there is no significant impact on other coefficients as well as $\bar{R}^2$. Similarly in equation seventh, dropping the variable of operational cost shows no significant impact on the result of equation.

From our above analysis an important point to be noted down is that the most important factors in determining returns to scale are land area, seed, manure and fertilizer and pesticides (S) and availability of irrigation. Both, variables of operational cost and labour days are contributing in-significantly in returns to scale in all the equations. However, cropping intensity has also significant influence upon production process. As the area under study is mainly irrigated belt, there is no particular importance of question whether we are using tractor for cultivation or are ploughing by traditional way of bullocks. For practical support we have used tractor as a Dummy variable which is included in the list of regressors. Plotting value 1 for farmers who own tractor and 0 for those who do not. The regression equation with tractor dummy as an independent variable is given below:

$$\text{Log VO} = 4.574 - 0.15161\ D + \underset{(0.10872)}{0.48044}\ \log \text{NOA}^{*} \underset{(0.12115)}{-0.65}\ \log \text{NOAD}$$

$$+ \underset{(0.877)}{0.466}\ \log S^{*} + \underset{(0.0366)}{0.187}\ \log \text{SD} - \underset{(0.0301)}{0.026}\ \log \text{TR} \underset{(-0.042)}{-0.130}\ \log \text{TRD}$$

$$+ \underset{(0.040)}{0.182}\ \log I^{*} + \underset{(0.0655)}{0.255}\ \log \text{ID} - \underset{(0.0529)}{0.037}\ \log \text{Ld} + \underset{** (0.0013)}{0.0069}\ \log \text{LdD}$$

$$+ \underset{(0.2207)}{0.407}\ \log \text{CI}^{**} + \underset{(0.0190)}{0.0660}\ \log \text{CID}$$

$\bar{R}^2$ = 0.96020

(Figures in parentheses are standard errors)

* Significant at 1 percent level

** Significant at 10 percent level

Equation reveals that intercept as well as slope dummy for tractor use turn out to be insignificant meaning thereby that the use of tractor has no significant impact on output. In other words returns to scale is not affected by the way of cultivation, of tractor or bullock. Bullock cultivation is as much effective as tractor in the region under study.

Our present results of increasing and constant returns to scale are in line with many previous studies which found constant returns to scale in Indian agriculture[17] and increasing returns to scale in certain regions[18].

4.8 Farm Size Productivity:

The recent studies based on analysis of farm management data offer different explanations on size productivity relationship. In fact the exact relationship between farm size and productivity has become a matter of hot debate in Indian agriculture. Two types of arguements are given in this regard. The first opinion is put forward by the noted economists like A.K. Sen, Khusro, Mazumdar, Krishna Bardwaj and Hanumatha Rao. Using Farm Management data in grouped form they established the

inverse relation ship between farm size and productivity per acre i.e. as the size of holdings increase, productivity declines. Thus maintained Sen, productivity was more on small farms as compared to large farms[19]. The inverse relationship between farm size and productivity has been questioned by the second group of economists like Rudra, A.P. Rao and others. Rudra has expressed doubts about the statistical basis of earlier investigations. He further investigated the problem and showed that inverse relationship between farm size and productivity did not exist in any of the 20 completely surveyed villages from Punjab, Haryana and Western U.P.[20] These Economists believe that such a relationship is possible to exist only when aggregate farm management data (and not disaggregative data) are analysed. However, we are not going into the whole debate.

In the previous section we examined the nature of returns to scale. We have proceeded to analyse the cross section observations to examine the statistical validity of the size productivity relationship in the present analysis. As in returns to scale we analysed the relationship of all farm size by the method of ordinary least square. Here we have fitted the following log linear equation to the farm level data.

$$\log Y = \log A + b \log X$$

where Y is gross value of output of all crops and their by products and X is size of operational holdings (acres).

Result:

$$\log Y = 8.95014 + \underset{(0.02351)}{0.9815^{*}} \log X$$

$$\bar{R}^2 = 0.93651 \text{ and d.f.} = 118$$

$$\frac{b-1}{SE\ b} = -0.632$$

From the above equation, it is clear that the inverse relationship between farm size and productivity is neutralised as regression coefficient is not significantly different from unity. About 94 percent explanation of change in output is given by or is due to change in farm size.

The sole cause of negation of inverse relationship in this study seems to be the adoption of new technology. The new production technology consists of bio-chemical and mechanical innovations. Use of high yielding variety seeds, chemical fertilizers, pesticided and regulated dozes of irrigation, all these comprise of bio-chemical technology. The use of bio-chemical technology enhances the productivity on the one hand and it is neutral to the scale of operation on the other hand. Mechanical innovations consist of Tractors, Threshers,

harvesters, seed drills etc. and are useful in making the crop rotation possible and thus influencing the cropping intensity positively. As we found in the previous analyses of returns to scale, (as well as in third chapter) it is bio-chemical technology which has more succeeded in the area under study[21] and so has been helpful in reversing the inverse relationship of farm size productivity. Not only big farmers but also small and marginal farmers are equally utilising these innovations (as we saw in the previous chapter). It seems that use of these inputs has become size neutral and so influences productivity on all size of farms equally. Mechanical innovations which are more size biased are less important in the area under our study.

Table - 4.2

Correlation Matrix of 9 Generated variables

	1 NOA	2 GCA	3 CI	4 VO	5 S	6 I	7 TR	8 Ld	9 Lc
1. NOA	1.000								
2. GCA	.9969 (.001)	1.000							
3. CI	-.4217 (.001)	-.3951 (.001)	1.000						
4. VO	.9673 (.001)	.9755 (.001)	-.4033 (.001)	1.000					
5. S	.9664 (.001)	.9739 (.001)	-.4159 (.001)	.9757 (.001)	1.000				
6. I	.8623 (.001)	.8541 (.001)	.3753 (.001)	.8282 (.001)	.7807 (.001)	1.000			
7. TR	.8050 (.001)	.7964 (.001)	.3265 (.001)	.7665 (.001)	.7404 (.001)	.8494 (.001)	1.000		
8. Ld	.9149 (.001)	.9243 (.001)	.3890 (.001)	.9143 (.001)	.8984 (.001)	.8005 (.001)	.7647	1.000	
9. Lc	.9228 (.001)	.9233 (.001)	.4055 (.001)	.9177 (.001)	.9118 (.001)	.8091 (.001)	.7215 (.001)	.8193 (.001)	1.000

Figures in the Parentheses are the level of significance of correlation.

