SUMMARY OF THE FINDINGS AND CONCLUSION

An attempt has been made to analyse some aspects of production conditions under the changing agricultural technology in different regions of Haryana. Agricultural technology has been defined as the adoption by a farm household of one or more components of the irrigation, high yielding variety seeds, fertilisers and mechanisation in terms of the use of tractors and other machinery. Along with a study of these inputs, the utilisation pattern of labour as an input and the farm size has also been considered.

The spatial pattern that emerges due to the impact of the introduction of the new agricultural technology has been studied, to begin with, on the basis of the available secondary data. The changes taking place in the output, area and yield under various crops, between 1962-65 and 1973-76 have been used to analyse the growth rate of agricultural production in different districts of Haryana. The relative contribution of the changes in area, cropping pattern and yield to the overall growth rates have also been studied. Three-year averages of the end-periods have been taken to mitigate the effect of extreme fluctuations. The decomposition exercise shows that changes in cropping pattern and yield levels have
contributed largely to the growth of agricultural output. It is only in Hissar that the interaction between yield and cropping pattern has proved to be the most important factor. The overall compound growth rate of the crop output for the state between 1962-65 and 1973-76 has been 5.37% per annum of which changes in cropping pattern has contributed 1.66% per annum, changes in yield 1.65% per annum, changes in area 0.91% per annum while the interaction factor has contributed 1.15% per annum. In Jind, Mahendragarh, Ambala and Rohtak, changes in agricultural output have been predominantly due to the changes in the cropping pattern. Yield changes have contributed more to the changes in the agricultural output in Karnal and Gurgaon. As mentioned earlier, it is only the Hissar district, where the interaction factor has been more important.

The changes in area have had relatively an insignificant impact on the changes in agricultural output. The net area sown in Haryana has registered a marginal increase of only 2.47% over the period of eleven years, rising from 3469.67 thousand hectares in 1962-65 to 3569.67 thousand hectares in 1973-76. The changes in gross cropped area in Haryana has been more significant (13.15%) over the period, that is, from 4549.33 thousand hectares in 1962-65 to 5147.67 thousand hectares in 1973-76. This implies an increase in the area under double cropping of 48.06% over the period of eleven years.
The changes in the cropping pattern are seen in terms of a large increase in area under wheat in all the districts of Haryana. Similarly, area under paddy has also registered an increase in all the districts except that paddy is not still grown on a significant scale in Gurgaon and Mahendergarh. Paddy is, however, a significant crop only in Karnal. Area under bajra has shown a decline only in Gurgaon and Mahendergarh while gram has registered a decline in all the districts.

The non-foodgrain crops have registered an increase in the area under them but the increase has not been as significant as for some of the food crops. Jind, Bissar, Ambala and Mahendergarh registered an increase in the area under the non-foodgrain crops, while Karnal, Rohtak and Gurgaon registered a decline. There is increasing shift in some districts towards the foodgrain crops, especially wheat.

The changes in yield have contributed considerably towards the growth of agricultural output in Haryana. The yield changes have been more significant for crops like wheat, paddy and bajra. Grain and sugarcane have a declining trend for some districts. The yield level of cotton has shown an increase, however, inspite of this, the area under cotton has not increased substantially as compared to wheat. The reason seems to be the less attractive prices and greater fluctuations in prices then those for wheat and paddy.
These conclusions have further been looked into through a sample survey in the three districts of Haryana, namely, Karnal, Hisar and Gurgaon corresponding to the three broad agro-economic regions of the state. The purpose of the survey has been to study the overall conditions of the cultivating households as a result of the changes in the technical inputs of agriculture. The aspects studied are: the variations in agricultural productivity both among the villages and within each village; the relationship of farm size and productivity and other aspects like the asset position; the cost of production and the returns of a farmer.

