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Assessment of Marketable and Marketed Surplus of Major Foodgrains in Punjab

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PREFACE

In a growing economy the rate of growth of urban industrial sector depends on the availability of food from the rural agricultural sector. Understanding the behavior of marketed surplus and the variables affecting it can be of great importance in the development of sound policies with respect to agricultural marketing and prices, imports and exports, national reserves and overall rural and national development objectives of the country. In order to make correct estimates of food supplies for human consumption, the scientific estimation of seed and feed requirement along with the post-production foodgrains losses during storage, transportation and marketing is of utmost importance. To meet the ever increasing demand of foodgrains, country is heavily dependent on the availability of adequate local supplies particularly from the Punjab state. In Punjab, wheat and rice are the most dominating crop enterprises and this tiny state with only 1.54 percent of the total geographical area of the country contributes about 45 to 70 percent of wheat and 35 to 40 per cent of rice towards the central pool of food grains for last two decades. Looking at the role of Punjab in Indian food security, it is important to estimate marketable and marketed surplus of wheat and rice in the state.

The present study is very much relevant and important in providing the authentic estimates on marketable and marketed surplus as well as post harvesting losses of major food grains and thus availability of foodgrains for human consumption in the state and country.

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Authors

Abstract

The present study has been taken to estimate marketed surplus and retention of wheat and rice for self consumption, seed, feed, wages and other payments in kind. Further it examines the role of various factors such as institutional, infrastructural, socio-economic, etc. in influencing household marketed surplus of these crops. The study is based on the survey of 300 paddy-wheat growing farm households, comprising 36 marginal, 60 small, 96 medium and 108 large farmers conducted in three major wheat and paddy growing districts of Punjab which together accounts for 26 per cent of the area as well as production of study crops in state. The comprehensive survey was conducted in the sample villages at end of crop year 2011-12. In addition to the primary data collected from the farmers, relevant secondary data were collected from various published sources. Tabular analysis and simple statistical tools such as averages and percentages were used for the interpretation of the results. The results of primary data revealed that overall average operational farm size on sample farms in state was 4.22 ha comprising 3.23 ha of owned land and 0.99 ha of leased in land. The incidence of leasing in land to increase the farm size was found to be directly and positively related to the farm size. Paddy and wheat were major crops on all the farm size categories and on average accounted for 40.38 and 45.66 per cent of the gross cropped area on the sample farms in state with average per farm production of 233.33 and 203.00 quintals. With some variations the crop productivity of paddy and wheat was relatively more on the larger size farms. Overall losses of paddy and wheat at different stages of handling accounted for 2.47 and 2.16 per cent of the total production of the respective crops. In both of study crops, harvesting stage accounted for the major proportion of the losses, followed by transportation, and marginal losses were observed during farm level storage. Total retention of paddy on sample farms on an average accounted for 0.64 per cent of farm production. Purpose-wise the home consumption, payment in kind, feed and seed accounted for 0.24, 0.22, 0.09 and 0.08 per cent of paddy production, respectively. Total retention of wheat on sample farms on an average accounted for 9.95 per cent of farm production. Purpose-wise the home consumption, seed, feed and payments in kind accounted for 6.26, 1.52, 1.61 and 0.14 per cent of wheat production, respectively. In both crops the percentage share of total as well as purpose-wise retention in total farm production declined with the increase in farm size. The marketed surplus accounted for 99.37 and 90.06 per cent of the paddy and wheat output, respectively. The entire marketed surplus of both of the crops was disposed of in months immediately after harvesting and about 99 per cent of this was sold to the government procurement agencies at the MSP. The average distance covered to sell the marketed surplus was less than 5 km. Among factors affecting the marketed surplus, size of the operational area, crop farming as main occupation and education had a positive relationship with the marketed surplus. On the other hand under social grouping the belonging of farm household to schedule casts or other backward class had shown the negative relationship with the marketed surplus of wheat and paddy crop. Print media mainly the news papers was the major source of price information of the respondents. Effective price policy through significant increase in Minimum Support Prices (MSP), assured procurement and development of market infrastructure particularly for wheat and paddy coupled with relatively better production technology available has driven the state agriculture at remarkable rate and resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state. Tremendous increase in production of paddy and wheat was coupled with simultaneous increase of marketed surplus/ arrivals of these crops.

Chapter 1

Introduction

1.1. Macro Overview of State Agriculture

Punjab state holds place of pride among the Indian States for its outstanding achievements in agricultural development. Consolidation of holdings, land reforms, development of irrigation, power, research and extension service, credit, marketing and transport infrastructure along with effective price policy and facilities for output procurement and distribution of farm inputs were the important factors which helped Punjab agriculture in making rapid strides since mid 1960s. In 2010-11, the state had its 98 per cent net sown under the irrigation. Hundred per cent of the area of wheat and rice is under HYVs and that of maize is nearly 98 per cent. Per hectare consumption of chemical fertilizers (NPK) has achieved the levels of 246 kg. The rapid adoption of the green revolution technology in Punjab has led to the sharp increase in farm mechanization. The number of tractors and tube wells in state is 4.98 lakh and 13.82 lakh, respectively. With development of irrigation infrastructure along with large scale mechanization of state agriculture the intensity of cropping has been reached at 190 per cent.

Consequently, the Punjab state comprising only 1.54 per cent of the total geographical area of country now contributes 13-14 per cent towards the total food grain production of the country. In last four decades, the production of wheat in state has gone up by about three times from 5.62 million tonnes in 1971-72 to 16.5 million tonnes in 2010-11. Similarly, production of rice another major crop of state, during this period increased by about twelve times from 0.92 million tonnes to 10.8 million tonnes. Total food grain production over this period increased by more than three and half times. Yields of wheat, paddy and total food grains nearly doubled over the period. State has earned a name of granary of India through contributing 35 to 40 per cent of rice and 45 to 70 per cent of wheat to the central pool during the past two decades. Besides, production of cotton, potato and milk during this period has gone up by 1.76, 7.24 and 4.47 times, respectively. On the other hand, the production of pulses and oilseeds went down drastically over this period and that of sugarcane with some variations remained almost stagnant. The reason of decline of production of these crops was the drastic decline of area under these

crops due to encroachment by paddy and wheat which together constituted about 80 per cent of the gross cropped area in state during 2010-11 (Singh *et al*, 2012).

However, the fast track growth of agricultural production in the state has led to many production related problems. Stagnating yield levels and the escalating cost of cultivation of major crops further aggravated the situation through squeezing the profitability of agriculture adversely affecting the socio-economic condition of farmers in the state. Thus, the agriculture in state has reached a plateau making it very hard to make further progress under available technologies and natural resource base. The state cropping pattern dominated by wheat-rice rotation is causing a serious damage to the state's natural resource base. Paddy in particular, a water-intensive crop is blamed for water-table depletion in tube-well irrigated areas and water-logging in canal irrigated areas. Increasing incidence of nutrient deficiency in the soils including micronutrients and insect-pest attacks on the crops are also posing major threats to productivity, food grain production and sustainability of agriculture in the long run. Diversification of cropping pattern towards environment friendly high value crops with emphasis on quality output and promotion of agro-processing industry has been felt as the need of hour.

1.6 Concept of Marketed and Marketable Surplus

Marketable surplus is the quantity of produce which can be made available to the non-farm population of the country. It is a theoretical concept. It is the residual left with the producer farmers after meeting his requirements for family consumption, farm requirements for seed and feed for cattle, payment to labour in kind, payments to artisans like carpenter, blacksmith or mechanic, payment to land lord as rent and social and religious payments in kind.

Marketed surplus as generally been defined as the portion of production which actually enters the market irrespective of farmer's requirements for family consumption, farm requirements, social and religious payments. It also includes the distress sales. Thus, the marketed surplus may be more, less or equal to the marketable surplus. Marketed surplus is more than the marketable surplus when farmer retains a smaller quantity of crop than his actual family and farm requirements. This is true especially of small and marginal farmers whose need for cash is immediate. This is termed as distress or forced sale. Such farmers generally buy the produce from the market in a later period to meet their requirements. Marketed surplus is less than the marketable surplus when the farmers especially larger ones with better retention capacity retain

some of the marketable surplus in anticipation of fetching higher prices in future period (Acharya and Agarwal, 2004).

Region, type of crop, size of holding, size of family, price of crop output, level of production, seed and feed requirements and consumption habits are some of the the important factors which determine the quantity of the marketable surplus.

1.7 Relevance of Study

In the liberalized era, improving productivity, competitiveness and increasing marketed surplus are important goals of agriculture sector. The generation of marketed surplus and its transfer from agricultural sector to non agricultural sector is crucial for achievement of self sustaining economic growth. In a growing economy the rate of growth of urban industrial sector depends on the availability of food from the rural agricultural sector. Thus, understanding the behaviour of marketed supply of food crops grown partly for home consumption is of prime importance (Krishna, 1962, Bardhan and Bardhan, 1971). Understanding the behaviour of marketed surplus and the variables affecting it can be of great importance in the development of sound policies with respect to agricultural marketing and prices, imports and exports, national reserves and overall rural and national development objectives of the country. At present the Indian government through its agencies is actively involved in marketing of staple food products especially the food grains. Huge and increasing amount of money in food security and agricultural development assistance schemes depicts the urgency of meeting the basic needs of the people. Implications of National Food Security Bill may be enormous in the form of requirement of food grains and government involvement in food grain trade. In order to make correct estimates of food supplies for human consumption, the scientific estimation of seed and feed requirement along with the post-production food grain losses during storage, transportation and marketing is of utmost importance. An understanding of marketed surplus behaviour is also important in determining the size, placement and rules for release of reserve stocks. Thus, understanding of food grain marketed surplus and its determinants is an essential element of effective planning and program design.

Wheat and rice contributes significantly in maintaining adequate Buffer Stock of country to meet emergencies like weather vulnerability as well as for domestic market stabilization measures. With increased incomes and urbanization the people substitute wheat and rice

products for other staples particularly the coarse grain, thus leading to the increased demand for these. To meet this increasing demand of the food grains, country is heavily dependent on the availability of adequate local supplies particularly from the Punjab state. In Punjab, wheat and rice are the most dominating crop enterprises and this tiny state with only 1.54 percent of the total geographical area of the country contributes about 45 to 70 percent of wheat and 35 to 40 per cent of rice towards the central pool of food grains for last two decades. Looking at the role of Punjab in Indian food security, it is important to estimate marketable and marketed surplus of wheat and rice in the state. Equally important is to know the proportion of farm and family requirements and post harvest losses of these important food grains. This study is very much relevant and important in providing the authentic estimates on marketable and marketed surplus as well as post harvesting losses of major food grains and thus availability of food grains for human consumption in the state and country.

1.8 Objectives of Study

The present study has been taken with the following specific objectives:

1. To estimate marketed and marketable surplus of wheat and rice
2. To estimate the retention of wheat and rice for consumption, seed, feed, wages and other payments in kind
3. To examine the role of various factors such as institutional, infrastructural, socio-economic, etc. in influencing household marketed surplus

1.9 Review of Literature

In order to have an insight into marketable and marketed surplus and post harvest losses of food grains, a number of earlier studies were reviewed and presented hereafter in chronicle order.

Wycliff and Nath (1972) examined the extent of the farmer's marketable surplus and the factors determining its volume on the basis of data from 160 farmers in Deoria district of Uttar Pradesh. The marketable surplus of paddy was 35.59 per cent, and of wheat 36.03 per cent of total production. The quantity and percentage of marketable surplus, marketed surplus and residual surplus were positively correlated with the size of holding for both the crops. Level of production was also positively correlated with marketable surplus. Small farmers lagged behind

the larger farmers in increasing marketable surplus, mainly because of lack of land per capita and low production.

Birewar (1977) brought out that the quantitative increase in food grain production has been achieved through improved pre-harvest agricultural techniques. There was also a need of equal importance to quality and quantity of the grains produced and to avoid losses during the post-harvest operations, which were estimated to be of the order of about 10 per cent in India. The prevention of waste and loss of food grains at post harvest level could be best achieved in the process of threshing, transport, storage, processing and marketing.

Singh and Khosla (1978) conducted a study on post-harvest food grain losses in India and highlighted the magnitude of food grains losses at various levels. The study brought out that during 1969-73 the transit and storage losses in food grains were between 1.03 per cent and 1.09 per cent of the value of sales. The total range of loss in rice at different post-harvest stages was estimated between 10 and 37 per cent.

Tomer *et al* (1978) assessed the crop productivity and marketable surplus in the Pounta Valley of Himachal Pradesh and reported that on small farms retention of paddy for home consumption, seed and for payment of wages was 90.84 per cent, 2.2 per cent and 3.66 per cent, respectively. Marketable surplus on these farms constituted only 3.3 per cent of the paddy production. Marketable surplus on medium and large category farms was found out to be 4.61 per cent and zero per cent, respectively.

Gill and Singh (1986) reported that with increase in market arrivals of wheat and paddy and stocks with the procurement agencies, there occurred severe losses in handling, transportation, storage and distribution process. The total losses of food grains including the losses at the threshing floor has been reported at 9.33 per cent.

Reddy (1987) studied the marketable surplus of paddy in Chittor district of Andhra Pradesh and reported that marketable surplus on small and marginal category, medium category and on large category of farmers constituted 4.59 per cent, 31.12 per cent and 52.51 per cent of the total production on the respective categories.

Ahmed *et al* (1990) conducted a study on marketed surplus and its farm level determinants of paddy in Assam. The results revealed that on an average marketable surplus of paddy accounted for 48.56 per cent of the paddy production. It was also found out that marketable surplus of fine winter paddy was higher than coarse winter paddy.

Pothuluru and Yadagiri (1992) investigated the marketed surplus and the marketing problems of small and marginal farm households in Nalgonda district, Andhra Pradesh, India. Data were collected for 1987-88 from a random sample of 20 small and 20 marginal farm households in 8 villages. The ratio of marketed quantity to total household production was 35 per cent for rice, 63 per cent for pulses and 100 per cent for groundnuts whereas all of the sorghum production was retained for family consumption. In order to pay off the debt, a considerable proportion of the produce marketed was sold to money lenders/traders immediately after harvest, at lower than market prices. Cooperative marketing was suggested as an alternative to free small and marginal farmers from the exploitation and malpractices of middlemen.

Malik *et al* (1992) used regression analysis to examine the relationship between marketed /marketable surplus of wheat and rice and seven explanatory variables for a sample of marginal, small, medium and large farms in Kurukshetra district of Haryana. The data relate to the marketing year 1988-89. Production, consumption, marketed and marketable surplus of wheat and rice increased with the increase in farm size. The volume of total production and wages in kind to farm labourers had a positive and significant relationship with marketed surplus for both crops.

Upender (1992) estimated the gross and net marketed surplus functions and domestic annual consumption functions for rice using data drawn from a random sample of 48 farmers from three districts of Telangana region of Andhra Pradesh. The regression analysis revealed a negative relationship between net marketed surplus and family size. The quantity of marketed surplus is not always equivalent to real surplus because sometimes farmers are forced to sell their production in order to meet their immediate requirements and later on depend on the market to meet household consumption needs. The production coefficient was positive and highly significant in two of the three villages. In all the villages the elasticity of marketed surplus with respect to output was positive and greater than unity.

Singh *et al* (1992) reported that wheat crop suffered 1.49 to 1.55 per cent losses during harvesting with sickle whereas such losses with harvester combine ranged from 1.57 to 1.60 per cent. Threshing loss to wheat was from 1.42 to 1.45 per cent. Losses in traditional storage structures made of mud etc. were very alarming ranging from 6.79 to 6.84 per cent. Loss during marketing of the grains was estimated at 0.80 per cent.

Singh and Singh (1992) taken up a study to examines the size of marketed surplus for different size groups of crop farms; to estimates the contribution of different size groups of farms to total marketed surplus in the Indian Punjab; and to study the factors affecting marketed surplus. The study pertains to the year 1987-88. It showed that the proportion of marketed surplus was directly related to the size of farm. The contribution of the small size categories of farms to supply, even for wheat and rice was high. Of the factors determining marketed surplus, production was found to be a significant determinant for all crops. The major share of the benefits of the Green Revolution, which was directly proportional to marketed surplus, was cornered by the larger farms.

Upendra *et al* (1998) estimated marketable surplus of paddy in Karimnagar district of Andhra Pradesh. The study revealed that proportion of marketable surplus of total paddy production on small, medium and large category of farmers was 33.49 per cent, 27.96 per cent and 38.56 per cent, respectively.

Kumar (1999) brought out that in Haryana marketed surplus of paddy on an average was 96.31 per cent of the production. On marginal, small, semi-medium, medium and large farm categories it was 90.82, 90.73, 94.39, 96.39 and 98.14 per cent, respectively.

Gill (2000) revealed that 7-10 per cent post-harvest losses from farm to market level and another 4 -5 per cent from market to distribution level resulted into loss of 12 to 16 million tonnes of food grains as a whole. Storage function was another major culprit for food grain losses in the form of theft and damages besides the leakages.

Singh (2000) observed that the post-harvest quantitative and qualitative losses occur to the stored food grains due to physical factors (temperature and moisture), biological factors (insects, micro-organisms, rodents, birds and mites), chemical breakdown along with mechanical factors and pesticide use. It was estimated that about 10 per cent of the food grains were being lost due

to conventional means of storage at the farm level. Thus problems relating to post harvest handling and storage of food grains need to be addressed on priority.

DMI (2002) conducted a study on marketable surplus and post harvest losses of wheat in India. For this the survey was conducted in 100 districts, selected from 25 states of the country during TE 1998-99. From selected districts, out of which 71 percent were wheat-growing villages, about 86 per cent area under wheat was grown as irrigated. The state-wise distribution of area under wheat showed that in states like Uttar Pradesh, Punjab, Haryana, wheat was grown mainly as irrigated crop and in total production; contribution of irrigated wheat was 92.67 percent. The contribution of High Yielding Varieties in production was estimated at 91.65 percent. The total requirement of wheat for farm-family consumption (retention for consumption at farmer level and purchases) accounted for 29.66 percent of the estimated production. The estimates of retention for various purposes and purchases of wheat to meet the total requirement of farm-family viz. for farm-family consumption, for consumption by permanent and temporary labour, estimated purchases for consumption, for seed purpose, for animal feed and for payment in cash and kind were worked out at 27.49, 2.13, 0.04, 3.35, 1.79 and 1.88 per cent, respectively. The total post harvest losses of wheat at producers' level (in transport from field to threshing floor, threshing and winnowing, transportation and farm storage) were estimated at 1.79 percent of the total production. The total marketed surplus was estimated to be 53.81 percent. The share of direct sales by the producers to consumers was 14.56 percent. The co-operatives purchased only 9.42 percent and the share of FCI was merely 20.00 percent. In this context, study suggested the introspection for the co-operative sector and FCI to evaluate their role in marketing of wheat for the benefit of the farming community. To serve the interests of the farm households, the study clearly established the need for development of marketing infrastructure and facilities at the village level.

DMI (2002) conducted a study on marketable surplus and post harvest losses of paddy. The survey conducted during TE 1998-99 covered 100 districts selected from 25 states of India. The State-wise distribution of area under paddy showed that in states like Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Punjab, Haryana, paddy was grown mainly as irrigated crop. The coverage of the High Yielding Varieties was of the order of 77.19 percent. In total paddy production irrigated paddy and High Yielding Varieties contributed 75.89 percent and 85.56 percent,

respectively. The total requirement of paddy for farm-family consumption was estimated at 33.67 percent of the estimated production. The estimates of retention for various purposes and purchases of paddy to meet the total requirement of farm-family like farm-family consumption, for consumption by permanent and temporary labour, estimated purchases for consumption, for seed purpose, for animal feed and for payment in cash and kind were worked out at 26.08, 2.22, 5.38, 1.80, 0.18 and 1.54 per cent, respectively. The total post harvest losses of paddy at producers' level were estimated at 2.72 percent of the total production. The total marketed surplus was estimated to be 51.97 percent. The share of direct sales by the producers to consumers was 3.64 percent. The co-operatives purchased only 3.90 percent and share of FCI was merely 9.73 percent. The study stressed upon the need to open up avenues through marketing reforms for promoting direct sales by the producer to the target group in order to enhance producer's share in consumer's rupee. Development of infra-structure and facilities at the village level to serve the interests of the farm households were of utmost important as 64.66 percent of total sales were within villages. Study suggested shifting the focus of development from the urban market centres (largely developed) to the rural market centres.

Goyal and Berg (2004) analyzed the marketed surplus response of cereals in Haryana State. A model that considers the effect of both factor and output prices on marketed surplus was used for this purpose. To derive input demand and output supply elasticities, the normalized quadratic profit function and demand equations were estimated jointly with the seemingly unrelated regressions (SUR) estimation technique using farm level panel data. The data confirmed the theoretical framework. The derived price elasticities of input demand, output supply, and marketed surplus have been simulated to examine alternative price policies for securing different levels of marketed surplus. Study revealed that at the observed price structure marketed surplus of wheat will increase almost equal to population growth, but in case of paddy it will grow at a very low rate. The study further revealed that besides price adjustment, technological improvement and non-price factors are also of critical importance for increasing output supply and, hence, marketed surplus.

Chauhan and Chahabra (2005) conducted a study on production, marketed surplus, disposal channels and price spread of maize cultivation in Hamirpur district of Himachal Pradesh. The results revealed that farm level marketable surplus of maize comprised of 53.21 per cent of the total production. About two-thirds of the marketable surplus of maize was disposed of by about

72 per cent of the farmers in first quarter of harvesting period viz. October to December. Producer-local trader-wholesaler/commission agent-processor/consumer had been the main marketing channel accounting for about 72 per cent of the marketed surplus.

Singh (2005) examined the existing system of marketing of agricultural commodities in India; the extent of state intervention; and the factors impacting marketing efficiency. It also draws policy implications to improve marketing efficiency and reduce the need for a large-scale state intervention in different states. The crops covered in this study were: rice and wheat in Haryana, Punjab and Uttar Pradesh; rice and groundnut in Andhra Pradesh; rice and jute in Assam; and cotton, sugarcane and onions in Maharashtra. The study also examined the level of marketed surplus and the prices received by farmers by farm size; the share of public and private agencies in the marketed surplus; the price spread of individual commodities; and the spread of the marketing season. The study pertained to the agricultural year 2001-02 in all the states except in Punjab (2000-01). Among all the states, market intervention was very high in the marketing of rice and wheat in Haryana and Punjab and in rice in Andhra Pradesh. The procurement of wheat and rice had been also going on for quite some time in Uttar Pradesh. The prevailing system of marketing and the extent of state intervention varied considerably in the case of the three study crops in Maharashtra. The monopoly procurement scheme for cotton in Maharashtra had accumulated a huge amount of losses. The marketing of rice in Assam threw light on how the system of marketing of rice in the state differed from that of other states and whether the farmers were able to receive minimum support prices.