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CHAPTER - 5

Farm & Non Farm Income Distribution

Green revolution has brought about noticeable changes in Indian agriculture . With the adoption of new agricultural technology, a new era of achievements has been ushered into the rural economy. The Indian farmer is now more optimistic regarding his occupation than ever before. The new technology in its wake has brought about new opportunities for investment in Indian agriculture because of the high rate of returns to such investment now made feasible. Application of high yielding variety seeds, chemical fertilizers, pesticides and mechanised operations on the farm as well as multiple-cropping has enhanced per farm income, which promises agricultural growth and improvement in the welfare of the farm people. However, it has important implications regarding the distributional aspect of new-technology, which needs to be dealt with utmost care.

The main question to which we presently address ourselves is - have different cultivating households equally benefited from the new agricultural technology in the region of its application. In other words we want

to know whether the inequalities in the distribution of income among different Strata of the farming community within the same region have growmas a result of adoption of new hybrid seeds, fertilizer, pesticide , irrigation and tractorisation technology.

Within the framework of a traditional agriculture, the small farmers, with their relative abundance of of family labour, could attain a relatively higher intensity of cultivation and also claim a relatively higher productivity per unit of land through increased input of human labour and other traditional resources in farming. From the inverse relationship between productivity per acre and farm size and that of intensity of cropping and farm size,[1] we can conclude that the small farmers were able to some extent, reduce the inequalities in farmable income arising out of the uneven distribution of land among cultivators. As we presently see, the emergence of new technology which is more capital intensive as compared to previous labour intensive technique, seems to have neutralized the advantage of productivity per acre hither to enjoyed by small farmers[2]. The very requirement of capital to carry out new agriculture has tilted the balance against the small farmers who have very limited approach to capital and in favour of big farmers having abundance of capital resources. Moreover the large

farmers can make more rational use of these resources as compared to small farmers because of the favourable farm size.

Thus, whereas seed fertilizer revolution has augmented the physical output as well as farmers income, it has given rise to certain problems mainly with respect of equity, employment, welfare and so on. This chapter deals mainly with the equity problem and attempts to examine the distribution of income among different categories of cultivating and landless agricultural labour households.

The benefits accruing out of new technology have a bearing upon the availability of capital resources, social status, education, financial position, farm size, nature of soil etc. However, the impact of new technology has not been uniform in different regions and even among different sizes of farms within the same region. Most of the empirical studies conducted in India as well as abroad have concluded that the benefits of green revolution (new technology) have not been equally shared by different categories of rural households even in the same regions and in the homogeneous areas (details of which is given in chapter I). There is a controversy over the extent of the increase in incomes of various categories of farms. Some studies

have brought out that the large farmers have benefited more than the small ones[3]. Certain others have pointed out that in terms of income gains, the small farmers have done relatively better than the large ones.

G.S. Bhalla in his work on Haryana during 1973-74 made an empirical study of 723 cultivator households and 142 agriculture labour households. By using Lorenz Curve technique for adopter and non adopter cultivators, he comes to the conclusion that income is unevenly distributed. He further concludes that contrary to the generally held view, the green revolution has tended to reduce the income inequalities among adopters rather than aggravate them.[4]

A study on Punjab using farm management data for the years 1967-68, 1968-69 and 1969-70 shows a small increase in inequality with development in the region.[5] Besides a study of 49 demonstration forms in Hissar, Jind, Ambala, Mahendragarh and Gurgaon using data on farm family income, investment, expenditure, and savings and using Lorenz Curve and Gini ratios concluded that both, the absolute and the relative income gains have tended to increase with the increase in the size of holdings, level of mechanisation, formal education of the head of the family and the number of earners in the family. Furthermore, variation

in socio-economic factors seemed to accentuate inter-regional and intraregional income imbalances which might involve serious socio political implications[6].

The precise nature of income distribution among farmers is still unknown. An attempt has, therefore, been made in this chapter to examine the distribution of farm income and income from other sources among the cultivators and agricultural labourers. The total surplus for these households has been assessed after substracting their consumption expenditure from total income.

In the first section we look into the various sources of income of the five farm size groups with a view to analysing the income distribution. We also identify the share of farm and non farm incomes accruing on each farm size group. Profitability of farm size has also been tried in this section. For working out the income inequality, in the second section, the cultivating households are arranged into decile groups in ascending order of net area operated. Gini concentration ratio for F.B.I., Total income and total consumption are computed in accordance to the decile groups. Standard deviation of log income and coefficient of variation of income are also calculated. Finally in the third section income distribution among agricultural labourers has been put forward.

For the purpose of comparison of the income of different size cultivators, the term Farm Business income is used. Farm Business income is calculated by deducting from gross value of output, all material costs as presented in the previous chapter, paid out labour cost for hired labour and costs for leasing in land. Thus Farm Business income and gross value added differ only by way of paid out labour costs and that of hiring in land. In this analysis, no imputed cost of owned labour as well as owned land and depreciation for capital is included and therefore, they are not deduced from total output to calculate Farm Business income.

Before starting our analysis, it is essential to remind that despite our efforts to get accurate figure for different items of farm income non farm income and consumption, there is a general tendency among farmers to over state their consumption especially of milk and beverages (Tea & Sugar) and under state their income especially among all farmers and particularly among large farmers. It is necessary to keep in mind these short-comings while analysing the results.

From table 5.1 and table 5.2 it is clear that non farm income is an important source of total income, particularly a lion's share is provided by non farm income in case of marginal farmers. In their

case as against 31 percent of farm income about 69 percent is raised from non farm income. Percentage of non farm income decreases substantially for large and very large farmers. It is only 18.9 percent for the category of very large farmers. Therefore, share of farm business income has a direct relationship with farm size.

The above assertion of direct relationship between farm size and the proportion of income through farm business and inverse relationship between farm size and the proportion of income through non farming (generally known as supplementary income) acts as an important instrument in reducing the inequalities in total income which is the sum total of farm and supplementary income. It is clear from table- 5.2 the ratio between highest category and lowest category of F.B.I per capita is 8.1 which falls to 3.1 for corresponding category for the total income per capita. Whereas supplementary income per household is highest in the case of very large farmers, its per capita value is highest for marginal farmers.

