CHAPTER ONE
CHAPTER I

INTRODUCTION

The extent of capital accumulation in an economy determines, largely, the pace of its development. Capital accumulation, in its turn, in the initial stages of development is determined by the surplus from agriculture.¹ An increasing surplus from agriculture supports and sustains industrial development in several important ways. First, it permits agriculture to release a part of its labour force for industrial employment and also meets the increased food requirements of the non-agricultural sector. Second, it raises incomes in the agricultural sector which creates the rural purchasing power needed to buy the new industrial goods. It also provides rural savings which may then be mobilised by direct or indirect means to finance industrial development. Thirdly, agriculture also supplies the major wage-good (food) to industrial workers at prices favourable to the profitability of new industry.²

In under-developed countries, agriculture assumes even greater importance because it provides employment to nearly

1. In the earlier stages of industrial development, European countries utilised their surplus from agriculture. The role of landowners is particularly important as the supplier of capital and sometimes entrepreneurship, in these countries.

75% of the population. About 50% of their national income is contributed by agriculture alone.\textsuperscript{3} Such a tremendous dependence on agriculture requires a stable and highly productive agricultural sector, which, however, is not available to underdeveloped countries. The prominent feature of these countries has been a backward agriculture characterised by low levels of productivity resulting in shortages of foodgrains and industrial raw materials. This leads to large imports, not only of industrial goods, but also of agricultural raw materials and foodgrains. To remedy the situation, successful efforts have been made to raise the production and productivity levels in some countries, the first among these being Taiwan and Mexico. Emphasis was laid here on improved techniques of agriculture signified by the use of irrigation, better-variety seeds and fertiliser. Along with these inputs, labour-intensive techniques were generally given more importance because of the labour-dominant character of most underdeveloped economies.

An important question to be asked, however, is whether the progress that Taiwan and Mexico have made is due to the immediate results of the steps taken to modernise their

\textsuperscript{3} This overwhelming dependence on agriculture has been generally in “the traditional colonial or semi-colonial regions – the agriculture, plantation and raw material hinterlands of the big capitalist powers, which have exploited these areas as a source of cheap raw materials and foodstuffs and as spheres of investment”.

agriculture or is it the result of some favourable factors achieved over a time period. The first kind of approach has been adopted by Schultz in his analysis of development of agriculture in Mexico.² He maintains that rapid advances in agriculture are possible in a short period without necessarily requiring the foundations having to be laid in an earlier gradual development spread over many decades. The second approach is adopted by Raj⁵ in analysing the growth pattern of Taiwan and Mexico to compare it with Indian agriculture. Raj gives a lot of evidence to argue out his case in relation with Mexican and Taiwanese agriculture.

He finds that between 1948-63, the estimated growth rate of crop output in Taiwan was 4% per annum, while that of Mexico was still higher at 6% per annum.⁶ It is the growth experienced by Mexico after 1940s that is always stated as an example. He divides the period of growth in Mexico into two phases - 1939 to 1949 and 1950 to 1960. In the first phase agricultural output increased at 6.5% per annum whereas in the second phase, it was only 3.7% per annum.⁷ The sharp increase in crop output in the first

---


7. K.N. Raj, ibid, p. 103.
phase registered a decline in the second phase. "Increase
in yield between 1939-50 was more due to the extension of
cultivation to superior new lands and improvement of old
lands under irrigation ... No significant rise in yields
occurred in the older unimproved agricultural regions ... 
Changes in crop pattern were responsible for 60% of the
rise in agricultural production in 1940-44". The rise of
hybrid seed introduced in the latter period, did not have
a very significant effect on cropping pattern and rate of
growth. It is clear that the growth in agricultural output
was much more impressive between 1940-50 than the perfor-
mance in 1950-60. There are also striking regional dif-
ferences in the agricultural performance of Mexico. The
growth was concentrated in two states (Sinaloa and Sonora)
out of the seven. It was the very high agriculture growth
in these two states that increased the overall average for
Mexico.