Pouchepparadjou and Sendhil (2006) assessed the level of producer surplus of rice and the factors associated with marketed surplus in the Cauvery Delta Zone, the "rice bowl" of Tamil Nadu and the Puducherry. The study covered the years 2002-04 and was based on data from a sample of 500 farm households distributed in 40 villages in proportion to the area under rice crop in each village. On an average, the marketable surplus and total retention were 9745.02 kg (73.86% of total production) and 3448.58 kg (26.14%), respectively. The average net marketed surplus and repurchases were 9060.21 kg and 453.06 kg, respectively. Farm size, rice output, wages in kind, and a dummy variable for education were found to have positively contributed to the marketed surplus.

Basavaraja *et al* (2007) estimated the post-harvest losses at different stages in two major

food grains, viz. rice and wheat in India. The post-harvest losses at the farm level have been estimated to be 3.82 kg/ q for rice and 3.28 kg/q for wheat. The losses have been highest during storage in both the crops.

Singh *et al* (2011) estimated the extent and pattern of marketed surplus and home utilization of wheat on farm households in Punjab. The analysis of monthly records in this respect of cross-section data collected under Comprehensive Scheme to Study the Cost of cultivation of Principal Crops revealed that 7.69, 3.17, 2.41, and 2.28 percent of the total wheat output was utilized at home as food, animal feed, seed and kind payments, respectively. The output elasticity of marketed surplus which was found out to be positive and more than unity indicated that in state the marketed surplus of wheat grew faster than the increase in production. In contrast to the official records indicating only 62 percent of total wheat produced in state as market arrivals, the study indicated that marketed surplus constituted about 82 percent of the wheat produced on sample farm households, thus clearly indicating that a significant proportion of marketed surplus was disposed of without entering the state records, resulting in loss to the state exchequer through evasion of market fee, rural development fund and other taxes.

Chapter 2

Coverage, Sampling Design and Methodology

2.1 Coverage and Sampling Design

To meet the specific objectives of the study, at first stage of sampling three major wheat and paddy growing districts (14 per cent of the total number of districts) viz. Gurdaspur, Ludhiana and Ferozepur were selected. These districts besides being major producers of the study crops also represent three agro ecological regions of the state. While Gurdaspur represents the sub-mountain undulating zone, Sangrur and Ferozepur represent the central plain zone and south-western plain zone of the state, respectively (Figure 1). The selected sample districts accounts for 26 per cent of the area as well as production of study crops in Punjab state.

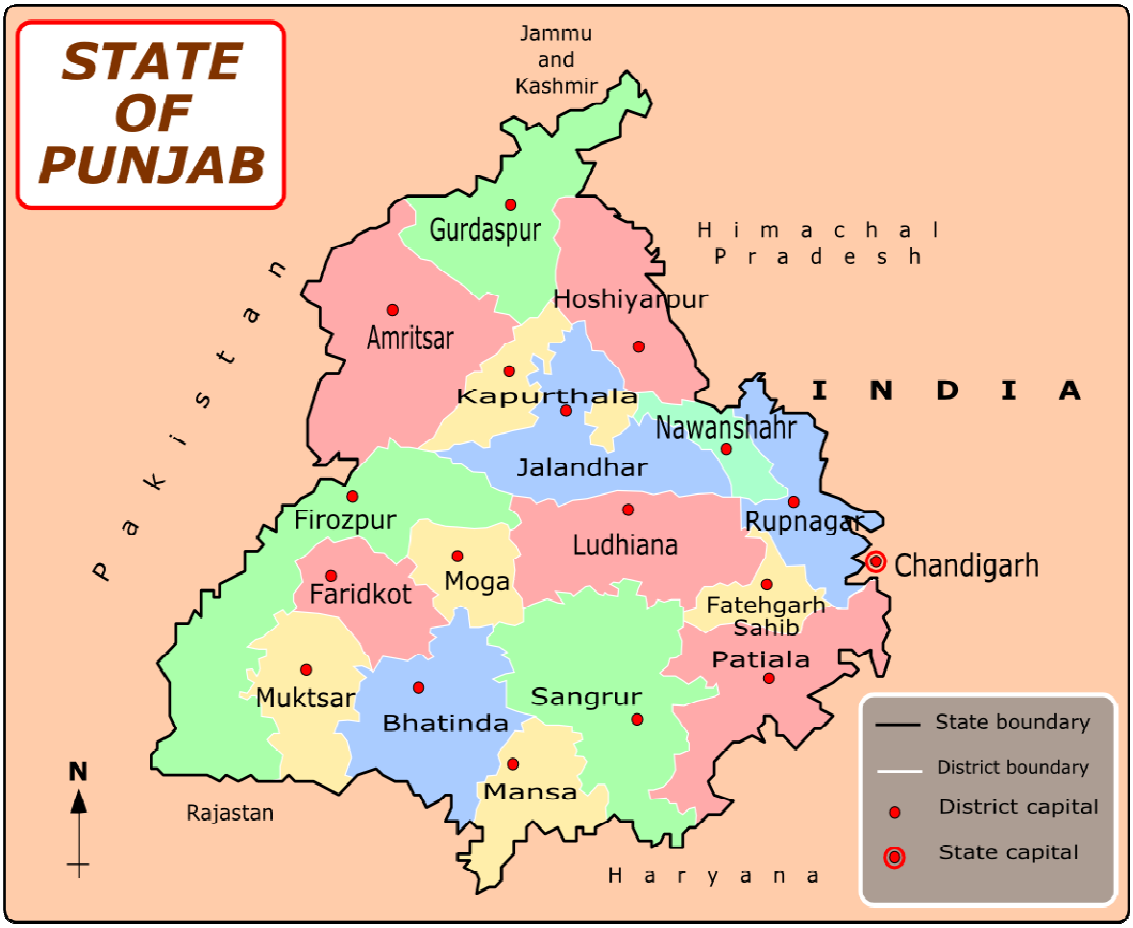

Figure 1: Map of Punjab State

At second stage, two major wheat and paddy producing blocks from each of the selected district were selected. Thus overall six blocks from the sample districts were selected. At next stage of sampling a total of twelve villages i.e. two villages each from the selected blocks were selected randomly for the farm household survey. Finally from each of the selected village, 25 representative cultivators growing both wheat and paddy, in proportion to their respective proportionate share in different categories as per standard national level definition of operational holdings viz., marginal (< 1 ha), small (1.01 to 2 ha), medium (2.01 to 4 ha) and large (> 4 ha acres) were selected randomly. Thus, overall from state total sample of 300 farmer households producing both wheat and paddy, comprising 36 marginal, 60 small, 96 medium and 108 large farmers forms the basis for the present enquiry. The detail of sampled districts, blocks and villages is provided in Table 2.1.1.

In order to accomplish the objectives of the study, the required information pertaining to the production, on farm requirements, marketed surplus and losses at various stage of handling of wheat and paddy output along with other socio-economic aspects was collected from the sample farmers through the interview method using the specially designed schedules for the purpose. The comprehensive survey was conducted in the sample villages at end of crop year 2011-12 (Reference year). In addition to the primary data collected from the farmers, relevant secondary data were collected from various published sources such as Statistical Abstracts and Economic Surveys of Punjab. Tabular analysis and simple statistical tools such as averages and percentages were used for the interpretation of the results.

Table 2.1.1: List of selected districts, blocks and villages in Punjab, 2011-12.

Agro-climatic Zone	District	Name of Blocks	Name of Villages	Number of Sample Farmers				
				Marginal	Small	Medium	Large	Total
Sub-mountain Undulating	Gurdaspur	1.Dhariwal	1.Chouderpura	3	5	8	9	25
			2.Lehal	3	5	8	9	25
		2.Hargobindpur	1.Chone	3	5	8	9	25
			2.Bohja	3	5	8	9	25
Central Plain	Sangrur	1.Bhawanigarh	1.Bhattiwal Kalan	3	5	8	9	25
			2.Jhaneri	3	5	8	9	25
		2.Dhuri	1.Kakkarwal	3	5	8	9	25
			2.Hasanpura	3	5	8	9	25
South-western Plain	Ferozepur	1.Ghal Khurd	1.Ferozeshah	3	5	8	9	25
			2.Misriwal	3	5	8	9	25
		2.Zeera	1.Malsian Kalan	3	5	8	9	25
			2.Mansur Deva	3	5	8	9	25
Total sample size				36	60	96	108	300

2.2 Conceptual Framework and Theoretical Model of Marketed Surplus

Although price forms an important factor in determination of marketed surplus, but in the wake of effective Minimum Support Price of both wheat and paddy as well as the stabilized output prices throughout the year, its major effect is being translated through the change in area under crop and output. Further in as the primary data pertained to short run of one year, the variation in cross sectional farm price of wheat and paddy was negligible, thus making it impossible to measure the effect of price on its marketed surplus. Influence of non price factors including socio-economic, economic, infrastructural, institutional and technological factors on the marketed surplus was revealed by the tabular analysis. According to literature, among socio-economic factors, size of the operational area and crop farming as main occupation had a positive relationship with the marketed surplus. Similarly, institutional and infrastructural development in the form of regulated markets and price information, better road connectivity, storage, credit availability, etc can significantly influence the marketed surplus of agricultural commodities. Role of technological factors both in production and marketing along with economic factors in the form of price are very important in determination of the marketable surplus.

Chapter 3

Overview of Foodgrains Economy of State

The progress made by agriculture in Punjab state is unparalleled in the history of world agriculture. The state which was deficit in food at the time of independence had made rapid strides in agricultural development. Dominating agrarian structure, consolidation of holdings, development of irrigation infrastructure and hard working peasantry led to the early progress. With adoption of new agricultural technology in mid sixties backed with adequate agricultural policies, the state turned surplus in food grains and became a model of India's successful green revolution strategy. Punjab state with only 1.5 per cent geographical area of the country besides feeding its growing population has been contributing 35-40 per cent of rice and 45-70 per cent wheat to the central pool since last two decades. From 1971-72 to 2010-11 the production of wheat in state has gone up by about three times from 5.62 million tonnes to 16.5 million tonnes. Similarly, production of rice another major crop of state, during this period increased by about twelve times from 0.92 million tonnes to 10.8 million tonnes. Total food grain production over this period increased by more than three and half times. Yields of wheat, paddy and total food grains nearly doubled over this period of time. Besides, production of cotton, potato and milk during this period has been gone up by 1.76, 7.24 and 4.47 times, respectively. On the other hand, the production of pulses and oilseeds went down drastically over this period and that of sugarcane with some variations remained almost same.

3.1 Structural Transformation of State Economy: Changing Sectoral Shares of the Economy

Overall structure of economic activities in state had been changed over a period of time and primary sector experienced a decline in terms of its share in Gross State Domestic Product (GSDP). Sectoral distribution of GSDP of Punjab at current prices presented in Table 3.1.1 revealed that GSDP of Punjab at current prices has increased from Rs 4877.13 crore in 1980-81 to Rs 19325.9 crore in 1990-91, Rs 68448.3 crore in 2000-01 and Rs 224975 crore in 2010-11. Over time, the contribution of primary sector consisting of agricultural and allied activities towards GSDP has increased from Rs 2123.9 crore in 1980-81 to Rs 69690 crore in 2010-11. Over this period the GSDP from secondary and tertiary sectors of state increased from 1095.74 crore and 1657.49 crore in 1980-81 to 58574.9 crore and 96710 crore in 2010-11, respectively.

Table 3.1.1: Gross state domestic product at factor cost by sectors in Punjab at current prices

(Rs. Crore)

Sector	**1980-81**	**1990-91**	**2000-01**	**2010-11**
Agriculture and livestock	2110.68	8316.61	26280.8	63572.9
Agriculture	1488.14	6020	17824.6	44762.9
Livestock	622.54	2296.61	8456.19	18810
Forestry and logging	11.07	114.08	299.83	5547.12
Fishing	1.84	14.4	182.71	537.06
Agriculture & allied	2123.59	8445.09	26763.3	69657.1
Mining and quarrying	0.31	4.55	5.44	32.95
Sub- total (Primary)	**2123.9**	**8449.64**	**26768.8**	**69690**
Manufacturing	692.75	3000.78	9924.74	37956.02
Registered	352.19	1698.04	6777.46	22214.1
Un-registered	340.56	1302.74	3147.28	15741.9
Construction	273.36	985	4277.78	16305.8
Electricity, Gas & water supply	129.63	749.27	2567.97	4313.05
Sub- total (Secondary)	**1095.74**	**4735.05**	**16770.5**	**58574.9**
Total industry	1048.74	3157.94	11117.3	58607.8
Transport, storage & communication	201.78	703.36	3442.07	13061.3
Railways	-	-	-	1894.89
Transport & other means	-	-	-	7567.79
Storage	-	-	-	534.64
Communication	-	-	-	3063.93
Trade, Hotel & restaurants	846.96	2454.58	7675.24	24797
Banking & insurance	101.77	639.97	3017.04	11607.8
Real estate, ownership of dwelling & business services	86.67	536.28	2410.62	12862.7
Public administration	107.03	673.64	3877.91	10538.3
Other services	313.28	1133.38	4486.21	23842.9
Sub- total (Tertiary)	**1657.49**	**6141.21**	**24909.1**	**96710**
Gross state domestic product	**4877.13**	**19325.9**	**68448.3**	**224975**

Source: Statistical Abstract, Punjab

Percentage distribution of gross state domestic product at factor cost by sectors in Punjab at current Prices revealed that share of primary sector in GSDP which was 43.55 per cent during 1980-81 declined significantly to 30.98 per cent in 2010-11(Table 3.1.2).

Table 3.1.2: Percentage distribution of gross state domestic product at factor cost by sectors in Punjab at current Prices

Sector	1980-81	1990-91	2000-01	2010-11
Agriculture and livestock	43.28	43.03	38.40	28.26
Agriculture	30.51	31.15	26.04	19.90
Livestock	12.76	11.88	12.35	8.36
Forestry and logging	0.23	0.59	0.44	2.47
Fishing	0.04	0.07	0.27	0.24
Agriculture & allied	43.54	43.70	39.10	30.96
Mining and quarrying	0.01	0.02	0.01	0.01
Sub- total (Primary)	**43.55**	**43.72**	**39.11**	**30.98**
Manufacturing	14.20	15.53	14.50	16.87
Registered	7.22	8.79	9.90	9.87
Un-registered	6.98	6.74	4.60	7.00
Construction	5.60	5.10	6.25	7.25
Electricity, Gas & water supply	2.66	3.88	3.75	1.92
Sub- total (Secondary)	**22.47**	**24.50**	**24.50**	**26.04**
Total industry	21.50	16.34	16.24	26.05
Transport, storage & communication	4.14	3.64	5.03	5.81
Railways	0.00	0.00	0.00	0.84
Transport & other means	0.00	0.00	0.00	3.36
Storage	0.00	0.00	0.00	0.24
Communication	0.00	0.00	0.00	1.36
Trade, Hotel & restaurants	17.37	12.70	11.21	11.02
Banking & insurance	2.09	3.31	4.41	5.16
Real estate, ownership of dwelling & business services	1.78	2.77	3.52	5.72
Public administration	2.19	3.49	5.67	4.68
Other services	6.42	5.86	6.55	10.60
Sub- total (Tertiary)	**33.98**	**31.78**	**36.39**	**42.99**
Gross state domestic product	100.00	100.00	100.00	100.00

Source: Statistical Abstract, Punjab

Over this period the share of secondary sector in GSDP gone up from 22.47 per cent to 26.04 per cent. Major increase was observed in case of contribution from the tertiary sector and its contribution in GSDP went up from 33.98 per cent in 1980-81 to 42.99 per cent in 2010-11.

Thus, while the contribution of primary sector consisting of agriculture and allied fields in state income decreased overtime in a major way (about 13 per cent), the contributions from tertiary sector had been observed to be increased tremendously (about 9 per cent). Over this period the contributions from secondary sector consisting the manufacturing in GSDP increased by only three and half per cent.

3.2 Changing Structure of State Agriculture

In the wake of new technology, Punjab agriculture made rapid progress since mid sixties. This progress has been made possible by speedy adoption of improved seeds, irrigation and increased use of non-conventional inputs like fertilizers, machinery and pesticides supported by the natural resource base of state. The progress was spectacular in early phase due to rising agricultural productivity and expansion in gross cropped area. However, of late the progress in agricultural production has slowed down and signs of stagnation are visible. The agrarian structure of state witnessed significant changes in last four decades. Distribution of operational holdings, cropping patterns and proportionate share of each sub-sector in primary sector's contribution in Gross State Domestic Product (GSDP) determines the agrarian structure. The agrarian structure of Punjab state revealed by above said factors is discussed in this section as follows:

3.2.1 Operational holdings

The information on distribution of operational holdings in state of Punjab at different points of time from 1970-71 to 2010-11 is depicted in Table 3.2.1. Since 1970-71, land holding distribution of Punjab has witnessed significant changes. From 1970-71 to 1980-81, the number of marginal and small holdings declined sharply, while those in the higher-size categories showed a modest increase. These changes occurred primarily due to the reasons that with the onset of the green revolution technology, crop production activities became economically attractive, which created an active land-market for leasing and selling land. During period from 1980-81 to 1990-91, with falling farm profitability and lack of growth of employment opportunities in the non-farm sector, the absolute number of holdings in the state increased. The number of marginal farmers increased steeply from 1, 97,323 in 1980-81 to 2, 95,568 in 1990-91 (an increase of more than 50%), the number of small farms too increased but marginally. In 2000-01, while the absolute number as well as the proportionate share of marginal and small holdings in total operational holdings decreased, the number and share of relatively large size

categories increased. The data shows that the total operational holdings in state during the recent decade (2000-01 to 2010-11) increased by about 61 thousand from 9.97 lakh to 10.58 lakh. Point worth noting in recent decade is the marginalization of holdings with proportionate increase in marginal and small farmers.

Table 3.2.1: Distribution of operational holdings in Punjab

Year	Number					
	Marginal (Below 1 ha)	Small (1-2 ha)	Semi-medium (2-4 ha)	Medium (4-10 ha)	Large (10 ha and above)	All holdings
1970-71	517568 (37.63)	260083 (18.91)	281103 (20.44)	247755 (18.01)	68883 (5.01)	1375392 (100.00)
1980-81	197323 (19.21)	199368 (19.41)	287423 (27.98)	269072 (26.20)	739741 (7.20)	1027127 (100.00)
1990-91	295668 (26.47)	203842 (18.25)	288788 (25.86)	261481 (23.41)	67172 (6.01)	1116951 (100.00)
2000-01	122760 (12.31)	173071 (17.35)	328231 (32.91)	300954 (30.18)	72356 (7.23)	997372 (100.00)
2010-11 (P)	164000 (15.50)	196000 (18.52)	327000 (30.90)	301000 (28.45)	70000 (6.61)	1058000 (100.00)
Area Operated (000 hectare)						
1970-71	NA	NA	NA	NA	NA	NA
1980-81	126 (3.02)	291 (6.98)	841 (20.16)	1672 (40.09)	1241 (29.75)	4171 (100.00)
1990-91	164 (4.07)	328 (8.13)	841 (20.86)	1622 (40.23)	1077 (26.71)	4032 (100.00)
2000-01	77 (1.91)	242 (6.02)	876 (21.78)	1731 (43.04)	1096 (27.25)	4022 (100.00)
2010-11 (P)	101 (2.53)	270 (6.76)	862 (21.57)	1728 (43.24)	1035 (25.90)	3996 (100.00)

Source: Statistical Abstract, Punjab, various issues
Figures in the brackets indicate the percentage to the total

The proportion of marginal and small holdings which contributed 12.31 and 17.35 per cent of the total operational holdings in 2000-01 increased to 15.50 and 18.52 per cent, respectively. On the other hand, the proportion of holdings in all other categories viz. semi-medium, medium and large had been declined during this period. Overtime, the proportion of area operated by marginal and small size category farmers in total area declined marginally from

3.02 and 6.98 per cent in 1980-81 to 2.53 and 6.76 per cent in 2010-11, respectively. Over the same period, the proportion of area operated by semi-medium farmers increased from 20.16 per cent to 21.57 per cent. Correspondingly, over this period while the proportionate area operated by medium farmers increased from 40.09 to 43.24 per cent, the area operated by large farmers declined from 29.75 to 25.90 per cent.

3.2.2 Cropping pattern

The green revolution brought significant changes in the cropping pattern of Punjab. The cropping pattern in Punjab state at selected points of time is given in Table 3.2.2. In 1970-71, about 40.49 per cent of the gross cropped area (GCA) was under wheat crop which increased to 43.63 per cent in 1990-91, and then rose further to 44.53 per cent during 2010-11. Rice, which occupied around 6.87 per cent of the gross cropped area in 1970-71, increased to 26.86 per cent in 1990-91, and then rose further to 35.85 per cent in 2010-11. The increase in wheat cultivation has been at the cost of gram, rapeseed and mustard, while that of rice has been obtained by shifting the area from maize, groundnut, millets and cotton.

Table 3.2.2: Shift in cropping pattern in Punjab (1970-71 to 2010-11)

(Percent)

Crop	1970-71	1980-81	1990-91	2000-01	2010-11
Rice	6.87	17.49	26.86	32.89	35.85
Wheat	40.49	41.58	43.63	42.92	44.53
Cotton	6.99	9.60	9.34	5.97	6.13
Maize	9.77	5.65	2.51	2.08	1.69
Sugarcane	2.25	1.05	1.35	1.52	0.89
Potato	0.30	0.59	0.31	0.75	0.81
Pulses	7.29	5.04	1.91	0.68	0.25
Total foodgrains	69.18	68.82	75.55	79.05	82.52
Total oilseeds	5.20	3.52	1.32	1.01	0.71

Source: Statistical Abstract, Punjab

The proportionate area under cotton in 1970-71 was around 7 per cent of gross cropped area and increased to 9.34 per cent in 1990-91. After mid 1990s the area under cotton has been adversely affected due to inclement weather and pest attack and its share in GCA went down to 5.97 per cent in 2000-01. With introduction of Bt varieties, area under cotton started increasing

and in 2010-11, it accounted for 6.13 per cent of the GCA in state. Areas under sugarcane and potato have not remained stable. Respective share of pulses and oilseeds in GCA has recorded a sharp decline from 7.29 and 5.20 per cent in 1970-71 to 0.25 and 0.71 per cent in 2010-11. It can be concluded that imbalance in favour of two main cereals viz. rice and wheat in the cropping pattern has further sharpened despite all efforts on diversification of state agriculture. This happened because of better relative profitability of these crops with minimum production and marketing risk as compared to other crops.

3.2.3 Relative share of different agricultural activities in primary sector

Sub-sectoral distribution of GSDP from primary sector of state at current prices along with percent contribution of each component from year 1980-81 onwards is presented through Table 3.2.3. Out of total share of primary sector in GSDP at Rs 2123.9 crore during 1980-81, the contribution of agriculture, livestock, forestry & lodging and fishing turned to be about Rs 1488.14, Rs 622.54, Rs 11.07 and Rs 1.84 crore, respectively. During 2010-11, out of total primary sector's contribution of GSDP at Rs 69690.01 crore, the respective share of above sub-sectors were at Rs 44762.87, Rs 18810.01, Rs 5547.12 and Rs 537.06 crore.