Table 5.1 further suggests that around 72 percent of total income is incurred on consumption expenditure by marginal formers[7] as compared to only 28 percent by very large farmers. Although all categories of farmers are saving some thing but in absolute as

well as proportional terms, the savings are higher in the case of large farmers.

It appears that due to their additional efforts samll and marginal farmers are now able to share the benefits of green revolution by undertaking necessary expenditure to acquire modern inputs such as tubewells, hiring of necessary machinary etc. Table 5.2 further reveals that there is no significant difference between small and large farmers in per capita consumption, therefore, large farmers are left with high surplus. The question that remains to be answered is that, what is the way of spending total surplus and how much is for reinvestment on the farm by small as well as large farmer categories. Unfortunately we are unable to answer this question with the help of our survey data.

5.1 Sources of Non Farm Income:

Non household income or supplementary income has an important part in total household income. Tiny and small peasants get their earnings more from supplementary sources than from farm business. Therefore, it becomes necessary to identify the sources from which these small peasants derive their supplementary income and seek employment opportunity. The most important sources of non farm

income were pension and salaries (service holders) craft and retail tradeshop and dairying. Other less important sources were rent from leasing out, wages from agriculture sector or that of non agriculture sector, hiring out of agricultural implements, income from agro-industries like flour mill, rice mill, gur production and oilseed pressing and income from property.

Table-5.3 providies details of household supplementary income derived from various sources. Table 5.4 gives details of the percentage of these sources in the total non-farm income. Pension and salaries provide highest 40 percent of non farm income for all size categories. About 49 percent of non farm income is derived from pension and salaries from government or private institutions by small farmers. It appears that non farm activities other than pension and salaries are not accessible to small farmers with equal ease. All other activities such as dairying, crafts, etc. require some initial investment to run such occupation, which small and marginal farmers lack. Large farmers having a higher education status were able to get government jobs so that their proportion is also highest from salaries and pension although they are having a huge amount to invest in other non farm activities requiring a high level of initial investment.

Income from craftship, tradeshop and dairying also play an important role in non farm activities. In chapter- 3, we saw that fodder crops such as barseem,

Table - 5.1

Farm and Non Farm income, consumption and saving per house-hold. (Rupees)

Item	Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	Very Large Farmers	All size
Total Farm output	15119	36473	54359	110571	241517	64152
Total costs	7231	15875	27562	55197	118910	31245
Farm Buisness Income	8688	20598	26797	55374	122607	32907
Non Farm income	19678	16723	12823	21567	28600	18225
Total Household income	28366	37321	39620	76941	151207	51132
% of Income from Cultivating activities	30.63	55.19	67.63	71.97	81.08	64.36
% from Non Farm income	69.37	44.81	32.37	28.03	18.92	35.64
Annual Home consumption expenditure	9904	10072	13712	19986	27213	13960
Cash purchase Annually	10349	8669	10165	14303	15060	10928
Total consumption * Annually	20253 (71.40)	18741 (50.22)	23877 (60.26)	34289 (44.56)	42273 (27.96)	24888 (48.67)
Total surplus	8113 (28.60)	18580 (49.78)	15743 (39.74)	42652 (55.44)	108934 (72.04)	26244 (51.33)

Figures in Parentheses are percentage of total household income .

* Including only day to day consumption such as- Cereals, Pulses, Milk and its products, edible oils, meat, eggs, vegetables, fruits, sugar, salt and spices, beverages and Pan tobacco, fuel and light.

Table 5.2

Farm and Non Farm income, consumption and saving (Per capita)

Item	Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	V.Large Farmers	All size
FBI (Per Acre)	4344	4577	3581	3775	3630	3828
FBI (Per Capita)	1310	3304	3128	4746	10610	3981
Non Farm income (Per Capita)	2966	2683	1497	1849	2475	2205
Total household income (Per Capita)	4276	5987	4625	6595	13085	6185
Annual consumption (Per capita)	3053	3006	2787	2939	3658	3011
Household saving (Per capita)	1223	2981	1838	3656	9427	3174

Table 5.3

Sources of Non Farm Income

(Per Household)

Item	(Farm size group) Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	V.Large Farmers	All Sizes
Net income from dairying and poultry	3620	3053	3667	4681	6156	3866
Income from property(other than land)	-	333	80	114	1111	206
Pension & Salaries*	7400	8200	2747	10990	12000	7410
Income from Agro-Industries	200	-	987	-	-	297
Outside Remittance etc.	87	667	-	171	-	218
Income from crafts and Retail tradeshop	3960	2837	4227	3181	7667	3888
Wages of labour	1928	-	-	-	-	482
Hiring out of agriculture Implements	-	-	600	2429	1667	700
Rent from leased out land	24	1633	517	-	-	1158
Total Non Farm Income	19678	16723	12823	21567	28600	18225

*Comprises of service holders in Government as well as private institutions.

Table - 5.4

Percentage of different sources in total Non farm Income.

Item	Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	V.Large Farmers	All size.
Dairying and poult-ry	18.40	18.26	28.60	21.70	21.52	21.21
Property (other than land)	-	1.99	0.62	0.53	3.88	1.13
Pension & Salaries	37.60	49.03	21.42	50.96	41.96	40.66
* Agro-Industries	1.02	-	7.70	-	-	1.63
Remittances from outside	0.44	3.99	-	0.79	-	1.20
** Crafts & Retail trade shop	20.12	16.96	32.96	14.75	26.81	21.33
Wages (Non agrl. and agrl.	9.80	-	-	-	-	2.64
Hiring out of Agrl. Implements	-	-	4.68	11.22	5.83	3.84
Rent for leased out land	12.62	9.76	4.03	-	-	6.35
Total Non Farm Income	100.00	100.00	100.00	100.00	100.00	100

* including - Flour Mill, Rice Mill, Gur Production, Oilseed Pressing & others.

** Tailoring, Weaving, Blacksmith, Carpentary, Fishering etc.

jowar, bajra, maize etc. have a very high proportion in the total cropped area, particularly in case of small and marginal farmers. It suggests that the availability of excess family labour and domestic farm fodder and the prospect of steady income from the sale of milk have provided enough incentive for the most of the marginal and small farmers to keep and rear milch cattles.

Income received from leasing out land (as discussed above) provides important contribution to only marginal farmers and no income is received by large farmers from leasing out land. In case of wages, it is interesting to point out that wage employment in-side or outside of agriculture is preferred only by marginal farmers. Wheareas, marginal farmers try to maximise their income by hiring out their labour services, medium and large farmers try to maximise their earnings by optimally utilizing their capital resources i.e. by hiring out agricultural implements (see Table. 5.4).