Similarly for Taiwan, the fast increase in agricultural
output was not only due to the technological changes intro-
duced during the period (1940-60). The foundations for
technological progress had been laid over a period of four
decades before 1940. Before the second world war, there

8. The Economic Development of Mexico, Report of the Combined
Mexican Working Party, published by International Bank
for Reconstruction and Development, 1953, pp. 27-31,
in K.N. Raj, op. cit., p. 105.


10. Ibid., p. 111.
was an increase in the area under cultivation. Irrigation facilities also increased very fast. High yielding variety seeds, multiple cropping and chemical fertilisers, were increasingly used. However, rather 'unconventional' methods had to be used to make the farmers adopt the new methods of cultivation in the absence of land reforms. In the post-war period, land reforms were carried out to give more incentive to farmers to improve agriculture. It is clear, therefore, that historical factors played a crucial role in the utilisation of the new technology. These historical factors worked in the form of forcible land reforms, forcible use of better agricultural practices, availability of irrigation over a period of time etc. 

It is with this background, that an analysis has been attempted of the efforts made to modernise Indian agriculture to increase both output and productivity. India launched the new agricultural technology to overcome the recurring shortages on agricultural front in mid-60's.

11. Ibid., p. 112

12. Raj gives an interesting example of how police force was used by the Japanese in Taiwan to introduce new customs and techniques in their agriculture. New crops were forcibly introduced and supervised by the (imperialist) Japanese police force. It had to be done because there was no change in land tenure system to give an incentive to the cultivators to adopt new techniques of cultivation, See, K.N. Raj, op. cit., p. 112.


This scheme, initially pioneered by the Ford Foundation, was known as Intensive Agricultural Development Programmes. In essence, it called for the implementation of a "package" programme of new inputs in the selected districts.

The intensive utilization of "input package" did give higher outputs especially for crops like wheat, rice, maize, sorghum and millets. During the period 1966-67 to 1970-71, the area under the high yielding varieties went up very rapidly. The total area under the HY of the five crops mentioned above, increased from 1.88 million hectares in 1966-67 to 15.39 million hectares in 1970-71. Out of this area, the highest increase was experienced by wheat. In 1971-72, 39% of the total wheat production area of the country was covered by HY programme and for Punjab and Haryana, it was almost 90%. Average yield per hectare of wheat for the country increased from 789 kg. in 1965-66 to 1,307 in 1970-71 and the aggregate wheat output increased from 10.39 million tonnes to 23.83 million tonnes over the same period. During the same period, the area under paddy

---

15. Amongst the earliest efforts to increase agricultural production have been: "Grow More Food Campaign" of 1943 and Community Development Programmes 1952. However, these schemes achieved very limited gains. Again in 1959, the Ford Foundation Mission in its recommendations suggested giving top priority to food production, price stabilisation measures, security of land tenure and consolidation, provision of credits through cooperatives, a nine-fold increase in fertiliser consumption, an intensive irrigation programme and so on... See Ford Foundation Agricultural Production Team Report, Report on India's Food Crisis and Steps to Meet It, 1959.

increased by 19% while the yield per hectare increased from 845 kg. in 1965-66 to 1,123 kg. in 1970-71, with the total output of rice increasing from 33 million tonnes to 42 million tonnes. Although the high yielding varieties of rice were not doing as well as those for wheat, the rice and wheat together were largely responsible for increasing the food production from 72 million tonnes in 1965-66 to almost 95 million tonnes in 1967-68 and to 103 million tonnes in 1970-71.\textsuperscript{17}

This rapid increase was due to an increase in the consumption of fertilisers from 4 kg. per hectare in 1964-65 to 16 kg. per hectare in 1971-72, an increase in the diesel and electrical pump sets from 886,000 in 1964-65 to 1,775,000 in 1971-72 and an increase in the number of tractors from 54 thousand to 100 thousand over the time period.\textsuperscript{18}

