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Assessment of Marketable and Marketed Surplus of

Major Food-grains in Haryana

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PREFACE

The present study sponsored by the Ministry of Agriculture, Government of India is aimed at assessing the Marketable and Marketed Surplus of Major Foodgrains in Haryana by examining growth, domestic consumption, retention for seed, feed and kind payments. Primary as well as secondary sources of data have been used in order to fulfill these objectives. Primary data were collected through a field survey of 300 farmers in the selected districts of Karnal and Bhiwani in Haryana growing paddy, wheat and bajra.

The results of this study reveal (i) growth in production of paddy, wheat and bajra in Haryana was 4.01, 3.81 and 3.35 per cent per annum between 1980-81 and 2008-09. In case of paddy, it was driven by area expansion while area as well as yield was responsible for growth in wheat production. Bajra was an exception since, growth in production occurred exclusively due to yield growth despite negative growth in area, (ii) the districts of Mewat, Bhiwani and Mahendergarh registered higher growth in the production of paddy, wheat and bajra, respectively, despite low coverage of irrigation (iii) farmers retained 0.88 per cent of paddy, 6.95 per cent of wheat and 1.31 per cent of bajra produce for domestic consumption, (iv) marketed surplus of paddy, wheat and bajra on sampled farms was 95.49, 84.26 and 81.47 per cent respectively. It was found relatively low in farms upto size class of 2 ha. but the proportion steadily increased thereafter, (v) a positive relationship emerged between farm size and share in the total marketed surplus of selected foodgrains since quantum of production was found to be the major determinant of marketed surplus, (vi) infrastructural, institutional and technological factors together facilitated growth in marketed surplus and production.

The following policy measures are suggested to improve the marketed surplus scenario of paddy, wheat and bajra in Haryana (i) Haryana has a great potential of increasing marketed surplus by raising yield rates in districts with limited irrigation availability by facilitating adoption of technology with full package of practices, (ii) in view of extremely limited scope of area expansion in major paddy areas, priority may be accorded to R & D in yield raising innovative technologies to further increase production, (iii) Provision of institutional credit for small and marginal farmers for agricultural purposes on easy terms and conditions by expanding institutional sources of credit, (iv) making efforts to popularize use of ICT for eliciting information on important matters related to agriculture

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INTRODUCTION

1.1 Status of Agricultural Economy in Haryana:

Haryana state and the green revolution in Indian agriculture were born simultaneously in 1966-67. This year was a turning point in the course of development of agriculture in the state. With 1.3 per cent of the country's area and around 2 per cent of its population, Haryana is one of India's smaller states, a "Lilliput among Titans", but within a span of around five decades, it has made remarkable progress in agricultural sector and a front-runner amongst the states in terms of per capita income. For understanding this phenomenon, an insight into its past is essential.

Agriculture occupies a dominant place in the economy of Haryana and is favorably placed in respect of water resources and soil potential. The old and new alluviums are ideal for the production of wheat and rice under irrigated conditions. Of the total cropped area, more than two-third is shared by foodgrains. In addition, cash crops such as sugarcane, oilseeds and cotton are also grown. The legumes are gradually loosing area. The introduction of these crops in crop rotation may increase production of fine foodgrains due to complementary relationship between grains and legumes, since legumes are known for nitrogen fixing quality. This will reduce cost of production and improve farm economics. The farmer must search for the combinations through diversification of crops that will provide higher farm business income from his limited land and economic resources. It is imperative to determine the most profitable and environmentally sustainable crop rotation, using value productivity and cost of production per hectare for each crop over a period of three to four agricultural years.

There has been a sharp shift in area under various crops. It has shifted in favor of those crops, which provide higher returns due to increasing productivity, or increasing prices or both i.e. rice, wheat, rapeseed-mustard and American cotton. For the above mentioned crops, in particular, growth in area and yield has been impressive but growth in area was comparatively higher. In view of higher

proportion of area under rice-wheat rotation and rice being major consumer of irrigation water, the state is experiencing sharp decline in groundwater table and deterioration in the agro-economic system. It is therefore, important to reduce area under this crop rotation system in order to sustain production and agro-eco-system of the state in the long run.

So far, potential of the new seed-fertilizer technology has been fully exploited in Haryana. The limited scope for expansion of irrigation facilities via canals was circumvented by increasing number of tube wells and pumping sets from about 28,000 to over five lakh. Haryana has been catapulted to the forefront of agricultural scene in the country. The higher growth in various sectors of economy could help in visualizing overall perspective. During the period 1981-91, GSDP grew at 6 to 7 per annum, sustained by a 7-8 per cent per annum growth in the industrial and service sectors and a 4 per cent growth in the agricultural sector. It has been contributing about 3 per cent to the national income (GDP). The share of the industrial sector in the GSDP in 1980-81 was 19.46 per cent, which rose to 29.07 per cent in 2010-11. Conversely, though agriculture continues to have a dominant place in economy, its share in GSDP has come down from 53.78 per cent in 1980-81 to 20.92 percent in 2010-11. The share of the service sector has appreciated from 26.76 per cent to 50.01 per cent during this period.

1.2 Objectives of the Study:

The present study was undertaken with the following specific objectives.

(i) To estimate the magnitude of marketed and marketable surplus of wheat, paddy and bajra.

(ii) To estimate the retention of above mentioned crops for consumption, seed, feed, wages and other payments in kind.

(iii)To analyze crop losses in harvesting and other operations.

(iv)To examine the role of various factors such as institutional, infrastructural, socio-economic in influencing marketed surplus.

1.3 Concept of Marketed and Marketable Surplus

Efficient marketing of food grains plays an important role in sustaining the level of economic development. Efficient marketing system is important in order to ensure that scarce and essential commodities reach the consumers. It not only maintains the balance between demand and supply but also is a link between the producers and consumers. It maintains price stability and ensures equitable distribution of goods and services that lead to rapid economic development.

Agricultural marketing is the most important multiplier of agricultural development as it helps in stimulating production and consumption. From the marketing point of view, producer's surplus is one of the most important concepts. Producer's surplus is defined as the quantity which is actually made available to the non-producing population of the country. The pace of agricultural development is determined by the rate at which agricultural production expands. However, it is the growth in the marketable surplus that determines the level of economic development. Producer's surplus can be broadly classified into two types, namely:

Marketable Surplus: It is the quantity of total produce which can be made available to the non-farm population of the country. It is a theoretical concept and is the left over produce with the producer-farmer after meeting personal requirements i.e. family consumption, requirements for seeds, feed for cattle and payment to hired labor and artisans in kind, rent to the landlord in case of sharecropping and social and religious payments in kind.

Marketed Surplus: It is the quantity of the total produce which the producer actually sells in the market, irrespective of his total personal requirement. It may be more, less or equal to the marketable surplus.

$$Marketed\ surplus \gtreqless Marketable\ surplus$$

Factors affecting Marketable Surplus

S. No.	Factors	Relationship with marketable surplus
1.	Size of Holding	Positive
2.	Production	Positive
3.	Price of the commodity	positive and negative (depending upon short run or long run or micro and macro considerations)
4.	Size of the family	Negative
5.	Nature of Commodity	Higher for non-food crops like cotton than food crops like wheat.

Source: Acharya and Agarwal, 5th edition, 2011

Relation between Marketed Surplus and Marketable Surplus

S.No.	Condition	Reason	Relation with the price level
1.	Marketed surplus > Marketable Surplus	This is true in case of small and marginal farmers as their need for cash is more immediate. This kind of sale is called distress or forced sale.	Fall in the price level leads to an increase in the distress sale as more quantity needs to be sold to meet the cash requirements.
2.	Marketed Surplus < Marketable Surplus	Larger farmers retain more of produce to sell it at higher price in later period.	Fall in the price level, decreases the level of marketed surplus as producer-farmer retains it for later period.
3.	Marketed Surplus = Marketable Surplus	A farmer neither retains more nor less than his actual requirement. It happens in the case of an average farmer.	Impact of change in the price level is ambiguous.

Source: Ibid

Prior to green revolution in mid sixties, marginal and small farmers carried out subsistence cultivation of foodgrains primarily to fulfill family requirement. Now, the farmers with the same size of holdings are in a position to have surplus produce as they have been adopting improved technology which has substantially raised the level of farm productivity. If area under food grains in the marginal/small holdings is insufficient to yield the minimum quantity of foodgrains for family consumption, they depend on alternatives. Sometimes, unavoidable circumstances induce the poor farmers to sell the produce that had been kept for family consumption, at lower prices after harvest and later on, they purchase the same produce at higher prices and this leads to a negative surplus. Under such circumstances, they repurchase the required foodgrains from the farmers with surplus or from the retail market to meet their home consumption. This indicates the extent of distress sales by small holders on one hand and their dependence on other sources.

All farmers with different size of holdings may not be expected to have the same proportion of produce as marketable surplus. It depends on the distribution of food grains among various components of retention and repurchases. Farmers, normally retain produce for family consumption, seed, feed, payments in kind and other purposes. If they retain higher proportion of produce for these purposes, marketable surplus will be lower. Therefore, it is important to investigate the details of retention. We have explored factors affecting the marketable surplus and its determinants in Chapter-IV. The farm to farm variations in production and retention affect marketable surplus. In this context, differences in availability in terms of stock from previous year, magnitude of repurchases and distress sale become important. The distress sale of the produce by marginal/small farmers takes place in agriculturally backward areas where incomes are low and therefore, these groups are hard pressed to sell the produce immediately after the harvest in order to fulfill other basic requirements. On the other hand, farmers in prosperous states like Haryana which occupy an outstanding position in green revolution states do not opt for distress sale in normal circumstances. As a result, agriculture has commercialized and phenomenon of distress sale has become insignificant. They market the produce

after keeping a portion of produce for their own requirement. The marketed surplus is that part of the produce which is actually marketed by the farmers.

1.4 Review of Literature

The study of marketable and marketed surplus of food grains in India has received inadequate attention by the scholars. The available studies on the subject can be grouped into two categories. The first category consists of those studies which estimate the distribution of marketable and marketed surplus across the farm sizes at the national and state levels with the help of aggregate data by using indirect approach (Narain, 1961; Sharma, 1972; Patnaik, 1975 and Gulati, 1980; etc.). The second category of studies is based on direct approach and estimated marketed surplus by using micro level data (Bhattacharjee, 1960; Dhandekar, 1964; Raj Krishna, 1965; Agarwal, 1970; Nadakarni, 1980, etc.).

A study by Narain (1961) deals with the problem of distribution of marketed surplus of farm produce by size groups. Working with the relevant data relating to 1950-51, he found that marketed surplus as a proportion of output followed a U-shaped pattern with respect to the size of the operational holding. He also brought out another aspect of the problem i.e. marketed surplus had a negative response to a rise in price, implying a negative income effect for a given change in price. These results implied that a given transfer of land from large to the small farmers through Land Ceiling Acts would not reduce the marketed surplus.

Another study by Sharma (1972) based on indirect estimation used the data of 1961 Population Census about cultivating households, Farm Management Survey results on area under cultivation and productivity of food grains and the data on consumption of food grains from the second Agricultural Labor Enquiry and NSS, 15th Round. It was found that size class up to 5 acres had a negative marketable surplus at the national level and also in states except Andhra Pradesh, Kerala and Tamil Nadu. Even the next size class of 5 to 10 acres showed a deficit in Gujarat and Maharashtra, though it showed a positive surplus in other states and at the

national level. The proportion of marketable surplus to net production of food grains also increased consistently with an increase in the size of holding.

A study conducted by Patnaik (1975) using 1960-61 data found that the behavior of marketed surplus as a proportion of output was not U-shaped but simply a rising one. She found that share of medium (10-30 acres) and large cultivators (more than 30 acres) in the total marketed surplus had increased and that of small cultivators (0-10 acres) had dwindled. The study explains the decline in the contribution of small cultivators from 46.5% to 33.24% in 1950 in terms of the concentration of economic resources in the hands of large cultivators who dominated the agrarian scene not numerically but economically.

Another study conducted by Gulati (1980) by using 1971-72 data found that marketed surplus keeps on increasing as holding size increases. His findings also revealed that contribution of small cultivators (0-10 acres) in the total marketed surplus is quite significant (45.75%) as compared to the contribution of large farmers (17.28%). Gulati's plausible explanation for this phenomenon was in terms of the pattern of net area leased-in and leased-out by various size groups. The smallest cultivator leased-in heavily on net basis and therefore, has to pay out comparatively higher amount of kind rents. This raises his retentions and hence, depresses marketed surplus which is in contradiction to what happens in case of large cultivators.

In all these studies, ratio of marketed surplus was quite high for the richest cultivators. This shows economic independence of rich farmers. Marketed surplus as a percentage of output increased with a rise in operational holding as compared to the 1950-51 and 1960-61 results. This shift has been observed because of technological and institutional changes in agrarian structure which occurred between 1960 and 1971.

However, all India studies on the distribution of marketed surplus of food grains by size class are not available for the recent period. But, we have a number of micro level studies which throw some light on important issues related to marketable and marketed surplus. These studies have been undertaken with a

view to estimate the magnitude of marketable and marketed surplus of various crops by size class besides studying income levels, productivity, price response and factors determining the marketed surplus.