Table 3.2.3: Share of different primary sub-sectors in total primary sector (at current prices), Punjab

(Rs. Crore)

Sector	1980-81	1990-91	2000-01	2010-11
Agriculture and livestock	2110.68 (99.38)	8316.61 (98.43)	26280.8 (98.18)	63572.88 (91.22)
Agriculture	1488.14 (70.07)	6020 (71.25)	17824.6 (66.59)	44762.87 (64.23)
Livestock	622.54 (29.31)	2296.61 (27.18)	8456.19 (31.59)	18810.01 (26.99)
Forestry and logging	11.07 (0.52)	114.08 (1.35)	299.83 (1.12)	5547.12 (7.96)
Fishing	1.84 (0.09)	14.4 (0.17)	182.71 (0.68)	537.06 (0.77)
Agriculture & allied	2123.59 (99.99)	8445.09 (99.95)	26763.3 (99.98)	69657.06 (99.95)
Mining and quarrying	0.31 (0.01)	4.55 (0.05)	5.44 (0.02)	32.95 (0.05)
Total primary	2123.9 (100.00)	8449.64 (100.00)	26768.8 (100.00)	69690.01 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses indicates per cent share in total primary sector

The collective per cent share of agriculture and livestock sub-sector in GSDP from primary sector, which was 99.38 percent in 1980-81 declined to 91.22 percent during 2010-11. During this period while the contribution of agriculture in primary sector decreased from 70.07 per cent to 64.23 percent, the contribution of livestock decreased marginally from 29.31 per cent to about 27 per cent. Over this period, the respective contribution of forestry and fishing sub-sectors in overall primary sector of state went up from 0.52 per cent to 7.96 per cent and 0.09 per cent to 0.77 per cent. Thus, while from 1980-81 to 2010-11, the contribution of primary sector (agriculture and allied activities) in GSDP went down significantly from 43.55 per cent to 30.98 per cent (Table 3.1.2), the composition of agriculture sector with regard to respective share of different components had witnessed only small changes during this time period.

3.3 Trends in Area, Production and Productivity of Selected Crops in the State: District-wise Analysis

3.3.1 Area, production and productivity of wheat

To meet increasing demand of wheat, country is heavily dependent on the availability of adequate local supplies particularly from the Punjab state. In Punjab wheat is the most dominating crop enterprise accounting for about 43 percent of the gross cropped area. This tiny state with only 1.54 percent of the total geographical area of the country contributed about 45 to 70 percent towards the central pool of the wheat food grains for last two decades.

District wise area, production and productivity of wheat in Punjab at decadal intervals from 1970-71 to 2009-10 are presented in Table 3.3.1. Data indicated that the area under wheat cultivation in Punjab during 1970-71 was 22.99 lakh ha which increased to 35.22 lakh ha in 2009-10. During the same time period productivity and total production increased from 2238 kg per ha and 51.45 lakh tonnes to 4307 kg per ha and 151.7 lakh tonnes, respectively. Area under wheat crop increased in district Hoshiarpur, Gurdaspur, Kapurthala and Sangrur districts from 1970-71 to 2009-10. On the other hand in district Jalandhar, Ludhiana, Ferozepur, Amritsar, Bathinda, Patiala, Rupnagar and Faridkot area under wheat crop increased initially but declined in last two decades. These declines in area were not due to the shift of wheat area towards some other crop, but due to the reorganization of the districts as new districts were carved out from the old districts. During 2009-10, Ferozepur was the leading wheat producing district of state with 1636 thousand tonnes followed by Sangrur (1302 thousand tonnes), Ludhiana (1200 thousand tonnes), Patiala (1063 thousand tonnes), Bathinda (1013 thousand tonnes), Muktsar (950

thousand tonnes) and Gurdaspur (940 thousand tonnes) districts in order. In terms of area under wheat crop, the leading districts were Ferozepur (395 thousand ha), Sangrur (287 thousand ha), Ludhiana (259 thousand ha), Bathinda (251 thousand ha), Patiala (235 thousand ha), Gurdaspur (230 thousand ha) and Muktsar (205 thousand ha). On the other hand, Fatehgarh Sahib leads in productivity with 4932 kg/ha followed by Kapurthala (4816 kg/ha). The lowest productivity was recorded in Hoshiarpur (3849Kg/ha).

Table 3.3.1: District wise area, production and yield of wheat crop in Punjab, 1970-71 to 2009-10.

District	Year	1970-71	1980-81	1990-91	2000-01	2009-10*
Hoshiarpur	A	131	156	163	142	153
	P	192	318	466	489	589
	Y	1468	2041	2858	3443	3849
Jalandhar	A	180	211	219	167	170
	P	449	518	820	773	735
	Y	2492	2456	3746	4626	4325
Ludhiana	A	338	265	269	258	259
	P	780	838	1148	1334	1200
	Y	3279	3163	4268	5169	4634
Ferozepur	A	427	332	400	378	395
	P	872	972	1512	1704	1636
	Y	2054	2928	3781	4509	4142
Amritsar	A	242	298	355	361	185
	P	563	809	1319	1690	753
	Y	2326	2715	3717	4682	4072
Gurdaspur	A	141	182	206	217	230
	P	295	398	663	924	940
	Y	2089	2186	3219	4257	4085
Kapurthala	A	67	96	113	111	111
	P	169	267	418	493	457
	Y	2527	2781	3700	4439	4816
Bathinda	A	283	248	348	243	251
	P	602	683	1153	1014	1013
	Y	2121	2753	3313	4172	4634
Patiala	A	255	286	330	261	235
	P	542	753	1322	1191	1063
	Y	2009	2633	4005	4564	4523
Sangrur	A	274	331	392	393	287
	P	587	1015	1662	1921	1302
	Y	2143	3067	4241	4889	4538

Rupnagar	A	-	72	82	86	65
	P	-	158	262	312	277
	Y	-	2190	3194	3631	4257
Faridkot	A	-	334	394	111	117
	P	-	945	1407	524	481
	Y	-	2829	3570	4721	4107
Mansa	A	-	-	-	163	170
	P	-	-	-	748	730
	Y	-	-	-	4591	4297
Fatehgarh Sahib	A	-	-	-	86	85
	P	-	-	-	434	419
	Y	-	-	-	5041	4932
Moga	A	-	-	-	172	177
	P	-	-	-	818	779
	Y	-	-	-	4755	4401
Muktsar	A	-	-	-	189	205
	P	-	-	-	869	950
	Y	-	-	-	4596	4634
Nawanshahar	A	-	-	-	70	74
	P	-	-	-	313	316
	Y	-	-	-	4463	4271
Punjab	A	2299	2812	3273	3408	3522
	P	5145	7677	12159	15551	15169
	Y	2238	2730	3715	4563	4307

A indicates Area 000' ha; P indicates Production 000' metric tones; Y indicates Yield Kg/ha

The details on district-wise compound annual growth rates (CAGR) of area, production and yield of wheat are presented in Table 3.3.2. During first three decades (1970-2000), the area, production and yield of wheat in state increased with a falling compound annual growth rates and ultimately become almost stagnant since the last decade with some variations. On an average the area, production and productivity of wheat in the state increased with a growth rate of 1.08, 3.07 and 1.97 per cent, respectively. Results clearly showed the wheat production in the state has reached a plateau and without new technological breakthrough it may not increase significantly in the years to come.

During 1970s and 1980s wheat production increased significantly in all most all districts due to significant increase in both area and productivity. In 1990s, the wheat production increased at a relatively low CAGR as compared to earlier decades and the productivity mainly contributed in this increase in production. During this decade, in Hoshiarpur, Jalandhar,

Ludhiana, Patiala, Bathinda and Faridkot districts decline in CAGR both for area and production were mainly due to the reorganization of these districts resulted with the formation of new districts. During 2000s production of wheat remained stagnated in most of the districts due to insignificant changes in the productivity during this decade with some variations. However significant decline in CAGR of area under wheat and production in districts of Amritsar and Rupnagar during this period was the result of the formation of new districts. Overall from 1970-71 to 2009-10, significantly positive growth in area, production was observed in most of the districts with some variations, reason being the reorganization of the districts. Productivity of wheat increased significantly in all the districts during various decades and at overall level except in a few districts where it declined during the recent decade. This increased productivity resulted in increased production in almost all the districts except in a few ones. At state level, growth in area under wheat crop was more in 1970-71 to 1979-80 period while in later decades growth was positive but less pronounced. Growth in productivity and production was more in 1970-71 to 1979-80 and 1980-81 to 1989-90 decades while in 1990-91 to 1999-2000 period, growth in productivity and production was positive but less pronounced. On the other hand in many districts CAGR of productivity and production declined in 2000-01 period; however, this decline was not significant. Overall, there was a significant growth in area, productivity and production under wheat crop in the Punjab state.

Thus, it can be concluded that inter district wheat production trends indicated the same pattern as the overall state level trends. Wheat production in the state increased significantly during the first three decades of the green revolution period and became stagnant during the last decade with some periodic variations. A new technological breakthrough is necessary to break this stagnation in productivity of wheat. New districts namely, Mansa, Fatehgarh Sahib, Moga, Muktsar and Nawanshahar which were carved out in later decades, the data for these districts were available for the last two decades only.

3.3.2 Area, production and productivity of rice

In Punjab rice is the second most important crop enterprises after wheat accounting for about 36 percent of the gross cropped area. Punjab contributed about 35 to 40 percent towards the central pool of the rice for last two decades. District wise area, production and productivity of rice in Punjab at decadal intervals from 1970-71 to 2009-10 are presented in Table 3.3.3. The perusal of the table reveals that there was continuous increase in

Table 3.3.2: District wise compound annual growth rates of area, production and productivity of wheat in Punjab

District		1970-71 to 1979-80	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2009-10	Overall 1970-71 to 2009-10
Hoshiarpur	A	0.67ns	0.15ns	-1.95**	0.97***	-0.16ns
	P	3.94**	4.30***	0.10ns	1.94***	2.21***
	Y	3.24**	4.14***	2.09***	0.97**	2.37***
Jalandhar	A	1.83***	0.20ns	-4.46***	0.15ns	-0.69***
	P	3.02**	4.12***	-2.58ns	-0.72*	1.22***
	Y	1.16*	3.91***	1.97*	-0.87**	1.92***
Ludhiana	A	0.95**	-0.13ns	-0.54***	0.10ns	0.08*
	P	1.88*	2.83***	-0.59ns	-1.01*	1.46***
	Y	0.91ns	2.96***	1.14*	-1.11**	1.39***
Firozpur	A	-1.47ns	1.53***	0.04ns	0.61***	0.73***
	P	2.01ns	3.95***	1.97***	0.81ns	2.68***
	Y	3.54***	2.38***	1.93***	0.21ns	1.94***
Amritsar	A	2.38***	1.54***	-0.12ns	-9.59***	-0.03ns
	P	4.09***	4.94***	1.80**	-10.78***	1.94***
	Y	1.69ns	3.35**	1.93**	-1.31***	1.97***
Gurdaspur	A	3.56***	1.01***	0.09ns	1.02***	1.07***
	P	4.75***	4.42***	2.81***	0.37ns	3.35***
	Y	1.15*	3.38**	2.72***	-0.64ns	2.25***
Kapurthala	A	4.96***	1.35***	-0.79ns	-0.21ns	1.10***
	P	6.27***	5.30***	0.85ns	-0.75ns	3.37***
	Y	1.25ns	3.90***	1.64ns	0.54ns	2.24***
Bathinda	A	-1.03ns	3.11***	-5.31***	0.41***	0.07ns
	P	1.39ns	4.96***	-2.84ns	1.21*	2.20***
	Y	2.45*	1.80ns	2.61***	.80ns	2.13***
Patiala	A	2.01**	0.58ns	-2.93***	-1.45***	-0.22ns
	P	7.59***	4.67***	-1.63ns	-1.43**	2.13***
	Y	5.47**	4.07***	1.34**	0.02ns	2.35***
Sangrur	A	1.72***	1.49***	0.12ns	-4.59***	0.47**
	P	4.57***	4.90***	1.06**	-4.96***	2.47***
	Y	2.80***	3.34***	0.94**	-0.39ns	2.00***
Rupnagar	A		0.80**	0.43**	-4.77***	-0.29ns
	P		4.15***	2.59***	-4.06**	1.29***
	Y		3.32**	2.15***	0.75ns	1.58***
Faridkot	A		1.45***	-17.42***	0.74***	-5.71***
	P		3.20***	-15.11***	0.27ns	-4.29***

	Y		1.72**	2.79***	-0.47ns	1.51***
Mansa	A	-	-	-	0.44**	0.72***
	P	-	-	-	0.70ns	1.24**
	Y	-	-	-	0.26ns	0.52ns
Fatehgarh Sahib	A	-	-	-	0.07ns	-0.00ns
	P	-	-	-	-0.45ns	-0.19ns
	Y	-	-	-	-0.51ns	-0.19ns
Moga	A	-	-	-	0.54***	2.61***
	P	-	-	-	0.50ns	2.53***
	Y	-	-	-	-0.04ns	-0.00ns
Muktsar	A	-	-	-	0.81***	1.42***
	P	-	-	-	1.84**	2.73***
	Y	-	-	-	1.02ns	1.30**
Nawanshehar	A	-	-	-	0.66*	1.91***
	P	-	-	-	0.38ns	2.17**
	Y	-	-	-	-0.27ns	0.25ns
Punjab	A	2.33***	1.25***	0.26ns	0.42***	1.08***
	P	4.70***	4.29***	2.24***	0.25ns	3.07***
	Y	2.31***	3.00***	1.98***	-0.17ns	1.97***

Note: The period of analysis for Rupnagar & Faridkot is since 1980-81, for Mansa, Fatehgarh Sahib, Moga, Muktsar & Nawanshehar it is since 1996-97

*****, ** and * Significant at one, five and ten percent level of probability, respectively**

area under rice crop in the state due to the introduction of its high yielding varieties (HYV's). There was a sharp jump in the area under rice crop in Jalandhar, Ludhiana, Bathinda and Sangrur districts of the state during the last four decades; however, area also increased in other districts namely Hoshiarpur, Ferozepur, Amritsar, Gurdaspur, Kapurthala, Patiala, Rupnagar and Faridkot but this increase was less prominent. There was almost three times increase in productivity of rice crop in Patiala, Sangrur and Bathinda districts while in other districts of the state the increase in productivity was nearly twice. Due to tremendous increase in area under rice crop in districts of Jalandhar, Ludhiana, Bathinda and Sangrur, production also increased, while in other districts of the state, quantum of increase in production was less. During 2009-10, Sangrur was the leading rice producing district of state with 1273 thousand tons followed by Ludhiana (1206 thousand tons), Patiala (1021 thousand tons), Ferozepur (964 thousand tons), Moga (812 thousand tons) and Gurdaspur (640 thousand tons) districts in order. Productivity of rice was found to be the highest in Nawanshehar district at 4770 kg/ha followed by Moga (4721 kg/ha)

and Sangrur (4694 kg/ha). Productivity was the lowest in Amritsar district at 2706 kg/ha. At Punjab level, area under rice crop increased from 3.90 lakh hectare in 1970-71 to 28.02 lakh hectare in 2009-10 while the corresponding increase in productivity in the same period was 1765 kg/ha to 4010 kg/ha and that of production from 6.88 lakh metric tonnes to 112.36 lakh metric tonnes.

Table 3.3.3: District wise area, production and yield of rice in Punjab, (1970-71 to 2009-10)

District		1970-71	1980-81	1990-91	2000-01	2009-10*
Hoshiarpur	A	31	45	65	63	70
	P	49	109	186	192	248
	Y	1595	2416	2862	3047	3536
Jalandhar	A	14	88	158	136	161
	P	26	260	496	488	636
	Y	1850	2951	3139	3588	3948
Ludhiana	A	5	94	225	238	257
	P	9	356	824	939	1206
	Y	1800	3790	3662	3947	4692
Ferozepur	A	64	162	237	248	262
	P	116	413	750	898	964
	Y	1820	2547	3165	3622	3680
Amritsar	A	89	197	277	319	185
	P	174	349	763	972	501
	Y	1953	1774	2755	3047	2706
Gurdaspur	A	80	141	173	191	204
	P	131	289	441	569	640
	Y	1647	2050	2549	2980	3135
Kapurthala	A	28	66	98	103	115
	P	55	197	279	358	452
	Y	1965	2984	2847	3476	3934
Bathinda	A	2	8	50	99	104
	P	3	28	172	350	476
	Y	1380	3542	3440	3539	4575
Patiala	A	61	191	280	256	240
	P	103	583	946	857	1021
	Y	1685	3054	3379	3348	4255
Sangrur	A	11	90	287	357	271
	P	15	336	1062	1342	1273
	Y	1365	3665	3700	3759	4696
Rupnagar	A	-	22	36	49	38
	P	-	72	113	163	135

	Y	-	3297	3139	3316	3559
Faridkot	A	-	78	138	90	98
	P	-	242	503	310	414
	Y	-	3107	3645	3446	4219
Mansa	A	-	-	-	84	77
	P	-	-	-	306	324
	Y	-	-	-	3636	4211
Fatehgarh Sahib	A	-	-	-	84	86
	P	-	-	-	350	391
	Y	-	-	-	4162	4544
Moga	A	-	-	-	159	172
	P	-	-	-	596	812
	Y	-	-	-	3747	4721
Muktsar	A	-	-	-	89	100
	P	-	-	-	309	387
	Y	-	-	-	3476	3873
Nawanshehar	A	-	-	-	47	104
	P	-	-	-	158	496
	Y	-	-	-	3364	4770
Punjab	A	390	1183	2015	2612	2802
	P	688	3233	6506	9157	11236
	Y	1765	2733	3229	3506	4010

A indicates Area 000' ha; P indicates Production 000' metric tonnes; Y indicates Yield Kg/ha

The district-wise CAGR in area, production and yield of rice crop in Punjab have been depicted in Table 3.3.4. The results reveal that there was tremendous growth in area under rice crop in Jalandhar, Ludhiana, Ferozepur, Amritsar, Gurdaspur, Kapurthala, Bathinda, Patiala and Sangrur districts during 1970-71 to 1979-80. However, during the subsequent decades, the growth in area under rice crop in almost all the districts of the state increased but at a lower rate. The productivity growth was also found to be higher during 1970-71 to 1979-80 decade in district Jalandhar, Ludhiana, Ferozepur, Amritsar, Gurdaspur, Kapurthala, Bathinda, Patiala and Sangrur. In the subsequent two decades, except Amritsar district the increase in productivity was observed to be insignificant in all other districts. However, during 2000-01 to 2009-10, again there was significant increase in productivity in almost all the districts of the state. The growth in production was more pronounced in 1970-71 to 1979-80 as compared to the subsequent decades. Overall at state level, the decadal CAGR of both area under rice and its production though remained significantly positive, but declined continuously over the decades with some variations. The CAGR with respect of rice productivity was found to be positively significant (5.29 per

cent) during 1970-71 to 1979-80, remained insignificant during the next two decades and was observed to be significantly positive again during the recent decade of 2000s (1.76 per cent). On an average in the state from 1970-71 to 2009-10, the area, production and productivity of rice increased at CAGR of 4.79, 6.42 and 1.56 per cent, respectively.

Table 3.3.4: District wise trends in area, production and yield of rice in Punjab, (1970-71 to 2009-10)

District		1970-71 to 1979-80	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2009-10	Overall 1970-71 to 2009-10
Hoshiarpur	A	2.76**	3.78***	-0.23ns	0.54ns	1.56***
	P	5.86***	3.73**	-0.20ns	2.54*	3.13***
	Y	3.01***	-0.04ns	0.03ns	1.97**	1.54***
Jalandhar	A	18.03***	6.84***	-2.75**	2.11***	4.58***
	P	24.76***	7.34***	-2.64**	3.19***	5.73***
	Y	5.72***	0.48ns	0.11ns	1.06*	1.10***
Ludhiana	A	35.24***	8.29***	0.59*	0.99***	8.37***
	P	46.14***	8.04***	-0.10ns	2.68***	9.65***
	Y	8.06***	-0.23ns	-0.68ns	1.68***	1.19***
Ferozepur	A	11.41***	3.59***	1.88**	0.86*	3.12***
	P	15.57***	4.50***	2.58***	1.95***	4.65***
	Y	3.73**	0.88ns	0.69ns	1.08*	1.48***
Amritsar	A	8.62***	3.82***	1.10***	-8.15***	2.27***
	P	12.09***	7.66***	2.22***	-8.47***	3.38***
	Y	3.19**	3.70**	1.11**	-0.35ns	1.09***
Gurdaspur	A	7.18***	2.65***	1.02***	0.58*	2.26***
	P	12.09***	3.34**	1.55**	1.65*	3.73***
	Y	4.58***	0.68ns	0.52ns	1.06***	1.44***
Kapurthala	A	9.94***	4.32***	-0.13ns	1.31***	3.54***
	P	13.74***	3.14ns	1.05ns	2.75***	4.74***
	Y	3.45***	-1.13ns	1.18ns	1.42**	1.15***
Bathinda	A	19.17*	19.10**	6.35ns	-0.07ns	12.41***
	P	27.21**	18.65**	6.24*	2.79**	14.40***
	Y	6.75***	-0.37ns	-0.10ns	2.85***	1.77***
Patiala	A	13.08***	3.08***	-0.99ns	-0.71**	2.56***
	P	19.97***	4.40***	-1.67ns	2.09***	4.15***
	Y	6.09***	1.28ns	-0.68ns	2.82***	1.56***
Sangrur	A	26.83***	11.86***	2.11***	-4.06***	8.20***
	P	38.67***	12.21***	1.89**	-1.74ns	10.11***
	Y	9.10***	0.31ns	-0.21ns	2.41***	1.77***
Rupnagar	A	-	4.40***	3.47***	-4.37***	2.38***

	P	-	5.58**	2.55***	-2.68**	2.72***
	Y	-	1.13ns	-0.88ns	1.78***	0.33**
Faridkot	A	-	5.33***	-9.46**	1.82*	-1.51ns
	P	-	7.05***	-10.85**	4.37***	-0.81ns
	Y	-	1.62**	-1.53*	2.51***	0.72***
Mansa	A	-	-	-	-1.84ns	0.11ns
	P	-	-	-	0.70ns	2.49**
	Y	-	-	-	2.59**	2.37***
Fatehgarh Sahib	A	-	-	-	0.50**	0.41***
	P	-	-	-	1.58**	2.42***
	Y	-	-	-	1.08*	2.00***
Moga	A	-	-	-	1.46***	4.14***
	P	-	-	-	4.10***	6.32***
	Y	-	-	-	2.60***	2.10***
Muktsar	A	-	-	-	1.13ns	7.29**
	P	-	-	-	3.32**	9.53***
	Y	-	-	-	2.17**	2.08***
Nawanshehar	A	-	-	-	11.11***	6.84***
	P	-	-	-	16.31***	9.94***
	Y	-	-	-	4.68***	2.90***
Punjab	A	12.69***	5.34***	2.52***	0.89***	4.79***
	P	18.66***	6.70***	2.54***	2.67***	6.42***
	Y	5.29***	1.30ns	0.17ns	1.76***	1.56***

Note: The period of analysis for Rupnagar & Faridkot is since 1980-81, for Mansa, Fatehgarh Sahib, Moga, Muktsar & Nawanshehar it is since 1996-97

*****, ** and * Significant at one, five and ten percent level of probability, respectively**

3.4 Marketed Surplus Ratios of Major Food Grain Crops in State

Advent of green revolution pushed up the marketed surplus not only with the large farmers but small farmers also started generating the marketed surplus. As the government of India wanted to maintain the tempo of production of food grains with the farmers, thus it provided incentive oriented effective food grain especially wheat and paddy procurement policies to the farmers. The state government took lead in creating and developing market infrastructure in the form of all weather metalled approach roads to all the villages and market yards to facilitate the efficient marketing of farm produce. As a result the assured market at remunerative prices encouraged the farmers to push up the wheat and paddy production and market arrivals.