After 1971-72, however, there was a tapering off of these sharp increases in agricultural output. After the high level of output achieved in 1970-71 (103 million tonnes) it declined to 105 million tonnes in 1971-72 and declined still further to 97 million tonnes in 1972-73.\textsuperscript{19} In spite of this decrease in output, the area under high yielding

\textsuperscript{17} See, Government of India, Ministry of Agriculture, \textit{Indian Agriculture in Brief}, 1973, p. 103

\textsuperscript{18} C.H.H. Rao, \textit{Technological Change and Distribution of Gain in Indian Agriculture}, Delhi, 1975

varieties has been increasing as shown by Government statistics. The use of fertilizer registered an increase from 1.4 million tonnes in 1974-75 to 1.9 million tonnes in 1975-76. Except for the year 1975-76, the agricultural production in India declined between 1971-72 and 1976-77.²⁰ The overall production of foodgrains during 1974-75 was 99.8 million tonnes which was lower than the level of 104.7 million tonnes reached in 1973-74. In 1975-76, partly due to exceptionally good monsoons the production of foodgrains went up to 121.03 million tonnes and in 1976-77, it declined to 111.6 million tonnes.²¹

Fluctuations in the agricultural output make it imperative to look into the factors responsible for them. Similar fluctuations in yield level have also been taking place. Some of the reasons for this decline are : low availability and use of inputs; spread of the high yielding variety of seeds to less fertile areas and to less resourceful farmers, and also the failure of the irrigation system which shows that the role of monsoons continues to remain crucial.²² The full potential of new technology has not been realised because the 'seed revolution has so far been limited mainly to wheat and rice and to a smaller degree to bajra and gram.

²⁰ Ibid., p. 6
Besides, there have resulted a few pockets of high agricultural growth, with most other areas continuing with backward agriculture. This high concentration also limits the use of new innovations by large number of farmers due to their economic backwardness. Areas that have been associated with high agricultural growth are Punjab, Haryana, western parts of Uttar Pradesh and some pockets in Karnataka, West Bengal, etc. The present study is an attempt to take up one of such areas, namely, Haryana for a detailed study.

Objectives

The following objectives have been laid down for the present study:

1. to study the productivity variations among different regions (districts) and also among different farm size categories;
2. to attempt to identify the factors, including specific technological inputs influencing productivity levels of farmers in different regions (districts);
3. to study the utilisation of these inputs in different districts and by different size categories and their impact on productivity levels;
4. to study the changes in agricultural practices in terms of cropping pattern and intensity of cultivation in relation to farm size and productivity;

5. to study the changes taking place in institutional factors such as tenancy and types and forms of rent and attempt to relate them to productivity levels;

6. to assess the availability of non-land assets such as livestock, implements — traditional and modern — for different land size categories in relation to productivity; and

7. to study the variations in costs and returns as related to farm size and productivity levels.

Study of all these aspects has been attempted to arrive at an overall picture of the changing agricultural situation in Gayaana under the changing technology. A causal relationship has been attempted between yield per acre and a number of explanatory variables.

Choice of Variables

The following variables have been selected to study the relationship between the inputs and the output. Output per unit of land has been taken as the dependent variable and the explanatory variables are irrigation, high yielding variety seeds, fertilisers and mechanisation, labour utilisation and the size of the farm.

Productivity: The Dependent Variable

A lot of debate has ensued on the measurement of productivity and any measurement procedure is bound to meet
with objections of one type or another. Three approaches to the measurement of productivity in agriculture have generally been adopted viz., (i) output per unit of land; (ii) output per unit of labour, and (iii) in terms of the input–output ratios.

The last two approaches, viz., output per unit of labour and input–output ratios have not often been used in under-developed countries on account of certain problems. Under-developed countries are generally labour-abundant, therefore, labour productivity in agriculture, while meaningful for certain purposes does not reflect critical input position. The input–output ratios present practical computational problems.