Bhattacharjee (1960) in his study analyzed the data pertaining to six villages from the states of Bihar, Orissa and West Bengal for the period 1955-56 and 1956-57. He considered small farmers as those with a holding of less than two hectares. These farmers are said to have contributed less than one-fourth of the total marketed surplus in relation to farm size and the same was found to vary with the level of development of the village. An important conclusion of this study was the decline in the phenomenon of distress sales and the growing significance of speculative and precautionary motives in influencing the quantities of physical supplies.

An important study by Dhandekar (1964) indicates the role of large farmers with respect to their marketed surplus. His study is based on the data gathered from Farm Management studies carried out in Akola and Amravati districts for the period 1955-57. The farmers whose holdings were large enough to satisfy their requirements for food grains (wheat, jowar, etc.,), constituted only 10% of the sampled farmers.

A paper by Raj Krishna (1965) is based on direct observations and is one of the pioneering studies that covered a wide range of samples in order to identify and measure the effect of other factors which determine the quantity of marketed surplus of a subsistence crop contributed by various households in a poor and partially monetized economy. Based on data available with the Agro-Economic Research Centres and the Punjab Board of Economic Enquiry for the period of fifties and early sixties for 23 samples from eight states of India, the study tried to explain the functional relationship between marketable surplus and output. However, it does not explain the distribution of surplus either by size of holding or by the size of output to evaluate the relative significance of the subsistence cultivators in relation to their control over marketed surplus. The marketable surplus function turned out to be linear in the case of a majority of the samples

analysed with a negative intercept suggesting: i) constant marginal propensity to sell (MPS) over a wide range of output above the minimum subsistence, ii) average MPS or the sale ratio increased with the increase in output but at a decreasing rate, iii) elasticity of sales with respect to output was found positive and high; 1.04 to 1.06 in respect of wheat and 1.04 to 1.36 for most rice samples, iv) MPS varied widely between different regions; more than 0.80 in Punjab villages, around 0.50 in Maharashtra and more than 0.90 in the Delta villages of Andhra and Madras.

The paper by Beherman (1966) is concerned primarily with the price response of the marketed surplus of a single crop for various adjustment periods. A model is derived for the estimation of this response. The study indicated that estimates of the price elasticity of the marketed surplus for Thai rice were positive because the estimates of the total production response were positive and no counteracting income effect on consumption was observed. The results of the paper indicate that there is statistically significant positive short-run price response in both total and marketed supplies of Thai rice. Limited short-run supply increases, therefore, could be expected to result from increasing the domestic price of rice through measures such as a reduction in the export tax.

A paper by Kalpana Bardhan (1970) used linear model to estimate the relationship between marketed surplus as a proportion of food grain production on one hand and other variables, viz. food grain production per adult unit of cultivating population, average price of food grain, value of production of commercial crops per adult unit of cultivating population, average income of cultivators from sources other than the production of crops and index of concentration of cultivated acreage in a village using village survey data of the Agricultural Economics Research Centre, University of Delhi for twenty-seven villages of Punjab and Uttar Pradesh. The variables with statistically significant influence on marketed proportion are production and price of food grains and in some cases, average income from milk production in a village and net disposal of food grains in the form of payments in kind as a proportion of production. The study suggests that in the long run, problem of marketed surplus could be resolved by increase in

output, in the short run, a higher price, given the level of output, does not induce higher marketable surplus and a low price policy need not necessarily go against short run goal of augmenting marketable surplus.

Agarwal (1970), in his study has classified factors affecting the marketed surplus broadly into two categories: (1) factors that affect the volume of production, and (2) factors affecting consumption out of given volume of production. The study was carried out in Etawah district of Uttar Pradesh for the agricultural year 1965-66 and explained marketed surplus as agricultural produce actually sold in the market. The study demonstrates that retention and surpluses were directly related with size of land holdings; the small cultivators retained a major part of output and released less output as surplus for sale.

A micro level study by Nadkarni (1980) illustrates market dependence of different size groups of farm holdings in a millet region in Maharashtra. This study is based on Farm Management data from Ahmed Nagar district- a millet dominated region, where, wheat assumes the role of a cash crop. The results across the different size-classes of farm households revealed negative net marketed and marketable surplus for both jowar and bajra, but in case of wheat such a rise was not sharp. The small farmers were found to be market oriented in selling one food grain and buying another for consumption. The elasticities with respect to output were the highest and above unity in case of marketable surplus but lowest though above unity in case of gross marketed surplus.

Another study by Barbara (1982) established relationship of exchange through an analysis of price and non-price factors conditioning the marketed surplus of paddy in north Arcot district of Tamil Nadu with relatively simple agrarian economy. The data used in the study were derived from a random sample of 200 paddy cultivators, 149 of whom cultivated paddy in 1973-74 over three seasons (samba, the main one with its harvest in January, navarai and sornavari) on the rain fed and irrigated land.

The study by Reddy (1990) estimated marketable and marketed surplus in groundnut by size of farm and analyzed factors affecting marketable and

marketed surplus both in rain fed as well as in irrigated groundnut. Analysis revealed that per hectare marketable surplus in case of irrigated groundnut was about two and a half times that of rain fed groundnut and exhibited positive relation with the size of farm. Further, volume of groundnut production per farm and price of groundnut per quintal had a positive and significant impact on marketable surplus, while home consumption of groundnut per farm, quantity of seed used and size of family had negative impact.

Another study conducted by Chauhan and Chhabra (2005) regarding production, marketed surplus, disposal channels, margins and price-spread for maize cultivation in Hamirpur district of Himachal Pradesh revealed that farm-level marketable surplus comprised of 53.21 per cent of the total production. The practice of storing maize for some time and selling at a later date for higher price led to storage losses to the extent of 0.16 quintal (2.80% of marketable surplus). Much of the marketable surplus of maize (66.92%) was disposed off by majority of farmers (74.56%) during the first quarter (October- December). The main channel in the marketing of maize was Producer →Local trader →commission agent →Processor→ Consumer. This was followed by 71.93 per cent of farmers, accounting for about 70 per cent of the produce.

Further, investigation by Baba et al. (2010) reported growth of vegetable sector in relation to Technology Mission, extent and determinants of marketed surplus and price spread of vegetables in the Kashmir valley. A substantial increase in the area and production of vegetables was observed under Mini-Mission-II scheme of Technology Mission. On an average, producers' marketed surplus was found more than 92 per cent of the total production of selected vegetables. The estimates of regression function revealed that production, area under improved varieties, net price received by producers and education level were significant and positive determinants of marketed surplus, while spoilage at farm level and consumption have showed a negative contribution. The price spread of vegetables with respect to various marketing channels indicated that producers' share had an inverse relationship with the number of intermediaries. The study suggested that coverage

of Technology Mission should be expanded to other niche areas of vegetable cultivation. This study also highlighted the need for effective measures to reduce marketing losses at various stages. It emphasized strengthening of institutions, establishment of processing units and development of market infrastructure in the area.

A recent study by Chauhan and Kumar (2010) concluded that about 63% of the total maize cultivated area was under high yielding varieties (HYV) and remaining 37% area was still under traditional local varieties. The total area under maize, both HYVs and local, showed positive relationship with size of holdings. The study also observed that irrigation played an important role in the enhancing maize production and productivity of both local and HYVs. The marketable surplus of maize estimated at 48% was mostly (72 to 83%) disposed off in second quarter (December-February) due to inadequate storage structure at the farmers level and fear of its spoilage due to attack of insect pests. Results show that production was most dominant and significant factor in determination of magnitude of marketed surplus.

A micro-level study conducted by Dwivedi, Sudhakar and Jha (2011) in West-Champaran district of Bihar assessed the marketable and marketed surplus of rice. Findings show that there were both marketable and marketed surplus on marginal farm households, however, marketable surplus increased with increase in size of land holdings with respect to quantum and proportion to rice production because it is main staple food crop which is grown for home consumption. But, marketed surplus was less than marketable surplus in case of all categories of households because farmers prefer to keep a portion for family consumption and do not like to sell entire quantum stating that agriculture is risk prone and there is no guarantee of good harvest in the next season. The study emphasized on an urgent need to initiate risk mitigating arrangement in Bihar in order to increase marketed surplus of rice.

An investigation by Borate et al. (2011) estimated marketable and marketed surplus of red gram and identified factors influencing surplus in Vadodara district of Gujarat. The author used data collected by him from 120 red gram growers spread over 10 villages of Karjan taluka during 2007-08. A multiple regression technique was applied to gauge effect of various factors influencing marketable and marketed surplus. Results show that marketable surplus was positively and significantly related with cropped area and average productivity in all the four categories of farms. It was negatively related with family size and quantity retained for wages in kind indicating inverse relationship between extent of marketable surplus and these factors. An examination of individual coefficients revealed that marketed surplus was positively and significantly related with total production, current price and financial obligations while family size showed negative sign indicating inverse relationship of marketed surplus with family size on sampled farms.

In a study conducted by Sandhu (2011), percentage of marketable surplus was found lower in case of large farmers (80.85 %) who paid their wages in kind to labors and artisans. On the other hand, share of marketable surplus was observed higher for small farmers (90.85 %). It revealed larger marketed surplus in case of small farmers than other category farmers due to their immediate cash requirement.

The role of marketable surplus in economic development may also be illustrated by the experiences in other countries. Chinn (1976) in his research has pointed out that a substantial increase in marketable surplus in agriculture is a necessary condition for economic development and Taiwan has solved this problem by raising productivity in agriculture. Another study based on primary data collected from 496 farm households covering 16 villages in Bangladesh in 1982 was carried out by Abul Quasem (1987). He has estimated marketed surplus of paddy and has identified market participants by farm size. In addition, determinants of marketed surplus were also examined. He has estimated only 28 and 11 per cent of paddy production as gross and net marketed surplus. Around 47 per cent of selected

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farms have generated this net marketed surplus. The two most important factors affecting the marketed surplus of paddy were per capita production and prices of paddy.

Ahmed et al (2008) attempted to develop and demonstrate procedures for modeling the impact of agriculture technology, adoption decisions on consumption and nutrition in a subsistence-farming context in Southern Honduras in Central America where new sorghum cultivars and erosion control techniques are being introduced. The authors demonstrate that adoption of this technology has resulted in improved nutrition and substantial increase in marketed surplus of sorghum.

The above review of literature on marketable and marketed surplus of different agricultural commodities is useful for policy formulation. The marketed surplus was influenced by farm size, price, level of output, cropped area and yield. Most of the studies however, were confined to only few states such as Punjab, West Bengal, Gujarat and Uttar Pradesh. Even the studies carried out by scholars in other countries were confined to a few countries. Secondly, analysis of retention is limited despite retention being an important component in determining marketed surplus. None of the studies covered crop losses which influence marketed surplus of agricultural commodities. Moreover, studies are confined to period of fifties to nineties. There are hardly studies which cover new millennium. In this background, it would be useful to carry out a detailed study of marketable and marketed surplus of food grains across farm sizes in an agriculturally developed state of Haryana in order to provide latest empirical evidence.

1.5 Organization of the Study

The study is divided into five chapters. Chapter-1 is introductory and presents an overview of agriculture in Haryana, objectives of the study, literature survey and organization of the study. Chapter-2 provides coverage, sampling design and research methodology used in the study. Chapter-3 is devoted to the analysis of structural transformation in the economy and agricultural development in Haryana

during the study period. It also presents district-wise growth rates of area, production and yield of selected crops. Chapter-4 is devoted to empirical results of marketed and marketable surplus of selected crops on the basis of field evidence. In addition, this chapter presents factors affecting marketed surplus. The final chapter presents summary and conclusions of the study.

Chapter-2

RESEARCH METHODOLOGY AND ANALYTICAL FRAMEWORK

The methodology adopted for the selection of study area, sampling design, data collection and analytical framework used in the light of specific objectives of the study is discussed in this chapter.

At the outset, it would be desirable to present an overview of selected foodgrain crops (rice, wheat and bajra) in India. Table-2.1depicts area, production and yield rates of these crops in important producing states along with irrigated area and ratio of marketed surplus based on secondary data during 2010-11.

We begin with wheat story. A perusal of Table-2.1indicates that Uttar Pradesh followed by Punjab and Haryana were the major states in terms of area allocation and production of wheat. These states together shared around 54 per cent of area under wheat while Bihar, Gujarat and Maharashtra contributed around 12 per cent in area. A clear out gap could be observed between share in area allocation and production of wheat. Punjab with a share of around 12 per cent in area contributed 18.39 per cwent in production. The same pattern could be observed for Haryana. On the other hand, Madhya Pradesh, Bihar, Maharashtra, Uttrakhand and Himachal Pradesh contributed proportionately less due to low productivity of wheat.

The average productivity of wheat in India was 2988 kgs/ha during 2010-11. Punjab and Haryana were the leading states with yield rate of 4692 and 4615 kgs/ha. The level of productivity of wheat was found extremely poor in Bihar, Maharashtra and Himachal Pradesh. A robust policy implication can be derived from this scenario that there is huge potential of raising productivity of wheat in several states by initiating appropriate policy measures.

The status of irrigation in case of wheat was found impressive at the all India and individual state level barring Himachal Pradesh where around 20% of area under wheat cultivation was observed irrigated during 2009-10.

The last column of the table provides information on ratio of marketed surplus. Around 73% of wheat output was marketed at the all India level, Gujarat,

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Rajasthan and Haryana reported more than 80% of wheat production as marketed while states of Bihar and Madhya Pradesh marketed between 70-75%.

These results imply that more than 10% of wheat production was retained by the producers for consumption, feed, seed and payments in kind. Also, wheat is the main staple grain consumed by the population in Uttar Pradesh, Bihar and Rajasthan including Punjab and Haryana that also impacted quantum of disposal in the market by the farmers.