Table 3.4.1 indicates the production, market arrivals and marketed surplus ratio (market arrivals to production) of wheat and paddy in Punjab state over period. Market arrivals of paddy increased from 6.37 lakh tonnes during 1970-71 to 131.36 lakh tonnes during 2010-11. The market arrivals for wheat in the corresponding period increased from 23.75 lakh tonnes to 102.78 lakh tonnes. Marketed surplus ratio taken as proportion of market arrivals to total production of paddy and wheat in state during 1970-71 was 0.62 and 0.49, respectively. Overtime during last four decades, these marketed surplus ratios of both paddy and wheat in state increased and were observed to be 0.81 and 0.62 during the year 2010-11.

Table 3.4.1: Marketed surplus ratios of wheat and paddy crops, Punjab

(000' Metric Tonnes)

Year	Paddy			Wheat		
	Market arrivals	Production	Ratio	Market arrivals	Production	Ratio
1970-71	637	1032	0.617	2375	4865	0.49
1980-81	4432	4850	0.914	4270	7677	0.56
1990-91	7882	9710	0.812	7109	12159	0.58
2000-01	11057	13735	0.805	9698	15551	0.62
2010-11	13136	16148	0.813	10278	16472	0.62

3.5 Trends in Consumption of Major Inputs and Services Such as HYVs, Irrigation, Fertilizers, Farm Machinery

Punjab state had made remarkable progress in agriculture through taking a big leap forward in terms of irrigation facilities, use of chemical fertilizer, pesticide, high yielding varieties, mechanization etc. Backed with effective agricultural policies, the farmers of state tended their crops according to the advice of experts through well established agricultural extension network and achieved the record productivity levels. Major drivers of state agricultural growth are provided in Table 3.5.1. The irrigated area, which was merely 71 per cent to the net area sown in 1970-71, has reached to a level of about 98 percent by the year 2010-11. The number of tube wells has gone up from 1.92 lakh in 1970-71 to 13.82 lakh in 2010-11. The proportion of area under HYVs to gross cropped area has increased tremendously. Hundred per cent of the area of wheat and rice is under HYVs and that of maize is nearly 98 per cent.

Table 3.5.1: Consumption of major inputs in Punjab agriculture, 1970-71 to 2010-11

Indicators/Period	1970-71	1980-81	1990-91	2000-01	2010-11
No. of tractors (Number)	5281	118845	289064	434032	498517
Number of tractors per 000' ha	1.30	28.34	69.53	102.13	119.89
No. of tube wells (Lakh)	1.92	6.00	8.00	10.73	13.82
Number of tube wells per 000' ha	47.37	143.06	189.66	252.47	332.37
Cropping intensity (%)	140.09	161.37	177.86	186.07	190
Consumption of chemical fertilizers (000' nutrient tone)	213	762	1220	1313	1911
Consumption of chemical fertilizers (kg/ha)	37.50	112.50	162.60	168.33	243
Consumption of insecticides/pesticides (technical grade M.T)	-	3200	6500	6970	5600
Gross cropped area (000'ha)	5678	6763	7502	7941	7872
% of net irrigated area to net area sown	71	81	93	93	97.9
Area under HYVs in 000'ha (figures in parentheses are per cent of total area under crop)					
Rice	130 (33.33)	1095 (92.56)	1906 (94.59)	2506 (95.94)	2826 100.00
Maize	49 (8.83)	127 (41.78)	160 (85.11)	154 (93.33)	129 96.99
Bajra	126 (60.87)	34 (49.28)	11 (91.67)	5 (31.25)	3 (100.00)
Wheat	1589 (69.12)	2757 (98.04)	3271 (99.94)	3408 (100.00)	3510 (100.00)
No. of Regulated markets	-	120	143	144	146
Minimum support price (Rs./qtl)					
Paddy	51	105	205	540	1030
Wheat	76	117	215	580	1170
Cotton	-	304	620	1625	2500-3000
Procurement of major food crops (figures in parentheses are per cent of total production)					
Paddy	637 (62.03)	4432 (89.09)	7882 (78.73)	11057 (81.10)	13136 (81.35)
Wheat	2375 (46.16)	4270 (55.62)	7109 (58.47)	7698 (49.50)	10278 (62.40)

Source: Statistical Abstract, Punjab

The adoption of HYVs in Punjab raised the consumption of chemical fertilizers and plant protection materials tremendously. The per hectare consumption of chemical fertilizers (NPK) which was merely 37.50 kg in 1970-71 has achieved the levels of 243 kg in 2010-11. Total consumption of chemical fertilizers (nutrient) in state which was only 213 thousand tonnes in 1970-71 had been gone up to 1911 thousand tonnes in 2010-11. Consumption of insecticides and pesticides (Technical Grade) had been increased from 3200 MT in 1980-81 to 5600 MT in 2010-

11. The rapid adoption of the green revolution technology in Punjab has led to the sharp increase in farm mechanization. The number of tractors in state was only 5281 in 1970-71, which increased to more than 4.98 lakh in 2010-11. The Punjab state is one of the leading states for number of tractors tillers in terms of density per 1000 hectare of net sown area. Development of irrigation infrastructure along with large scale mechanization of state agriculture helped in increasing the gross copped area from 5678 thousand ha in 1970-71 to 7872 thousand ha in 2010-11. Consequently, over this period the intensity of cropping jumped from 140 per cent to 190 per cent. Effective price policy through significant increase in Minimum Support Prices (MSP), assured procurement and development of market infrastructure particularly for wheat and paddy coupled with relatively better production technology available has driven the state agriculture at remarkable rate and resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state.

Thus, rapid dissemination and adoption of new technologies and modern inputs viz. HYVs, fertilizers and pesticides, irrigation, agricultural credit, development of necessary infrastructure and setting up of institutional mechanisms for the supply of agricultural inputs and procurement of agricultural produce created an enabling environment for enhancing agricultural production in state.

Chapter 4

Marketed and Marketable Surplus of Major Food Grains in State: An Empirical Analysis

4.1 Main Features of Agriculture in Selected Districts

4.1.1 Location and geographical units

The Punjab state lies between the 29°33'-32°3'N latitude and 73°53'- 76°55'E longitude and is bounded on the, west by Pakistan, on the north by Jammu and Kashmir, on the north-east by Himachal Pradesh and on the south by Haryana and Rajasthan. Study district Gurdaspur is the northern most district of Punjab state. It falls in the Jalandhar division and is sandwich between river Ravi and Beas. The district lies between north-latitude 31^0-36' and 32^0-34' and east longitude 74^0-56' and 75^0-24' and shares common boundaries with Pathankot district in the north, Beas River in the north-east, Hoshiarpur district in the south-east, Kapurthala district in the south, Amritsar district in the south west and Pakistan in the north west. The district Ferozepur is situated in south-western region of state along the India Pakistan border. Ganganagar district of state Rajasthan touches the boundaries on the south-west side of this district and the united stream of the Sutlej and Beas generally separates it from the Tarntaran district in the north-west. Sangrur is one of the southern districts of the State and lies between 29°, 34 ' & 30°,42 ' north latitude and 75°,18 ' and 76°,13 ' east longitude. It is bounded by Ludhiana district in the north, by Barnala district in the west, by Patiala district in the east and by Fatehabad district of Haryana State in the south.

Gurdaspur district consists of 3 tehsils/subdivisions, 11 development blocks and 1157 inhabited villages. Sangrur consists of 6 tehsils/subdivisions, 13 development blocks and 585 inhabited villages. Ferozepur district consists of 5 tehsils/subdivisions, 10 development blocks with number of inhabited villages at 954. The geographical area of Gurdaspur, Sangrur and Ferozepur districts is 2610 square km., 3614 square km. and 5850 square km covering 5 per cent, 7 per cent and 11.61 per cent of the total geographical area of the state, respectively.

The topography of the selected districts is generally plain of alluvial formation. However, the landscape of the Gurdaspur comprises undulating plain too, the flood plains of the Ravi and the Beas and the up land plain. The south east side of Ferozepur district which is dominated by the light soils has brackish underground water. The climate of all the three selected districts is

on the whole, dry and is characterized by hot summer, a short rainy season and a bracing with winter. The cold season is from November to March, followed by the summer season which lasts up to about end of the June. January happens to be the coldest month when the minimum temperature occasionally drops to about the freezing point of water. June is generally the hottest month and on individual days, the maximum temperature may be above 45°C. The period from July to the middle of September constitutes the monsoon season. The latter half of September and October may be termed as the post-monsoon or the transition period. About 70 percent of the annual rainfall in all these sampled districts is received during the period from July to September. Some rainfall occurs during the pre-monsoon months, mostly in the form of thunder showers. In the winter season, some rainfall occurs under the influence of westerly disturbances.

4.1.2 Socio-economic indicators

The selected socio-economic indicators of the study districts of Punjab state are presented in Table 4.1.1. According to 2001 census, total population of Gurdaspur district, Sangrur district and Ferozepur district constituted about 9 per cent (21.04 lakh), about 6 per cent (14.73 lakh) and 7.17 per cent (17.46 lakh) of the total state population, respectively. The number of females after 1000 males was found 895 in Gurdaspur, 883 in Sangrur and 893 in Ferozepur district. The population density per square km which was 649, 449 and 380 in the respective districts indicated that Gurdaspur district was much densely populated as compared to the other two study districts. All the selected districts were found to be dominated by the rural population as about 70 - 75 per cent of total population of these districts resided in the rural areas. The overall literacy was found to be relatively high in Gurdaspur district (81.10 per cent) as compared to that in Sangrur (68.9 per cent) and Ferozepur district (69.8 per cent).

The cropping intensity in Sangrur was found to be relatively higher at 198.08 per cent. In Ferozepur and Gurdaspur districts it was recorded at 187.74 per cent and 175.87 per cent. Area put under high yielding varieties was found out to be 90, 88 and 75 per cent of the gross cropped area in Sangrur, Gurdaspur and Ferozepur districts, respectively. As compared 86.70 per cent of the net sown area was irrigated in Gurdaspur, almost whole of the net sown area in Ferozepur and Sangrur districts was irrigated. Source of irrigation was found much different in these districts as in Sangrur district, under groundwater is providing assured irrigation to 93.93 per cent of the total net area sown as compared to that of 78.22 per cent and 65.53 per cent in Gurdaspur and Ferozepur districts, respectively.

Table 4.1.1: Selected socio-economic indicators of sample districts and Punjab

Particulars		Gurdaspur	Ferozepur	Sangrur
Population (2001)	Total (thousand) Rural (thousand) Urban (thousand) Agricultural workers (% is to total workers)	2104.01 1568.79 535.22 34.54	1746.11 1295.38 450.73 56.35	1473.24 1048.99 424.25 45.97
Population Density (per sq km.) (2001)		649	380	449
Female per thousand males (2011)		895	893	883
Percentage of SC Population to total (2011)		24.75	22.82	26.67
Percentage of ST Population to total		-	-	-
Literacy rate (percent) 2011		81.1	69.8	68.9
Average annual rainfall (mm), (2011)		445.9	203.4	416.10
Average size of holdings (2000-01)		3.60	6.02	3.29
Percentage of irrigated area to net sown area (2011)		86.7	99.4	100
Percent of groundwater irrigated area to NIA (2011)		78.22	65.53	93.93
Electricity use in Agriculture (% to total) (2011)		40.18	52.77	58.23
Cropping intensity (%) (2011)		175.87	187.74	198.08
No. of banking offices per lakh population (2011)		14	12	16
No. of regulated markets* (2011)		12 (297)	11 (482)	13 (278)
Total road length per lakh population (2010-11)		311	400	376
Input use:				
	Fertilizer (kg/net sown ha) (2010-11) HYVs area of wheat and paddy (%), 2010-11 HYVs coverage as % of GCA (2010-11) Wheeled Tractors (per 000 ha of NSA) 2010	395 100 88 51	410 100 75 122	527 100 90 171
Area under major crops (percent to GCA): 2010-11				
	Total Cereals	87.77	74.27	90.73
	Total Pulses	0.44	0.29	0.23
	Total Foodgrains	88.21	74.56	90.95
	Total Oilseeds	0.80	0.63	0.18
	Sugarcane	4.17	0.11	0.32
	Cotton	NA	13.06	1.77
	Fruits and Vegetables	1.32	3.31	0.75
Productivity (kg/ha): 2010-11				
	Total Cereals	3747	4010	4740
	Total Pulses	546	689	929
	Total Foodgrains	3732	3988	4731
	Total Oilseeds	825	1610	1000
	Sugarcane	6190	6222	7500
	Cotton (lint)	NA	563	551

Source: GOP (2011), Statistical Abstract, Punjab

*** Figures in the brackets indicates the average area served per regulated market (Sq. Kms)**

The rest of the area depended on Government canals in the respective districts. Electricity use in agriculture constituted 58.23 per cent, 52.77 per cent and 40.18 per cent of the total electricity consumption in Sangrur, Ferozepur and Gurdaspur districts, respectively. Use of fertilizer, the most important agricultural input was found out to be relatively high at 527 kg per net sown ha in Sangrur district as compared to that of 410 kg per ha in Ferozepur district and 395 kg per ha in Gurdaspur district. Similarly, the number of tractors for every thousand hectare of net sown area was higher in case of Sangrur district (171) as compared to Ferozepur district (122) and Gurdaspur district (51). Productivity per gross cropped ha of foodgrains which accounted for 90.95, 74.56 and 88.21 per cent of the gross cropped area in Sangrur, Ferozepur and Gurdaspur districts, respectively was found to be much higher in Sangrur district (4731 kg/ha) followed by Ferozepur district (3988 kg/ha) and Gurdaspur district (3732 kg/ha).

4.1.3 Classification of workers

Overtime, though agricultural sector of Punjab experienced a decline in the importance in terms of its share in GSDP and work force, yet it remains the single most important sector of the state economy. As per 2001 census data total main workers and marginal workers constituted the 85.85 and 14.15 per cent of the total workforce in state. The workforce of state was 9127474, out of which 3554928 were dependent on agriculture and allied activities (Table 4.1.2). Cultivators and agricultural labours directly dependent on agriculture accounted for about 39 percent of the total workforce of state. Out of the total agricultural work force cultivators and agricultural labours accounted for 58.09 and 41.91 per cent, respectively. While in Gurdaspur district the main workers constituted 81.12 per cent of the total workforce, in Ferozepur and Sangrur districts their share was 82.61 and 87 per cent, respectively. The share of marginal workers in total workforce was 18.88, 17.39 and 13 per cent in the respective districts. Proportionate share of cultivators and agricultural labours directly dependent on agriculture was found to be much higher in Ferozepur district (56.35 per cent) as compared to that in Gurdaspur district (34.54 per cent) and Sangrur district (45.97 per cent). The reason behind might be the relatively low level of the industrialization in Ferozepur district.

Table 4.1.2: Classification of main & marginal workers in sample districts and Punjab (Population Census 2001)

Class of Workers	Gurdaspur		Ferozepur		Sangrur		Punjab	
	No.	*% to Total workers*	*No.*	*% to Total workers*	*No.*	*% to Total workers*	*No.*	*% to Total workers*
Cultivators	141874	20.25	198722	30.64	169470	29.22	2065067	22.62
Agricultural Labourers	100098	14.29	166785	25.71	97141	16.75	1489861	16.32
Workers engaged in Household Industries	33447	4.77	16631	2.56	18477	3.19	333770	3.66
Others	425138	60.69	266538	41.09	294826	50.84	5238776	57.40
Total main worker	568322	81.12	535889	82.61	504568	87.00	7835732	85.85
Total marginal worker	132235	18.88	112787	17.39	75346	13.00	1291742	14.15
Total main & marginal workers	**700557**	**100.00**	**648676**	**100.00**	**579914**	**100.00**	**9127474**	**100.00**

Source: GOP (2010), Statistical Abstract, Punjab

4.1.4 Land use pattern

The total geographical area of the state is 50.36 lakh ha. During 2010-11, the net sown area was at 41.58 lakh ha which indicated that about 83 per cent of the area in state is already under cultivation. As indicated by the data given in Table 4.1.3, state has been virtually reached the saturation point in the matter of addition to the physical area horizontally. The forest wealth of state is very poor with only 5.84 per cent of the total area under the forest cover. The area under permanent barren and unculturable land has been almost found to be negligible at 0.48 per cent of the state area. District wise, out of total geographical area, about 80, 81 and 87 per cent was under cultivation in Gurdaspur, Ferozepur and Sangrur districts, respectively. The proportionate area under forest cover and that put to non-agricultural uses in Gurdaspur district was found to be at 10.11 and 6.18 per cent, respectively. In Ferozepur district area under forest and non-agricultural uses was 2.05 and 7.01 per cent of the geographical area. Contrary to this the area under forest in Sangrur district was only 1.38 and the land put under non-agricultural uses was 11.91 per cent of the geographical area.

Table 4.1.3: Land use pattern in sample districts and Punjab, 2010-11

(000'ha)

Sr. No.	District	Total Geographical Area	Area under Forest	Land Not Available for Cultivation		Other un-cultivated land	Fallow land		Net Area Sown
				Land put to non-agricultural uses	Barren and Un-cultivable land		Current Fallow	Other Fallows	
1.	Gurdaspur	356 (100.00)	36 (10.11)	22 (6.18)	4 (1.12)	2 (0.56)	1 (0.28)	-	286 (80.34)
2.	Ferozepur	585 (100.00)	12 (2.05)	41 (7.01)	-	-	-	-	473 (80.85)
3.	Sangrur	361 (100.00)	5 (1.38)	43 (11.91)	-	-	-	-	313 (86.70)
Punjab		5036 (100.00)	294 (5.84)	508 (10.09)	24 (0.48)	2 (0.04)	33 (0.66)	4 (0.08)	4158 (82.57)

Source: GOP (2011), Statistical Abstract, Punjab.
Figures in parenthesis denotes per cent share in total geographical area

4.1.5 Land holdings

The information on distribution of operational holdings in districts of Gurdaspur, Ferozepur, Sangrur and in state of Punjab during 2000-01 is depicted in Table 4.1.4. The figure shows that during 2000-01 there were total 10.04 lakh operational holdings in state, out of which about 32 per cent were small and marginal holdings. The proportionate share of marginal, small, semi-medium, medium and large farm holdings in state was 13.42, 18.22, 31.85, 29.44 and 7.06 per cent, respectively and average size of holding in state was 3.95 ha. In Gurdaspur district the proportion of smaller size holdings was relatively more as compared to the other districts. On the other hand the proportion of larger size holdings was observed to be relatively large in Ferozepur district as compared to the other two study districts. As compared to 17 per cent in district of Ferozepur, the small and marginal holdings accounted for about 41 and 25 per cent of the total holdings in Gurdaspur and Sangrur districts, respectively. On the other hand large holdings constituted 2.52, 16.02 and 7.60 per cent of the total holdings in Gurdaspur, Ferozepur and Sangrur districts, respectively. The average size of holdings in respective districts was at 3.28, 6.02 and 3.10 ha.

Table 4.1.4: Number of operational holdings in sample districts and Punjab (2000-01)

District	Marginal (<1 ha)	Small (1-2 ha)	Semi-medium (2-4ha)	Medium (4-10 ha)	Large (>10 ha)	Total	Av. Size of holdings (ha)
Gurdaspur	15465 (17.74)	20491 (23.50)	30072 (34.49)	18961 (21.75)	2194 (2.52)	87183 (100)	3.28
Ferozepur	4120 (5.22)	9305 (11.80)	22523 (28.56)	30286 (38.40)	12634 (16.02)	78868 (100)	6.02
Sangrur	9016 (8.94)	15907 (15.77)	34050 (33.75)	34246 (33.95)	7662 (7.60)	100881 (100)	3.10
Punjab	**134762 (13.42)**	**183062 (18.22)**	**319933 (31.85)**	**295749 (29.44)**	**70960 (7.06)**	**1004466 (100)**	**3.95**

Source: GOP (2011), Statistical Abstract, Punjab
Figures in parenthesis denotes the per cent share in total

4.1.6 Irrigation

Source wise irrigated area in study districts along with state of Punjab is presented in Table 4.1.5. As indicated by the figures the net irrigated area as proportion to the net cropped area in state was 97.88 per cent. It turns out to be about 99.79 per cent in Ferozepur and Sangrur districts, respectively as compared to 86.71 per cent in Gurdaspur district.

Table 4.1.5: Source wise area irrigated in sample districts and Punjab, 2010-11

(Area 000'ha)

District	Irrigated Area by source		Net Area Irrigated (NIA)	% area under groundwater (net)	Net Cropped Area (NCA)	% NIA to NCA	Net Dry land (%)
	Surface	Tube well &Well					
Gurdaspur	54	194	248	78.23	286	86.71	13.29
Ferozepur	162	308	470	65.53	473	99.79	0.21
Sangrur	19	294	313	93.93	313	100.00	-
Punjab	1116	2954	4070	72.58	4158	97.88	2.12

Source: GOP (2011), Statistical Abstract, Punjab

In Gurdaspur district 13.29 per cent of the net cropped area was found to be under dry land agriculture. Proportionate share of tube-wells (electric and diesel) as source of irrigation in net irrigated area was 78.23, 65.53 and 93.93 per cent in Gurdaspur, Ferozepur and Sangrur districts, respectively. Surface irrigation (Government canals) turn out to be the source of irrigation for about 34 per cent of the net irrigated area in Ferozepur district, while its share in Gurdaspur and Sangrur was found to be about 22 and about 6 per cent, respectively.

4.1.7 Cropping pattern

The cropping pattern in study districts and Punjab state is given in Table 4.1.6. It can be observed that cropping pattern of state as well as of the study districts is dominated by the food grains mainly wheat and paddy which together constituted about 80 per cent of the gross cropped area in state.