Output per unit of land has been used more frequently on account of some theoretical and operational considerations though this too has been widely discussed. Economists are agreed that, though there are several factors responsible for agricultural productivity in different regions, it would be convenient and operationally meaningful, if comparison is based on productivity per unit of land, while variations in respect of other factors might also be included in a study

---

of possible causes of variations in productivity. Therefore, output per unit of land has been preferred to measure the spatial and temporal variations attempted in the present study. It was felt that while the yield per unit of land could be used to measure the productivity level of individual crops, to work out the composite productivity of a number of crops in a region, methods like (i) ranking method (ii) standard nutrition unit method and (iii) value of output per unit of area, may be used.

In the ranking method, various units are ranked according to the yield per unit of output and the Ranking Coefficient is calculated. The method of conversion of production into nutrition calories is also used by over-simplifying the problem of aggregation and comparison.

However, the most commonly used method is that of the value of output per unit of land. Here, harvest or wholesale prices are used to convert the physical output into money values and thus, the difficulties of aggregation of different crops are eliminated. Due to the relative advantage of this method, the same has been used in the present study.


Explanatory Variables

A number of explanatory variables have been taken on the assumption that productivity is a function of these variables. This functional relationship is limited to the input package available to an Indian farmer which includes among others, irrigation, high-yielding variety seeds, fertilisers, pesticides and mechanisation. We discuss in the following sections the significance of these variables.

Irrigation

Irrigation is the most important pre-requisite for agricultural development and also for the application of the new agricultural technology. It has become a sort of technological constraint and once this is removed, the farmer could be persuaded (with less or more ease) to apply the inputs complementary to regular watering and to adopt the cropping patterns that bring a high yield. Irrigation has both direct and indirect benefits, thus becoming the most crucial variable in terms of both extensive and intensive utilisation of land. It may be remembered that extension of irrigation was the most potent factor for agricultural growth during the pre-1966/67 period in India.

Along with the extent of irrigation, the type of irrigation also assumes an equal importance. Relative profitability of canal and tube well irrigation, on the one hand, and of the private and public tube wells on the other, seems to suggest that private tube wells have proved to be more efficient. 28

High Yielding Variety Seeds

Besides irrigation, the most critical factor for recent agricultural growth has been the evolving, adoption and use of the high yield variety (HYV) seeds. High yielding variety seeds are those that possess high yielding potential and superiority over the local varieties in regard to quality, resistance to pests and diseases, time and period of maturity. Introduction of high yield variety seeds increases the yield by two or three times as compared to that of traditional varieties. However, as far as the adoption and utilisation of high yielding varieties of seeds are concerned, it is seen that smaller

---


Farmers tend to lag behind in its use.  

High yielding and better varieties of seeds, as stated earlier, have been developed in case of wheat, rice, jowar and bajra, thereby raising the production of foodgrains manifold.  

Fertilisers

Following irrigation and the high yielding varieties of seeds, the use of fertilisers is recognised as one of the most important factors in increasing the agricultural productivity. Due to continuous cultivation over years.

30. A number of studies have been carried out on this aspect. See, among others, M.S. Shetty, "Agricultural Innovations — Leaders and Lagards", Economic and Political Weekly, August 17, 1968, pp. 1275-82.  


32. A number of studies have been carried out on the impact of fertilisers on agricultural production. See, among other, K. Singh and A.S. Kahlon, op. cit.  

nutrient elements of the soil have to be restored to sustain agricultural production. Both organic and inorganic manures are required to increase soil fertility. Various fertiliser tests have been carried out to estimate the response of new varieties to fertilisers as compared to that of the traditional varieties. Studies suggest that for the owners, the returns on investment in fertilisers were much higher than those for the tenant-users.