The above analysis indicates that there is an unequal distribution of income among different categories of farmers not due to acute household non farm income but due to uneven distribution of Farm Business Income. However, it is basically the inequality in the distribution of land holdings which has led to wide disparity in the Farm Business Income. There is a

definate relationship between FBI and total area operated by the cultivators. In the previous chapter, we noted the constant relationship between value of output and farm size. Table- 5.2 shows the relationship between farm size and FBI per acre of operated land. We see that FBI per acre is highest for the category of small farmers and decreases with the increase in farm size. We undertake a statistical analysis of this relationship and see its bearing on the phenomenon observed above. The following function postulates the relationship.

$$\log Y = a + b \log x$$

where Y is Farm Business income (rupees) and x denotes to Farm size (acres). The terms a and b stand for respective constant term and the regression coefficient. From this log linear form, the estimated regression equation is put forward as:

$$Y = 8.366 + \underset{(.04997)}{0.9195^{*}}\, x$$

$$\bar{R}^{2} = 0.739$$

$$\frac{(b-1)}{(SE_b)} = \frac{0.9195-1}{.04997} = -1.6109$$

The coefficient of this regression equation is not different from one at 5% level of significance. It suggests that there is a constant relationship between Farm size and Farm Business Income. FBI increases proportionally with the enhancement of farm size. It

supports our proposition that maldistribution of FBI is due to skewed distribution of land towards large farmers. It is clear from the equation that 74 percent change in FBI is due to change in net operated area. Thus we can conclude that although FBI per acre is in favour of small and marginal farmers, they are forced to derive less income from farming activities on account of keeping small area of land under operation.

5.2. Distribution of Farm, Non Farm Income & Consumptions :

Two most important and commonly used measures of income inequality are the Lorenz Curve and the Geni-concentration ratio (or simply Gini ratio). To plot the Lorenz Curve the percentage of population arranged from the poorest to the richest are represented on the horizental axis and percentage of income enjoyed by them on the vertical axis. Thus the diagonal line represents the equal income distribution or is the line of perfect equality. The deviation from this line of egalitarian distribution gives the measure of inequality. Generally Lorenz Curve is used for a graphical representation of income inequality and a more detailed study however, is based on the relative measure of Gini ratio.
The Gini coefficient is the ratio of the difference between the line of absolute equality (the diagonal) and the Lorenz Curve - represented in Diagram as the

shaded area - to the triangular region underneath the diagonal.

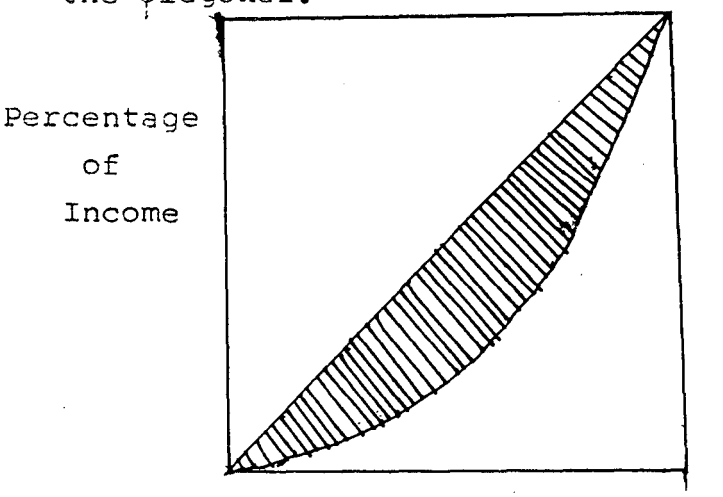


Fig 5.1

The range of this ratio is from zero to unity. Zero means perfect equality and unity represents perfect inequality. For computation of this concentration ratio in this analysis, the following formula is used.

$$G = \frac{1}{100 \times 100} \sum_{i=1}^{n} \left| X_i Y_{i+1} - X_{i+1} Y_i \right|$$

where G is the Gini ratio, n the number of categories, X_i is cumulative percentage of households and Y_i is the cumulative percentage of income.

The pattern of distribution of income and consumption among the various strata of cultivating households have been analysed, making use of the Lorenz Curve and the Gini concentration ratio. For this purpose we have rearranged our data into decile groups, in ascending order of net operated area. Tables 5.5 and 5.6 show

the cumulative percentage of households and cumulative percentage of land operated, income (FBI & non Farm income) and consumption, per household and per capita of these income and consumption respectively. The bottom 20 percent of the cultivators till only 4.36 percent of land area and enjoy just 5.14 percent of total FBI. Whereas top 20 percent households operate 52.6 percent land area and enjoy 51.9 percent of total Farm buisness income.

Disparities in land and income are most evident from the fact that the top 10 percent of the cultivators till as much land and enjoy as much income as more than 65 percent of the bottom cultivators. Gini's concentration ratio turns out to be 0.46 in case of operational land and 0.43 in case of F.B.I. These figures indicate a high degree of concentration in the distribution of operational land holding and farm income and indicate a striking similarity between their decile distribution.

Contrary to the Farm Business income, Non Farm income shows much more equitable distribution. Total income being the sum total of FBI and non farm income, therefore, more equitable than farm business income. The top 20 percent households share 30 percent of non farm income while the bottom 20 percent households also share 20 percent of non farm income. It is important to

Table- 5.5

Concentration of Land, Income (Farm & Non Farm) and Consumption .