Variations in Agricultural Productivity

Agricultural productivity tends to vary from place to place depending broadly on the level of the utilisation of technical inputs, cropping pattern etc. The sample villages have been classified on the basis of existing yield level into high (Rs. 600 and above per acre), medium (Rs. 400-600 per acre) and low (below Rs. 400 per acre). Dharwana (Rs. 659.48 per acre), Karna Chor (Rs. 658.64 per acre) in Karnal and Guhrana (Rs. 631.42 per acre) in Gurgaon fall in the "high" category; Simla Gajran (Rs. 522.63 per acre), Sakhiana (Rs. 452.32 per acre) and Umarvat (Rs. 461.15 per acre) in Hisar and Triphri (Rs. 445.35 per acre) in Gurgaon fall in the "medium" category, while Gadhola (Rs. 377.09 per acre) in
Gurgaon and Samundra (Rs. 369.43 per acre) in Hisar fall in the “low” category. All the three villages in the ‘high’ category have predominantly tubewell-irrigation; in the ‘medium’ category Simla Gajran and Tripuri have predominantly tubewell-irrigation, Bakhtana is canal-irrigated and Unravat has Persian-wheel and the lift-irrigation system as the source of irrigation. As a general rule, productivity levels are higher in the areas with assured irrigation.

The yield per acre of wheat is the highest (792.40 kilograms) in Guhrana in Gurgaon and all the three villages of Kamal follow it. Kansa Chor in Kamal has the highest yield level for rice followed by Bharauna (Kamal). Gram, bajra, sugarcane and barley which require relatively less irrigation give a varied level of pattern of yield in different sample villages. Villages like Unravat get a high level of productivity due to a higher yield level of sugarcane and gram.

The productivity differentials between different farm-size categories show that the differences in yield levels broadly vary with the farm size while the intensity of cropping predominantly varies inversely with the size of the farm household. The large farm households have much higher productivity level than other categories – the absolute difference being the largest in Kamal. In Kamal, all the categories of farms have higher productivity level, while Hisar district has the
lowest. The spatial index number with Bissar as the base shows that the relative disadvantage of Bissar district is the least for medium farmers. While it is in the case of small farms that the relative disadvantage of Bissar district is the highest. The only satisfactory explanation of this rather poor performance of Bissar district can be the prevalence of canal irrigation and a different cropping pattern.

An analysis of the cropping pattern in the sample villages reveals that foodgrains are the predominant crops in all the three districts. Karnal has 66.16%, Bissar 66.90% and Gurgaon 81.55% of the total cultivated area under the foodgrain crops. The second largest area in Karnal is under non-foodgrain crops while in Bissar, it is the fodder crops. One also observes a similar pattern for different size categories.

An attempt has been made, in the present study, to analyse the impact of the technical inputs on the productivity level in the sample villages. Productivity per acre has been taken as a dependent variable. The explanatory variables have been taken as the level of irrigation, area under high yielding varieties of seeds, fertiliser, area under tractor cultivation, utilisation of labour and the size of farm household. The first four variables are the components of the input package that constitutes the new technology while the intensity
of labour utilisation is related to the availability and the knowledge of the "new technology." The size of the farm holding has been studied with respect to its impact on the overall resource-position of the farmer.

It is the use of labour, fertiliser and the levels of irrigation that explain the maximum variation in the productivity levels in the sample villages. In the district of Kamal, the utilisation of labour and fertiliser are more crucial variables due to the availability of tubewell-irrigation to a large number of farmers. In the recent years, the spread of tubewells has been rapid in Kamal considering the advantages of controlled irrigation. All the villages in Bissar and Gunjaon show the use of labour and the level of irrigation as the more crucial variables. It is because the canal irrigation is not as widely spread and controlled. Besides, even if some villages do have tubewell irrigation, it is not as widely spread as in Kamal. Though, the explanatory variables are highly inter-related there are some variables (such as labour, fertiliser and irrigation) that are more crucial than the rest.

An analysis of the consumption pattern of fertilisers shows a higher level for the areas with higher and relatively more assured irrigation. Villages in Kamal have a much higher consumption of fertilisers. Similarly, the larger the farm-size, the higher the expenditure on fertilisers.
The data on labour-absorption per cropped acre shows that Karsa Chor and Simla Gujran in Karnal have the highest utilisation of man-days per acre while in Dharuana (Karnal), Bakhilana and Samani (Nisar) and Gudhrana (Gurgaon) fall in the middle category and Un ravat (Nisar) and Gadhola (Gurgaon) fall in the lowest category of labour utilisation per acre. For most of the villages, utilisation of labour per acre increases with the increase in the farm-size though in some cases, there is a slight decline from small to medium (as in the case of Gudhrana and Tripri in Gurgaon and Karsa Chor in Karnal) or from medium to large farmers (as in the case of Simla Gujran in Karnal and Bakhilana in Nisar). Thus, a definite relationship between the size of farm and labour-utilisation cannot be established.