Mechanisation

As against the bio-chemical revolution in agriculture, mechanisation is not a direct input. It is, however, instrumental in the following ways. It increases the yield, firstly through timely operations, secondly through qualitatively improving the agricultural operation and thirdly through multiple cropping. It includes all the


Ashok Parikh, "Rate of Return on Chemical Fertilisers, in the Package Programmes Districts", April-June 1966, Indian Journal of Agricultural Economics, pp. 31-46

35. B. Venkatapish, "Farm Mechanisation in India - Inaugural Address", in Seminar on Farm Mechanisation, 1972, p. 3
numerous mechanical means whereby efficiency is imparted to agro-economic practices, i.e., those related to soil, water, seed, fertiliser or other practices. Mechanisation influences the cropping pattern and helps in increasing crop intensity, both of these, in turn, increase land productivity.36

In the present study, the area under tractor cultivation has been taken as an indicator of mechanisation. Mechanised implements like oil engines and electric pump sets have not been taken to avoid double counting with the percentage of area irrigated. Other implements like reapers, sprayers, and threshers were not considered useful indices due to their small number.

Other Variables

Other variables regressed are labour utilisation per acre and the size of the farm of sample households. Use of labour per acre has gone up due to improved agricultural practices. Keeping this in mind, labour per acre has been taken as one of the factors influencing productivity. Similarly, effect of variations in farm size has been also taken into account.

Data Base

The data for the present study are partly taken from secondary sources and partly collected through a sample

survey carried out in 1975-76. Data from secondary sources have been collected principally from various (i) Statistical Abstracts of Haryana, (ii) District Census Handbooks of Haryana for the 1971 Census and (iii) Crop and Season Reports for different years.

Data from primary sources has been collected through a sample survey from three districts namely Rampal, Hisar and Gurgaon.

**Statistical Methods**

The relevant statistical techniques used are:

1. The "decomposition" of components of agricultural growth as used by Minhas and Vaidyanathan;
2. Coefficient of variation to measure the degree of inter-farm variations in agricultural productivity;
3. Taking productivity as a dependent variable, a step-wise regression model has been used to identify the important variables causing variations in agricultural productivity.

**Methodology to Select the Sample**

To study the impact of new technology at the village level, a sample survey was carried out in three districts of Haryana. The sample was broadly selected in the following manner:

1. At the district and tehsil level, selection was made on the basis of 'purposive' two-stage sampling. It was done
on the basis of the levels of irrigation and hopefully of the application of "new technology". An underlying assumption for this was that irrigation is the major factor responsible for the introduction of the "new technology". Districts and tehsils were selected from three groups divided on the basis of the irrigation ratio.

(2) Besides, the purposive sampling of districts and tehsils, further stages of sampling was attempted on a modified random basis. Villages out of the sample tehsils and later, the household were selected on this basis.

Selection of Districts

Districts were selected on the basis of the extent of irrigation. The extent of irrigation was a priori, assumed to be as important as the type of irrigation (tube-wells, wells and canal) to decide the capacity of a farmer to adopt the package programme. Both these factors were kept in mind while selecting the districts and tehsils. Geographical position of the districts was also taken note of so that a fairly representative selection of regions could be made.

If we start with the assumption that the extent of irrigation is a fair indicator of the adoption of new technology, the districts of Bariyana can be clubbed together in three regions according to the level of irrigation. Kamal and Jind fall in the first category (irrigation ratio : 55% or above) while Hisar and Rohtak fall in the medium category
(irrigation ratio: 40 – 55%) and Gurgaon, Ambala and
Nahandragarh fell in the lowest category with Gurgaon
in the medium-low category (less than 40% irrigation
ratio).

<table>
<thead>
<tr>
<th>Districts</th>
<th>% of Gross Irrigated Area to Gross Cropped Area</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karnal</td>
<td>61.63</td>
<td>High</td>
</tr>
<tr>
<td>Jind</td>
<td>55.58</td>
<td></td>
</tr>
<tr>
<td>Rohtak</td>
<td>53.54</td>
<td>Medium</td>
</tr>
<tr>
<td>Hisar</td>
<td>43.48</td>
<td></td>
</tr>
<tr>
<td>Gurgaon</td>
<td>32.34</td>
<td></td>
</tr>
<tr>
<td>Ambala</td>
<td>16.34</td>
<td>Low</td>
</tr>
<tr>
<td>Nahandragarh</td>
<td>10.23</td>
<td></td>
</tr>
</tbody>
</table>

Source: Census of Haryana, 1971

One district was selected from each of the three
regions, the districts selected being Karnal from the
highest irrigation ratio category, Hisar from the medium
category and Gurgaon from the medium-low category.