Table 4.1.6: Cropping pattern in sample districts and Punjab, 2010-11

(Percentage to total GCA)

District	Gurdaspur	Ferozepur	Sangrur	Punjab
Rice	40.56	29.05	43.87	35.41
Wheat	44.93	44.71	46.29	44.51
Maize	2.19	0.06	0.08	1.76
Total Cereals	87.77	74.27	90.73	81.9
Total Pulses	0.44	0.29	0.23	0.24
Total Foodgrains	0.00	0.00	0.00	82.14
Sugar-cane	4.17	0.11	0.32	0.76
Cotton	0.00	13.06	1.77	6.46
Total Fruits	0.85	2.72	0.30	0.85
Total Vegetables	0.47	0.59	0.45	1.46

Source: GOP (2011), Statistical Abstract, Punjab

Wheat constituted 44.93, 44.71 and 46.29 per cent and paddy constituted 40.56, 29.05 and 43.87 of the gross cropped in Gurdaspur, Ferozepur and Sangrur districts, respectively. In Gurdaspur district the maize and sugarcane were the other important crops. In Ferozepur district cotton and fruits were the other two important crops constituting significant proportion of gross cropped area. In Sangrur district except for marginal area under cotton (1.77 per cent), the cropping pattern was totally dominated by wheat and paddy crops.

4.1.8 Infrastructure

The information on infrastructure in districts of Gurdaspur, Ferozepur, Sangrur and Punjab state is provided in Tables 4.1.7 to 4.1.9. Out of the total electricity consumption in state, about 31.39 per cent was used in agriculture sector and 24.56 and 34.22 per cent was used in domestic and industrial sector, respectively (Table 4.1.7).

Table 4.1.7: Sector wise use of electricity in sample districts and Punjab (2010-11)

(Million KWH)

Particulrs	Gurdaspur		Ferozepur		Sangrur		Punjab	
	Total use	% to total	Total use	% to total	Total use	% to total	Total use	% to total
Domestic	450.87	32.18	374.19	26.26	424.29	17.68	7915.24	24.56
Commercial	102.86	7.34	89.01	6.25	86.29	3.60	2380.6	7.39
Industrial	198.2	14.15	200.45	14.07	483.62	20.15	11030.57	34.22
Public Lighting	86.15	6.15	61.67	4.33	8.24	0.34	788.41	2.45
Agriculture	562.86	40.18	699.58	49.10	1397.39	58.23	10116.9	31.39
Total	1400.94	100.00	1424.9	100.00	2399.83	100.00	32231.72	100.00

Source: GOP (2011), Statistical Abstract, Punjab

Table 4.1.8: Road length by type of road in sample districts and Punjab, 2009-10

Road	Gurdaspur	Ferozepur	Sangrur	Punjab
National Highway (Km)	12 (0.15)	205 (2.44)	85 (1.29)	1094 (1.05)
State Highway (Km)	5297 (67.56)	5115 (60.78)	4456 (67.87)	62290 (59.73)
Other Roads (Km)	2531 (32.28)	3095 (36.78)	2026 (30.85)	40903 (39.22)
Roads per 100 sq. km of area (km)	220	159	182	207
Roads per lakh of population (km)	311	400	376	356
Total Roads (Km)	7840 (100.00)	8415 (100.00)	6567 (100.00)	104287 (100.00)

Source: GOP (2011), Statistical Abstract, Punjab
Figures in the parentheses indicate percent to total roads

Share of agriculture sector in total electricity consumption in Gurdaspur, Ferozepur and Sangrur districts was turned out to be 40.18, 49.10 and 58.23 per cent, respectively. The share of

industrial sector in electricity consumption in the respective districts was found to be 14.15, 14.07 and 20.15 per cent. In all of the study districts, 100 per cent villages are electrified and linked with the roads. In comparison to state average of 207 km, the road length per hundred square km of area was 220, 159 and 182 km in Gurdaspur, Ferozepur and Sangrur districts, respectively (Table 4.1.8). Gurdaspur, Ferozepur and Sangrur districts consists of 12, 11 and 13 regulated markets, respectively. The number of sub yards in the respective districts was 23, 14 and 19. In Gurdaspur district there were 278 bank offices and 289 primary agricultural cooperative societies and 127 veterinary clinics. The number of same in Ferozepur district was 215, 310 and 113 and in Sangrur district was 218, 349 and 97, respectively. The total numbers of registered industrial units in Gurdaspur, Ferozepur and Sangrur districts were 831, 704 and 1069, respectively (Table 4.1.9).

Table 4.1.9: Other important development indicators of sample districts and Punjab, 2010-11

Particulars	Gurdaspur	Ferozepur	Sangrur	Punjab
Area (Sq. Km)	3560	5850	3610	50362
Geographical Area (000 Ha)	356	585	361	5036
Total Cropped Area (000 Ha)	503	888	620	7882
No. of Villages	1532	968	573	12278
No. of Gram-panchayat	1659	1126	585	12775
No. of Towns	14	9	12	157
No. of Families (000)	366	301	257	4348.58
Percent of BPL Families (2004-05)*	NA	NA	NA	5.2
No. of Regulated markets	12	11	13	146
No. of Sub-yards	23	14	19	294
% of Villages Electrified	100	100	100	100
% of villages linked with roads	100	100	100	100
No. of Bank offices	278	215	218	8269
No. of PACS	289	310	349	3990
No. of Veterinary Clinics	127	113	97	1367
No. of Dispensaries & Insemination Units	108	82	113	1485
No. of Wells & Tube wells (000)	-	133.92	-	1341.49
Wells with Electric Motors (000)	89	92.62	106	1032.62
Wells with Oil Engines (000)	-	41.32	-	308.87
No. of Industrial Units (Registered)	831	704	1069	17517
No. of Poultry Birds (000)	3041.50	176.08	1172.26	18999.70
No. of Goats (000)	10.64	32.70	21.20	286.39
No. of Buffaloes (000)	281.39	392.11	486.33	5035.63
No. of Local Cows (000)	20.06	47.61	30.39	275.95
No. of C.B. Cows (Actual) (000)	101.45	102.05	38.13	1062.80
No. of Bullocks (000)	20.94	34.41	54.39	423.86

Source: GOP (2011), Statistical Abstract, Punjab *Economic Survey, Punjab, 2009-10

4.2 Main Features of Sample Households

4.2.1 Socio-economic profile of sample farmers

The socio-economic characteristics of the sample farmers have been presented in Table 4.2.1. The total sample of 300 farmer households growing wheat and paddy crops on their farms comprised 36 marginal, 60 small, 96 medium and 108 large farmers. All the selected farm households were having male as the family head. The average age of head of the family in over all sample farm households was 48.42 years. Category wise the average age on marginal, small, medium and large farmers was 47.14, 50.75, 46.20 and 49.53 years, respectively. Overall 97 per cent farmers reported agriculture as their main occupation, the highest by large category farmers (99.07 per cent) and the lowest by marginal farmers (88.89 per cent). Dairy was reported as main occupation by 2.08 per cent of medium farmers followed by 1.67 per cent small farmers, whereas none of the marginal as well as large farmers have it as main occupation. Among other occupations, 5.56 and 2.78 per cent marginal farm households reported service and farm labour, respectively as the main occupation. Service was found as the main occupation on 1.67 and 0.93 per cent of small and large farm households, respectively.

Table 4.2.1: Demographic profile of the selected wheat and paddy growing farmers

Characteristics	Marginal	Small	Medium	Large	All Farms
Age of decision maker (years)	47.14	50.75	46.2	49.53	48.42
Main Occupation (%)					
Crop Farming	88.89	96.67	97.92	99.07	97.00
Dairy	0.00	1.67	2.08	0.00	1.00
Service	5.56	1.67	0.00	0.93	1.33
Farm labour	2.78	0.00	0.00	0.00	0.33
Others.	2.78	0.00	0.00	0.00	0.33
Education (years of schooling)	6.19	5.98	7.99	8.05	7.39
Family Size (no.)	4.97	6.02	6.42	7.27	6.47
Male	2.75	3.2	3.33	3.95	3.46
Female	2.22	2.82	3.09	3.32	3.01
Social Grouping (%)					
General	86.11	95.00	97.92	99.07	96.33
SC/ST	5.56	3.33	1.04	0.00	1.67
OBC	8.33	1.67	1.04	0.93	2.00
Others	0.00	0.00	0.00	0.00	0.00
Gender of head of household (%)					
Male	100	100	100	100	100
Female	-	-	-	-	-

The education of the family members gives impetus to the adoption of new farm initiatives. An average year of schooling on the sample farmers in state was found to be 7.39 years with highest (8.05 years) in case of large farmers and the least (5.98 years) in case of small farmers. The average size of family on sample farm households in state was 6.47 consisting of 3.46 males and 3.01 females. Largest average family size of 7.27 members was recorded on large category farm households and the least in case of marginal category (4.97). Overall 96.33 per cent of sample farmers belonged to the general category, and other 1.67 and 2 per cent belonged to schedule casts (SC) and other backward castes (OBC), respectively. Category-wise, 5.56 and 8.33 per cent marginal farm households belonged to SC and OBC categories, respectively. Similarly, 3.33 and 1.67 per cent small farmers belonged to SC and OBC categories, respectively. Among medium farmers 1.04 per cent each belonged to the above mentioned social categories, whereas 0.93 per cent of larger category farmers belonged to the OBC category.

4.2.2 Operational holding characteristics

The characteristics of operational holding have been shown in Tables 4.2.2 - 4.2.4. Overall average operational farm size on sample farms in state turns out to be 4.22 ha comprising 3.23 ha of owned land and 0.99 ha of leased in land (Table 4.2.2). The average operational area on marginal, small, medium and large category farms was 0.77, 1.61, 3.09 and 7.82 ha, respectively. While all of the categories had leased in some of the operational area, only small and medium category farmers were found to leasing out their land. Irrespective of category, all of the sample farmers who leased in the land had taken it for fixed money ranging from Rs 75827 per ha on medium farms to Rs 77727 per ha on marginal farms (Table 4.2.3). Overall 34.33 per cent of the sample farm households leased in land accounting for the 23.40 per cent of the operational area on an average. It has been highlighted that 56.48 per cent of the large farmers had leased in land which accounted for 28.87 per cent of their operational area. Similarly, 11.11 per cent marginal farmers, 13.33 per cent small farmers and 31.25 per cent medium farmers had acquired land by leasing in which accounted for 7.91, 6.64 and 14.71 per cent of the operational area on the respective categories. Thus, incidence of leasing in land to increase the farm size was found to be directly and positively related to the farm size.

The major factor for productivity enhancement in almost all the crops is timely and adequate application of irrigation water along with other requisite inputs. There was adequate availability of irrigation water as entire operational area on the sample farms was under assured

irrigation (Table 4.2.4). About 64.33 per cent farms were having only tube well as the source of irrigation. While 17.67 per cent farms were having generators in addition to the tube well, another 18 per cent were having canal water in addition to the tube wells as source of irrigation. Category wise it can be seen that proportion of only one source of irrigation viz. tube well was larger on smaller size farm categories. Number of sources increased with the increase in farm size and was found to be highest on large size category farms.

Table 4.2.2: Operational area on the sample farm households

(ha/farm)

Size Class of Farm	Owned Land (1)		Leased in Land (2)		Leased out land (3)		Total Operational Holding (1+ 2-3)	
	U	I	U	I	U	I	U	I
Marginal	0.71	-	0.06	-	0.00	-	0.77	-
Small	1.59	-	0.11	-	0.09	-	1.61	-
Medium	2.68	-	0.46	-	0.05	-	3.09	-
Large	5.56	-	2.26	-	0.00	-	7.82	-
All farms	3.26	-	0.99	-	0.03	-	4.22	-

I: Irrigated, UI: Unirrigated

Table 4.2.3: Terms of lease on the sample farm households

	Incidence		Terms (%)				Rent		
Size Class of Farm	% Area leased in	% HHs leasing in	For fixed money (Rs.)	Fixed produce (Qtl.)	Share of Produce (%)	Others	For fixed money (Rs/ha)	Fixed produce (Qtl.)	Share of Produce (%)
Marginal	7.91	11.11	-	-	-	-	77727	-	-
Small	6.64	13.33	-	-	-	-	77500	-	-
Medium	14.71	31.25	-	-	-	-	75827	-	-
Large	28.87	56.48	-	-	-	-	76654	-	-
All farms	23.40	34.33	-	-	-	-	76558	-	-

Table 4.2.4: Source of irrigation on the sample farm households

Size Class of Farm	Source of Irrigation (%)			
	Surface/ Canal + Tube well	Tube Well/ Ground-Water	(Tube well + Diesel)	Others (Tube well +Generator)
Marginal	16.67	83.33	0.00	0.00
Small	15.00	76.67	0.00	8.33
Medium	17.71	61.46	4.17	16.67
Large	20.37	44.44	5.56	29.63
All farms	18.00	61.00	3.33	17.67

4.2.3 Cropping pattern

The cropping pattern on a farm depends upon the resource availability and gives an idea about the area covered under various crops in different seasons during the year. The cropping pattern followed on the sample farms have been depicted in Table 4.2.5. On marginal farms paddy and wheat were the major crops comprising 34.19 and 41.94 per cent of the gross cropped area followed by fodder (18.06 %) and basmati (5.81 %).

Table 4.2.5: Cropping pattern of selected farmers

(Ha/farm)

Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Paddy	0.53 (34.19)	1.28 (39.26)	2.51 (40.42)	6.20 (40.57)	3.36 (40.38)
Basmati	0.09 (5.81)	0.12 (3.68)	0.29 (4.67)	0.82 (5.37)	0.42 (5.05)
Pulses	-	-	-	-	-
Oilseeds	-	-	-	-	-
Cotton	-	-	-	-	-
Fodder	0.16 (10.32)	0.20 (6.13)	0.28 (4.51)	0.42 (2.75)	0.30 (3.61)
Vegetables and others	-	0.01 (0.31)	-	0.002 (0.01)	0.004 (0.01)
Rabi					
Wheat	0.65 (41.94)	1.42 (43.56)	2.82 (45.41)	7.03 (46.00)	3.80 (45.66)
Other cereals	0.00	0.00	0.00	0.002 (0.01)	0.001 (0.01)
Pulses	0.00	0.01 (0.31)	0.00	0.03 (0.20)	0.011 (0.13)
Oilseeds	0.00	0.00	0.00	0.019 (0.01)	0.002 (0.02)
Fodder	0.12 (7.74)	0.18 (5.52)	0.26 (4.19)	0.36 (2.36)	0.26 (3.12)
Vegetables and others	-	0.04 (1.23)	0.04 (0.64)	0.056 (0.37)	0.031 (0.37)
Summer	-	-	-	-	-
Perennial					
Sugarcane	0.00	0.00	0.01 (0.16)	0.36 (2.36)	0.13 (1.59)
Fruit	-	-	-	-	-
Others	-	-	-	-	-

Figures in the parenthesis indicate the percent of Gross Cropped Area

On small farms also, paddy and wheat comprised 39.26 and 43.56 per cent of the gross cropped area followed by fodder (11.65 %) and basmati (3.68 %) As far as medium farms are concerned, paddy and wheat shared 40.42 and 45.41 per cent of the gross cropped area on the sample farms followed by fodder (8.70 %) and basmati (4.67 %). Similarly, on large farms paddy and wheat accounted for 40.57 and 46 per cent of the gross cropped area followed by fodder (5.11 %), basmati (5.37 %) and sugarcane (2.36 %). Hence paddy and wheat were major crops on all the farm size categories and on average accounted for 40.38 and 45.66 per cent of the gross cropped area on the sample farms in state. Other important crops on sample farms were the fodder followed by sugarcane and basmati.

4.2.4 Crop productivity

The productivity of various crops sown on the sample farms have been presented in Table 4.2.6. In case of paddy crop, overall average productivity on sample farms was recorded at 6945 kg per ha and it varied from the lowest (6458 kg/ha) on marginal farms to the highest (7012 kg/ha) on the large farms.

Table 4.2.6: Average productivity of major crops grown by the selected households

(Kg/ha)

Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Paddy	6458	6862	6869	7012	6945
Basmati	3878	3775	4224	4268	4248
Pulses	-	-	-	-	-
Oilseeds	-	-	-	-	-
Cotton	-	-	-	-	-
Fodder	46650	49745	54111	47410	49667
Vegetables and others	-	9500	-	83500	19750
Rabi					
Wheat	5251	5104	5234	5420	5342
Other cereals	0	0	0	4150	3000
Pulses	0	1500	0	833	1091
Oilseeds	0	0	0	3895	1500
Fodder	86808	85522	87235	85186	87027
Vegetables and others	-	24150	5825	31732	29196
Summer	-	-	-	-	-
Perennial					
Sugarcane	0	0	70800	80747	80755
Fruit	-	-	-	-	-
Others	-	-	-	-	-

Wheat average productivity was found to varying from the lower (5104 kg/ha) on the small farms to the highest (5420 kg/ha) on large farms. Overall the average productivity of wheat on sample farms was 5342 kg per ha. Among other crops the average productivity of basmati crop was found to be the highest (4268 kg/ha) on the large farms and the lowest (3775 kg/ha) on small farms with 4248 kg per ha in an overall situation. Sugarcane was grown only on medium and large farms and its average productivity on the respective farms was 708.00 q/ha and 807.47 q/ha. Thus, with some variations the crop productivity was relatively more on the larger size farms.

4.2.5 Farm machinery investments

The level of investments on sample farm households in Rs per hectare is provided in Table 4.2.7. The average investment on machinery on the sample farms was worked out to be Rs 58321 per ha. Overall, the largest investment per ha was on the tractors and implements (Rs 48417) followed by tube wells (Rs 7331) and combine harvesters (Rs 2437). The respective per ha investment on marginal, small, medium and large farms was found to be Rs 23220, Rs 43885, Rs 71720 and Rs 56419, respectively. Per ha average investment on account of tractors was found to be the highest on medium farms (Rs 59307) followed by large farms (Rs 47914), small farms (Rs 32050) and marginal farms (Rs 4299). On the other hand, per ha average investment on account of tube wells was the highest on marginal farms (Rs 18921) followed by small farms (Rs 11607), medium farms (Rs 8533) and large farms (Rs 6039).

Table 4.2.7: Farm machinery investments on the sample households

Size of Farm	Level of Investment in Rs/ha.				
	Tractors & Implements	Combined Harvester	Threshing Machine	Tube Well	Avg. Investment per ha.
Marginal	4299	0	0	18921	23220
Small	32050	0	228	11607	43885
Medium	59307	3708	172	8533	71720
Large	47914	2349	117	6039	56419
All farms	48417	2437	136	7331	58321

4.2.6 Livestock

Livestock particularly milch and drought animals always remained an important part of agriculture on farm households in the state. The number of cattle and buffalo on the sample farm

households is presented in Table 4.2.8. Overall on sample farms the total number of livestock units per farm was found to be 5.65 comprising of 1.10 cattle, 2.70 buffalos and 1.85 others. Category wise number of livestock units per farm increased with the farm size from 3.98 on marginal farms to 7.01 on the large farms. Similarly the number of buffalos per farm increased with the increase in farm size. However, the number of cattle per farm were recorded to be the highest i.e. 1.30 on large farms followed by the marginal farms (1.06), small farms (1.00) and medium farms (0.96).

Table 4.2.8: Number of livestock units on the sample farms

Size of Farm	Cattle	Buffalo	Others	Total
Marginal	1.06	1.39	1.53	3.98
Small	1.00	2.28	1.47	4.75
Medium	0.96	2.65	1.73	4.34
Large	1.30	3.42	2.29	7.01
All Farms	1.10	2.70	1.85	5.65

4.3 Estimation of Crop Losses at Different Stages

The significant losses in foodgrains occur at various harvest/post-harvest stages viz. harvesting, threshing, transportation and storage. Precious foodgrains are lost during harvest as some of the ears or grains fell on ground due to shattering or due to defective machines (combine harvester). Similarly during threshing of produce, the losses occur due to some grains passing into straw and some proportion mixes with dirt in the threshing process. Wastages also occur during loading unloading of grains as well as during transportation from field to market or home. Also, losses occur during marketing process of food grains. All of the farmers store grains for home consumption as well as for seed and feed purpose or for payments in kind. Some well of farmers also store their produce to be sold in future to fetch better prices. Depending upon the type of storage structure used during storage process some of the grains get damaged. The major cause of food grain wastages in storage are the insect-pest infestation and rats. These losses can be minimized by taking various precautionary measures at different stages of handling of the crop. This section deals with assessment of wheat and paddy losses during harvesting, threshing, transportation and storage.

4.3.1. Production loss during harvest

The quantitative and per cent production losses during different stages of harvesting of paddy crop have been depicted in Table 4.3.1 and 4.3.2. On an average, per farm losses of paddy

on sample farms during different harvesting operation turned out to be 535.96 kg., and almost entire loss occurred during harvesting stage (535.94 kg). Reason being that almost entire crop on sample farms has been harvested by combined harvesters in which both harvesting and threshing operations are done by single machine at the same time. An insignificant output was harvested manually which needed threshing as separate operation and that also only on marginal farms. Category wise entire paddy output on small, medium and large farms was harvested by combined harvester and the corresponding losses were 198.37, 400.10 and 1005.88 kg per farm comprising the 100 per cent harvesting losses on these categories. On marginal farms while the output harvested by machine accounted for 100 per cent harvesting losses, in case of manual harvesting on these farms the harvesting and threshing losses accounting for 75 and 25 per cent of total harvesting losses, respectively.

Table 4.3.1: Quantity lost at different stages of harvest – Paddy crop (kg/farm)

Size Class of Farm	Mode/ Method	Loss in Harvesting.	Mode/ Method*	Loss in Threshing	Loss in Winnowing	Total loss
Marginal	Mechanical	50.52	-	-	-	50.52
	Manual	0.42	Manual	0.14	-	0.56
	Total	50.94	Total	0.14	-	51.08
Small	Mechanical	198.37	-	-	-	198.37
	Manual	0.00	Manual	-	-	0.00
	Total	198.37	Total	-	-	198.37
Medium	Mechanical	400.10	-	-	-	400.10
	Manual	0.00	Manual	-	-	0.00
	Total	400.10	Total	-	-	400.10
Large	Mechanical	1005.88	-	-	-	1005.88
	Manual	0.00	Manual	-	-	0.00
	Total	1005.88	Total	-	-	1005.88
All farms	Mechanical	539.89	-	-	-	539.89
	Manual	0.05	Manual	0.02	-	0.07
	Total	535.94	Total	0.02	-	535.96

*** Threshing operation performed manually**

Table 4.3.2: Proportionate losses at different stages of harvest – Paddy crop

(Percent)

Size Class of Farm	Mode/ Method	Loss in Harvesting.	Mode/ Method*	Loss in Threshing	Loss in Winnowing	Total loss
Marginal	Mechanical	100.00	-	-	-	100.00
	Manual	75.00	Manual	25.00	-	100.00
	Total	99.73	Total	0.27	-	100.00
Small	Mechanical	100.00	-	-	-	100.00
	Manual	-	Manual	-	-	-
	Total	100.00	Total	0.00	-	100.00
Medium	Mechanical	100.00	-	-	-	100.00
	Manual	-	Manual	-	-	-
	Total	100.00	Total	0.00	-	100.00
Large	Mechanical	100.00	-	-	-	100.00
	Manual	-	Manual	-	-	-
	Total	100.00	Total	0.00	-	100.00
All farms	Mechanical	100.00	-	-	-	100.00
	Manual	71.43	Manual	28.57	-	100.00
	Total	100.00	Total	0.00	-	100.00

*** Threshing operation performed manually**

The quantitative and per cent output losses during different stages of harvesting of wheat crop have been depicted in Table 4.3.3 and 4.3.4. On an average, per farm losses of wheat on sample farms during different harvesting operation turned out to be 398.81 kg. Per farm average loss during mechanical method and manual method was worked out to be 391.64 and 7.17 kg, respectively. Average per farm losses during harvesting on marginal, small, medium and large category farms were 45.56, 143.38, 309.69 and 737.68 kg, respectively. In harvesting of wheat by combine harvesters both of harvesting and threshing operations are done by single machine at the same time and losses are considered to be taken place during harvesting only (100 per cent). Output of wheat harvested manually required mechanical threshing as separate operation. In manual harvesting, the harvesting and mechanical threshing on average accounted for 51.19 and 48.81 per cent of the total harvesting losses, respectively.