Cumulative percentage of Farm Households	Cumulative Percentage of Land area operated	F.B.I	Non Farm income	Total income	Total consumption
10.00	1.84	2.49	12.55	6.08	7.90
20.00	4.36	5.14	20.92	10.76	15.48
30.00	7.85	9.17	31.47	17.12	24.24
40.00	13.09	15.50	42.76	25.22	31.33
50.00	18.90	22.25	49.93	32.13	39.17
60.00	26.27	29.30	55.18	38.52	48.0
70.00	35.29	37.57	64.83	47.29	57.7
80.00	47.41	48.04	69.10	55.55	68.80
90.00	64.71	64.95	84.29	71.84	83.00
100.00	100	100.00	100.00	100.00	100.00
Gini's concentration Co-efficient	0.4605	0.4311	0.1916	0.2939	0.1555

Table- 5.6

Concentration of Income & Consumption (per capita)

Cumulative percentage of Farm Population	Cumulative Percentage of FBI NSA	FBI Per Capita	Non Farm Income P.C.	Total Income P.C.	Total Cons. Per capita
10.00	12.93	3.82	16.92	8.63	10.34
20.00	22.47	7.89	26.62	14.76	20.39
30.00	33.02	12.89	37.85	22.05	30.02
40.00	44.20	22.16	52.80	33.40	39.84
50.00	55.03	33.13	62.07	43.75	50.78
60.00	63.94	42.93	68.85	52.44	60.69
70.00	72.52	52.44	76.71	61.34	70.41
80.00	88.74	61.18	79.57	67.93	78.75
90.00	89.86	72.54	88.97	78.57	87.74
100.00	100.00	100.00	100.00	100.00	100.00
Gini's coefficient of concentration	0.0533	0.2820	0.1554	0.1707	0.0509

note that the share of income from non-cultivating activities by the small farmers is much higher than their share of net operated area (see Table 5.5.). Thus it gives the impression of the importance of ancillary non-farm activities specially for the fate of small and marginal farmers which should be given the encouragement to improve the position of the lower strata income group.

The most equitable distribution is observed in case of consumption. Despite their higher level of income, large farmers are not induced towards higher consumption and therefore, are left with higher level of surplus. However such results partially may be due to the inaccuracy in data as mentioned above underestimation of data pertaining to consumption by respondents.

To gain a visual impression of the above results, Lorenz Curves for the distribution of income and consumption were drawn. Figure 5.2 shows the population of farm households and the distribution of net operated area and various types of income and consumption. While Figure 5.3 shows income and consumption per capita. From Figure 5.2 it is abundantly clear that inequalities in households FBI and net operated area are almost symmetric and highest. Inequalities in total income being less than that in FBI. The Lorenz Curve for Non farm income depicts much lower inequality than of FBI and that of household

consumption deplets milder inequality, Figure 5.3 shows more equitable distribution of income of Farm as well as Non farm and consumption per capita.

5.3 Dispersion of Income:

Two indices of inequality, the standard deviation of log of incomes and the coefficient of variation, were calculated to measure the divergence of incomes from their respective average.[8] The results are presented in the table below:

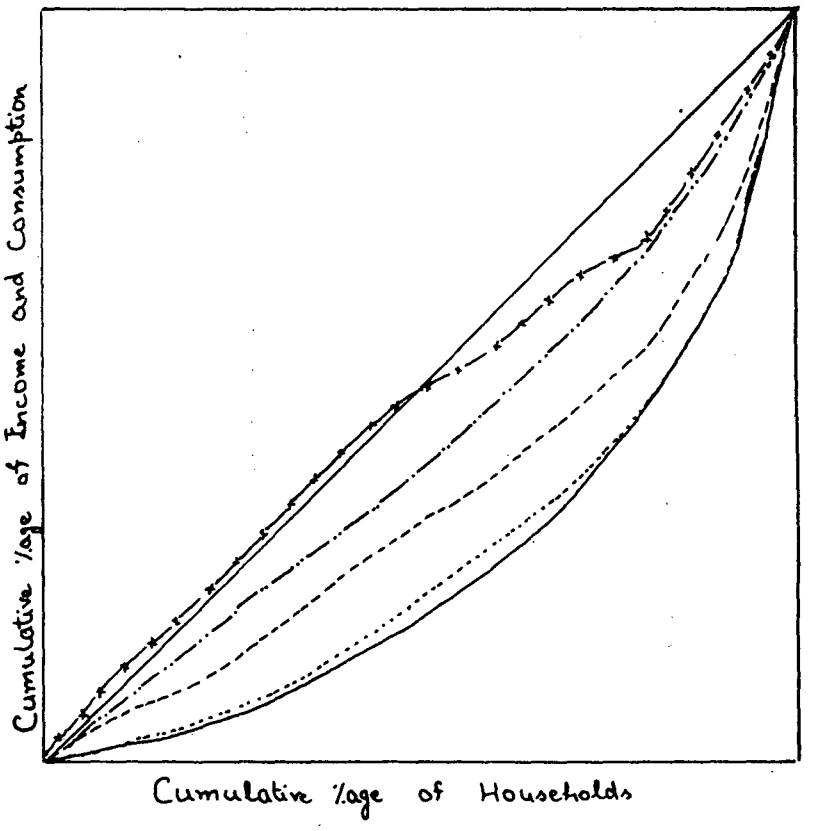
Table- 5.7

Dispersion of Income

	NOPA	FBI	Total Income	N
S.D. of log of variable	0.86	0.92	0.75	120
Coefficient of variation	106	104	82	120

Higher value of both these indices again support our contention that there exist rural income inequalities. Both Standard Deviation and Coefficient of variation indicate higher inequalities in case of FBI as compared to total farm income.