These three regions constitute:

1. Karnal (61.63%) and Jind (55.58%) have a high gross
area irrigated. Cropping pattern in these districts is
dominated by cultivation of wheat and paddy followed by
sugar cane. Source of irrigation is primarily tube-wells.
2. Rohtak (53.54%) and Hisar (43.58%) fall in the medium category. These districts grow wheat, gram, cotton etc. These are partly tubewell irrigated and partly canal irrigated.

3. Gurgaon (32.34%), Ambala (16.34%) and Panchkula (10.23%) fall in the lowest category. These districts cultivate mainly gram, wheat and barley. Source of irrigation are wells, tubewells and canals.

Kamal represents the tubewell irrigated district that grows predominantly wheat and paddy. Hisar is primarily canal irrigated and grows mainly gram, cotton and wheat. Gurgaon is partly well irrigated and partly canal irrigated. Tubewells are also being installed increasingly and the cropping pattern constitutes gram, wheat and sugarcane. Further, Gurgaon was selected in preference to Ambala and Panchkula in the dry region since very low irrigation ratio, it was assumed, would not permit adoption of new technology on any significant scale.

Selection of Tehsils

At the second stage of sampling, tehsils were also grouped together on the basis of the irrigation level. High, medium and low grouping based on irrigation was taken as the basis to select the nine tehsils, three each in each of the sample districts. At the tehsil level also,
<table>
<thead>
<tr>
<th>District</th>
<th>Tehsil</th>
<th>Irrigation</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Guhla</td>
<td>65.71</td>
<td></td>
</tr>
<tr>
<td>Kamal</td>
<td>Kamal*</td>
<td>65.36</td>
<td>High I</td>
</tr>
<tr>
<td></td>
<td>Panipat*</td>
<td>64.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Raichal</td>
<td>58.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thanesar*</td>
<td>56.99</td>
<td>High II</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>61.63</td>
<td></td>
</tr>
<tr>
<td>Bissar</td>
<td>Bansi*</td>
<td>69.91</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Batochabad*</td>
<td>53.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bissar</td>
<td>48.06</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Sirma</td>
<td>40.76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loharu</td>
<td>37.63</td>
<td>Medium-Low</td>
</tr>
<tr>
<td></td>
<td>Dalmali</td>
<td>37.18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dhivani*</td>
<td>7.04</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>43.48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Palwal*</td>
<td>48.35</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Ballahagarh</td>
<td>38.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rewari</td>
<td>34.46</td>
<td>Medium-Low</td>
</tr>
<tr>
<td></td>
<td>Gurseon*</td>
<td>34.23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suh</td>
<td>20.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Narasapur Jhirka*</td>
<td>15.58</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>32.34</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Census of Haryana, 1971*

*Note: asterisks show the tehsils that have been selected.*
an attempt was made to get a fair representation of varying types of cropping pattern and sources of irrigation. Tehsils selected were Karnal, Panipat and Thanesar in Karnal district, Bansi, Fatehabad and Bhiwani in Bhiwani district and Palwal, Gurgaon and Faroozepur Jhirka in Gurgaon (Table I.2).

The categories of high, medium and low are relative to the level of irrigation prevailing in the different districts and tehsils of Haryana. Bhiwani was selected, despite a very low irrigation ratio (7.04%) in 1971, since it was one of the tehsils which had received very high investment and development attention and which later became a separate district. Faroozepur Jhirka was selected to cover a low irrigation ratio tehsil inhabited predominantly by Mos population and having a distinct regional identity.

Selection of Villages

Villages with the irrigation broadly corresponding to the tehsil level were listed from the district census handbooks. Very small villages (having less than 75 households) and very large villages (having over 400 households) were eliminated from this list. Fisher's Random Tables were used to select the villages from this modified list of villages. Some margin was left on the upper and the lower limits of the scale to accommodate other specific
features of the village. Variations in terms of cropping pattern, source of irrigation, distance from the main town and the size of the villages were also taken account of. Irrigation by canals, wells and tubewells was also considered.