An examination of the area, production, yield, irrigated area and ratio of marketed surplus of rice in Table-2.1indicates that West Bengal, Uttar Pradesh, Andhra Pradesh and Punjab contributed around 52% to all India production during 2010-11. The states such as Odisha, Tamil Nadu and Chhattisgarh contributed between 6-7% each. Like wheat, a gap could be noticed between share in all India area allocation and production due to differentials in productivity.

The average yield of rice was 2239 kgs/ha in India during 2010-11. Punjab, Andhra Pradesh and Tamil Nadu recorded above the country level yield rates. It was disappointing to note that yield of rice (1095 kgs/ha) in Bihar was the lowest in terms of ranking. It could be due to relatively lower proportion of area covered under irrigation which is crucial for optimum yield of rice. It is worth mentioning that disparities in availability of irrigation for rice cultivation across the states were found to be wide since Assam recorded only 7.1 per cent of area under rice as irrigated against almost 100% in Punjab.

The marketed surplus ratio of rice in major growing states differed significantly. In Punjab, almost entire produce was marketed while in Assam, it was lower than 40%. The reasons could be differential levels of retention for various purposes by the producers.

Table-2.1
Major Producing States of Selected Foodgrains in India during 2010-11

Area: Million ha.
Production: Million Tonnes
Yield: Kg/ha

State	Area	% to all India	Production	% to all India	Yield	Irri. % 2009-10	Ratio of marketed surplus
WHEAT							
Uttar Pradesh	9.64	33.16	30.00	34.53	3112	98.1	66.99
Punjab	3.51	12.07	16.47	18.39	4692	98.7	86.74
Haryana	2.52	8.67	11.63	13.39	4615	99.4	83.54
Madhya Pradesh	4.34	14.93	7.63	8.78	1758	84.07	73.77
Rajasthan	2.48	8.53	7.21	8.30	2907	99.6	44.41
Bihar	2.10	7.22	4.10	4.72	1952	92.1	74.58
Gujarat	1.27	4.37	4.02	4.63	3165	98.8	87.77
Maharashtra	1.31	4.51	2.30	2.65	1756	73.9	NA
West Bengal	0.32	1.09	0.87	1.00	2754	95.9	NA
Uttrakhand	0.38	1.31	0.88	1.01	2316	57.5	NA
Himachal Pradesh	0.36	1.24	0.55	0.63	1528	20.2	3948
All India*	29.07	100.00	86.87	100.00	2988	91.7	73.20
RICE							
West Bengal	4.94	11.53	13.05	13.60	2642	48.2	67.72
Uttar Pradesh	5.66	13.21	11.99	12.49	2118	79.0	76.20
Andhra Pradesh	4.75	11.08	14.42	15.02	3036	97.5	91.06
Punjab	2.83	6.60	10.84	11.29	3830	99.6	99.70
Bihar	2.83	6.60	3.10	3.23	1095	56.7	77.50
Tamil Nadu	1.91	4.46	5.79	6.03	3031	92.8	90.70
Chattisgarh	3.70	8.63	6.16	6.42	1665	31.7	NA
Odisha	4.23	9.87	6.83	7.12	1615	46.8	67.43
Karnataka	1.54	3.59	4.19	4.37	2721	75.2	94.56
Assam	2.57	6.00	4.74	4.94	1844	7.1	38.54
Haryana	1.25	2.92	3.47	3.62	2776	99.9	97.09
Mahatashtra	1.52	3.55	2.70	2.81	1776	26.1	NA
All India	42.86	100.00	95.98	100.00	2239	58	80.65
BAJRA							
Rajasthan	5.49	57.13	5.57	44.07	832	4.5	53.03
Uttar Pradesh	0.94	9.78	1.56	15.04	1660	6.6	81.60
Gujarat	0.87	9.05	1.09	10.51	1253	22.1	84.00
Haryana	0.66	6.87	1.19	11.48	1803	38.1	80.93
Maharashtra	1.04	10.82	1.12	10.80	1077	5.0	75.56
Madhya Pradesh	0.16	1.66	0.31	2.99	1938	-	NA
Karnataka	0.31	3.17	0.33	3.18	1082	11.2	NA
Tamil Nadu	0.05	0.57	0.08	0.79	1513	11.1	NA
All India	9.61	100.00	10.37	100.00	1079	8.6	67.38

*Includes other states

Source: Agricultural Statistics at a glance, 2012

Bajra, known as nutri-cereal was primarily produced in Rajasthan which contributed around 44% to all India production. In addition, Gujarat, Maharashtra and Haryana contributed between 10 and 15 per cent. All these five states together contributed around 82% to the all India production. The average productivity of bajra was 1079 kgs/ha in India. Madhya Pradesh followed by Haryana and Uttar Pradesh indicated above average yield rates of bajra. It is essential to mention that productivity of bajra in first ranking state of Rajasthan was lowest and below 10 qtls/ha during 2010-11. Bajra is generally grown as rainfed crop and therefore, coverage of irrigation was 8.6% in India. However, Haryana and Gujarat reported more than 30 and 20% area as irrigated. Bajra is grown for self consumption and market disposal by the farm facilities in dry areas. The marketed surplus ratio of bajra was around 67% at the all India level but this proportion was between 80-84 per cent in Gujarat, Haryana and Uttar Pradesh.

2.1 Coverage, Sampling Design and Research Methodology

This study was conducted in the state of Haryana. It is based on published and un-published sources of secondary and primary data. The relevant information about the state and districts was obtained from various issues of the Statistical Abstract of Haryana, Government of Haryana, Panchkula. The required preliminary information regarding the selection of block and villages was obtained from the district officials. The meetings with the Deputy Director of Agriculture of selected districts were useful and informative. The crops for the study were decided as per the study design provided by the coordinator.

The scope of the study is confined to three food grain crops i.e. wheat, paddy and bajra grown in Haryana. Two districts namely, Karnal and Bhiwani with significant share in the acreage and production of these crops in the state were selected for in-depth study. The selection of respondents is based on multistage sampling design. At the first and second stage, major producing districts and

blocks in these districts were selected. At the third stage, villages were selected on the same criterion. A questionnaire was canvassed to the farmers growing these crops. All farm size categories in the sample i.e. marginal (less than one ha.) small (1-2 ha.), medium (2-4 ha.), and large (more than 4 ha.) were covered in the sample. The primary data pertaining to the year 2011-12 were collected from 300 farmers (200 in Karnal + 100 in Bhiwani). In view of the main objective of the study, it is found necessary to compare the marketable and marketed surplus of selected three food grains crops and their determinants. The detailed sampling design of the study is given below;

Crop	(No. of Farmers)
Wheat	200
Paddy	200
Bajra	100

2.2 Analytical Framework

The methodology followed for each aspect is different. For measuring the district wise growth rates of area, production and yield of wheat, paddy and bajra for the period 1980-81 to 2008-09, following semi-log equation was used

$$\text{Log } y = a + bt$$

Where,
y = area/production/yield of the crop

a = intercept

b = slope

t = time

The marketable surplus is computed by using the following formula.

$$MS = SPY + PRD - RET - CL - RP$$

Where,
MS   = Marketable surplus of the commodity

SPY   = Stock from previous year

PRD   = Production in the current Year

20

RET   = Retention for consumption, feed, seed and payments in kind.

CL   = Crop Losses

RP   = Repurchases

The marketed surplus in this study refers to the quantity of produce actually disposed off by the producer.

The literary evidences presented in chapter 1 on marketed surplus of food grains suggest that flow of marketable and marketed surplus in a particular region depend on price and non-price factors. Normally, marketed surplus would depend on socio-economic, institutional, infrastructural and technological factors. We have discussed these factors in detail in chapter-4. We have further carried out regression analysis to ascertain the determinants of the marketed surplus of selected food grain crops in Haryana. We have tried to gauge the impact of variations in stock, production, consumption, retention for other purposes, crop losses and farm size on the marketed surplus of paddy, wheat and bajra. This analysis based on primary data would be useful in formulation of policies for increasing marketed surplus of these food grains in Haryana which are also important staple food grains in India. Price is an important factor influencing marketed surplus through area allocation and production of agricultural commodities but it could not be included in this exercise since sampled farmers sold produce of the main crops (paddy and wheat) at the minimum support price, which is uniform in all cases. For empirical analysis, double log function was used to identify the determinants influencing marketed surplus. In the model, marketed surplus of the crop (y) was used as dependent variable and above mentioned six variables as independent variables.

In order to find the determinants of marketed surplus, a double log regression model of the following form was used.

$$y = a x_1^{b1} . x_2^{b2} . x_3^{b3} . x_4^{b4} . x_5^{b5} . x_6^{b6} + u$$

$$\log y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b4 \log x_4 + b5 \log x_5 + b_6 \log x_6 + u$$

where

y   = Marketed Surplus of the Crop

a   = Intercept

x_1 = Stock from Previous Year

x_2 = Production in the Current Year

x_3 = Consumption

x_4 = Other Payments

x_5 = Losses

x_6 = Farm Size

$b_1 \ldots b_6$ are regression coefficients

u   = Random Error.

Before regressing the primary data, we have tested problems of heteroscedasticity. In the presence of heteroscedasticity, inferences drawn from the standard testing procedures may be misleading. Therefore, we test for heteroscedasticity using White's test and utilize White's heteroscedasticity-corrected standard errors in those cases where the null hypothesis of homoscedasticity is rejected.

White's Test for Heteroscedasticity

White (1980) proposed a test of heteroscedasticity with the null hypothesis of no heteroscedasticity or homoscedasticity against the alternative hypothesis of heteroscedasticity of unknown form. The usual OLS regression is estimated to obtain the residuals. An auxiliary regression is then undertaken such that the squared residuals from the original regression are regressed on the original regressors and their squared values (cross-terms are assumed to be zero as we have a small sample). The R^2 from this auxiliary regression is used to calculate NR^2 which asymptotically follows the chi-squared distribution with degree of freedom equal to the number of slope coefficients in the auxiliary regression.

Heteroscedasticity Consistent Covariance Matrix

To obtain consistent estimates of coefficient covariance since we are dealing with conditional heteroscedasticity of unknown form, we utilize White (1980)'s degree-of-freedom heteroscedasticity consistent covariance matrix estimator

$$\widehat{\Sigma}_W = \frac{N}{N-k}(X'X)^{-1}\left(\sum_{i=1}^{N} \hat{\epsilon}_i^2 \, X_i X_i'\right)(X'X)^{-1}$$

where $\hat{\epsilon}_i$ are the estimated residuals from the model, N is the number of observations, k is the number of regressors, *N/(N-k)* is the degree-of-freedom correction, X denotes the $N{\times}k$ matrix of independent variables.

CHAPTER-3

AN OVERVIEW OF AGRICULTURE AND FOOD GRAINS ECONOMY OF HARYANA

Introduction

The agricultural economy of Haryana is dominated by food grains. Of these, wheat, paddy and bajra are the major food grains grown in the state. The share of Haryana in all India production of wheat, paddy and bajra was 12.94, 4 and 14.32 per cent respectively during the year 2010-11. After the adoption of new agricultural technology in mid sixties supported by adequate policies, Haryana has emerged as one of the major food grains producing states in the country. Haryana has been contributing significantly to the food basket of the country. As a result, contribution of Haryana in procurement of wheat and paddy for the Public Distribution System (PDS) was 27.69 and 5.21 per cent respectively during 2010-11.

This chapter aims to present status of various indicators which would be help in understanding marketed surplus. The results are based on secondary data collected from various sources. This chapter is divided into three sections. Section 1 presents structural transformation in the economy of Haryana while Section 2 deals with issues related to agricultural development. Section 3 examines district wise growth rates of area, production and yield of wheat, paddy and bajra during the study period of 1980-81 to latest available period.

Section-1

Structural Transformation of State Economy: Changing Shares of Different Sectors

The economy of Haryana has recorded excellent growth between 1980-81 and 2010-11. The GSDP at factor cost at current prices has risen at the rate of 14.45 per cent during this period. The growth of GSDP during the study period is mainly due to good performance of primary, secondary and tertiary sectors. The sectoral analysis reveals (Table 3.1) that GSDP at current prices from primary sector which comprises of agriculture, livestock, forestry, fishing and mining

sectors has increased from Rs. 1821 crore in 1980-81 to Rs. 55433 crore in 2010-11. The GSDP from secondary sector which covers manufacturing, construction, electricity, gas and water supply sectors has risen from Rs 659 crore in 1980-81 to Rs. 77021 crore in 2010-11. The contribution of tertiary sector, which comprises of trade, transport, banking, public administration and other services, has increased from 26.76 per cent in 1980-81 to 50.01 per cent in 2010-11 (Table 3.2).

The structural composition of state economy has witnessed significant change between 1980-81 and 2010-11 (Table 3.3). But, agricultural sector still continues to occupy a significant position in the state economy despite continuously declining share of this sector in the GSDP. The importance of agricultural sector is also responsible for good deal of instability in the rate of growth of economy due to fluctuations in agricultural output. Uncertainty in rainfall often causes substantial change in crop production, which eventually results in fluctuation and instability in the growth rate of state economy. The composition of the GSDP at current prices reveals that share of primary sector which includes agriculture and allied sectors has declined from 53.78 per cent during 1980-81 to 20.92 per cent during 2010-11.