The share of hired and family labour shows that on small and medium farms the man-days contributed by hired labour are much less than that of large farmers. The number of man-days (both family and hired) employed per household increases with the category of farm-size. Spatial variations exist in the intensity of labour utilisation. For small farm-size category, Tripri (Gurgaon), Samani (Nisar) and all the three villages of Karnal have a higher number of man-days employed per household than Gudhrana and Gadhola (Gurgaon) and Bakhilana and Un ravat (Nisar). Similar pattern is broadly observed for other farm-size categories. The
proportion of hired labour, as expected, is the highest for the large farm-size category. Simla Gujran and Bhangana have the largest proportion of hired labour while Bahliana in Hisar and Karsa Chor in Karnal have the lowest proportion.

The use of the mechanised implements, more so of tractors, is related to the aspect of labour-use and also productivity. Use of tractors, taken as a separate variable in the present study is highly scale-biased and is associated with the extent of other facilities available in the villages. Karnal has the largest area under tractors followed by Hisar and Gurgaon.

Other Related Production Aspects of Agriculture

The impact of the utilisation of new agricultural technology has been also studied in relation with the tenancy system, the asset position, the cost of production and the income level. The impact of the changing technological matrix is reflected in the changes being affected in the tenurial conditions, though a lot of leasing in is still prevalent in all the sample households. Tenancy contracts have become shorter and temporary. This increases the insecurity of the farmer and acts as a disincentive for undergoing any long term improvements on the land. Sharecropping, with one-third of the output going to the landlord, is still the predominant form though cash contracts are increasingly being accepted in Karnal and Hisar.
Another form of lease-contract, that is, one-half share of crop output with both the parties sharing half the cost of the inputs (seeds, fertiliser and irrigation charges), is also being increasingly adopted.

The ownership of livestock, especially draft cattle has been studied in relation to the asset position of the farmers. The number of livestock per household is higher in Bissar and Gurgaon than in Karnal. Cattle, like heifers, which are kept in the pipeline for draft cattle is also higher in these two districts. The number of draft cattle is low in Karnal because, increasingly tractors are used for ploughing and other operations. However, the number of milch cattle per household is higher in Karnal. The importance of milch cattle is recognised in all the three districts because the sale of milk provides with an extra income to the farmer. Introduction of governmental dairies have made this business more paying. The pattern of the ownership of cattle, according to the farm-size categories shows that small farmers maintain the minimum number or sometimes, none at all, of the draft cattle required while the other categories maintain a larger number of draft cattle.

The explanations provided for the lack of draft animal power differ in two different settings. These are : (1) linked with lack of resources to purchase the cattle or fodder, thus resulting in hiring in of bullock
power or (ii) a deliberate preference for hiring in of tractor services. The highest number of households with the first reason are in Gurgaon and Hissar while for the second reason, Karnal leads all the districts. It seems that in areas with a higher level of mechanisation, the importance of livestock as a source of draft power is decreasing. It also reduces, as mentioned earlier, the area under crops raised to feed the cattle.

The type of implements and equipment used is an indicator of the extent to which the "new technology" has penetrated the countryside. Farm implements divided into two broad categories include: (i) improved implements like crushers, bullock-operated fodder cutters, iron ploughs, persian wheels, bullock barrows, bullock carts etc. (ii) modern implements like threshers, tube-wells, pumping sets, power operated fodder cutters, tractors and ancillary items.