Sample villages have been given in Table No. 1.3 in a descending order of irrigation ratio, district-wise. A relatively lower level irrigation village in a highly irrigated district may be having a higher irrigation ratio than a relatively high irrigation village in the low irrigated district. The villages selected may be broadly divided into three regions.

**Table 1.3 Percentage of area irrigated in the sample villages – 1971**

<table>
<thead>
<tr>
<th>Districts</th>
<th>Sample Villages</th>
<th>Total Area Irrigated (Acres)</th>
<th>Total Irrigated Area as a proportion of total area cultivated (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karnal</td>
<td>Sirda Gufran</td>
<td>756</td>
<td>66.14</td>
</tr>
<tr>
<td></td>
<td>Karsa Chor</td>
<td>638</td>
<td>62.98</td>
</tr>
<tr>
<td></td>
<td>Dhanaura</td>
<td>673</td>
<td>62.01</td>
</tr>
<tr>
<td></td>
<td>Sakhliana</td>
<td>2,103</td>
<td>71.07</td>
</tr>
<tr>
<td>Hisar</td>
<td>Samani</td>
<td>1,683</td>
<td>31.35</td>
</tr>
<tr>
<td></td>
<td>Umarvat</td>
<td>113</td>
<td>8.42</td>
</tr>
<tr>
<td></td>
<td>Gudhrana</td>
<td>803</td>
<td>52.79</td>
</tr>
<tr>
<td>Gurgaon</td>
<td>Tripri</td>
<td>209</td>
<td>36.16</td>
</tr>
<tr>
<td></td>
<td>Gandhola</td>
<td>87</td>
<td>17.90</td>
</tr>
</tbody>
</table>

Source: Census of Haryana, 1971
<table>
<thead>
<tr>
<th>Villages</th>
<th>Total Area Cultivated</th>
<th>Total Area Irrigated</th>
<th>Total Area Irrigated by Source</th>
<th>Unirrigated Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Canal</td>
<td>Well</td>
</tr>
<tr>
<td>Karse Chor</td>
<td>1013</td>
<td>638</td>
<td>360</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(62.98)</td>
<td>(35.54)</td>
<td>(14.02)</td>
</tr>
<tr>
<td>Simla Gujran</td>
<td>1143</td>
<td>756</td>
<td>411</td>
<td>356</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(66.14)</td>
<td>(31.15)</td>
<td>(55.0)</td>
</tr>
<tr>
<td>Bhanaura</td>
<td>1084</td>
<td>673</td>
<td>311</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(62.010)</td>
<td>(1.48)</td>
<td>(60.61)</td>
</tr>
<tr>
<td>Bakhliana</td>
<td>2959</td>
<td>2103</td>
<td>2099</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(71.07)</td>
<td>(70.94)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>Samani</td>
<td>5368</td>
<td>1683</td>
<td>1683</td>
<td>311</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(31.35)</td>
<td>(31.35)</td>
<td>(1.11)</td>
</tr>
<tr>
<td>Unrupat</td>
<td>1342</td>
<td>113</td>
<td>113</td>
<td>311</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.42)</td>
<td>(8.42)</td>
<td>(1.11)</td>
</tr>
<tr>
<td>Gushraana</td>
<td>1521</td>
<td>803</td>
<td>777</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(52.79)</td>
<td>(51.08)</td>
<td>(1.71)</td>
</tr>
<tr>
<td>Tripri</td>
<td>578</td>
<td>209</td>
<td>209</td>
<td>311</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(36.16)</td>
<td>(36.16)</td>
<td>(1.11)</td>
</tr>
<tr>
<td>Gadhpola</td>
<td>486</td>
<td>87</td>
<td>87</td>
<td>311</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(17.90)</td>
<td>(17.90)</td>
<td>(1.11)</td>
</tr>
</tbody>
</table>

Source: Census of Haryana, 1971

Note: Figures in brackets give the percentage share of each source.
Highly irrigated villages with more than 55% area under irrigation include all the three villages in Farman district and one village (Sakhiara) in Nissar district. Villages with 40% to 55% of irrigation have been termed as medium level irrigation villages and these include one village (Gadhrana) in Gurgaon district. Low level irrigation villages are those with irrigated area below 40%. These include two villages, Sanani and Guravat in Nissar district and two villages Tripri and Gadhole in Gurgaon district.