Table: 3.1
Gross State Domestic Product of Haryana by Industry of Origin (At Current Prices)

(Rs. Crore)

S. NO.	INDUSTRY	1980-81	1990-91	2010-11
1.	Agriculture and Animal Husbandry	1794	5860	51617
2.	Forestry and Logging	12	60	3048
3.	Fishing	2	21	676
4.	Mining and Quarrying	13	37	91
	SUB TOTAL: PRIMARY	**1821**	**5978**	**55433**
5.	Manufacturing	492	2064	49234
5.1	Registered	358	1513	37095
5.2	Un-Registered	134	551	12139
6.	Electricity, Gas and Water Supply	44	107	4149
7.	Construction	123	377	23638
	SUB-TOTAL: SECONDARY	**659**	**2548**	**77021**
8.	Trade, Hotels and Restaurants	394	1776	52442
9.	Transport, Storage and Communication	114	651	21849
9.1	Railways	21	156	2257
9.2	Transport by other means	77	410	17130
9.3	Storage	4	13	157
9.4	Communication	12	72	2305
	Total: Transport, Communication and Trade	508	2427	74291
10.	Banking and Insurance	58	265	8952
11.	Real Estate, Ownership of Dwellings, Legal and Business Services	126	353	26230
	Total : Finance and Real Estate	184	618	35182
12.	Public Administration	76	404	6578
13.	Other Services	138	641	16530
	Total: Community and Personal Services	214	1045	23108
	SUB-TOTAL: TERTIARY	**906**	**4089**	**132581**
	Total Income(Gross Domestic Product at factor cost)	3386	12615	265035

Source: Department of Economic and Statistical Analysis, Haryana

Table: 3.2
Gross State Domestic Product of Haryana by Industry of Origin (At Current Prices)

(%Share)

S. NO.	INDUSTRY	1980-81	1990-91	2010-11
1.	Agriculture and Animal Husbandry	52.98	46.45	19.48
2.	Forestry and Logging	0.37	0.47	1.15
3.	Fishing	0.05	0.17	0.26
4.	Mining and Quarrying	0.38	0.29	0.03
	PRIMARY SECTOR	**53.78**	**47.38**	**20.92**
5.	Manufacturing	14.53	16.36	18.58
6.	Electricity, Gas and Water Supply	1.30	0.85	1.57
7.	Construction	3.63	2.99	8.92
	SECONDARY SECTOR	**19.46**	**20.20**	**29.07**
8.	Trade, Hotels and Restaurants	11.64	14.08	19.79
9.	Transport, Storage and Communication	3.37	5.16	8.24
10.	Banking and Insurance	1.71	2.10	3.38
11.	Real Estate, Ownership of Dwellings, Legal and Business Services	3.72	2.79	9.90
12.	Public Administration	2.24	3.20	2.48
13.	Other Services	4.08	5.09	6.22
	TERTIARY SECTOR	**26.76**	**32.42**	**50.01**
	Total	100	100	100

Source: Department of Economic and Statistical Analysis, Haryana

Table: 3.3
Percentage Share Of Primary, Secondary And Tertiary Sectors In Gross State Domestic Product Of Haryana

(At current prices)

Year	GSDP (Rs. In crore)	Primary Sector (%)	Secondary Sector (%)	Tertiary Sector (%)	Total (%)
1980-81	3386	53.78	19.46	26.76	100
1990-91	12615	47.38	20.20	32.42	100
2010-11	265034	20.92	29.07	50.01	100

Source: Department of Economic and Statistical Analysis, Haryana

Secondary sector occupies an important place in the state economy and it has witnessed a considerable improvement in its share overtime. Its contribution has increased from 19.46 per cent during 1980-81 to 29.07 per cent during 2010-11, reflecting a healthy sign of industrialization in the state. Tertiary sector which is a combination of different services like trade, transport, banking, public administration, education, health, etc. has also witnessed significant, increase in its' share. Its share in the GSDP at current prices has increased from 26.76 per cent in 1980-81 to 50.01 percent in 2010-11.

In a nutshell, composition of the GSDP of Haryana reveals that share of primary sector is continuously declining whereas the shares of secondary as well as tertiary sectors are continuously rising. It implies that state economy is shifting from agriculture to manufacturing and service sectors, which is a sign of structural change. This phenomenon has influenced proportion of workforce employed in the primary, secondary and tertiary sectors. But, decline in the share of agricultural sector in the GSDP and dependence of work force on this sector do not coincide (Table 3.4).

Figure.1
Percentage Share of Primary, Secondary and Tertiary Sectors in
Gross State Domestic Product of Haryana (At Current Prices)

2010-11

■ PRIMARY SECTOR
■ SECONDARY SECTOR
■ TERTIARY SECTOR
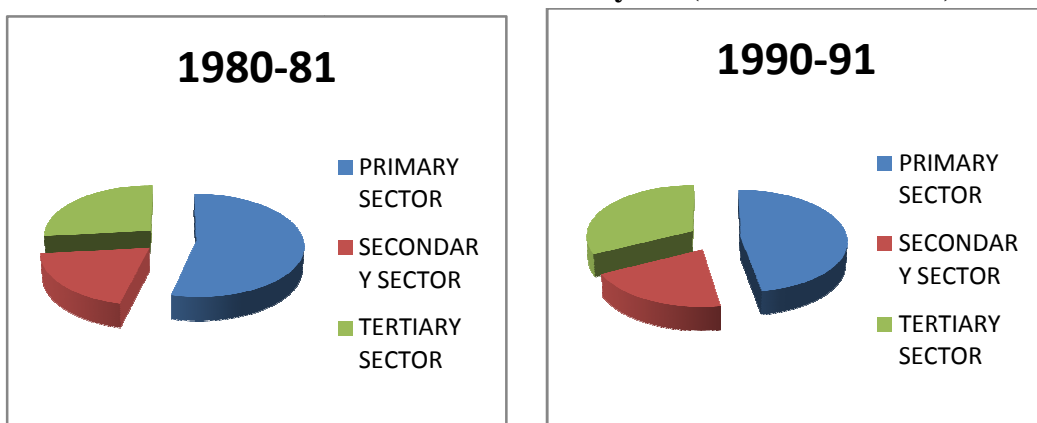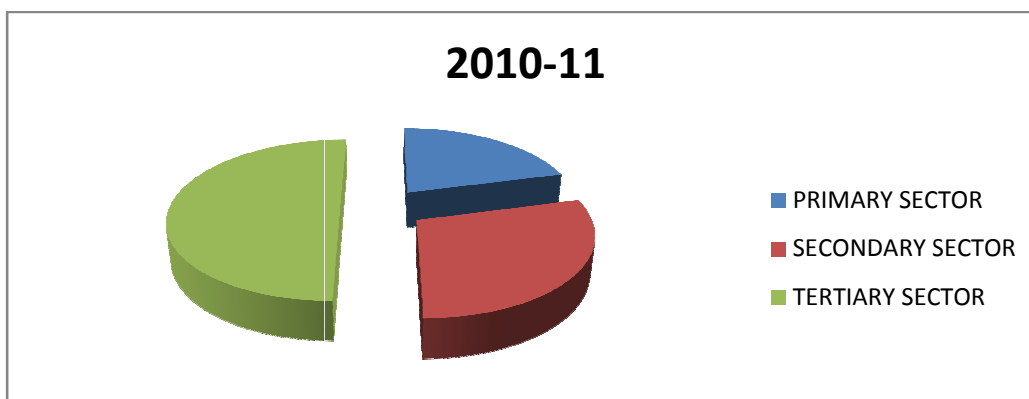
Section-2

An Overview of Agricultural Development in Haryana

Profile of the state

Haryana is located on the northwestern side of the Indian union adjoining Delhi. The state extends from 27°3' to 31°9' of north latitude and 74°6' of east longitude. It is bounded by the states of Punjab and Himachal Pradesh in the north, by Delhi and Uttar Pradesh in the east and by Rajasthan in the South and West. Haryana has a total surface area of 44,212 square kilometers and is one of the smallest states of the Indian union as it accounts only 1.34 per cent of total geographical area of India. On the basis of physiographical distinction, Haryana can be divided into two distinct regions of plains and hills. The plains cover entire state except southern part of Mahindergarh district, southwestern part of Gurgaon district and northeastern part of Panchkula district. The plains can be further sub-divided into eastern and western regions on the basis of aridity. The western plains cover Hisar and Mahindergarh district and have higher degree of aridity. Most of the land is covered by thorny bushes symptomatic of a desert. The unevenness in the surface of these plains is due to sand dunes or sand stumps of different size or extension of rocky hills. The eastern plains extend up to west of Yamuna River. These plains are remarkably flat. They form a rich fertile tract and produce major proportion of agricultural production of the state. Sometimes, smoothness of the surface is disturbed by the presence of old banks of abandoned channels of streams, which change their course frequently. The slope is from northeast to southwest and west except in Bhiwani. In Mahindergarh and Gurgaon, slope is towards north inhibiting expansion of irrigation.

The Aravalli range is a narrow ridge stretching into Haryana for 90 kilometers in the northeast and southwest directions of Delhi. It covers southern parts of Mahindergarh and adjoining areas of Gurgaon district. The Aravalli range at no place is higher than 518 meters above the sea level. The ridge area is generally unfavorable for cultivation due to its rocky nature.

There is not a single perennial river passing through Haryana. The Yamuna along with the Punjab rivers is the main source of irrigation. The Yamuna flows along the eastern boundary of the state. The Ghaggar, which is non-perennial, passes through the state and sometimes causes considerable damage to agriculture. There are other small rivulets like the Saraswati, Chautang and Sahibi and its tributaries like Kanseoti. These are dry for most the time of the year except the monsoon season.

The total population of Haryana was 2.53 crore persons in 2011. The sex ratio was 877, which is significantly lower than the all India level. The density of population defined as number of persons per square kilometer was 573 persons against 382 at the all India level. It is due to the proximity of Delhi and availability of employment opportunities in the primary, secondary and tertiary sectors (Table-3.4).

The literacy rate in Haryana has been 76.64 percent and a little higher than all India level (74.04 per cent). Among males, 85.38 percent and among females 66.77 per cent were literate during 2011. The contribution of women is important for the growth of the economy in Haryana. Therefore, it is essential to provide substantial educational facilities to women in the region. They should be motivated for this purpose.

In Haryana, 39.76 per cent of population was workers. Among males, this proportion was 50.47 per cent while it was 27.30 per cent among females. Work participation rate of population in the state is marginally higher than the all India level. It could be attributed to relatively higher work participation rate of female population. This figure is 27.30 per cent against 25.70 per cent for the all India. Looking at the development of the state, female work participation rate is low.

Only, females from weaker sections used to look for employment opportunities and this feature has reduced the overall work participation rate in Haryana. However, work participation rate of females in Haryana is marginally above the national level. It could be due to significant contribution of women in various economic activities, primarily in agricultural based activities.

Table 3.4
Area, Population and Work Participation Rate in Haryana and India
(2001 and 2011)

Item	Haryana		India	
I. Area	2001	2011	2001	
Total Area (000' Sq. km.)	44 (1.34)		3287 (100.00)	
II Population				
Total Population (lakh)	211.5 (2.05)	253.53 (2.09)	10287.37 (100.00)	12101.93 (100.00)
Sex Ratio (No.)	861	877	933	940
Rural Population (lakh)	150.29	165.31	7426.18	8330.87
% of Rural Population to Total Population	71.06	65.34	72.22	68.84
Population Density per Sq. km.	478	573	325	382
Literacy Rate (%)	67.91	76.64	65.00	74.04
III. Workers*				
Work Participation Rate (%)				
Male	50.47		51.90	
Female	27.30		25.70	
All	39.76		39.30	
% of main Workers to Total Workers	74.49		77.80	
% of Marginal Workers to Total Workers	25.51		22.20	

Figures in parentheses show percentage share
Source: Provisional Population Tables, Census of India, 2011, *Census 2001 as data for 2011 are not yet available

The occupational distribution of workers is the most important determinant of social, cultural, economic as well as environmental development of a region. It is responsible for social progress, creation of wealth, development of science and technology. Economic development of a region depends on proportion of working force engaged in primary, secondary and tertiary sectors. Agriculture is important source of employment in Haryana and around 52 per cent of workers earned their

livelihood from this sector in 2001. Like all India, proportion of workers was the highest in agriculture followed by other workers and household industry workers (Table 3.5).

The economic development of any area is best reflected in infrastructural facilities. A good infrastructure can be achieved by investment in basic amenities like roads, power, water and communication. The infrastructural development of Haryana has been one of the important components of development planning but so far, it has not been satisfactory. A serious effort is needed to enhance these facilities to promote economic development.

Table 3.5
Occupational Classification of Main Workers in Haryana and India
(2001)

Category	Haryana		India	
I. Cultivators	No. ('000)	%	No. ('000)	%
Male	1873	32.75	86328	31.33
Female	1173	44.03	41300	32.51
All	3046	36.33	127628	31.71
II. Agricultural Labourers				
Male	712	12.45	57354	20.83
Female	564	21.17	50093	39.43
All	1276	15.23	107448	26.69
III. Household Industry Workers				
Male	126	2.21	8312	3.02
Female	81	3.04	8084	6.36
All	207	2.47	16396	4.07
IV. Other Workers				
Male	3007	52.59	123469	44.82
Female	847	37.79	27571	21.70
All	3854	45.97	151040	37.52
% of Agricultural Workers to Total Workers		51.56		58.40
% of Cultivators to Total Agricultural Workers		70.47		54.29
% of Agricultural Labour to Total Agricultural Workers		29.53		45.71
% of Female Agricultural Workers to Total Agricultural Workers		40.18		38.88

Source: Agricultural Statistics at a Glance, 2008

Agricultural Development in the state

Agricultural development has been impressive in Haryana during the study period. This is an important sector because it employs more than 50 per cent of workers and provides livelihood security to the major proportion of population in the rural areas. At the outset, we will discuss land use pattern, which is manifestation of combined effect of various physio-climatic conditions in the region. Table-3.6 indicates that net sown area occupies dominant proportion of land and covers about 80 percent of the reported area in the state.