Table 4.3.3: Quantity lost at different stages of harvest – Wheat (kg/farm)

Size Class of Farm	Mode/ Method	Loss in Harvesting.	Mode/ Method*	Loss in Threshing	Loss in Winnowing	Total loss
Marginal	Mechanical	32.33	-	-	-	32.33
	Manual	9.06	Mechanical	4.17	-	13.23
	Total	41.39	Total	4.17	-	45.56
Small	Mechanical	133.22	-	-	-	133.22
	Manual	5.67	Mechanical	4.50	-	10.17
	Total	138.88	Total	4.50	-	143.38
Medium	Mechanical	300.73	-	-	-	300.73
	Manual	4.06	Mechanical	4.90	-	8.96
	Total	304.79	Total	4.90	-	309.69
Large	Mechanical	735.79	-	-	-	735.79
	Manual	0.42	Mechanical	1.48	-	1.9
	Total	736.20	Total	1.48	-	737.68
All farms	Mechanical	391.64	-	-	-	391.64
	Manual	3.67	Mechanical	3.50	-	7.17
	Total	395.31	Total	3.50	-	398.81

*** Threshing operation performed mechanically**

Table 4.3.4: Proportionate losses at different stages of harvest – Wheat crop

(Percent)

Size Class of Farm	Mode/ Method	Loss in Harvesting.	Mode/ Method*	Loss in Threshing	Loss in Winnowing	Total loss
Marginal	Mechanical	100.00	-	-	-	100.00
	Manual	68.48	Mechanical	31.52	-	100.00
	Total	90.85	Total	9.15	-	100.00
Small	Mechanical	100.00	-	-	-	100.00
	Manual	55.75	Mechanical	44.25	-	100.00
	Total	96.86	Total	3.14	-	100.00
Medium	Mechanical	100.00	-	-	-	100.00
	Manual	45.31	Mechanical	54.69	-	100.00
	Total	98.42	Total	1.58	-	100.00
Large	Mechanical	100.00	-	-	-	100.00
	Manual	22.11	Mechanical	77.89	-	100.00
	Total	99.80	Total	0.20	-	100.00
All farms	Mechanical	100.00	-	-	-	100.00
	Manual	51.19	Mechanical	48.81	-	100.00
	Total	99.12	Total	0.88	-	100.00

*** Threshing operation performed mechanically**

4.3.2 Crop losses during transport

Table 4.3.5 shows the quantity of paddy lost during transportation and handling as reported by the sample households. The head load mode of transportation from field to threshing floor was reported by only marginal farmers as some of them had harvested part of their crop manually. The mode of transportation from field/farm to market was tractor-trolley as revealed by all the sample households. The average quantity lost during transportation was worked out to be 0.35 q/ farm household. Category wise the total loss of paddy during transportation to market was 0.062, 0.13, 0.24 and 0.67 q per farm on marginal, small, medium and large farms, respectively. Except on marginal farms, the entire transportation loss of paddy was during transporting it from farm/field to the market.

Table 4.3.5: Quantity lost during transportation – Paddy crop (q/farm)

Size Class of Farm	Field to threshing floor			Field/Farm to Market			Total transport losses
	Mode/ Method	Quantity	% losses	Mode/ Method	Quantity	% losses	
Marginal	1	0.004	6.06	3	0.062	93.94	0.066
Small	-	0	0.00	3	0.13	100.00	0.130
Medium	-	0	0.00	3	0.24	100.00	0.240
Large	-	0	0.00	3	0.67	100.00	0.670
All farms	1	0.001	0.28	3	0.35	99.72	0.351

1: Head Load, 3: Trolley

Table 4.3.6: Quantity lost during transportation– wheat crop (q/farm)

Size Class of Farm	Field to threshing floor			Field/Farm to Market			Total transport losses
	Mode/ Method	Quantity	% losses	Mode/ Method	Quantity	% losses	
Marginal	1	0.04	50.00	3	0.04	50.00	0.08
Small	1	0.03	25.00	3	0.09	75.00	0.12
Medium	1	0.04	20.00	3	0.16	80.00	0.20
Large	1	0.02	4.26	3	0.45	95.74	0.47
All farms	1	0.03	11.11	3	0.24	88.89	0.27

1: Head Load, 3: Trolley

Quantity of wheat lost during transportation has been depicted in Table 4.3.6. All of the farmers who manually harvested their wheat crop had transported it to the threshing floor on head only. Quantitative loss during this operation on marginal, small, medium and large size farms were 0.04, 0.03, 0.04 and 0.02 q per farm comprising of the 50, 25, 20 and 4.26 per cent of the total transportation loss of wheat on the respective farm categories. Irrespective of farm size

category tractor-trolley was the only mode of transportation used by the sample households to transport their produce from field/farm to the market. Quantitative loss during transportation to market on marginal, small, medium and large size farms were 0.04, 0.09, 0.16 and 0.45 q per farm comprising of the 50, 75, 80 and 95.74 per cent of the total transportation loss of wheat on the respective farm size categories. Overall average transportation losses of wheat on sample farm households was 0.27 q per farm comprising of 0.03 q and 0.24 q per farm loss from field to threshing floor and from farm to market, respectively. Respective proportionate loss during these two operations accounted for 11.11 and 88.89 per cent of the total transportation loss of wheat.

4.3.3 Crop losses during storage at producer's level

The agricultural produce is affected by pests, rodents and fungus during storage if proper precautions are not taken at the household level. The quantity lost during storage of paddy at farmer level has been given in Table 4.3.7. Quantity of paddy stored by marginal, small, medium and large farmers was 0.77, 1.09, 1.19 and 2.19 q/farm and all of them used gunny bags and pucca storage with cemented floor and roof for this purpose. Overall average quantity stored per farmer was 1.48 q. which was gradually withdrawn from the storage as per requirement, thus, it was stored for the whole year. Average quantity lost during storage was 0.035 q/farm household accounting for the 2.36 per cent of total quantity stored. Storage loss varied from a minimum 1.66 per cent of stored quantity on marginal farms to the highest i.e. 2.93 per cent on the small farms. Overall, monthly average storage cost on respondent farms was worked out to be Rs 1.90 which varied from Rs 1.24 on marginal farms to Rs 2.35 on the large farms.

Table 4.3.7: Quantity lost during storage of paddy

(q/farm)

Size Class of Farm	Type of Storage	Amount of Quantity stored	% of Total Storage Capacity	Quantity lost	% of Stored Quantity Lost	Storage Time in Days	Average Cost of Storage Rs/Month
Marginal	2	0.770	NA	0.013	1.66	365	1.24
Small	2	1.090	NA	0.032	2.93	365	1.46
Medium	2	1.190	NA	0.026	2.17	365	1.89
Large	2	2.190	NA	0.052	2.38	365	2.35
All farms	2	1.480	NA	0.035	2.36	365	1.90

2: Pucca storage with cemented floor and roof

The mode of storage in case of wheat crop was steel bins used to about 90 per cent of the storage capacity with an average quantity of wheat stored was 20.18 quintal per household (Table 4.3.8). The per farm storage on marginal, small, medium and large category farms was 11.04, 15.11, 18.54 and 27.49 quintals, respectively. This stored produce was gradually withdrawn from the storage drums as per requirement for consumption, seed, feed and other purposes by the sample households and, therefore, was stored for the whole year. The storage losses reported by the sample households were found to be very low to the tune of 0.59 per cent and varied from 0.54 per cent of total stored wheat on medium farms to 0.72 per cent on marginal farms. The average quantity per farm household lost during wheat storage was found to be 0. 12 quintal. Overall, monthly average storage cost of wheat on respondent farms was worked out to be Rs 5.44 which varied from Rs 3.67 on marginal farms to Rs 7.05 on the large farms.

Table 4.3.8: Quantity lost during storage of wheat

(q/farm)

Size Class of Farm	Type of Storage*	Amount of Quantity stored	% of Total Storage Capacity	Quantity lost	% of Stored Quantity Lost	Storage Time in Days	Average Cost of Storage Rs/Month
Marginal	3	11.04	89.90	0.08	0.72	365	3.67
Small	3	15.11	90.48	0.10	0.66	365	3.94
Medium	3	18.54	90.84	0.10	0.54	365	5.21
Large	3	27.49	90.94	0.16	0.58	365	7.05
All farms	3	20.18	90.78	0.12	0.59	365	5.44

***3: Steel storage bin**

Total losses at different stages for paddy are provided in Table 4.3.9. Overall, in total post harvest losses of paddy (5.75q/farm), the losses during harvesting alone accounted for 93.21 per cent, followed by the transportation losses (6.09 %) and 0.70 per cent by storage losses. Proportionate share of losses during harvesting was lowest on marginal farms. However, relative share of transportation and storage losses in total losses was the highest on the marginal farms as compared to the other farm size categories. Total losses at various stages of handling as percentage of production of paddy are provided in Table 4.3.9a. On an average, total losses of paddy at various stages accounted for 2.47 per cent of paddy produced on sample farms. Out of this, losses during harvesting alone accounted for 2.30 per cent of production followed by 0.15 per cent in transportation and a negligible during the farm level storage. Category-wise, total

losses accounted for 1.74, 2.43, 2.48 and 2.47 per cent of paddy production on marginal, small, medium and large farms, respectively.

Table 4.3.9: Losses at different stages of handling: Paddy

(q/farm)

Stages	Marginal		Small		Medium		Large		Average	
	Qty	Percent	Qty	Percent	Qty	Percent	Qty	Percent	Qty	Percent
Harvesting	0.51	86.44	1.98	92.53	4.00	93.68	10.06	93.32	5.36	93.21
Transportation	0.07	11.86	0.13	6.07	0.24	5.62	0.67	6.22	0.35	6.09
Storage	0.01	1.70	0.03	1.40	0.03	0.70	0.05	0.46	0.04	0.70
Total	0.59	100.00	2.14	100.00	4.27	100.00	10.78	100.00	5.75	100.00

Table 4.3.9a: Percent share of losses to the total production of Paddy

Farm size	Production (q/farm)	Harvesting	Transportation	Storage	Total
Marginal	34.01	1.50	0.21	0.03	1.74
Small	87.83	2.25	0.15	0.03	2.43
Medium	172.4	2.32	0.14	0.02	2.48
Large	434.77	2.31	0.15	0.01	2.47
Overall	233.33	2.30	0.15	0.02	2.47

Total losses at different stages for wheat are provided in Table 4.3.10. Overall, in total losses of wheat (4.38 q/farm) at different stages, the losses during harvesting alone accounted for 91.10 per cent, followed by the transportation losses (6.16 %) and during storage (2.74 %). Proportionate share of losses during harvesting in total losses was lowest on marginal farms to the tune of 74.20 per cent as compared to 86.67, 91.18 and 92.13 per cent on small, medium and large farms, respectively. However, relative share of transportation losses in total losses was highest on the marginal farms (12.90%) and decreased with the increase in farm size being lowest on the large farms (5.87%). Similarly, relative share of storage losses in total losses was highest on the marginal farms (12.90%) and decreased with the increase in farm size being lowest on the large farms (2.00%). Total loss at various stages of handling as percentage of production of wheat is provided in Table 4.3.10a. Overall on an average, total loss of wheat at various stages accounted for 2.16 per cent of wheat produced on sample farms. Out of this,

losses during harvesting alone accounted for 1.97 per cent of production followed by 0.13 per cent in transportation and a negligible 0.06 per cent during the farm level storage. Category-wise, total losses accounted for 1.81, 2.28, 2.31 and 2.10 per cent of wheat production on marginal, small, medium and large farms, respectively.

Table 4.3.10: Losses at different stages of handling: Wheat

(q/farm)

Stages	Marginal		Small		Medium		Large		Average	
	Qty	Percent	Qty	Percent	Qty	Percent	Qty	Percent	Qty	Percent
Harvesting	0.46	74.20	1.43	86.67	3.10	91.18	7.38	92.13	3.99	91.10
Transportation	0.08	12.90	0.12	7.27	0.20	5.88	0.47	5.87	0.27	6.16
Storage	0.08	12.90	0.10	6.06	0.10	2.94	0.16	2.00	0.12	2.74
Total	0.62	100.00	1.65	100.00	3.40	100.00	8.01	100.00	4.38	100.00

Table 4.3.10a: Percent share of losses to the total production of Wheat

Farm size	Production (q/farm)	Harvesting	Transportation	Storage	Total
Marginal	34.12	1.35	0.23	0.23	1.81
Small	72.47	1.97	0.17	0.14	2.28
Medium	147.61	2.10	0.14	0.07	2.31
Large	381.05	1.94	0.12	0.04	2.10
Overall	203	1.97	0.13	0.06	2.16

4.4 Estimation of Marketable and Marketed Surplus ratios of Selected Crops

To estimate the marketable and marketed surplus of wheat and paddy it is important to work out the total availability of these food grains as well as the on farm requirement for various purposes. In both of the crops marketed surplus was found to be exactly equivalent to the marketable surplus.

4.4.1 Availability of paddy and wheat

The total availability of paddy on the respondent farms is provided in Table 4.4.1. Overall, on an average the per farm beginning stock of paddy was 0.08 quintal with variation from 0.01 q/farm on marginal households to 0.17 q/farm on the large farm households. The average production of paddy on sample farms was 233.33 q/farm, thus, leading to the net average

availability at 233.41 q/farm. The production of paddy during the reference year on marginal, small, medium and large farms was worked out 34.01, 87.83, 172.40 and 434.77 q/farm, respectively. The net average availability of paddy on the respective categories was 34.02, 87.86, 172.44 and 434.94 q/farm.

Table 4.4.1: Availability of paddy on various farm size categories households (q/farm)

Farm Size	Paddy		
	Average Beginning Stock (1)	Average Production (2)	Net Average Availability (1+2)
Marginal	0.01	34.01	34.02
Small	0.03	87.83	87.86
Medium	0.04	172.40	172.44
Large	0.17	434.77	434.94
All farms	0.08	233.33	233.41

The total availability of wheat on the respondent farms is provided in Table 4.4.2. Overall, the average per farm beginning stock of wheat was 2.13 quintals. Beginning stock of wheat varied from 0.82 q/farm on marginal households to 3.31 q/farm on the large farm households. The production of wheat during the reference year on marginal, small, medium and large farms was 34.12, 72.47, 147.61 and 381.05 q/farm respectively. The net average availability of wheat on the respective categories was 34.94, 73.58, 149.54 and 384.36 q/farm. The overall average production and net availability of wheat on sample farms was worked out at 203.00 q/farm and 205.13 q/farm, respectively.

Table 4.4.2: Availability of wheat on various farm size categories households (q/farm)

Farm Size	Wheat		
	Average Beginning Stock (1)	Average Production (2)	Net Average Availability (1+2)
Marginal	0.82	34.12	34.94
Small	1.11	72.47	73.58
Medium	1.93	147.61	149.54
Large	3.31	381.05	384.36
All farms	2.13	203.00	205.13

4.4.2 Crop retention pattern

On farm requirements of food grains for different purposes viz. home consumption, requirements for seed, feed and kind payments determine the total quantity to be retained by the

farmers. Purpose-wise retentions of paddy production on the sample farms are given in Table 4.4.3. Overall on average the total retention of paddy per farm was 1.48 quintals, out of which 37.16 per cent was retained for self consumption followed by for payments in kind (35.14%), feed (14.19%) and as seed (12.16%). On marginal, small, medium and large farms the quantity of paddy retained was worked out to be 0.77, 1.09, 1.19 and 2.16 q/farm, respectively. Out or the respective quantity retained on various farm size categories the major proportion was retained for self consumption followed by kind payments. Significant proportion of total retention was also kept for seed and feed uses on all the categories of farms.

Table 4.4.3: Purpose-wise retention of paddy by the farmers (q/farm)

Farm Size	Self-consumption (1)			Seed (2)	Feed (3)	Others (4)	Payments in kind (5)	Total retention (1+2+3+4+5)
	Retention (1)	Purchased						
		Qty	Price					
Marginal	0.41 (53.25)	-	-	0.02 (2.60)	0.17 (22.08)	0.01 (1.30)	0.16 (20.77)	0.77 (100.00)
Small	0.46 (42.20)	-	-	0.10 (9.18)	0.15 (13.76)	0.01 (0.92)	0.37 (33.94)	1.09 (100.00)
Medium	0.66 (55.46)	-	-	0.09 (7.56)	0.08 (6.72)	0.01 (0.84)	0.35 (29.42)	1.19 (100.00)
Large	0.55 (25.47)	-	-	0.35 (16.20)	0.34 (15.74)	0.05 (2.31)	0.87 (40.28)	2.16 (100.00)
All farms	0.55 (37.16)	-	-	0.18 (12.16)	0.21 (14.19)	0.02 (1.35)	0.52 (35.14)	1.48 (100.00)

Figures in parentheses indicate the per cent of total retention

Table 4.4.3a: Purpose-wise proportionate share of retention of paddy to the total production (per cent)

Farm Size	Self-consumption (1)	Seed (2)	Feed (3)	Others (4)	Payments in kind (5)	Total retention (1+2+3+4+5)
Marginal	1.21	0.06	0.50	0.02	0.50	2.29
Small	0.52	0.11	0.17	0.01	0.42	1.23
Medium	0.38	0.05	0.05	0.00	0.20	0.68
Large	0.13	0.08	0.08	0.01	0.20	0.50
All farms	0.24	0.08	0.09	0.01	0.22	0.64

Total retention of paddy on sample farms on an average accounted for 0.64 per cent of farm production (Table 4.4.3a). Purpose-wise the home consumption, payment in kind, feed and

seed accounted for 0.24, 0.22, 0.09 and 0.08 per cent of paddy production, respectively. Percentage share of total as well as purpose-wise retention of paddy in total farm production declined with the increase in farm size.

Purpose-wise retentions of wheat production on the sample farms is given in Table 4.4.4. Overall on average the total retention of wheat per farm was 20.17 quintals, out of which 12.70, 3.26 and 3.08 quintals constituting 62.96, 16.17 and 15.27 per cent of the total retained quantity was retained for self consumption, feed and seed purpose, respectively. About 1.39 per cent of total quantity retained was used for kind payments and the rest 4.21 per cent for other miscellaneous purposes. On marginal, small, medium and large farms the quantity of wheat retained was worked out to be 11.04, 15.11, 18.54 and 27.49 q/farm, respectively. Out or the respective quantity retained on various farm size categories the major proportion was retained for self consumption (varying from 55.24 per cent on large farms to 80.52 per cent on marginal farms) followed by that for feed and seed purposes. Significant proportion (about 4 per cent) of total retention of wheat was also kept for other miscellaneous uses on all the categories of farms.

Table 4.4.4: Purpose-wise retention of wheat by the farmers (q/farm)

Farm Size	Self-consumption (1)			Seed (2)	Feed (3)	Others (4)	Payments in kind (5)	Total retention (1+2+3+4+5)
	Retention (1)	Purchased						
		Qty	Price					
Marginal	8.89 (80.52)	-	-	0.62 (5.62)	1.01 (9.15)	0.41 (3.71)	0.11 (1.00)	11.04 (100.00)
Small	11.22 (74.26)	-	-	1.12 (7.41)	1.87 (12.38)	0.66 (4.37)	0.24 (1.58)	15.11 (100.00)
Medium	12.19 (65.75)	-	-	2.17 (11.70)	3.23 (17.42)	0.79 (4.26)	0.16 (0.86)	18.54 (100.00)
Large	15.24 (55.44)	-	-	5.82 (21.17)	4.81 (17.49)	1.15 (4.18)	0.47 (1.71)	27.49 (100.00)
All farms	12.70 (62.96)	-	-	3.08 (15.27)	3.26 (16.17)	0.85 (4.21)	0.28 (1.39)	20.17 (100.00)

Figures in parentheses indicate the per cent of total retention

Total retention of wheat on sample farms on an average accounted for 9.95 per cent of farm production (Table 4.4.4a). Purpose-wise the home consumption, seed, feed and payments in kind accounted for 6.26, 1.52, 1.61 and 0.14 per cent of wheat production, respectively. Percentage share of total as well as purpose-wise retention of wheat in total farm production

declined with the increase in farm size. Total wheat retention on marginal, small, medium and large farms accounted for 32.42, 20.82. 12.57 and 7.21 per cent of total production.

Table 4.4.4a: Purpose-wise proportionate share of retention of wheat to the total production (per cent)

Farm Size	Self-consumption (1)	Seed (2)	Feed (3)	Others (4)	Payments in kind (5)	Total retention (1+2+3+4+5)
Marginal	26.06	1.82	2.99	1.23	0.32	32.42
Small	15.48	1.52	2.58	0.91	0.33	20.82
Medium	8.26	1.47	2.19	0.54	0.11	12.57
Large	4.00	1.53	1.26	0.30	0.12	7.21
All farms	6.26	1.52	1.61	0.42	0.14	9.95

4.4.3 Marketed surplus and sale pattern of crops

4.4.3.1 Paddy

The total marketed surplus of paddy, its sale pattern and prices received are depicted in Table 4.4.5. Overall, on sample farms the average per farm production of paddy was 233.33 quintals, out of which marketed surplus accounted for 99.37 per cent (231.85 quintals). Category-wise the ratio of marketed surplus to production of paddy was recorded highest on the large farms at 99.50 per cent and the least on marginal farms at 97.74 per cent. Regarding time of sale, it was found that entire marketed surplus on different categories of farms was disposed of in the months of October and November viz. immediately after harvesting. The average distance covered to sell was only 4.78 km, with the highest by the large farmers (5.19 km) followed by medium farmers (5.15 km), marginal farmers (3.94 km) and small farmers (3.92 km). Due to effective procurement policy adopted in the state, 99.20 per cent of the total marketed surplus of respondent farmers was purchased by the government procurement agencies at the MSP of Rs 1110/q. Category-wise, except for large farms; the entire marketed surplus of respondents was sold to the government agencies only. A very small proportion of marketed surplus on large farms viz. 0.21 per cent and 0.99 per cent (0.14 per cent and 0.67 per cent on overall farms) was sold to the private traders and processors, respectively. The price paid by trades and processors to the farmers was Rs 1090/q and Rs 1067/q, respectively which was below the the MSP (Rs 1110/q) provided by the government procurement agencies.