The highest number of adopters for "improved implements" are in Karnal followed by Hissar and Gurgaon. Karnal has the highest number of adopters in terms of "modern implements"; the most commonly adopted component being tube-wells. Use of 'improved implements', however, is more readily accepted than that of modern implements. Similarly, large farmers adopt 'modern technology' in larger numbers. It is the scale-biased nature of the modern implements that limits its use only to larger farmers.
The adoption of 'new technology' entails considerable investment in agricultural equipment and other durable assets. The components of investment have been divided into two broad categories: (i) farm investment and (ii) non-farm investment. The percentage of total farm investment per household is higher in Karnal (79.76%) than in Gurgaon (73.36%) and Hisar (56.28%). Farmers in Karnal and Gurgaon have started investing in tubewells and pumps which increases the proportion of the total farm investment. In Hisar, while the share of farm investment has been low, the absolute amount at Rs.761.40 per household has been higher than in Gurgaon at Rs.640.31.

The investment pattern of the three size-groups of farmers shows that farm investment increases as the size of the farm category goes up. The rise in farm investment is fairly sharp with the rise in the farm size category.

The pattern of variations in non-farm investment among different farm size-groups is not uniform. While non-farm investment rises fairly sharply between the small and the medium farmers in the three districts, it declines marginally between the medium and the large farmers.

The credit requirements of the farmer are going up as a result of the utilization of new technology. Besides this, farmers also borrow to meet their consumption
requirement. The dependence of the cultivators on private agencies (landlord, moneylender and trader) is still predominant although institutional credit agencies have also come into being. Trader is increasingly combining trade with moneylending and the pure moneylender, though he still exists, is not as resourceful as the trader. In some areas in Hissar and Gurgaon, landlords lend out their surplus funds.

The small farmers in Hissar and Gurgaon borrow considerably for consumption requirements while in Karnal district, it is the loans for the purchase of a tractor, tubewell and pumpset which form an important part of the borrowings in Karnal.

The impact of the utilisation of 'new technology' has been studied in terms of its effect on the costs and the returns accruing from the production. Our data show that the cost of output per acre is the highest in Karnal followed by Gurgaon and Hissar. The paid out material costs per acre are also the highest in Karnal and the lowest in Hissar. Similarly, the costs per household are very high in Karnal (Rs 6088.70) and much lower in Gurgaon (Rs 2995.64) and Hissar (Rs 2337.56).

The costs per acre show a general increase with an increase in the farm-size categories. The pattern is almost the same in all the districts. The superior resource position of the large cultivators is obvious
from their increased expenses; this becomes even more marked when we consider the returns accrued by different farm-size categories.

The returns per acre show a distinct spatial pattern with Karnal at a surplus of Rs. 203.99 per acre, Gurgaon with Rs. 161.05 per acre and Hisar with Rs. 125.55 per acre. Returns per household show even a greater amount of inequality in the three districts. The returns per household from the agricultural activity is Rs. 8013.76 in Karnal, Rs. 5930.56 in Gurgaon and Rs. 5727.76 in Hisar.

The inequality of the gains accrued from the utilization of the new technical inputs is more marked for different farm-size categories. The small farmers trail behind in all the three districts in terms of their agricultural income. The gap between the small (Rs. 2227.83) and the large (Rs. 22540.04) farmers is the largest in Karnal followed by Hisar and Gurgaon. The regional disparities are further sharpened by the increased benefit accrued by the large farmer.

These income inequalities, both over regional and over different farm-size categories, are further accentuated by the large gap in the non-agricultural income of these farmers. The non-agricultural income per household is the highest in Karnal (Rs. 1956.75), followed by Hisar (Rs. 735.00) and Gurgaon (Rs. 653.33). The disparity in non-agricultural income also exists for different farm size categories.
The inequality in the income level from the agricultural and the non-agricultural sources have shown a trend for its increasing concentration in the hands of the large farmers. The utilisation of "new technology" has given an added advantage to the farmers in Haryana; the productivity levels have gone up; so has the intensity of cultivation increased. The changes in the cropping pattern have shown a switch over to crops like wheat and paddy which due to the minimum price and the procurement policy of the Government, is a more reliable source of income for the farmers.

These changes, however, have not been independent of regional disparities. Some areas such as Karnal, have outstripped the others; and a high level of income - inequality is obvious within these "developed" areas also. Similarly the advances made in the less "developed" areas have not been independent of inter-regional and intra-regional disparities.