It may be noted (Table-3.6) that share of forests, land not available for cultivation, permanent pastures and other grazing lands in total geographical area of Haryana has declined over the reference period. The share of forestland has dropped from 3 per cent in 1980-81 to 0.89 per cent in 2010-11. This is not appropriate for the sustainable development of agriculture in the state. The net result has been a marginal decline in the percentage of net sown area from 81.86 per cent to 80.50 percent. The cropping intensity has improved with increase in multiple cropping. The GCA increased from 5462 thousand hectares in 1980-81 to 6505 thousand hectares in 2010-11. Haryana had 0.68 per cent of geographical area under cultivable wastelands during 1980-81 which declined marginally in 2010-11. These can be used for growing fruits. This will help in increasing income of the farming community. These lands can be brought under cultivation through proper planning and execution. These areas can also be utilized for plantation of fruits and flowers. Fallow lands comprised less than 1 per cent of the reported area but current fallows constitute 2.79 per cent of geographical area which can be reduced through policy interventions.

The net sown area formed 81.86 per cent of the geographical area during 1980-81. Out of this area, around 84 per cent was sown more than once. The percentage of net irrigated area to net sown area in Haryana was 82.06 per cent during 2010-11 (Table 3.7). The share of gross irrigated area in gross cropped area also has been

growing simultaneously during the study period. Major sources of irrigation are government canals, tube wells and wells. It is essential to mention that share of area irrigated by canals has declined by more than 10 per cent between 1980-81 and 2010-11 whereas it has increased in case of tube wells by around 13 per cent. It could be due to inadequate availability of canal water with great uncertainty. Other sources like tanks, etc. have very little contribution. In a nutshell, land use pattern has shown some change but it was not perceptible in Haryana during the study period.

Table 3.6
Land Use Pattern in Haryana

(Percentage)

@; area less than 500 hectares

Year	Forests	Not available for cultivation	Permanent pastures & other grazing lands	Land under misc. tree crops & grooves	Cultivable waste lands	Fallow lands	Current fallows	Net sown area	Cropping intensity	% of net sown area as irrigated
1980-81	2.99	1.47	0.68	-	0.68	-	4.02	81.86	152	59.2
1990-91	3.86	2.22	0.53	0.09	0.48	0.00	3.86	81.66	166	72.7
2010-11	0.89	2.33	0.62	0.25	0.62	0.07	2.79	80.50	184	82.06

Source: Director of Land Records, Haryana

Table 3.7
Irrigation Pattern in Haryana

District	Irrigated Area by Source (000 hectares)		Net irrigated area(NIA) (000 hectares)	Net Area Sown(NAS) (000 hectares)	%age of NIA to NAS
	Canal	Tube Well			
1980-81	1161 (54.4)	941 (44.09)	2134	3602	59.2
1990-91	1337 (51.42)	1248 (48.00)	2600	3575	72.7
2010-11	1236 (42.81)	1650 (57.15)	2887	3518	82.06

Values in parentheses are percentages
Source: Director of Land Records, Haryana

Operational Holdings

It may be noted that average size of operational holdings is only 2.25 hectares in Haryana (Table 3.8). Around 68 per cent of holdings are marginal and small. The size of these holdings is tiny and therefore, scale of economies cannot be availed of which makes crop husbandry low income generating proposition. Generally, these farmers opt for wheat rice rotation and grow vegetables as an additional crop but use expensive inputs when it is urgent. They also grow high value crops to augment their income. Urgent policy initiatives are needed for the development of smallholdings. The options like dairying, poultry and horticultural high value crops should be encouraged to increase per unit productivity of the available small pieces of land for cultivation.

Table: 3.8
Number and Area of Operational Holdings by Size in Haryana (2010-11)
(Area in Hectares)

Size Group (in Hectares)	No.	%	Area	%
Below 0.5	483415	29.9	136901	3.76
0.5-1.0	294727	18.2	223573	6.13
1.0-2.0	314818	19.5	462703	12.7
2.0-3.0	174959	10.8	437349	12
3.0-4.0	108869	6.73	377124	10.3
4.0-5.0	70796	4.38	319595	8.77
5.0-7.5	83247	5.15	513873	14.1
7.5-10.0	40651	2.51	351967	9.63
10.0-20.0	37088	2.29	508686	14
20.0 and above	8741	0.54	313833	8.61
Total	1617311	100	3645605	100
Average Size of Holdings			2.25	

Source: Agricultural Census, 2010-11

Crop Pattern

Table 3.9 indicates percentage of gross cropped area devoted to different crops in a region during an agricultural year. The agro-climatic variations in Haryana are large and hence, state is bestowed with a variety of crops. In dry areas of Bhiwani, oilseeds and pulses dominate the crop pattern while in Karnal, wheat and paddy are the main crops (Table3.9). Wheat (27.07%) followed by bajra (15.92%), gram (12.19%) and rice (8.86%) were the principal crops of the state during 1980-81 (Table 3.9). In addition, cotton was also grown on almost 5 percentage points of gross cropped area. The fact remains that crop pattern in Haryana was dominated by food grains, which occupied 72.54% of GCA in 1980-81. The share of food grains dropped to 72.47% in 2010-11. The proportion of area under wheat and rice increased while bajra has indicated a decline of around 5 per cent. It appeared that traditional crops like pulses lost heavily while wheat and rice gained significantly. Pulses lost area by almost 12 per cent during the reference period. This shift could be attributed to expanding irrigation facilities in Haryana. After harvesting wheat and paddy, other crops are generally sown as pure crop or mixed crops. The land unsuitable for main crop is often devoted to other crops. Information presented in Table-3.9 suggests that main crops occupy major share of area and rest of GCA is devoted to other crops.

TABLE 3.9

Percentage of GCA* Under Important Food Grains in Haryana

(Percentages)

Year	GCA ('000 ha.)	Rice	Wheat	Bajra	Maize	Gram	Total Pulses	Other Food Grains	Total Food Grains	Other Crops	All
1980-81	5462	8.86	27.07	15.92	1.3	12.19	14.55	4.84	72.54	27.46	100
1990-91	5919	11.17	31.25	10.28	0.58	10.96	12.53	3.1	68.91	31.09	100
2000-01	6115	17.24	38.5	9.94	0.25	2.03	2.56	2.54	71.03	28.97	100
2010-11	6505	19.13	38.66	10.16	0.15	1.72	2.67	1.70	72.47	27.53	100

Gross Cropped Area
Source: Director of Land Records, Haryana

Figure: 2

Percentage of GCA under important food grains in Haryana
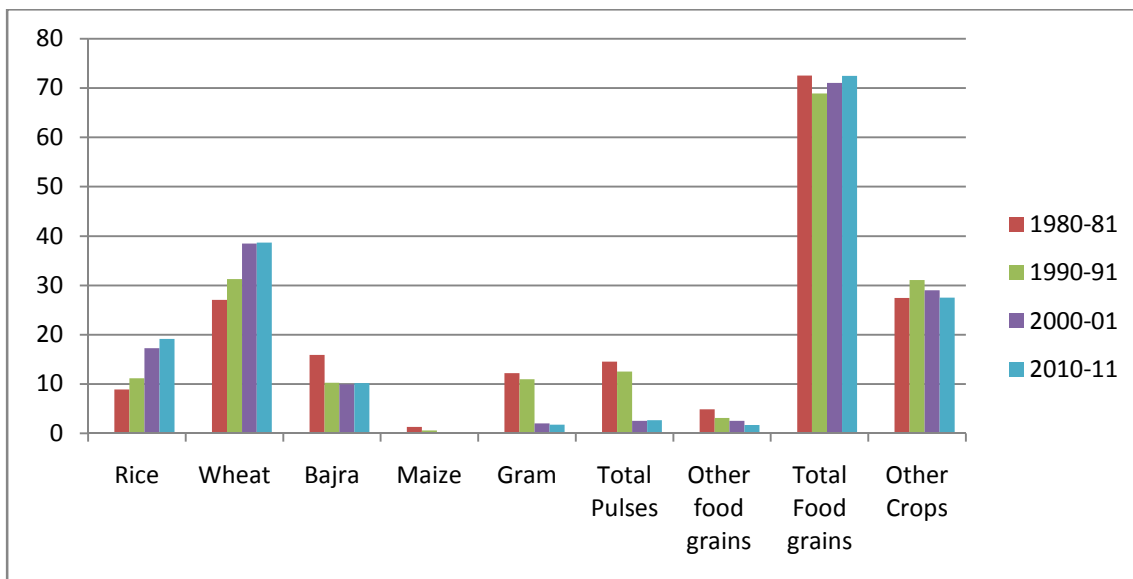
Input Use

The utilization of HYV seeds, fertilizer, pesticides, tractor and tube wells play an important role in boosting the agricultural development of a region. Haryana is using these inputs for a long time. The consumption of fertilizer was 386 kg./ha. during 2010-11. The nitrogenous fertilizers were preferred over phosphatic and potassic fertilizers. The state of Haryana has already moved towards agricultural mechanization. Use of tractors, tube wells and pumping sets is found common (Table-3.10). It may be noted that Haryana is ahead of many states in the production as well as distribution of high yielding variety seeds. These were used on 98.2 per cent of cultivated area in case of wheat while for maize; it was 70.0 per cent.

The agricultural output per hectare in Haryana at current prices in 2008-09 was Rs.93906. Also, Haryana has a good network of metalled roads. Potential of organic farming in Haryana is excellent. In view of rising demand for organic products, state should exploit this opportunity. Lack of infrastructural facilities in remote areas creates problems for the cultivators. Especially power sector needs improvement. It is not available round the clock in rural areas and it hinders agricultural operations. Massive investment is needed to address this shortcoming.

Government should give priority to this aspect to boost growth of agriculture in the state.

TABLE 3.10
Status of Input Use in Haryana

Item	2010-11
% of Cultivated Area under HYV Seeds	
Wheat	98.2
Rice	66.3
Bajra	97.6
Maize	70.0
Fertilizer consumption (Kgs/ha)	
N	277
P	95
K	14
Total	386
Tractors per '000 hectares	75
Tube wells per '000 hectares	206
% of Power used for agriculture	33.72
Gross value of agricultural output per ha. at current prices (2009-10)	93906

Source: Statistical Abstract of Haryana, 2009-10 & 2011-12

Section-3

District wise growth of Area, Production and Yield of Selected Crops

This section presents compound growth rates of area, production and Yield of selected crops i.e. paddy, wheat and bajra for the period 1980-81 to 2008-09. The study period is divided into two periods. Period I covers 1980-81 to 1994-95 while the II period relates to 1994-95 to latest available year.

At the outset, we have provided area, production and yield of selected crops in Haryana and India. A perusal of Table 3.11 indicates that area under wheat cultivation has increased from 22.28 million hectares in 1980-81 to 29.07 million hectares in 2010-11 in India exhibiting an increase of 30.48 per cent during the 30 years period. It has improved from 1.48 million hectares in 1980-81 to 2.52 million in 2010-11 in Haryana. This increase is found to be higher in comparison to India. This marks an increase of around 70 per cent during the same period. Further, production and yield of wheat have also shown an increasing trend for

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the specified period, both for India and Haryana. It was due to expansion in area and improvement in yield.

Table-3.11
Area, Production and Yield of Wheat, Paddy and Bajra in Haryana and India

Area: Million ha.
Production: million tonnes
Yield: Kg/ha

Item	1980-81	1990-91	2000-01	2010-11
Wheat				
India				
Area	22.28	24.17	25.73	29.07
Production	36.31	55.14	69.68	86.87
Yield	1630	2281	2708	2988
Haryana				
Area	1.48	1.85	2.36	2.52
Production	3.49	6.44	9.67	11.63
Yield	2360	3479	4106	4615
Paddy				
India				
Area	40.15	42.69	44.71	42.86
Production	53.63	74.29	84.98	95.98
Yield	1336	1740	1901	2239
Haryana				
Area	0.48	0.66	1.05	1.25
Production	1.26	1.83	2.70	3.47
Yield	2606	2775	2557	2776
Bajra				
India				
Area	11.66	10.48	9.83	9.61
Production	5.34	6.89	6.76	10.37
Yield	458	658	688	1079
Haryana				
Area	0.87	0.61	0.61	0.66
Production	0.47	0.53	0.66	1.19
Yield	544	864	1079	1803

Source: Agricultural Statistics at a glance, 2012

Like wheat, area, production and yield of paddy recorded an increase in India and Haryana between 1980-81 and 2010-11. The area in India has improved from 40.15 million hectares to 42.86 million hectares by showing an increase of less than 10 per cent (6.75 per cent) during a period of 30 years. It appears that area under paddy has reached to saturation level in the major growing states and

therefore, efforts should be made in other areas with scope of expansion. The production of paddy in the country has however, increased by 78.96 per cent due to increase of 67.16 percent in productivity.