fig. 5.2



LEGEND

——— Land area operated

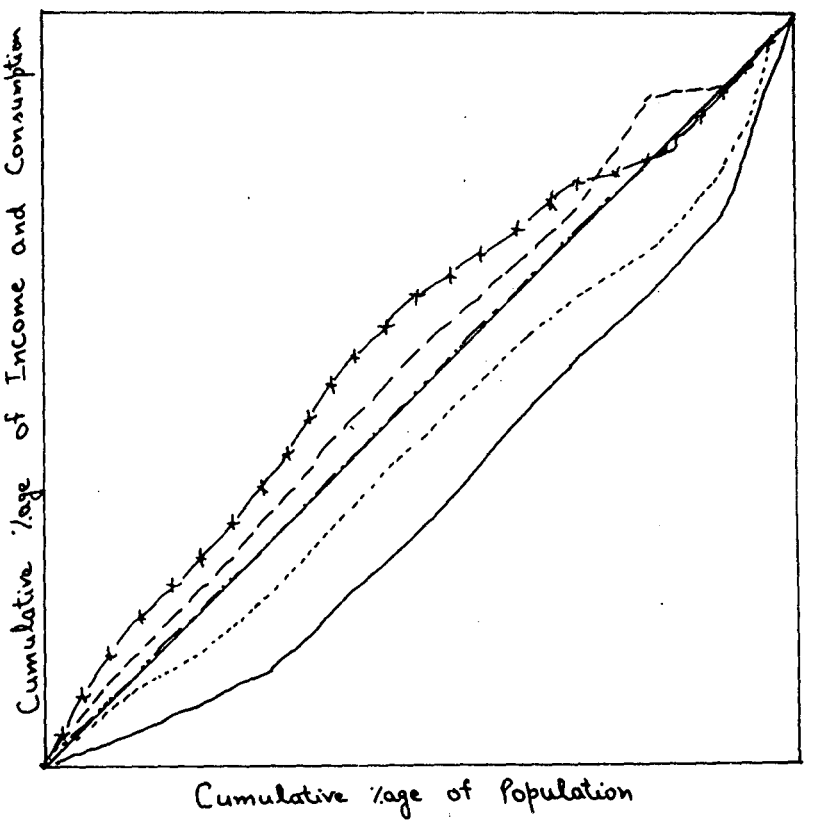
..... FBI

—·—·—·— Total Consumption

– – – – – Total Income

—x—x—x—x— Non-farm Income

fig. 5.3



LEGEND

- FBI/NSA
- FBI/PC
- Total Income per capita
- Total Consumption per capita
- Non-Farm Income per capita

5.4 Agriculture Labour households:

Agricultural labourers is the class of population who is mostly landless, forming a significant section of the rural society and dependent mainly upon agricultural wages. This is the section of society, worst exploited, majority of which belongs to Scheduled Castes and Scheduled Tribes. These labourers are basically unskilled and earn their livelihood through manual labour. Our purpose here is to alalyse the income of landless labour households in the area under consideration.

As already mentioned in the introductory chapter, a sample of 30 farm labour households was selected from two villages for studying the nature of distribution of income among them. Out of these 30 households, 28 belong to Scheduled Caste, so called 'Harijans'. The average size and economic status of these labourers and marginal farmers (for camparison) are given in Table- 5.8. The average size of family of selected labour households is calculated to be around 6. The General contention that the poor generally have larger family has not been proved by this study as we find family size around 7 in case of marginal cultivators and around 11 in case of large farmers (see chapter 3).

Table 5.8

Demographic Data for Labour and Marginal Cultivators

Item	Agrl. Labour	Marginal Farmer
Full time earners	1.97	2.20
Part time earners	1.30	
Average size of family	6.2	6.63

It seems that economic prosperity alone does not result in reduced family size. It may be noted that despite the small size of their family, the total nember of earners (Part time and full time), among labour category is higher than the cultivators category. This is perhaps an indication of the fact that the women and children in the families of agricultural labourers offer work for wages in agricultural operation due to their lower income levels.

Table- 5.9

Household income of Agricultural Labourers and Small Cultivators.

(Rs)

Item	Agrl. Labour	Marginal cultivator
House hold income from wages	15003	-
Household income from other sources	3482	19678*
Total Household income	18485	28366
Total income per capita	2981	4276

* including income from wages.

Table 5.10

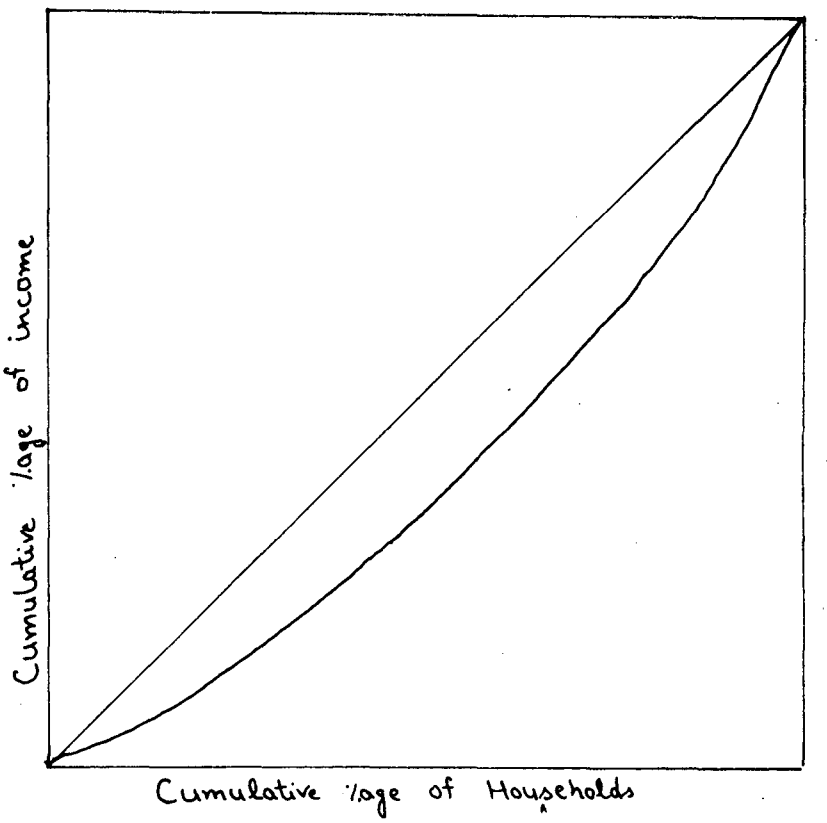
Concentration of income of Agricultural landless labourers

Cumulative Percentage of Households	Cumulative Percentage of income
10.0	3.375
20.0	9.99
30.0	16.734
40.0	24.795
50.0	33.739
60.0	43.374
70.0	54.176
80.0	65.666
90.0	79.425
100.0	100.00
Gini Ratio	0.2374

Table- 5.9 shows that on an average, a farm labour household earns Rs. 18,485 per annum of which Rs. 15003 per annum are from agricultural wages and rest Rs. 3482 per annum are from other services such as salary and pension, poultry farming dairy farming etc. Monthly per capita income comes to be only Rs. 248 for the category of labourers which is quite less than that of marginal cultivators (Rs.356) whose position again is not very good.

It is important to point here that the above mentioned income includes wages as cash, king and perquisites. A large part of these wages are in the form of perquisities as meal and therefore, these households get a very little income in real terms except meals. As such they are left with little options for any productive investment. Most members of these families usually have their meals from their employer. Therefore, it is very difficult to get any reliable data on consumption and the amount of surplus fof these families. Obviously as compared to cultivators, income distribution of Agricultural labourers is less stewed because it is an homogeneous group which is dependent on their labour only. The bottom 20 percent households in this category enjoy around 10 percent of total households income while top 20 percent households share around 34 percent of total income. The Gini ratio for labour

fig. 5.4



LEGEND

——— Total Income

category is calculated 0.2374. This ratio is less than that of Cultivators (0.2939). Lorenz Curve for the labour category is shown in Figure 5.4. Lorenz Curve points out that there are more income inequalities in the case of Cultivators as compared to agriculators landless labourers (see Figure 5.2).