Table 4.4.5: Marketed surplus of paddy and its sale pattern

Size Class of Farms	Total Production	Total quantity sold	Month of Sales*	Distance (in km)	To whom and quantity sold in quintals							
					Govt. Agencies		Pvt. Trader or Money Lender		Processor/Miller		Others	
					Quantity (%)	Price	Quantity (%)	Price	Quantity (%)	Price	Quantity (%)	Price
Marginal	34.01	33.24 (97.74)	10-11	3.94	100.00	1110	0.00	0.00	0.00	0.00	-	-
Small	87.83	86.74 (98.76)	10-11	3.92	100.00	1110	0.00	0.00	0.00	0.00	-	-
Medium	172.40	171.21 (99.31)	10-11	5.15	100.00	1110	0.00	0.00	0.00	0.00	-	-
Large	434.77	432.58 (99.50)	10-11	5.19	98.80	1110	0.21	1090	0.99	1063	-	-
All farms	233.33	231.85 (99.37)	10-11	4.78	99.20	1110	0.14	1090	0.67	1063	-	-

***10: October and 11: November**

Table 4.4.6: Marketed surplus of wheat and its sale pattern

Size Class of Farms	Total Production	Total quantity sold	Month of Sales*	Distance (in km)	To whom and quantity sold in quintals							
					Govt. Agencies		Pvt. Trader or Money Lender		Processor/Miller		Others	
					Quantity (%)	Price	Quantity (%)	Price	Quantity (%)	Price	Quantity (%)	Price
Marginal	34.12	23.08 (67.64)	4-5	3.52	81.02	1285	0.00	0.00	4.81	1285	14.17	1285
Small	72.47	57.36 (79.15)	4-5	3.93	99.56	1285	0.00	0.00	0.00	0.00	0.49	1285
Medium	147.61	129.06 (87.43)	4-5	4.57	99.24	1285	0.00	0.00	0.00	0.00	0.77	1285
Large	381.05	353.56 (92.79)	4-5	5.27	98.39	1285	1.32	1347	0.00	0.00	0.29	1290
All farms	203.00	182.83 (90.06)	4-5	4.57	98.39	1285	0.92	1347	0.07	1285	0.62	1287

***4: April and 5: May**

4.4.3.2 Wheat

The total marketed surplus of wheat on sample farms, its sale pattern and prices received are depicted in Table 4.4.6. Overall, on sample farms the average per farm production of wheat was 203.00 quintals, out of which marketed surplus accounted for 90.06 per cent (182.83 quintals). Category-wise the ratio of marketed surplus to production of wheat was recorded highest on the large farms at 92.79 per cent and the least on marginal farms at 67.64 per cent. Regarding time of sale, it was found that entire marketed surplus on different categories of farms was disposed off in the months of April and May viz. immediately after harvesting of the crop. The average distance covered to sell was only 4.57 km, with the highest by the large farmers (5.27 km) followed by medium farmers (4.57 km), small farmers (3.93 km) and marginal farmers (3.52 km). Due to effective procurement policy adopted in the state, 98.39 per cent of the total marketed surplus of respondent farmers was purchased by the government procurement agencies at the MSP of Rs 1285/q. Contrarily to the other farm size categories, a significant proportion of the marketed surplus on marginal farms was sold to the processors (4.81 %) and to others (14.17%), although the prices received from them were same as provided by the government procurement agencies. Very small quantities of marketed surplus accounting for 0.49, 0.77 and 0.29 per cent of marketed surplus on small, medium and large farms, respectively, was also found to be sold to others mainly comprising the neighbor and friends. Overall on all the study farms 0.92, 0.07 and 0.62 per cent proportion of the marketed surplus was sold to private traders, processors and others, respectively. While the prices received from processors or others was equivalent to the MSP; it was the large farmers who received relatively higher price to the tune of Rs 1347/q by selling 1.32 per cent of their marketed surplus to the private traders.

4.5 Factors Effecting Marketed Surplus of Selected Crops

Marketed surplus of agricultural commodities besides determining the income level or benefits of the farmers; provides the food security to the non farming population and thus plays pivotal role in development of a country. Therefore it is important to examine the role of various factors which determines the level of marketed surplus of agricultural commodities.

4.5.1 Socio-economic factors

Most important socio-economic factor influencing the marketable surplus of wheat and paddy was the operational area on the farm. Size of the operational area had a positive

relationship with the marketed surplus. The average operational area on marginal, small, medium and large size farm categories was worked out to be 0.77, 1.61, 3.09 and 7.82 ha, respectively (Table 4.2.2). The corresponding marketed surplus of paddy on these categories was 33.24, 86.74, 171.21 and 432.58 q/farm which accounted for 97.74, 98.76, 99.31 and 99.50 per cent of the total paddy production on the respective farm categories. The respective wheat marketed surplus on these farm size categories was 23.08, 57.36, 129.06 and 353.56 q/farm which accounted for 67.64, 79.15, 87.43 and 92.79 per cent of total per farm production on the respective categories (Table 4.4.5 and Table 4.4.6). Thus, in both of the study crops farm size was having significant positive effect on the marketed surplus. Crop farming as main occupation was reported by 88.89, 96.67, 97.92 and 99.07 per cent marginal, small, medium and large farms, respectively. Thus, crop farming as main occupation has also positive effect on the marketed surplus of the study crops. Education of household head taken as years of schooling which was 6.19, 5.98, 7.99 and 8.05 years on marginal, small, medium and large farms had positively affected the marketed surplus. Similar relationship between the family size and marketed surplus was seen on the respondent farm house holds. On the other hand under social grouping the belonging of farm household to schedule casts or other backward class had shown the negative relationship with the marketed surplus of wheat and paddy crop (Table 4.2.1).

Thus, while the farm size, crop farming being main occupation, education and family size were found have positive effect on the marketed surplus of the study crops; belongings of farm household to SC or OBC social group was found to be negatively related to the quantum of marketed surplus of these crops.

4.5.2 Institutional factors

Institutional aspects and their role in marketing and economic development revolves around market facilitation through setting up of Marketing Boards, Minimum Support Prices, Procurement Prices and state procurement, transaction costs, market information flows and the institutional environment. The contractual arrangements in legal environment and the future markets are also having institutional nature which can affect the marketing and marketed surplus. Owing to institutional aspects, the development of marketing institutions can be of great help in increasing the marketing efficiency and farmers' access to the formal markets.

Under Agricultural Produce Markets Act, 1961, the market charges in Punjab have been regularized and transactions are conducted by open auction in the regulated markets. Under this

act at market level there is a market committee represented by farmers, traders, labourers and officials of agriculture and cooperative departments. The weights and measurement act provides for standardization of weights and measures used in the markets. The Punjab State Agricultural Marketing Board (PSAMB) is an executive-cum-advisory body and is concerned with bringing about improvements in the regulation scheme. It also supervises the functioning of regulated markets and advises market committees and the State Government on related matters. The board closely monitors the sale of agricultural produce and formulates laws for the sale/purchase of the agricultural commodities. The number of regulated market in Punjab has increased from 88 in 1970-71 to 146 in the year 2010-11. Likewise, the number of sub-yards attached with these regulated market has increased from 154 to 294 during the same period. Over this period, the geographical area and average number of villages served per regulated market in Punjab decreased from 573 to 345 sq. km and from 139 to 84, respectively (Table 3.5.1). Since 2003, APMC Act was partially amended to safeguard the interest of farmers through provisions for private markets and contract farming. Though establishment of private market yards was allowed but the direct purchase was not permitted. Similarly, amendments regarding registration of contract farming agreement with the appropriate authority, dispute settlement mechanism and specifications of model agreement for contract farming were made but not adopted. The amendments regarding registration (not licensing) of market functionaries and single registration for trade/ transaction in more than one market has also been made but not implemented. The act has also been amended with respect to double market fee i.e. market fee shall not be levied for the second time in any market area of the State by market committee as well as market fee not to be levied more than once in commercial transactions between traders or sale to consumers. This amendment has been adopted by the state. Since 2003, Government of Punjab has launched contract farming in a number of high value crops. However, both of the study crops viz. wheat and common paddy are not covered under the contract farming with aim to substitute a sizable area under rice–wheat system by the high value crops.

The government of India wanted to maintain the tempo of production of food grains production, thus it provided production incentive oriented procurement prices to the farmers. As result of the assured market at remunerative prices coupled with market infrastructure and available production technology, the Punjab farmers has pushed up the paddy and wheat production and, thus, marketed surplus of these crops remarkably. Table 4.5.1 indicates that market arrivals for

paddy and wheat in state during year 2010-11 were at 131.36 and 102.78 lakh tones, respectively. Institutionalization of procurement of paddy and wheat can be seen from the Table 4.5.2. Looking at agency-wise procurement, since 2007-08 the role of government agencies in procurement has been increased in a major way. During 2010-11, 98.41 and 99.41 per cent of total market arrivals of paddy and wheat, respectively were procured by the government agencies. This assured market for paddy and wheat has great effect on the generation of marketed surplus of these crops.

Table 4.5.1: Market arrivals of paddy and wheat in Punjab

(000, tonnes)

Year	Paddy	Wheat
2007-08	12802	7911
2008-09	13234	10584
2009-10	14237	10994
2010-11	13136	10278

Source: Statistical Abstract, Punjab

Table 4.5.2: Procurement of paddy and wheat by different agencies in Punjab

(000, tonnes)

Agency	2007-08	2008-09	2009-10	2010-11
Paddy				
State government	2674 (20.89)	3627 (27.41)	4155 (29.18)	4073 (31.01)
FCI	132 (1.03)	205 (1.55)	671 (4.71)	517 (3.94)
Markfed	2426 (18.95)	2775 (20.97)	2864 (20.12)	2707 (20.61)
PUNSUP	2611 (20.40)	2714 (20.51)	3171 (22.27)	3021 (23.00)
PSWC	1356 (10.59)	1502 (11.350	1687 (1.85)	1488 (11.33)
Punjab Agro Industries Corporation (PAIC)	1133 (8.85)	127 (89.66)	1318 (9.26)	1121 (8.53)
Private traders	2470 (19.29)	1133 (8.56)	371 (2.61)	209 (1.59)
Total	12802 (100.00)	13234 (100.00)	14237 (100.00)	13136 (100.00)
Wheat				
State government	1279 (16.17)	1847 (17.45)	1682 (15.30)	1707 (16.61)
FCI	726 (9.18)	1074 (10.15)	1716 (15.61)	1654 (16.09)
Markfed	1886 (23.84)	2481 (23.44)	2557 (23.26)	2382 (23.18)
PUNSUP	1781 (22.51)	2369 (22.38)	2392 (21.76)	2301 (22.39)
PSWC	771 (9.75)	1279 (12.08)	1403 (12.76)	1122 (10.92)
Punjab Agro Industries Corporation (PAIC)	764 (9.66)	1200 (11.34)	1222 (11.12)	1051 (10.23)
Private traders	704 (8.90)	334 (3.16)	22 (0.20)	61 (0.59)
Total	7911 (100.00)	10584 (100.00)	10994 (100.00)	10278 (100.00)

Source: Statistical Abstract, Punjab

Figures in parentheses are percentage to the total

The net work of market information both electronic and print media and farmers access to it can play significant role in increasing marketing efficiency, farmers income and generation of marketed surplus. Different sources of price information are provided in Table 4.5.3. Print media

mainly the news papers was the major source of price information of the respondents. About 36 per cent of the farmers had access to market information through print media. Other major sources of the market information were the Primary Agricultural Cooperative Societies followed by Market Committees and traders. Larger size categories of farmers were found to have better access to the print media as compared to the smaller size categories. Marginal farmers were found to be relatively highly dependent on traders for this purpose.

Table 4.5.3: Sources of price information for respondent farm households

(Per cent)

Source	Size of Farms				
	Marginal	Small	Medium	Large	All farms
Trader	22.22	11.67	9.38	15.74	13.67
Print media	16.67	20.00	40.63	46.30	35.67
Radio	5.56	1.67	2.08	2.78	2.67
APMC Mandi	22.22	23.33	15.63	7.41	15.00
Telephone	2.78	3.33	2.08	1.85	2.33
Visit to Market	0.00	0.00	0.00	0.00	0.00
Buyers in Village	0.00	0.00	0.00	0.00	0.00
Cooperative Society	19.44	33.33	22.92	20.37	23.67
Others	11.11	6.67	7.29	5.56	7.00

Availability of credit for purchase of agricultural inputs like seed, fertilizers, wages etc. is the other major institutional factor which might affect the marketed surplus of farmers. Information on access to credit of the respondent farmers is provided in Table 4.5.4. Overall, 96 per cent of the sample farmers were having access to the credit. Major source of the credit was found to be Primary Agricultural Credit Societies (54.51 %) followed by commission agents (35.42 %) and commercial banks (9.38 %). Out of the total credit taken by respondents, 50 per cent was the crop loan, 45.49 per cent for consumption and only 4.51 per cent for the investment purpose. The results revealed that total amount of credit taken and outstanding increased with the increase in farm size. While none of the marginal farmer was having the Kisan Credit Card (KCC), 1.75 per cent small farmers, 9.68 per cent medium farmers and 14.42 per cent of the large farmers were found to have this facility.

Table 4.5.4: Source-wise and purpose of credit on sample farm households

Particulars	Size of Farms				
	Marginal	Small	Medium	Large	All farms
Access to Credit (%)	94.44	95.00	96.88	96.30	96.00
Source					
Private money lender	2.94	0.00	0.00	0.00	0.35
Commission Agent	44.12	33.33	33.33	35.58	35.42
Relatives and Friends	0.00	0.00	1.08	0.00	0.35
Commercial Bank	2.94	5.26	9.68	13.46	9.38
Miller	0.00	0.00	0.00	0.00	0.00
Co-operative Society	50.00	61.40	55.91	50.96	54.51
Others	0.00	0.00	0.00	0.00	0.00
Purpose (%)					
Crop loan	52.94	50.88	50.54	48.08	50.00
Investment-loan	2.94	1.75	5.38	5.77	4.51
Consumption	44.12	47.37	44.09	46.15	45.49
Credit Amount	48097	92904	160311	285048	178767
Total Outstanding	7500	11526	24247	31394	22333
Problem in getting loan from bank (yes %)	0.00	0.00	0.00	0.00	0.00
Have Kisan Credit Card (%)	0.00	1.75	9.68	14.42	8.68
If yes, Limit of KCC	0.00	100000	183889	496667	368200

4.5.3 Economic factors

Price is the most important economic factor affecting the marketed surplus. Effective price policy through significant increase in Minimum Support Prices (MSP) has resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state, thus overall market arrivals of these crops.

Farmers' awareness of Minimum Support price (MSP) and sale possibilities at higher price are presented in Table 4.5.5. As revealed by the results, awareness has positive relationship with the size of farm and thus with marketed surplus. However, none of the respondent was aware regarding the future trading. Regarding additional sale possibilities with the increase in price, overall only 1.67 per cent farmers revealed that they would have increased the marketed surplus by retaining less for seed/feed and for self consumption. Further, it was only medium and large farmers comprising 1.04 per cent medium and 3.70 per cent of total farmers in their respective categories who revealed such possibility. While on large farms the increase in

marketed surplus would have taken by curtailing seed/feed and home consumption in equal ratio, medium farmers would have increased the marketed surplus by retaining less for seed/feed only.

Table 4.5.5: Awareness of MSP and sale possibilities with increase in price

Particulars	Size of Farms				
	Marginal	Small	Medium	Large	All farms
Aware of MSP (%)	86.11	95.00	96.88	98.15	95.67
Aware of Futures Trading (%)	-	-	-		-
Used Futures (%)	-	-	-	-	-
Futures Helped in Price Risk Management (%)	-	-	-	-	-
Sale Possibilities at higher prices					
Yes (%)	0.00	0.00	1.04	3.70	1.67
If Yes, Source					
a. Less Retention for seed and feed.	-	-	100.00	50.00	60.00
b. Less Retention for self consumption.	-	-	-	50.00	40.00
c. Change in Consumption Pattern	-	-	-	-	-

4.5.4 Infrastructural Factors

Infrastructure consisting roads, warehouses, cold stores, processing units, research and training institutes, means of communication and transportation, market yards, sub-yards etc., sustain the addition to place, time and form utilities to the products and services. Thus, type of the infrastructural facilities is in great way helping the development of agriculture through increasing efficiency in marketing and commercialization.

Punjab Mandi Board the coordinating body for market committees played the lead role in developing the village approach roads and market yards on priority to facilitate the efficient marketing of farm produce and agricultural input delivery system in state. Indicators of marketing infrastructure presented in Table 4.5.6 revealed that the number of regulated market in Punjab has increased from 88 in 1970-71 to 146 in the year 2010-11. Likewise, the number of sub-yards attached with these regulated market has increased from 154 to 294 during the same period. Over this period, the geographical area and average number of villages served per regulated market in Punjab decreased from 573 to 345 sq. km and from 139 to 84, respectively.

With large scale state procurement of food grains which takes time to be dispatched to the deficit states; state owned storage capacity remained a major issue. In the recent years many steps has been taken in this regard and total state owned storage capacity increased from 176.39 lakh tons in 2007-2008 to 226.33 lakh tones in 2010-11 which was almost equivalent to the total state procurement of wheat and paddy in the state.

The Punjab Mandi Board provided all weather metalled roads to all the villages so that the farmers could sell their output throughout the year. It is very encouraging that hundred per cent villages of Punjab are linked with the all weather metalled roads which helped in efficient marketing of farm output in state.

Table 4.5.6: Market and warehouse infrastructure in Punjab

Particulars	**1970-71**	**1985-86**	**2000-01**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
No. of regulated markets	88	130	144	145	145	146	146
No. of sub yards attached	154	516	519	294	294	294	294
Average no. of villages served per regulated market	139	94	86	85	85	84	84
Average area served per regulated market (Sq. Km)	573	387	350	347	347	345	345
No. of focal points	NA	362	597	597	596	596	596
Marketed surplus of foodgrains and non foodgrains handled (Lakh tonnes)	NA	132.40	270.56	311.44	325.93	332.05	326.96
Per cent of villages linked with metalled roads	NA	97.59	99.24	99.90	100	100	100
State owned storage capacity (Lakh tonnes)	NA	117.63	251.59	176.39	203.50	251.40	226.33
Storage capacity as % to procurement of Paddy and Wheat	NA	88.11	121.22	56.23	85.44	83.05	99.66

Source: Statistical Abstract, Punjab

Note: NA – Not available.

The information pertaining to proportion of paddy and wheat marketed by the sample farmers through regulated and unregulated markets is presented in Table 4.5.7. In case of paddy the entire marketed surplus on marginal, small and medium categories of farmers was disposed off through the regulated markets only. Large farmers while sold their 98.79 per cent proportion

of marketed surplus through the regulated markets, rest about 1.21 per cent was sold directly to the rice mills in the unregulated or out of the regulated markets. Overall, 99.19 per cent marketed surplus of paddy of sample farmers was sold in the regulated markets.

In case of wheat, on average 98.39 per cent proportion of the total marketed surplus was disposed off in the regulated markets and the rest 2.94 per cent in the unregulated markets. Category-wise, it was the marginal farmers who sold significant proportion of the marketed surplus (18.98%) in the unregulated markets followed by the large farmers (1.61%).

Table 4.5.7: Crop-wise disposal of marketed surplus according to type of market (regulated and unregulated)

(q/farm)

Size Class of Farms	Marketed surplus	Regulated market		Unregulated	
		Quantity	Percent	Quantity	Percent
Paddy					
Marginal	33.24	33.24	100.00	0.00	0.00
Small	86.74	86.74	100.00	0.00	0.00
Medium	171.21	171.21	100.00	0.00	0.00
Large	432.58	427.35	98.79	5.23	1.21
All farms	231.85	229.97	99.19	1.88	0.81
Wheat					
Marginal	23.08	18.70	81.02	4.38	18.98
Small	57.36	57.09	99.53	0.27	0.47
Medium	129.06	128.07	99.23	0.99	0.77
Large	353.56	347.86	98.39	5.70	1.61
All farms	182.83	179.89	98.39	2.94	1.61

The disposal pattern of marketed surplus according to the distance and type of market by the respondent farmers is presented in Table 4.5.8. The entire marketed surplus was disposed through the primary markets and 98.33 per cent of this was sold in the local markets. Average distance of primary market for the respondent farmers was 4.77 km, ranging from 3.93 km for small farmers to 5.18 km for the large farmers.

On average about 89 per cent of the distance to the market covered by the farmers for disposing the marketed surplus was the pucca roads and the rest about 11 per cent was the kutcha roads. None of the marginal farmers had approached the distant market where as other categories had disposed off from 1.67 to 2.08 per cent of their total marketed surplus in the distant markets. For selling in distant market the average cost was worked out at Rs 10.2/q, highest on the large farms (Rs 12.50/q) and the least on small farms (Rs 5/q).

Table 4.5.8: Disposal pattern of marketed surplus according to the distance and type of market (primary and secondary).

Factors	Size of Farm				
	Marginal	**Small**	**Medium**	**Large**	**All farms**
Sale in Local Market (%)	100.00	98.33	97.92	98.15	98.33
Distant Market (%)	0.00	1.67	2.08	1.85	1.67
Avg. Transport Cost (Rs/Qtl.)	0.00	5.00	10.50	12.50	10.20
Type of market					
Primary %	100	100	100	100	100
Secondary %	-	-	-	-	-
Distance to market (Km)	4.01	3.93	5.10	5.18	4.77
Connected with Pucca road (%)	86.53	90.08	89.41	87.84	88.68
Connected with Kutcha Road (%)	13.47	9.92	10.59	12.16	11.32

4.5.5 Technological factors

Technological factors affecting the marketed surplus consists advances in technology both in agricultural production and marketing. Moreover, in order to sustain the market participation of the farmers, the institutional developments need to be accompanied by technological changes.

Over time, technological advances in agricultural production in terms of irrigation intensity, area under HYVs, use of agro-chemicals, agricultural mechanization etc. leading to remarkable increase in state agriculture has already been discussed in section 3.5. Effective price policy through significant increase in Minimum Support Prices (MSP), assured procurement and development of market infrastructure particularly for wheat and paddy coupled with relatively better production technology available has driven the state agriculture at remarkable rate and resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state. Tremendous increase in production of paddy and wheat was coupled with simultaneous increase of marketed surplus/ arrivals of these crops.

Table 4.5.9: Percentage of area covered under purchased seed to the total area under crop.

	Size of Farm				
Name of Crop	Marginal	Small	Medium	Large	All farms
Rice	86.00	75.16	85.94	73.38	79.28
Wheat	16.67	27.58	25.94	18.43	22.45

The seed replacement ratio of paddy and wheat an indicator of technological awareness among the sample farmers is given in Table 4.5.9. The results revealed that 79.28 per cent of the total area under paddy on sample farmers was sown by the purchased seeds. Similarly about 22

per cent of the total area under wheat had been sown by the purchased seeds. Although it seems to be low in case of wheat but it is near to the recommendations of experts in this regard that every year one third of total area under wheat need to sown by replacing the seed.