An analysis of area, production and yield of paddy in Haryana during the referred period indicates that area has improved by showing a commendable growth of 160.42 per cent. Further, production has increased by 175.40 per cent whereas yield has improved by 6.52 per cent, which is low in view of agricultural development of the state. In brief, appreciable growth in production of paddy in Haryana was largely driven by area expansion between 1980-81 and 2010-11.

The scenario of the third selected coarse cereal crop of bajra presents a contrasting picture as compared to the superior cereals i.e. wheat and paddy. The area under bajra has declined substantially in India and Haryana. It has dropped by 17.58 per cent in India and by 24.13 per cent in Haryana between 1980-81 and 2010-11. The production has however more than doubled due to significant improvement in productivity that was 231.43 per cent during this period.

After providing an overview of area, production and yield of selected crops in India and Haryana, we have examined district wise growth in area, production and yield of paddy, wheat and bajra for the entire period and two sub-periods.

An examination of growth in acreage of paddy presented in Table 3.12 indicates that area under paddy grew at the rate of 3.39 per cent per annum between 1980-81 and 2008-09. First sub-period from 1980-81 to 1994-95 was found better than the second sub-period from 1994-95 to 2008-09. The district of Rohtak followed by Mewat, Jhajjar, Gurgaon, Palwal and Fatehabad exhibited a commendable acreage growth of more than 10 per cent per year during this period. It seems that expansion in irrigational facilities has made it possible. Sonipat and Ambala also indicated impressive growth of more than 5 per cent per annum in the acreage of paddy during this period. Karnal, a major paddy growing district of Haryana has however, indicated a growth rate of around 2 per cent.

Yield is an important factor influencing production. The scenario of growth in yield of paddy between 1980-81 and 2008-09 was not encouraging in Haryana as it grew at less than 1 per cent per annum. Contrary to area expansion, growth in yield was found better in the second sub-period in comparison to first sub-period. The districts of Ambala, Faridabad and Palwal indicated higher growth in yield in comparison to other districts. But, the overall scenario of yield growth of paddy in Haryana causes a serious concern for policy makers.

The production of paddy in Haryana grew at an impressive rate of around 4 per cent per annum between 1980-81 and 2008-09. It was found almost uniform in both the sub-periods. The disparities across the districts were common. Rohtak, Jhajjar, Palwal, Fatehabad and Faridabad exhibited a commendable growth rate of more than 10 per cent per annum in production of paddy. Ambala and sonipat have also shown around 7 per cent per annum growth. In a nutshell, improvement in production of paddy during the referred period was driven largely by area expansion.

After analyzing growth of production of paddy, we have presented growth scenario of wheat in Haryana during the period 1980-81 to 2008-09 (Table 3.13). Results reveal that acreage of wheat in the state grew at the rate of 1.65 per cent per annum. The two sub periods show narrow variation. Among the districts, Bhiwani, Fatehabad and Sirsa indicated an increase of more than 3 per cent per annum. Other districts with around 2 per cent growth were Hisar, Ambala, Mewat and Rewari. Mixed results were obtained in growth of wheat acreage across districts in the two sub-periods. It may be noted that none of the districts showed commendable growth in the wheat acreage during this period.

The scenario of yield growth of wheat in Haryana during the reference period was not impressive. The yield of wheat in Haryana grew at the rate of 2.12 per cent per annum in this period. The period of eighties was found better in comparison to the combined period of mid-nineties and the new millennium. The district wise disparities were common. Several districts with 2-3 per cent growth were ahead of

district Panchkula which indicated a poor yield growth of 0.42 per cent per annum in the entire period.

Production is the outcome of acreage and yield improvement. In Haryana, production of wheat grew at the rate of 3.81 per cent per annum during the mentioned period. The first sub-period was found far superior than second sub-period in terms of improvement in production of wheat in the state. The districts of Bhiwani, Fatehabad, Sirsa and Ambala exhibited impressive growth of more than 5 per cent per year. Mewat, Rewari, Yamunanagar, Hisar, and Jind showed growth between 4-5 per cent per annum in this period. The first sub-period was better for most of the districts in comparison to the second sub-period. The negative growth of wheat production in Panchkula, Faridabad and Gurgaon in the second sub-period was due to declining growth of area and productivity in Panchkula while negative growth in acreage alone was responsible for declining production in other districts.

Table 3.12
District Wise Growth of Area, Production and Yield of Paddy in Haryana

District	Area			Production			Yield		
	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %
	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09
Ambala	3.70	2.93	5.08	6.36	5.22	7.06	2.57	2.23	1.89
Panchkula	4.05	-1.16	-4.19	6.72	-0.07	-2.86	2.57	1.10	1.38
Yamunanagar	4.87	2.02	3.51	-	-	-	-	-	-
Kurukshetra	3.86	0.42	2.15	5.25	3.05	3.58	1.34	2.62	1.40
Kaithal	0.95	0.71	1.85	0.68	2.13	2.11	-0.26	1.41	0.26
Karnal	3.33	0.60	2.04	2.96	3.11	2.75	-0.36	2.50	0.70
Panipat	1.46	0.99	1.27	0.13	1.67	0.86	-1.32	0.68	-0.41
Sonipat	5.69	2.46	6.40	8.73	4.17	7.07	2.88	1.67	0.63
Rohtak	3.04	8.12	13.07	12.06	6.76	14.45	8.75	-1.26	1.22
Jhajjar	3.04	8.35	11.61	12.06	6.19	12.93	8.75	-1.99	1.18
Faridabad	10.77	1.15	8.47	15.29	2.16	10.23	4.07	1.00	1.63
Palwal	10.77	9.07	10.98	15.29	10.18	12.79	4.07	1.02	1.63
Gurgaon	16.25	-2.80	11.02	-	-1.89	-	-	0.94	-
Mewat	13.88	6.90	12.70	21.80	6.38	14.71	6.95	-0.48	1.78
Rewari	-	-	-	-	-	-	-	-	-
Mahendragarh	-	-	-	-	-	-	-	-	-
Bhiwani	-	39.72	-	-	-	-	-	-	-
Jind	3.02	2.10	4.56	4.31	2.54	4.74	1.25	0.44	0.17
Hisar	6.34	0.86	3.76	8.28	-1.01	2.47	1.83	-1.85	-1.24
Fatehabad	6.34	8.45	10.05	8.28	10.93	11.14	1.83	2.28	0.98
Sirsa	2.57	4.60	3.80	3.32	5.48	4.69	0.74	0.85	0.86
Haryana	3.23	2.06	3.39	3.85	3.81	4.01	0.59	1.72	0.60

Source: Ibid

Table 3.13

District Wise Growth of Area, Production and Yield of Wheat in Haryana

District	Area			Production			Yield		
	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %
	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09
Ambala	1.85	2.27	2.57	4.87	3.47	5.15	2.96	1.18	2.52
Panchkula	2.19	-1.76	-2.58	5.22	-2.79	-2.16	2.96	-1.04	0.42
Yamunanagar	2.18	2.17	1.59	5.87	3.41	4.23	3.61	1.21	2.59
Kurukshetra	1.02	1.09	0.62	4.48	2.35	2.72	3.42	1.24	2.09
Kaithal	1.48	0.46	0.67	5.00	1.96	2.70	3.47	1.49	2.02
Karnal	0.64	0.42	0.54	3.99	1.90	2.56	3.33	1.47	2.01
Panipat	1.21	0.56	0.23	4.52	2.27	2.26	3.27	1.69	2.03
Sonipat	-0.68	0.67	0.60	3.08	2.23	3.00	3.78	1.55	2.39
Rohtak	0.63	2.42	1.27	4.13	3.07	3.31	3.48	0.63	2.02
Jhajjar	0.63	1.29	1.12	4.13	2.16	3.25	3.48	0.86	2.11
Faridabad	0.83	-3.69	-0.47	3.97	-2.62	1.79	3.12	1.11	2.27
Palwal	0.83	4.39	2.03	3.97	5.44	4.30	3.12	1.01	2.23
Gurgaon	-0.30	-2.68	0.10	3.38	-1.46	2.96	3.69	1.26	2.86
Mewat	-0.14	4.06	2.19	3.48	4.17	4.64	3.63	0.11	2.39
Rewari	3.15	0.59	2.10	7.79	1.19	4.41	4.50	0.60	2.26
Mahendragarh	-0.52	1.14	0.92	4.23	1.30	3.04	4.77	0.15	2.10
Bhiwani	2.92	4.78	4.53	6.93	4.86	6.52	3.89	0.08	1.91
Jind	1.50	1.70	1.56	5.53	2.88	4.02	3.96	1.16	2.42
Hisar	4.00	1.72	2.53	8.22	2.21	4.48	4.06	0.48	1.91
Fatehabad	4.00	3.17	4.10	8.22	4.49	6.36	4.06	1.28	2.18
Sirsa	4.41	2.19	3.47	8.06	2.87	5.37	3.50	0.67	1.83
Haryana	1.67	1.53	1.65	5.40	2.54	3.81	3.66	1.00	2.12

Source: Ibid

Having analyzed the production performance of paddy and wheat in Haryana, we have examined the growth scenario for bajra. The production of bajra grew at the rate of 3.35 per cent per annum between 1980-81 and 2008-09. The growth performance was found superior in the second sub-period in comparison to the first sub-period. Large variations were noticed in the growth of production across the districts. Mahendragarh followed by Kaithal, Rewari, Hisar and Bhiwani exhibited more than 4 per cent per annum growth in bajra production. The growth of production was however negative in Sirsa, Fatehabad and Faridabad. A mixed scenario was observed across the districts.

Acreage of bajra declined at the rate of 1.06 per cent despite its importance in the nutritional security of the poor. Area allocation has declined at the rate of 3.30 per cent in the first sub-period while it has increased at the marginal rate of 0.53 per cent during the second sub-period. The district wise results of acreage growth of bajra present a depressing scenario since acreage has dropped in 90 per cent cases during the entire period. It was however positive in 11 districts out of 21 districts during the second sub-period.

Yield growth of bajra in Haryana between 1980-81 and 2008-09 was found better than paddy and wheat since it grew at the rate of 4.45 per cent per annum. Further, both the sub-periods were equally important and have shown almost uniform growth. Among districts, Mahendragarh, Rewari, Yamunanagar and Rohtak exhibited more than 5 per cent per annum growth in bajra yield. None of the bajra growing districts exhibited poor performance in terms of yield growth. The variations across the districts were wide. The overwhelming increase in the productivity of bajra was the major factor behind significant increase in the level of production.

TABLE 3.14

District Wise Growth of Area, Production and Yield of Bajra in Haryana

District	Area			Production			Yield		
	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %	CGAR %
	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09	1980-81 to 1994-95	1994-95 to 2008-09	1980-81 to 2008-09
Ambala	-4.26	-	-	1.87	-	-	6.41	-	-
Panchkula	-3.94	-	-	2.21	-	-	6.41	-	-
Yamunanagar	0.16	-4.99	-2.16	5.90	1.72	3.13	5.73	7.06	5.40
Kurukshetra	-24.74	-	-	-	-	-	-	-	-
Kaithal	6.59	6.56	3.28	9.19	13.74	6.49	2.44	6.74	3.11
Karnal	-12.90	0.30	-3.94	-	9.53	-	-	9.20	-
Panipat	-9.92	-	-	-	-	-	-	-	-
Sonipat	-11.08	-0.31	-2.92	-6.04	6.52	1.62	5.66	6.85	4.68
Rohtak	-7.29	-1.29	-3.41	-1.76	5.78	1.46	5.97	7.16	5.04
Jhajjar	-7.29	1.39	-1.23	-1.76	7.00	2.78	5.97	5.54	4.06
Faridabad	-5.12	-8.09	-5.67	-2.69	-4.71	-2.60	2.56	3.68	3.26
Palwal	-5.12	0.73	-2.88	-2.69	4.29	0.20	2.56	3.54	3.17
Gurgaon	-1.51	-0.31	-0.34	0.83	6.00	3.78	2.38	6.33	4.13
Mewat	-1.75	0.61	-0.22	0.53	5.16	3.33	2.33	4.52	3.56
Rewari	-2.47	1.22	-0.78	6.46	5.30	5.59	9.15	4.03	6.42
Mahendragarh	1.33	0.65	0.79	8.18	3.51	7.82	6.75	2.84	6.98
Bhiwani	-3.59	0.36	-0.87	1.01	3.73	4.03	4.77	3.36	4.95
Jind	-5.89	3.09	-1.86	-3.07	7.45	1.51	3.00	4.23	3.44
Hisar	-2.49	1.65	0.15	1.65	5.73	4.56	4.24	4.01	4.40
Fatehabad	-2.49	-5.96	-5.78	1.65	-1.34	-1.61	4.24	4.92	4.43
Sirsa	-9.24	0.95	-4.65	-7.76	6.85	-0.28	1.62	5.85	4.58
Haryana	-3.30	0.53	-1.06	0.74	4.70	3.35	4.18	4.15	4.45

Source: Ibid

To conclude, production of paddy and wheat has risen at the rate of 4.01 and 3.81 per cent per annum during 1980-81 to 2008-09. In case of paddy, growth is largely driven by area expansion since productivity growth was found poor. The area as well as yield contributed to the production growth of wheat. Bajra, a largely rain fed crop of Haryana has shown an increase of 3.35 per cent per annum in production despite negative acreage growth and hence, production growth was contributed only by yield growth.