Due to the seasonal character of agriculture industry, this class suffers from unemployment and disguised unemployment. Steps should be taken to promote occupations ancillary to agriculture to improve their lot. Subsidiary occupations such as poultry farming, Dairy farming, bee-keeping, goat-keeping etc are best suited in these area and need to be scientifically explcited.

From the above analysis we come to the conclusion that Farm income is the main source of earnings of large farmers while non farm income provides the main share of earning of small cultivators. In the supplementary activities, Pension and Salaries stand to be main source for large as well as small farmers. The hypothesis set out in the first chapter that inequality in the size of operational land holdings is the main cause of unequal distribution in farm income stands to be true. As the distribution of Non

farm income (depicted by Lorenz Curve in Figure 5.2) is near egalitarian line and FBI having large disparities in its distribution due to unequal distribution of operated area, causes unequal distribution of total income of cultivators. Finally distribution of income of landless labourers is less skewed as compared to cultivators.

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2. Inverse relationship is reversed now as is clear from our previous chapter due to increased use of input per acre by large farmers.

3. Frankel. R. Francine, " India's Green Revolution : Economic Gains and Political Costs" Oxford University Press, Bombay, 1971.

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6. D.S. Nandal, " Pattern of Income, Investment, Expenditure and Saving of Selected Demonstration Farms in Haryana", IJAE, 27, October- December, 1972.

7. The figure given in the table under estimates the total consumption expenditure as no portion of income for consumption of durable goods is included in consumption expenditure.

8. S.D. of log of Income $= \left[\frac{1}{N} \sum_{i=1}^{N} (\log Xi - \log \bar{X})^2\right]^{1/2}$

   C.O.V. $= \left[\frac{1}{N} \sum_{i=1}^{N} (Xi - \bar{X})^2\right]^{1/2} \Big/ \bar{X}$

   Where N is the total Number of Individuals and Xi is the income of each individual.

CHAPTER-6

Summary and Conclusion :

The use of hybrid seeds, coupled with scientific inputs such as chemical fertilizers, insecticides and pesticides, commonly called the Green Revolution, has resulted in substantial increase in productivity and output in the agricultural sector in India. Haryana along with Punjab has pioneered the adoption of new techniques in agriculture. It has registered a substantial break-through in agricultural production and incomes. The basic purpose of this study has been to analyse the impact of the new technology on income generation and its distribution among various categories of cultivating and agriculture labour households in rural areas of Haryana at the micro level. The results are based on an analysis of cross section primary data collected from 150 households from two villages in Karnal district selected with the help of circular sampling method.

A review of land use pattern in Haryana revealed that the proportion of fallow land and other uncultivable land had continuously declined resulting in the expansion of area under cultivation. Cropping pattern in the state has undergone a significant change. Rice and

Wheat, the major crops covered under High Yielding Variety Programme have recorded a sharp rise in area as a percentage of gross cropped area. As a consequence there is a decline in the area under pulses from 35 percent in 1960-61 to 12 percent in 1986-87.

The study of broad trends in the compound growth rate of area, production and yield of major crops has been done by fitting the semi-log function to the time series data. The analysis has been carried out by dividing the period arbitrarily into three distinct phases- Pre-green revolution, first phase of post-green revolution and second phase of post green revolution and also for the entire time period. Results show that in the pre-green revolution period, the growth of output was generally due to the growth of area. In the first phase of post-green revolution, the position is completely reversed. During this period, the growth of output is mainly due to the growth of yield. While successfully adopting the new technology, rice and wheat during first phase have encroached upon the area under other crops. These crops have maintained the growth of area as well as production during second phase of green revolution. During second phase also growth of output is almost entirely due to growth of yield as the possibility of area expansion has almost exhausted.

Growth of yield in the post-green revolution period is made possible by the expansion of assured irrigation facilities due to installation of tubewells, accelerating the process of modernisation of agriculture. As a result of assured water supply the use of fertilizers and pesticides has also increased rapidly. With the increased use of irrigation and fertilizers, area under HYV crops has experienced a major increase. 76 percent of rice and 96 percent of wheat area was under high yielding variety seeds during 1986-87.

The main hypotheses tested in this study using the primary data are:

i) The new technology has resulted in increasing returns to scale in agriculture.

ii) With the spread of new technology in agriculture, the inverse farm size productivity relationship tends to disappear.

iii) Inequality in the size of operational land holdings is the main cause of unequal distribution in farm income.

To test the returns to scale, Cobb-Douglas Production function in restricted and unrestricted form has been used. Farm size-Productivity relationship is calculated

by using double log production function, taking value of output as dependent variable and farm size as independent variable. Distribution of income is studied by using Lorenz Curve and Ginis ratio. To find out the dispersion of income from its average value, Standard Deviation and coefficient of variation are also calculated. Finally to find out profitability of farm size, relationship between farm size and farm business income is calculated by log linear equation. Our main findings are given below :

Household size increases with the farm size, giving an impression of direct relationship between farm size and household size. While, all farm size categories take land on lease, large farmers lease in more land, both absolutely as well as proportionately as compared to small farmers. This phenomenon is recently emerging in Indian agriculture and is generally termed as switching of tenancy.

Cropping intensity calculated as gross cropped area divided by net sown area is highest in the small size groups and lowest for the large size farmers - i.e. there is an inverse relationship between farm size and cropping intensity. Moreover the cropping intensity has affected the cropping pattern of the region. In our study area, like that of Haryana, there is a rice and wheat cycle. These crops constitute about 82 percent

of gross cropped area for all farm size category. The other important crops are fodder crops constituting around 16 percent of gross cropped area. However the proportion of fodder crops to GCA is more in case of marginal farmers than very large and large farmers and that of rice and wheat is more in case of large farmers as compared to marginal farmers. This emphasises the importance of bullocks and milch cattles for marginal farmers.

On account of their larger area, large farmers are able to get higher output per household as compared to small farmers. Output per acre however stands to be highest for small farmers and lowest for very large farmers giving the impression of inverse relationship at average level, infact the coefficient turns out to be insignificant with disaggregated data as is spelt out in the later paragraph.