Chapter 5

Summary, Concluding Observations and Policy Implications

5.1 Main Findings

Wheat and rice contributes significantly in maintaining adequate Buffer Stock of country to meet emergencies like weather vulnerability as well as for domestic market stabilization measures. To meet the increasing demand of the food grains country is heavily dependent on the availability of adequate local supplies particularly from the Punjab state. In Punjab, wheat and rice are the most dominating crop enterprises and this tiny state with only 1.54 percent of the total geographical area of the country contributes about 45 to 70 percent of wheat and 35 to 40 per cent of rice towards the central pool of food grains for last two decades. Looking at the role of Punjab in Indian food security, the present study was taken to generate the authentic estimates on farm level production, farm and family requirements, marketed surplus as well as post harvesting losses of major food grains viz. paddy and wheat in the state. Main findings of study are as followings:

- Percentage share of primary sector in GSDP in Punjab which was 43.55 per cent during 1980-81 declined significantly to 30.98 per cent in 2010-11. Over this period the share of secondary sector in GSDP gone up from 22.47 per cent to 26.04 per cent. Major increase was observed in the contribution from the tertiary sector and its contribution in GSDP went up from 33.98 per cent in 1980-81 to 42.98 per cent in 2010-11. Thus, while the contribution of primary sector consisting of agriculture and allied fields in state income decreased overtime in a major way (about 13 per cent), the contributions from tertiary sector had been observed to be increased tremendously (about 9 per cent).
- During 1980s, the absolute number of holdings in the state especially the number of marginal farmers increased significantly. In 1990s, while the absolute number as well as the proportionate share of marginal and small holdings in total operational holdings decreased, the number and share of relatively large size categories increased. The total operational holdings in state during the recent decade (2000-01 to 2010-11) increased by about 61 thousands from 9.97 lakh to 10.58 lakh. Point worth noting in recent decade is

the marginalization of holdings with proportionate increase in marginal and small farmers.

- In last four decades, the production of wheat in state has gone up by about three times from 5.62 million tones in 1971-72 to 16.5 million tones in 2010-11. Similarly, production of rice another major crop of state, during this period increased by about twelve times from 0.92 million tonnes to 10.8 million tonnes. Total food grain production over this period increased by more than three and half times. Yields of wheat, paddy and total food grains nearly doubled over this period of time. Paddy and wheat together constituted about 80 per cent of the gross cropped area in state during 2010-11.
- During first three decades (1970 to 2000), the area, production and yield of wheat in state increased with a falling compound annual growth rates (CAGR) and ultimately these became almost stagnant since the last decade (2000s) with some variations. On an average the area, production and productivity of wheat increased with a growth rate of 1.08, 3.07 and 1.97 per cent, respectively.
- The growth in production of rice was more pronounced in 1970-71 to 1979-80 as compared to the subsequent decades. Overall at state level, the decadal CAGR of both area under rice and its production though remained significantly positive, but declined continuously over the decades with some variations. On an average from 1970-71 to 2009-10, the area, production and productivity of rice in Punjab increased at CAGR of 4.79, 6.42 and 1.56 per cent, respectively.
- In Punjab, the market arrivals of paddy increased from 6.37 lakh tones during 1970-71 to 131.36 lakh tones during 2010-11. The market arrival of wheat in the corresponding period increased from 23.75 lakh tones to 102.78 lakh tones. Marketed surplus ratio taken as proportion of market arrivals to total production of paddy and wheat in state during 1970-71 was 0.62 and 0.49, respectively. Overtime during last four decades, these ratios of both paddy and wheat in state increased significantly and were observed to be 0.81 and 0.62 during the year 2010-11.
- The study districts viz. Gurdaspur, Sangrur and Ferozepur constituted about 9, 6 and 7 per cent of the total state population, respectively. All the selected districts were found to be dominated by the rural population as about 70 to 75 per cent of total population of these districts residesd in the rural areas. The cropping intensity in Sangrur was found to

be relatively high at 198.08 per cent. In Ferozepur and Gurdaspur districts it was recorded at 187.74 per cent and 175.87 per cent, respectively. Use of fertilizer, the most important agricultural input was found out to be relatively high at 527 kg per net sown ha in Sangrur district as compared to that of 410 kg per ha in Ferozepur district and 395 kg per ha in Gurdaspur district. Similarly the number of tractors for every thousand hectare of net sown area was higher in case of Sangrur district (171) as compared to Ferozepur district (122) and Gurdaspur district (51). Productivity per gross cropped ha of foodgrains, was found to be much higher in Sangrur district (4731 kg/ha) followed by Ferozepur district (3988 kg/ha) and Gurdaspur district (3732 kg/ha). The cropping pattern of the study districts was dominated by the food grains mainly wheat and paddy. In all of the study districts, 100 per cent villages were electrified and linked with the roads.

- All of the sample farm households were having male as the family head and the average age of head of the family in over all sample farm households was about 48 years. Overall 97 per cent farmers reported agriculture as their main occupation, the highest by large category farmers (99.07 per cent) and the lowest by marginal farmers (88.89 per cent). Average years of schooling of households on the sample farms in state was found to be 7.39 years with highest (8.05 years) in case of large farmers and the least (5.98 years) in case of small farmers. The average size of family on sample farm households in state was 6.47 consisting of 3.46 males and 3.01 females. Largest average family size of 7.27 members was recorded on large category farm households and the least in case of marginal category (4.97). Overall 96.33 per cent of sample farmers belonged to the general category, and other 1.67 and 2 per cent belonged to schedule casts (SC) and other backward casts (OBC), respectively.
- Overall average operational farm size on sample farms was 4.22 ha comprising 3.23 ha of owned land and 0.99 ha of leased in land. The average operational area on marginal, small, medium and large category farms was 0.77, 1.61, 3.09 and 7.82 ha, respectively. Overall 34.33 per cent of the sample farm house holds leased in the land accounting for the 23.40 per cent of the operation area on an average. The incidence of leasing in land to increase the farm size was found to be directly and positively related to the farm size. There was adequate availability of irrigation water as entire operational area on the

sample farms was under assured irrigation. Number of sources of irrigation increased with the increase in farm size and was found to be highest on large size category farms.

- The average investment on machinery on the sample farms was worked out to be Rs 58321 per ha. Overall, the largest investment per ha was on the tractors and implements (Rs 48417) followed by tubewells (Rs 7331) and combine harvesters (Rs 2437). The respective per ha investment on marginal, small, medium and large farms was found to be Rs 23220, Rs 43885, Rs 71720 and Rs 56419, respectively.
- Overall on sample farms the total number of livestock units per farm was found to be 5.65 comprising of 1.10 cattle, 2.70 buffalo and 1.85 others. Category wise number of livestock units per farm increased with the farm size.
- Paddy and wheat were major crops on all the farm size categories and on average accounted for 40.38 and 45.66 per cent of the gross cropped area on the sample farms in state. Other important crop on sample farms was the fodder followed by basmati and sugarcane.
- The average production of paddy on sample farms was 233.33 q/farm, which along with carry over stock of previous year, lead to the net average availability at 233.41 q/farm. The production of paddy during the reference year on marginal, small, medium and large farms was 34.01, 87.83, 172.40 and 434.77 q/farm, respectively. The net average availability of paddy on the respective categories was 34.02, 87.86, 172.44 and 434.94 q/farm.
- The production of wheat during the reference year on marginal, small, medium and large farms was 34.12, 72.47, 147.61 and 381.05 q/farm, respectively. The average availability of wheat on the respective categories was 34.94, 73.58, 149.54 and 384.36 q/farm. The overall average production and availability of wheat on sample farms was worked out at 203 q/farm and 205.13 q/farm, respectively.
- In case of paddy crop, overall average productivity on sample farms was recorded at 6945 kg per ha and it varied from the lowest (6458 kg/ha) on marginal farms to the highest (7012 kg/ha) on the large farms. Wheat average productivity was found to varying from the highest (5420 kg/ha) on the large farms to the lowest (5104 kg/ha) on small farms. Overall the average productivity of wheat on sample farms was 5342 kg per

ha. With some variations the crop productivity was relatively more on the larger size farms.

- On average, per farm losses of paddy on sample farms during different harvesting operation turned out to be 535.96 kg., and almost entire loss occurred during harvesting stage (535.94 kg). Reason being that almost entire crop has been harvested by combine harvesters. An insignificant output was harvested manually which needed threshing as separate operation and that also only on marginal farms.
- On average, per farm losses of wheat on sample farms during different harvesting operation turned out to be 398.81 kg. Per farm average loss during mechanical method and manual method was worked out to be 391.64 and 7.17 kg, respectively.
- The mode of transportation from field/farm to market was tractor-trolley as revealed by the all the sample households. The average quantity loosed of paddy during transportation was worked out to be 0.35 quintal per farm household. Category wise the total loss of paddy during transportation to market was 0.07, 0.13, 0.24 and 0.67 q per farm on marginal, small, medium and large farms, respectively. Except on marginal farms the entire transportation loss of paddy was during transporting it from farm/field to the market.
- All of the farmers who manually harvested their wheat crop had transported it to the threshing floor on head only. Tractor-trolley was the only mode of transportation used by the sample households to transport their produce from field/farm to the market. Overall average transportation losses of wheat on sample farm households was 0.27 quintal per farm comprising of 0.03 and 0.24 q per farm loss from field to threshing floor and from farm to market, respectively. Respective proportionate loss during these two operations accounted for 11.11 and 88.89 per cent of the total transportation loss of wheat.
- All of the sample farmers used gunny bags and pucca storage with cemented floor and roof for storing paddy. Overall average quantity stored per farmer was 1.48 quintal. Storage loss varied from a minimum 1.66 per cent of total stored quantity on marginal farms to the highest i.e. 2.93 per cent on the small farms.
- The mode of storage in case of wheat crop was steel bins used up to about 90 per cent of the storage capacity with the average wheat stored at 20.18 quintal per household. This stored produce was gradually withdrawn from the storage drums as per requirement for

consumption, seed, feed and other purposes by the sample households and, therefore, was stored for the whole year. The storage losses reported by the sample households were found to be very low and varied from 0.54 per cent of total stored wheat on medium farms to 0.72 per cent on marginal farms.

- Losses of paddy at various stages of handling viz. Harvesting, transportation and storage accounted to be 2.30, 0.15 and 0.02 per cent of total production. Wheat losses at the respective stages of handling were found out to be 1.97, 0.13 and 0.06 per cent of total farm production on the respondents.
- Overall on average the total retention of paddy per farm was 1.48 quintals, out of which 37.16 per cent was retained for self consumption followed by for payments in kind (35.14%), feed (14.19%) and as seed (12.16%). On marginal, small, medium and large farms the quantity of paddy retained was worked out to be 0.77, 1.09, 1.19 and 2.16 q/farm, respectively. Out or the respective quantity retained on various farm size categories the major proportion was retained for self consumption followed by that for kind payments. Total retention of paddy on sample farms on an average accounted for 0.64 per cent of farm production. Purpose-wise the home consumption, payment in kind, feed and seed accounted for 0.24, 0.22, 0.09 and 0.08 per cent of paddy production, respectively. Percentage share of total as well as purpose-wise retention of paddy in total farm production declined with the increase in farm size.
- Overall on average the total retention of wheat per farm was 20.17 quintals, out of which 62.96, 16.17 and 15.27 per cent of the total quantity was retained for self consumption, feed and seed purpose, respectively. About 1.39 per cent of total quantity retained was used for kind payments and the rest 4.21 per cent for other miscellaneous purposes. Total retention of wheat on sample farms on an average accounted for 9.95 per cent of farm production. Purpose-wise the home consumption, seed, feed and payments in kind accounted for 6.26, 1.52, 1.61 and 0.14 per cent of wheat production, respectively. Percentage share of total as well as purpose-wise retention of wheat in total farm production declined with the increase in farm size. Total wheat retention on marginal, small, medium and large farms accounted for 32.42, 20.82. 12.57 and 7.21 per cent of total production.

- The marketed surplus accounted for 99.37 per cent of the paddy output on the sample farms. Category-wise the ratio of marketed surplus to production of paddy was recorded highest on the large farms at 99.50 per cent and the least on marginal farms at 97.74 per cent. The entire marketed surplus on different categories of farms was disposed off in the months of October and November viz. immediately after harvesting and 99.20 per cent of this was sold to the government procurement agencies at the MSP of Rs 1110/q. The average distance covered to sell the marketed surplus was only 4.78 km. A very small proportion of marketed surplus on large farms was sold to the private traders and processors who purchased at relatively low prices.
- The marketed surplus accounted for 90.06 per cent of wheat output on the sample farms. Category-wise the ratio of marketed surplus to production of wheat was recorded highest on the large farms at 92.79 per cent and the least on marginal farms at 67.64 per cent. Regarding time of sale, it was found that entire marketed surplus on different categories of farms was disposed off in the months of April and May viz. immediately after harvesting of the crop and 98.39 per cent of this was sold to the government procurement agencies at the MSP of Rs 1285/q. The average distance covered to sell was only 4.57 km. Contrarily to the other farm size categories, a significant proportion of the marketed surplus on marginal farms was sold to the processors (4.81 %) and to others (14.17%), although the prices received from them were same as provided by the government procurement agencies.
- Most important socio-economic factor influencing the marketable surplus of wheat and paddy was the operational area on the farm. Size of the operational area had a positive relationship with the marketed surplus. Crop farming as main occupation has also positive effect on the marketed surplus of the study crops. Education of household head taken as years of schooling had shown positive relationship with the marketed surplus. On the other hand, under social grouping the belonging of farm household to schedule casts or other backward class had shown the negative relationship with the marketed surplus of wheat and paddy crop.
- Under Agricultural Produce Markets Act, 1961 the market charges in Punjab have been regularized and transactions are conducted by open auction in the regulated markets. The weights and measurement act provides for standardization of weights and measures used

in the markets. The number of regulated market in Punjab has increased from 88 in 1970-71 to 146 in the year 2010-11. Over this period, the geographical area and average number of villages served per regulated market in Punjab decreased from 573 to 345 sq. km and from 139 to 84, respectively. This assured market for paddy and wheat has great effect on the generation of marketed surplus of these crops. Print media mainly the news papers was the major source of price information of the respondents. Other major sources of the market information were the Primary Agricultural Cooperative Societies followed by Market Committees and traders. Larger size categories of farmers were found to have better access to the print media as compared to the smaller size categories. Marginal farmers were found to be relatively more dependent on traders for this purpose. Overall, 96 per cent of the sample farmers were having access to the credit. Major source of the credit was found to be Primary Agricultural Credit Societies (54.51 %) followed by commission agents (35.42 %) and commercial banks (9.38 %).

- Looking at infrastructure, Punjab Mandi Board the coordinating body for market committees played the lead role in developing market yards on priority to facilitate the efficient marketing of farm produce. Hundred per cent villages of Punjab are linked with the all weather metalled roads which helped in efficient marketing of farm output in state. With large scale state procurement of food grains in the recent years many steps has been taken and total state owned storage capacity increased from 176.39 lakh tons in 2007-2008 to 226.33 lakh tones in 2010-11 which was almost equivalent to the total state procurement of wheat and paddy in the state.
- In case of paddy the entire marketed surplus on marginal, small and medium categories of farmers was disposed off through the regulated markets only. Large farmers while sold their 98.78 per cent proportion of marketed surplus through the regulated markets, and rest 1.21 per cent was sold by them directly to the rice mills in the unregulated or out of the regulated markets. In case of wheat the entire marketed surplus was disposed through the primary markets and 98.39 per cent of this was sold in the regulated markets. Average distance of primary market for the respondent farmers was 4.77 km, ranging from 3.93 km for small farmers to 5.18 km for the large farmers. On average about 89 per cent of the distance to the market covered by the farmers for disposing the marketed surplus was the pucca roads.

- ❖ Effective price policy through significant increase in Minimum Support Prices (MSP), assured procurement and development of market infrastructure particularly for wheat and paddy coupled with relatively better production technology available has driven the state agriculture at remarkable rate and resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state. Tremendous increase in production of paddy and wheat was coupled with simultaneous increase of marketed surplus/ arrivals of these crops.

5.2 Conclusions

To meet increasing demand of the food grains, country is heavily dependent on the availability of adequate local supplies particularly from the Punjab state. In Punjab, wheat and rice are the most dominating crop enterprises and this tiny state with only 1.54 percent of the total geographical area of the country contributes about 45 to 70 percent of wheat and 35 to 40 per cent of rice towards the central pool of food grains for last two decades. Looking at the role of Punjab in Indian food security, it is important to estimate marketable and marketed surplus of wheat and rice in the state. Equally important is to know the proportion of farm and family requirements and post harvest losses of these important food grains. The study is important in providing the authentic estimates on marketed surplus as well as post harvesting losses of major food grains and thus availability of food grains for human consumption in the state and country.

To meet the specific objectives of the study, at first stage of sampling three major wheat and paddy growing districts (14 per cent of the total number of districts) viz. Gurdaspur, Ludhiana and Ferozepur were selected. These districts besides being major producers of the study crops also represent three agro ecological regions of the state. The selected sample districts accounts for 26 per cent of the area as well as production of study crops in Punjab state. At second stage two major wheat and paddy producing blocks from each of the selected district were selected. Thus, overall six blocks from the sample districts were selected. At next stage of sampling a total of twelve villages i.e. two villages each from the selected blocks were selected randomly for the farm household survey. Overall from the selected villages, total sample of 300 paddy-wheat cultivating farm households, comprising 36 marginal, 60 small, 96 medium and 108 large farmers formed the basis for present enquiry. The comprehensive survey was conducted in the sample villages at end of crop year 2011-12 (Reference year). In addition to the primary data collected from the farmers, relevant secondary data were collected from various

published sources. Tabular analysis and simple statistical tools such as averages and percentages were used for the interpretation of the results.

The results of primary data revealed that overall average operational farm size on sample farms in state turns out to be 4.22 ha comprising 3.23 ha of owned land and 0.99 ha of leased in land. The incidence of leasing in land to increase the farm size was found to be directly and positively related to the farm size. Paddy and wheat were major crops on all the farm size categories and on average accounted for 40.38 and 45.66 per cent of the gross cropped area on the sample farms in state. With some variations the crop productivity of paddy and wheat was relatively more on the larger size farms. Major proportion of output of both of the study crops was harvested mechanically and very low output (insignificant in case of paddy) was harvested manually. The mode of transportation field/farm to market was tractor-trolley as revealed by the all the sample households. The average per farm quantity loosed during transportation of paddy and wheat was worked out to be 0.35 and 0.27 quintal, respectively. All of the sample farmers used pucca storage with cemented floor and roof for storing paddy and metal bins for wheat. Storage loss of paddy varied from a minimum 1.66 per cent of stored quantity on marginal farms to the highest i.e. 2.93 per cent on the small farms. Similarly for wheat the storage losses reported by the sample households were found to be very low and varied from 0.54 per cent of total stored wheat on medium farms to 0.72 per cent on marginal farms. Overall losses of paddy and wheat at different stages of handling accounted for 2.47 and 2.16 per cent of the total production of the respective crops.

Total retention of paddy on sample farms on an average accounted for 0.64 per cent of farm production. Purpose-wise the home consumption, payment in kind, feed and seed accounted for 0.24, 0.22, 0.09 and 0.08 per cent of paddy production, respectively. Percentage share of total as well as purpose-wise retention of paddy in total farm production declined with the increase in farm size. Total retention of wheat on sample farms on an average accounted for 9.95 per cent of farm production. Purpose-wise the home consumption, seed, feed and payments in kind accounted for 6.26, 1.52, 1.61 and 0.14 per cent of wheat production, respectively. Percentage share of total as well as purpose-wise retention of in total farm production declined with the increase in farm size. Total wheat retention on marginal, small, medium and large farms accounted for 32.42, 20.82. 12.57 and 7.21 per cent of total production.

The marketed surplus accounted for 99.37 and 90.06 per cent of the paddy and wheat output, respectively. The entire marketed surplus of both of the crops was disposed off in months immediately after harvesting and about 99 per cent of this was sold to the government procurement agencies at the MSP. The average distance covered to sell the marketed surplus was less than 5 km.

Among factors affecting the marketed surplus, size of the operational area, crop farming as main occupation and education had a positive relationship with the marketed surplus. On the other hand under social grouping the belonging of farm household to schedule casts or other backward class had shown the negative relationship with the marketed surplus of wheat and paddy crop. The assured market for paddy and wheat has great effect on the generation of marketed surplus of these crops. Print media mainly the news papers was the major source of price information of the respondents. Marginal farmers were found to be highly dependent on traders for this purpose. Overall, 96 per cent of the sample farmers were having access to the credit, major source being the Primary Agricultural Credit Societies (54.51 %) followed by commission agents (35.42 %) and commercial banks (9.38 %). Effective price policy through significant increase in Minimum Support Prices (MSP) has resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state, thus increasing the overall market arrivals of these crops. Effective price policy through significant increase in Minimum Support Prices (MSP), assured procurement and development of market infrastructure particularly for wheat and paddy coupled with relatively better production technology available has driven the state agriculture at remarkable rate and resulted into the emergence of paddy and wheat crops as the most secure and profitable ones in the state. Tremendous increase in production of paddy and wheat was coupled with simultaneous increase of marketed surplus/ arrivals of these crops.

5.3 Policy Implications

In Punjab state the advancement of agricultural technologies as well as improvement in market infrastructure contributed significantly in the overall development of farm sector by ensuring better returns to farmers through tremendous increase in production of rice and wheat as well as marketed surplus of these crops. The present policy of providing assured marketing of paddy and wheat at procurement prices had played great role in remarkable increase in market arrivals of these crops through providing favorable technological/institutional and infrastructural

developments and, thus ensuring the food security in country. Any change in this policy need to be examined in the context of serious issue of food security.

Looking at the role of infrastructural and institutional factors in generating marketed surplus and development of farm sector in Punjab, all states need to regulate the markets and provide all weather roads to the villages. As significant proportion of farmers especially the marginal still dependent upon the traders for price information, there is need of providing wider coverage to collecting and dissemination of agricultural market intelligence/information so that prices prevailing in each and every market is available to them for making adequate marketing decisions. Lack of awareness regarding future trading and use of Warehouse Receipts Programme among the farmers of agriculturally most developed state of Punjab suggests for taking serious and effective steps for promotion of these services.

Sale of almost entire marketed surplus of farmers immediately after harvesting has serious implications in the form of handling and storage costs to the procurement agencies. Farmers need to be encouraged to opt for farm level storage through helping in creation of efficient storage structures at farm level. Staggered procurement by having functional rise in price from post harvest to lean period may help in this regard. Harvesting losses accounted for the major proportion of the total losses at various stages of handling in both of the paddy and wheat output. To minimize the harvesting losses during harvesting operations strict standard need to be fixed and applied on the manufacturing of harvesting machinery (combine harvesters).

It can be concluded that with exiting technology and policy the farm level marketed surplus of rice and wheat in state have been reached at almost its peak level (99.37 and 90.06 per cent of the paddy and wheat output). As there is no further scope for increase in area under these crops, the future increase in marketed surplus on state farms depends only on the technological breakthrough leading to significant rise in paddy and wheat productivity.

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