It is evident from Table 2.4 that different sources of irrigation in terms of canal, wells and tubewells have also been considered.

Selection of Households

The purpose of the present study is limited to the aspects of the production conditions of the cultivating households. Due to this, only the cultivating households were taken. A cultivating household was considered as a household that cultivated land irrespective of its ownership. All other households were termed as non-cultivating households and are excluded from the study. All the cultivating households were listed according to the size of the farm. Farm size has been categorised as small with less than 5 acres of land, medium with 5 to 15 acres of land and large with more than 15 acres of land. The break-up
of land-size categories is given in Table 1.5.

**TABLE 1.5 PATTERN OF LAND-DISTRIBUTION OF THE SAMPLE HOUSEHOLDS (OPERATIONAL HOLDINGS) (IN ACRES)**

<table>
<thead>
<tr>
<th>Kamal</th>
<th>Hissar</th>
<th>Gurgaon</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Area (Acres)</td>
<td>No.</td>
</tr>
<tr>
<td>Small</td>
<td>30</td>
<td>112.50</td>
</tr>
<tr>
<td>Medium</td>
<td>56</td>
<td>569.50</td>
</tr>
<tr>
<td></td>
<td>(52.93)</td>
<td>(43.64)</td>
</tr>
<tr>
<td>Large</td>
<td>20</td>
<td>623.00</td>
</tr>
<tr>
<td></td>
<td>(18.87)</td>
<td>(47.74)</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>1305.00</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
<td>(100.0)</td>
</tr>
</tbody>
</table>

Note: Figures in brackets give the percentage of land under various categories to the total area surveyed.

These households have been taken on the basis of operational holdings. A number of households did not possess any land but had been leasing it in every year. Table 1.6 gives the average size of operational holdings in the sample. Surprisingly, the average size of holdings in Kamal (12.31 acres) is higher than Hissar (11.39 acres) and Gurgaon (11.93 acres). In Umrawat village in the Hissar district and in Gadholia village in the Gurgaon district, land holdings have become very small because of increasing sub-division. Despite of the meagre irrigation facilities, land holdings are sub-divided because
of the hunger for land due to the non-availability of opportunities outside the agricultural sector. 37

<table>
<thead>
<tr>
<th></th>
<th>Karnal</th>
<th>Hisar</th>
<th>Gurgaon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>3.75</td>
<td>3.47</td>
<td>3.60</td>
</tr>
<tr>
<td>Medium</td>
<td>10.17</td>
<td>9.90</td>
<td>9.87</td>
</tr>
<tr>
<td>Large</td>
<td>31.15</td>
<td>29.28</td>
<td>31.47</td>
</tr>
<tr>
<td>Total</td>
<td>12.31</td>
<td>11.39</td>
<td>11.93</td>
</tr>
</tbody>
</table>

Source: Survey Data

As stated earlier, the present study, therefore, attempts to probe into the following questions:

(i) the growth rate of agricultural output in Haryana and the contribution of changes in area, cropping pattern and yield in the changing growth rate;

(ii) to identify the more crucial variables from the total input package of new technology and the utilisation of these inputs;

(iii) to study the productivity differentials in various regions and over different farm size categories; and

37. This is in conflict with the findings of some other scholars who find that higher land-productivity has accelerated subdivision of land in Punjab and Haryana. The Agricultural Census shows a quadrupling of small farms during 1960-1970.
(iv) to study the pattern of land relations, costs and returns per acre in different regions and for different size categories.