It is disappointing to note that productivity of important food grain of Haryana i.e. paddy has shown marginal growth. Under these circumstances, there is a need for urgent action so that yield of paddy could be improved. This is possible by adoption of high yielding variety seeds on the scale as recorded for wheat. The full adoption of recommended farm practices would maximize benefits.

In view of problems arising out of rice-wheat rotation, it would be prudent to work out ways to break away from wheat-rice crop pattern. Moreover, Haryana is facing problem of poor yield growth of paddy and over exploitation of water resources and the answer lies in crop diversification. Also, most of the rice eating states have become self sufficient in the production of rice and wheat and buffer stocks at the centre are more than the requirement. In these circumstances, Haryana should focus rigorously on promotion of pulses and horticultural crops through easy availability of certified seeds of area specific varieties and remunerative prices for the growers by way of marketing reforms. The time has come when crop diversification appears to be the way out for sustainability of agriculture in Haryana.

Chapter-4

Marketable and Marketed Surplus of Food Grains: An Empirical Analysis

Introduction

We have presented research methodology adopted for the selection of study area, sampling design, data collection and analytical frame work used in the light of specific objectives of the study in Chapter-2. Further, we have discussed transformation in the economy of Haryana, main indicators related to agricultural development, status of foodgrains in the crop economy and district wise compound growth rates of area, production and yield of the selected food grain crops in Chapter-3. Now, we provide a brief background of the selected districts, socio-economic characteristics of sampled farm households and results of the field survey regarding various aspects related to the marketed surplus of paddy, wheat and bajra. This chapter is divided into three sections. Section 1 provides main features of the selected districts while Section 2 deals with socio-economic characteristics of sampled farms. Section 3 is devoted to marketed surplus, retention and losses of the selected crops during the reference year.

Section-1

Main Features of the Selected Districts

This section provides a brief background of the selected districts and main characteristics related to agricultural status of the selected districts.

Background of Selected Districts

Karnal

Karnal is one of the oldest and important districts of Haryana. It is centrally located on the National Highway i. e Grand Trunk Road No.1. Karnal district lies on the western bank of river Yamuna which once flew in the vicinity of Karnal, but now flows about 11 km to the east by forming eastern boundary of the district. It is between Delhi and Chandigarh, almost 125 kms. away from each city. Karnal is located at 29.69^0 N latitude and 76.98 E longitude and is about 250 meters above the mean sea level. Historically, Karnal is said to have been founded during ancient times by the Kauravas in the Mahabharata era for Karna, a mythological hero and a key figure in the epic. Karnal

district is surrounded by Kurukshetra district on its north-west, Jind and Kaithal districts on its west, Panipat district on its south and by state of Uttar Pradesh on the east. The district has been divided into two sub-divisions namely Karnal and Assandh and constitutes six blocks viz. Karnal, Gharaunda, Indri, Nilokheri, Assandh and Nissing. It has 434 villages with total geographical area of 2, 46,251 ha.

According to 2011 Census, total population of district Karnal was 15.06 lakhs persons (5.94 % of state). Out of this, urban population formed a small fraction and was around 30 per cent. The district is primarily rural in nature and agriculture is the main stay of people. The rural population of the district was around 70 per cent. The sex ratio was 886. Total workers in Karnal comprised of 26.57 per cent cultivators, 23.70 per cent agricultural labors and remaining 50 per cent were non-agricultural workers.

It is indicated in table 4.1 that around 79.61 per cent of geographical area is cultivated in Karnal. The average size of holding is however, marginally higher (2.47 ha.) than the state level. This district has commendable irrigation facilities. The share of gross irrigated area in gross cropped area is as high as 100 per cent which is 15 per cent above the state level. As a result of excellent irrigational facilities, cropping intensity was 195. Food grains followed by sugarcane are the main crops grown in the district Karnal. The yield rates of food grains are higher than the state level. The major reasons for the success could be availability of irrigation and higher consumption of fertilizers.

Infrastructure and institutions in the Karnal district comprise banks, primary agricultural co-operative credit societies and regulated markets. The road length per lakh population was 135 kms. against 160 kms. in the state.

The topography of Karnal district is almost plain and well irrigated through tube-wells and canals. The Net Irrigated area is about 200000 ha. while the Gross irrigated area is 390000 ha. The percentage of the gross irrigated area to total cropped is very high i.e. 100 per cent.

The climate of the district is dry and hot in summer and cold in winter. June is the hottest month while January and February are the coldest months of the year. Its maximum and minimum temperatures vary from 43^0 to 21.5^0 C in June and from 22^0 to 4^0 in January.

The land of Karnal district is plain and productive. Soils are medium to heavy (sandy loam to clay loam) in texture. The soils are alluvial and region is ideal for cultivation of crops like rice, wheat, sugarcane, vegetables, etc.

The rice-wheat cropping system (RWCS) is the mainstay of agriculture in the district. A significant increase in the productivity of these crops after the adoption of high yielding varieties of wheat and rice brought a paradigm shift in the agronomy of the district. These developments are responsible for better procurement, creation of infrastructure like marketing, irrigation and electricity. With this, use of fertilizers especially after 1970s and use of pesticides after 1980s increased substantially.

The benefits of green revolution also brought water crisis due to its over-exploitation. There has been a consistent but conspicuous decline in the water table during past 40 years due to declining level of rainfall and over-dependence on ground water for irrigation (Table 4.2). The subsidy on electricity led to high energy use for extracting water from deeper depths. For many years, we kept shrugging it off but now the time has come to relook at the cropping pattern for saving water and electricity. The government has included special schemes and special campaigns have begun. The farmers can be persuaded to adopt alternative crop pattern if alternatives are risk free and provide expected profits. The introduction of summer moong to displace summer rice, use of green manuring and adoption of other resource conserving technologies will help farmers and policy makers to cope with future water crisis. Although, this RWCS belt around Karnal may contain enough water in the deeper zones but extraction of water from deeper layers will be more expensive and time consuming. In view of higher use of external inputs and heavy cost of water extraction, sustainability of this crop rotation has become a cause of concern. Reducing the cost of cultivation and diversification of farming are the priority areas. Most of the farmers are receiving the benefits of subsidies which reduce

cost of inputs but such subsidies now may have to be viewed in terms of saving of natural resources.

Currently, there is no risk free alternative of kharif rice or rabi wheat. But, we need to accelerate our plans to diversify crops through permutation and combination of resource saving varieties. However, expectation of farmers for higher profits can help catalyzing diversification in favor of an integrated farming system which includes rearing milch animals, mushroom cultivation, vegetable farming, intercropping and multiple land use systems.

Bhiwani

Bhiwani district came into existence on 22nd December 1972. It was carved out of the erstwhile district of Hisar and Mahendragarh by the Rajput Neem after his wife named Bhani. It is bounded by Hisar district in north, Mahendragarh district in south, Rohtak and Jhajjar districts in east and by state of Rajasthan in west. Bhiwani comprises of five sub-divisions namely, Bhiwani, Dadri, Loharu, Siwani and Tosham. Total number of villages in the district is 444.

Bhiwani district is situated in the south-western part of Haryana and lies between 28^0 20 to 29^0 05' North latitude and 75 26' to 76^0 28' East longitude. Its distance from New Delhi is about 125 kms. The total geographical area of district Bhiwani is 466000 ha. Out of this area, 415000 ha. is cultivable and 371000 ha. is cultivated. The area under forest is 2000 ha. The land under non-agricultural uses is 27000 ha. In terms of area, it is the largest district of Haryana.

Bhiwani district falls in semi arid and sub tropical agro climatic zone and it shares border with the Rajasthan state, therefore it is the hottest & driest district of the state. It is largely dry and sandy with undulating topography. The climate remains hot as well as dry in summer and extremely cold in winter. The temperature touches 48^0 C in June and falls up to 0^0C in January. Heavy dust storms are common during the summer. The mean annual rain fall is about 350 mm with unevenly distributed throughout the year. The rainfall in

the district increases from west towards east (211 to 490 mm) and over 70% of precipitation occurs during July to September (Table 4.2). Soils are light to medium in texture and p^H varies from 7.8 to 8.2. The soils are largely sandy in Budhra, Loharu, Behal, Kairu and Siwani while sandy to loamy sand in Charkhi Dadri-II, Tosham and part of Bhiwani and sandy loam to loamy in Charkhi Dadri-I (part of Bhiwani & Bawani Khera).

In Bhiwani district, 401000 ha area is irrigated of which 84000 ha. is under canal irrigation while 116000 ha is under tube-well irrigation. The ground water depletion is a serious problem in the tube wells as it is going 3-5 ft. deeper every year.

According to 2011 Census, total population of district Bhiwani was 16.29 lakhs persons (6.43 % of state). Out of this, urban population formed a small fraction and was around 20 per cent. The district is primarily rural in nature and agriculture is the main stay of people. The rural population of the district was around 80 per cent. The sex ratio was 884. Total workers in Bhiwani comprised of 52.40 per cent cultivators, 11.50 per cent agricultural labours and remaining 36.10 per cent were non-agricultural workers.

Table 4.1

Major Indicators Related to Population and Agriculture in the Selected Districts in Haryana

S. No.	Particulars	Karnal	Bhiwani	Haryana
I	**Population**			
	Population (2011) (lakh)	15.06 (5.94)	16.29 (6.43)	253.53 (100.00)
	Rural (lakh)	10.50	13.05	165.32
	% of Rural Population	69.73	80.10	65.21
	Urban (lakh)	4.56	3.24	88.21
	% of Urban Population	30.27	19.90	34.79
	Population Density (per sq. km)	598	341	573
	Sex Ratio	886	884	877
	% of SC Population to Total Population*	20.99	19.61	19.35
	Literacy Rate 2011 (percent)	76.40	76.70	76.60
II	**Workers***			
	Cultivators	26.57	52.40	36.03
	Agricultural Labourers	23.70	11.50	15.26
	Agricultural Workers	50.27	63.90	51.29
	Non-Agricultural Workers	49.73	36.10	48.71
III	**Area Cultivated and Irrigation**			
	% of Net Area Sown to Geographical Area	81.30	79.61	80.50
	Average size of Holdings (in ha.) (2010-11)	2.47	3.05	2.25
	Percentage of Gross Area Irrigated to Total Cropped Area (2010-11)	100	53.5	85.2
	Percent of Net Irrigated Area to Net Area Sown (2010-11)	99.9	54.4	82.1
	Cropping Intensity (%) 2010-11	195	202	185
IV	**Percentage of GCA under important crops**			
	Total Cereals	87.32	48.21	68.26
	Total Pulses	0.48	11.17	2.83
	Total Foodgrains	87.80	59.38	71.09
	Total Oilseeds	0.25	18.50	8.12
	Sugarcane	2.43	0.16	1.39
	Cotton	0.02	3.93	7.02
	Fruits and Vegetables	0.91	0.23	1.00
V	**Yield Rates(Kg/ha.)**			
	Total Cereals	3671	2536	3606
	Total Pulses	737	1045	965
	Total Foodgrains	3655	2256	3501
	Total Oilseeds	2300	1526	1727
	Sugarcane	6646	5083	5752
	Cotton	-	2483	4082
VI	**Input Use**			
	Fertilizer (kg/ha) (2010-11)	562.56	191.81	385.91
	Number of Tractors (per 000 ha of NSA) (2010-11)	95	59	75
	Electricity use in Agriculture (% to total in (2008-09)	21.74	10.54	39.45
VII	**Miscellaneous**			
	No. of Primary Agriculture Cooperative Societies	48	41	628
	No. of Banks per lakh population	11	8	10
	Total Road Length per lakh Population (2008-09)	134.58	175.29	116.38
	No. of Regulated Markets per lakh ha of Net Sown Area (2008-09)	5	2	3

Source: Provisional Population Tables, Census of India 2011 and Statistical Abstract of Haryana, 2009-10, 2010-11, *Census 2001 as data for 2011 are not yet available.

It is indicated in table 4.1 that around 79.61 per cent of geographical area is cultivated in Bhiwani. The average size of holding was 3.05 ha. and above the state level. This district has medium irrigation facilities. The share of gross irrigated area in gross cropped area was 53.5 per cent which is significantly below the state level. However, crop intensity was around 202. Further, share of electricity used for agriculture was around 11 per cent. The crop pattern in Bhiwani was found diversified in comparison to Karnal district and the state of Haryana. Food grains followed by oilseeds, pulses and cotton were the major crops cultivated in the area. But, yield rates of all these crops were found below the state level due to inadequate irrigation facilities and low consumption of fertilizers.

Infrastructure in the Bhiwani district comprises banks, primary agricultural co-operative credit societies and regulated markets. The road length per lakh population was 175 kms. against 160 kms. in the state.

In Bhiwani district, around two third soils are sandy, undulating with poor fertility and low water holding capacity. Though the development of irrigation systems particularly use of sprinklers for irrigation and advanced agro-technology has facilitated substantial increase in agricultural production of the district, a wide gap could be noticed between productivity of farmer's field and demonstrations. Also, yield rates of various crops in Bhiwani are below the state level.

At present, economic and ecological sustainability of the farming systems in the district are in jeopardy. There are serious concerns about the depletion of ground water level, degradation in soil fertility, increasing soil salinity near canals and sodicity in tube-well area, problems related to insects-pests, decline in bio-diversity, stagnation in yield rates, rising costs and diminishing economic returns, decline in factor productivity, declining and fragmented small holdings and narrow economic base of the farmers.