The main factors constituting the cost of cultivation are hired labour, manure and fertilizer, use of tractor hiring in land and irrigation. Material cost per acre decreases with the increase in farm size, indicating economies of scale in agriculture. However total cost per acre does not show economies of scale may be due to non imputation of family labour, which is higher in the case of small farmers and lower in case of large farmers.

Though small and marginal farmers use more family labour and traditional inputs like bullock yet they are not far behind in use of modern inputs. New technology inputs like hybrid seeds, chemical fertilizers, pesticides and tractors are utilized by all size of farms equally showing no significant differences in their cost per acre, needless to say small farmers are hiring in services of tractors, threshers and tubewells.

In the process of modernisation both biotechnology as well as mechanical technology have played an important role. The impact of bio-technology is more pronounced as compared to mechanical technology and it constitutes the main elements of new strategy as hybrid seeds, fertilizer, pesticide and assured water supply.

By fitting Cobb-Douglas production function returns to scale are calculated. The regression coefficients in the production function are the production elasticities and their sum indicates the returns to scale. We tested the sum of regression coefficients for its deviation from unity by using F test. In all we have calculated 7 regression equations. It seems that the scene of the agriculture of the region is ruled in general by constant returns to scale as only two equations show significantly increasing returns to scale while the others show, constant returns to scale.

With the adoption of new technology by the cultivators, the inverse relationship between farm size and productivity per acre is completely reversed. Our regression coefficient is not significantly different from one (in a log linear regression) indicating constant relationship between farm size and value of output. Simultaneous existance of constant farm size productivity relationship and constant returns to scale suggests that farm size or area operated is the most important factor determining production on farms.

Farm Business Income is the major source of income of medium and large farmers, whereas small and marginal farmers derive major proportion of income through supplementary sources. The main sources of non farm activities for different size categories are pension and salaries, crafts and tradeshop and dairying and poultry farmings. Whereas small and marginal farmers try to fully utilize their labour resource and earn income from wages either in agriculture or non agriculture, large farmers earn income from hiring out of agricultural implements and thus fully utilize their capital resource.

The relationship between farm size and Productivity though important, does not bring into sharp focus the inequalities of income among farm households. This

analysis therefore studies the Farm Size and Farm Business income relationship. Our regression equation establishes constant relationship between farm size and FBI. This relationship explains the reason of skewed distribution of farming income. With keeping large area under operation the large farmers enjoy more farm business income than small farmers.

Distribution of farm business income and that of land area operated are almost similar as is also clear from Lorenz Curve of these two distributions Lorenz Curve of FBI merges with Lorenz Curve of land area operated in the later range, showing their symmetric distribution. Lorenz Curve for non farm income is more closer to diagonal line than that of total household income showing more equitable distribution for non farm income as compared to FBI and total income. As has already mentioned, the relationship between farm size and family size is direct therefore household income per capita as well as FBI and Non farm income per capita are showing less inequalities than the per household figures.

In the total earnings, agricultural labourers are far behind cultivators. However the distribution of income is more equitable in the former case. The Lorenz Curve of agriculture labour category is nearer to diagonal line (Figure. 5.4) than that of cultivators.

As Gini ratio of income stands 0.237 in case of agricultural labourers and 0.294 of cultivators.

Suggestions :

Some suggestions can be given for improving the economic condition of all marginal and small farmers and agriculture labour households -

It is established that the small and marginal farmers are equally efficient in new production technology as are large farmers. The only constraint is lack of adequate financial resources. To enable these farmers to acquire all modern inputs and to participate fully in future technological breakthroughs, adequate finance and aid should be provided them through the rural banks and agriculture co-operative societies.

To improve the lot of small and marginal farmers it becomes necessary to improve their land base. As with the existing operational land they will not be able to raise their farm income to any considerable extent even if the best production technology is made available to them. But to raise land base seems to be impossible task. It is not possible to raise land man ratio with growing population. The only way left is

of land redistribution which is almost impossible under the present socio-political structure. It is therefore advisable to try to uplift the small and merginal cultivators and particularly landless agricultural labourers and reduce their burden on land by the way of development of non farming activities.

There is substantial scope of employment in activities ancillary to agriculture. Especially subsidiary occupations such as diary farming, poultry farming, bee keeping, sheep farming goat keeping etc, rural industries such as pottery, handloom, leather products, ban, rope and mudha-making, carpentary and blacksmithy and agro based industries such as Gur making, rice processing, oilseed crushing and so on. Co-operatives and rural banks can play a dominant role in providing credit requirements for starting such occupations, some of which, intact, have already been undertaken.

Table - Appendix

Correlation Matrix of 15 variables on the basis data From Production Analysis.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
NOA 1.	1.00															
GCA 2.	.99	1.0														
CI 3.	-.42	- .39	1.0													
VO 4.	.97	.97	-.40	1.0												
S 5.	.95	.96	-.41	..96	1.0											
F 6.	.95	.96	-.40	.97	.94	1.0										
P 7.	.90	.90	-.40	.90	.86	.88	1.0									
CC 8.	.79	.78	-.32	.76	.69	.70	.68	1.0								
TBC 9.	.85	.84	-.37	.81	.77	.74	.75	.74	1.0							
TRC 10.	.77	.75	-.31	.69	.66	.64	.71	.76	.82	1.0						
LBH 11.	.92	.92	-.41	.92	.90	.90	.83	.75	.79	.68	1.0					
DH 12.	.92	.92	-.41	.92	.90	.90	.82	.75	.79	.68	1.0	1.0				
WF 13.	.54	.56	-.22	.55	.54	.51	.49	.43	.46	.38	.39	.30	1.0			
BULC14.	- .06	-.05	.02	-.04	-.03	-.05	-.08	-.14	-.02	-.25	-.28	-.08	.27	1.0		
IMPR 15.	.72	.73	-.29	.73	.71	.70	.65	.64	.79	.76	.68	.68	.46	-.17	1.0	

All figures are significant at 1% level.

Abb. =

NOA	=	Net op erated area	TBC	=	Tubewell charges
GCA	=	Gross cropped area	TRC	=	Tractor charges
CI	=	Cropping intensity	LBH	=	Hired labour charges
VO	=	Value of output	DH	=	Hired labour days
S	=	Seed	WF	=	Family worker days
F	=	Manure and Fertilizer	BULC	=	Bullock charges
P	=	Pesticides and Insecticides	IMPR	=	Implementation repair.
CC	=	Canal charges			

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