Keeping in view dominance of small fragmented holdings, lack of capital investment, necessity of recycling water, round the year employment, risk avoidance and non availability of quality irrigation water, farmers of the district started adopting mixed

farming by combining crops, animal husbandry, poultry, pisciculture, vermiculture, vegetable and fruit cultivation, etc. This concept of multiple uses of inputs was inadvertently put in practice based on traditional knowledge without proper market orientation. The success was achieved by large number of farmers through adoption of sprinkler irrigation and by integration of some other enterprises. Integration of food crops with vegetable and fruit crops is noteworthy. However, majority of the farmers are experiencing low productivity and profitability because of poor knowledge. Hence, there is an urgent need to impart farmers, a training on management skills in order to adopt high value crops/ enterprises at a wider scale.

Table: 4.2

Average Annual Rainfall in Selected Districts of Haryana

Year	Karnal (cm.)	Bhiwani (cm)
1980	83.5	30.1
1990	88.5	49.7
2000	47.1	18.7
2008	59.2	58.1

Source: Director of Land Records, Haryana

Operational Holdings

Table 4.3 presents distribution of farmers according to number and area of land operated by them in Karnal, Bhiwani and Haryana. Around 66 per cent of farmers in Karnal district cultivated land below 2ha. and their share in operated area was around 19 per cent. On the other hand, farmers owning land above 10 ha. constituted around 4 per cent of total farmers in number and cultivated around 29 per cent of total area. The scenario related to operational holdings in Bhiwani was different from Karnal district. The marginal and small farmers together constituted around 57 per cent of total farmers and cultivated around 16 per cent of total land. The large farmers with more than 10 ha, of land were 5 per cent of total farmers and operated almost 30 per cent of total area. The similar pattern emerged in Haryana where sizeable proportion of marginal and small farmers operated less than 22 per cent of land. In contrast, a minuscule number of large farmers owning more than 10 ha. cultivated more than 22 per cent of total land.

In a nutshell, small and marginal farmers dominated in number but remained impoverished due to operating tiny pieces of land. In contrast, large farmers, though handful in number controlled the land and therefore, produced more and enjoyed a better status by owning and operating land which is major asset in rural areas.

Table: 4.3
Number and Area of Operational Holdings by Size in Selected Districts and Haryana

(Percentage)

Size Group (in Hectares)	Karnal		Bhiwani		Haryana	
	No.	Area	No.	Area	No.	Area
Below 0.5	30.10	2.92	21.95	2.09	29.9	3.76
0.5-1.0	16.63	4.98	16.09	4.32	18.2	6.13
1.0-2.0	19.36	11.43	19.52	9.89	19.5	12.7
2.0-3.0	10.89	10.83	12.79	10.79	10.8	12
3.0-4.0	6.99	9.73	8.34	9.60	6.73	10.3
4.0-5.0	4.55	8.28	5.32	7.93	4.38	8.77
5.0-7.5	5.33	13.16	7.00	14.21	5.15	14.1
7.5-10.0	2.61	9.12	3.80	10.88	2.51	9.63
10.0-20.0	2.69	14.60	4.16	18.59	2.29	14
20.0 and above	0.85	14.95	1.03	11.70	0.54	8.61
Total	100	100	100	100	100	100

Source: Agricultural Census, 2010-2011

Cropping Pattern

Crop pattern signifies proportion of cultivated area under different crops at a point of time. Crop pattern of an area depends on soil, water and temperature. There are two important harvests in Haryana. Crops are grown mainly in two seasons namely, kharif and rabi. With adequate availability of irrigation facility, river beds are most suitable for the cultivation of summer season crops grown between April and July. Farmers' decisions to grow a particular crop during a season are mostly based on profitability,

resource availability and own requirement for consumption, payment in kind and feeding the livestock.

The information on cropping pattern in the selected districts of Karnal, Bhiwani and Haryana is given in table 4.4. Evidently, wheat and rice were the major crops constituting around 88 per cent of GCA in Karnal district. Sugarcane was also grown on 2.97 per cent of GCA. Thus, the agricultural economy of Karnal district was dominated by the food grain crops. The cropping pattern in Bhiwani district was dominated by rain-fed crops since around 27 per cent of GCA was devoted to bajra. The other crops like oilseeds and pulses enjoyed significant share in GCA. The important staple food grain of the population was wheat that was grown on 21 per cent of GCA. Profitability of agricultural sector can be measured on the basis of gross value from agriculture per hectare, which is presented in table 4.5. It indicates that gross value has been continuously increasing in both the districts since 1980-81.

At the state level, wheat, paddy, bajra, oilseeds and cotton were the major crops cultivated by the farmers. However, agricultural economy of the state like Karnal district was skewed towards food grain crops.

TABLE 4.4

Percentage of GCA under Important Food Grains in Selected Districts and Haryana (2010-11)

District	GCA ('000 ha.)	Rice	Wheat	Bajra	Gram	Pulses	Other food grains	Total food grains	Sugarcane	Oilseeds	Cotton	Other Crops	All
Karnal	390	44.28	43.79	0.10	0.02	0.31	1.11	88.59	2.97	0.28	-	11.41	100
Bhiwani	750	2.84	21.2	26.67	9.05	10.64	1.32	62.67	0.14	18.49	4.65	37.33	100
Haryana	6505	19.11	38.49	10.14	1.71	2.70	1.82	72.26	1.30	8.01	7.58	27.72	100

Source: Director of Land Records, Haryana.

Table: 4.5

Gross Value from Agriculture per Hectare at Current Prices

District	1980-81	1990-91	2000-01	2008-09
Karnal	7032	23768	64805	144778
Bhiwani	2783	9781	24246	60874
Haryana	4696	14574	41323	93906

Source: Department of Economic and Statistical Analysis, Haryana

Section-2

Socio-Economic Characteristics of Sample Households

The issues related to marketed surplus at the micro level considered for analysis in this study are complex and cannot be taken up for investigation in isolation without regard for some of the basic characteristics of the sampled households. We have included those characteristics that have a definite bearing on production and marketing decisions of the farmers. Specifically, we will look into demographic details such as caste, family size, and level of education and ownership of assets by the selected households in Karnal and Bhiwani districts during the year 2011-12. The other major characteristics such as land owned, leased in, leased out and irrigation status are covered as important correlates of the main theme.

General Background

We begin with presenting the distribution of surveyed households in the selected categories in Karnal and Bhiwani districts. This is presented in Table 4.6.

Table-4.6
Category Wise Number and Area Operated by Sampled Farms

Farm Size	No. of farmers				Area Cultivated			
	Karnal		Bhiwani		Karnal		Bhiwani	
	No.	%	No.	%	Area (ha)	%	Area (ha)	%
Marginal	58	29.00	28	28.00	48.4	9.31	22	8.27
Small	79	39.50	31	31.00	127.6	24.55	49.2	18.50
Medium	34	17.00	25	25.00	102.8	19.78	80	30.08
Large	29	14.50	16	16.00	241	46.36	114.8	43.16
All Farms	200	100.00	100	100.00	519.8	100.00	266	100.00

Source: Field Survey

It is indicated that marginal and small farmers together constituted 68.5 and 59% of the total households selected for the study in these districts. The medium and large categories formed at least 10% of the sample in each case. It may be noticed that share of each category in total cultivated area varied significantly since marginal plus small categories of farm households operated about 34 and 27% of total area, while large category cultivated more than 40% of total area in each selected district. It is evident from these

results that nature of disparity in terms of proportion in number and area cultivated in selected districts was found significant like Haryana. Further, these results substantiate that dependence of small holders for livelihood security was on small pieces of land. It is suggested that they should include alternative to food grain crops due to availability of family labor and expected higher returns.

The age of the head of the household plays an important role in adoption of technology and diversification of farming. The average age of the head of household was around 50 years in Karnal while it was 43 years in Bhiwani district.

The main occupation of the sampled farmers was crop farming. A significant fraction of them were also involved in dairying. The marginal farmers took up labour related work as and then they received opportunity to augment the family income. Thus, sampled farmers combined allied activities with main occupation of farming in the selected districts.

The educational level of head of the household is an indicator of better organizational set up and efficient use of available farm resources. Particularly, educational status of the head of the households affects the farm management techniques which in turn leads towards the optimum use of available farm resources and accelerates the agricultural production and farm income. Survey results point out that head of sampled households attended school for less than 10 years in all cases. This is indicative of overall poor attainment in terms of education by the head of households.

Table 4.7
Characteristics of Sampled Households in Karnal and Bhiwani Districts

A. Karnal

Sl. No.	Characteristics	Farm Size				
		Marginal	Small	Medium	Large	All Farms
I	Age of the decision maker (years)	45.98	48.71	52.38	59.17	50.06
II	Main Occupation (%)					
a.	Crop Farming	100.00	100.00	100.00	100.00	100.00
b.	Subsidiary					
	Dairy	82.76	70.89	50.00	31.03	65.00
	Service	0.00	2.53	0.00	0.00	1.00
	Farm Labour	8.62	7.60	0.00	0.00	5.50
	Others					
III	Education (years of schooling	6.21	6.63	9.65	9.76	7.48
IV	Family Size (no.)	6.53	6.98	7.88	8.66	7.25
	Male	3.62	3.87	4.41	4.62	4.00
	Female	2.91	3.10	3.47	4.03	3.25
V	Social Grouping					
	General	62.07	54.43	58.82	82.76	61.50
	SC/ST	6.90	1.27	0.00	0.00	2.50
	OBC	31.03	44.30	41.18	17.24	36.00
	Others	0.00	0.00	0.00	0.00	0.00
VII	Gender of head of household (%)					
	Male	100.00	100.00	100.00	100.00	100.00
	Female	0.00	0.00	0.00	0.00	0.00

B. Bhiwani

Sl. No.	Characteristics	Farm Size				
		Marginal	Small	Medium	Large	All Farms
I	Age of the decision maker (years)	44	42	42	46	43
II	Main Occupation (%)					
a.	Crop Farming	100.00	100.00	100.00	100.00	100.00
b.	Subsidiary					
	Dairy	89.29	83.88	60.00	37.50	72.00
	Service	0.00	0.00	0.00	0.00	0.00
	Farm Labour	0.00	0.00	0.00	0.00	0.00
	Others	0.00	0.00	0.00	0.00	0.00
III	Education (years of schooling)	7.00	8.00	7.00	8.00	7.00
IV	Family Size (no.)	5.68	5.58	5.84	6.44	5.81
	Male	2.89	3.13	3.08	3.44	3.10
	Female	2.79	2.45	2.76	3.00	2.71
V	Social Grouping					
	General	67.86	87.10	100.00	100.00	87.00
	SC/ST	32.14	12.90	0.00	0.00	13.00
	OBC	0.00	0.00	0.00	0.00	0.00
	Others	0.00	0.00	0.00	0.00	0.00
VI	Gender of head of household (%)					
	Male	100.00	100.00	100.00	100.00	100.00
	Female	0.00	0.00	0.00	0.00	0.00

Source: Ibid

The average size of family of sampled households was 7 and 9 persons respectively. It is essential to mention that large farmers exhibited higher size of family in comparison to other categories. It could be due to prevalence of joint family system.

If we look at the social grouping of sampled farmers, it may be observed that it was mix of general, SC and OBC categories. The largest percentage of cultivators belonged to general category in both the selected districts followed by OBC and SC households. The OBC households constituted 31% among surveyed cultivators in Karnal. The sizable proportion of OBC farm households in the sample implies ownership of land by OBC households in Karnal. On the other hand, none of the sampled farmers was OBC in Bhiwani but SC farmers constituted 13% of the sample. It may be noticed that males were the head of households in all cases and women headed households were non-existent. (Table 4.7). The broad features of sampled farmers are summarized below:

Broad Features of Selected Farmers

Items	Karnal	Bhiwani
Main Occupation	Farming	Farming
Subsidiary Occupation	Dairying	Dairying
Status of Land	Largely owned	Largely owned
Status of Irrigation	Fully Irrigated	Partially irrigated
Source of Irrigation	Electric and Diesel Tubewells	Canal + Electric and Diesel Tubewells
Crop Pattern	Monoculture	Diversified
Major Crops Grown	Paddy and Wheat	Wheat, Bajra, Gram, Mustard & Cotton
Yield Rates	Above National average	Mixed above National average for Bajra, Mustard and Cotton
Adoption of Technology	Good	Good
Farm Machinery used	Tractor, combined harvesters, etc.	Tractor, combined harvesters, etc.
Infrastructure	Good but needs improvements	Good but needs improvements

Land Details and Irrigation Status

Land details are important because they indicate the economic and social status of the farmer. The details of land owned and operated by sampled farmers and their tenancy status are presented in Table 4.8

We begin with average size of operational holding which is an important factor in augmenting agricultural income, marketable surplus and for adoption of improved farm management practices. The average size of holding of sampled farmers in Karnal district was around 2.6 hectares. Large farmers operated 8.31 hectares while marginal farm households operated less than one hectare. The overall net operated area by sampled farmers in Bhiwani district was around 1.47 ha. Irrigated and 1.19 ha. Unirrigated during the reference year. Like Karnal, disparity in land operated across farm size was high since large farmers operated 7.18 hectares against less than one hectare by marginal farmers.

The tenancy status of the farmer is an important factor in determining his involvement in agriculture. In our sample, large majority were owner cultivators. A fraction of cultivated land was found leased in. The system of leasing in and leasing out was not found popular among the sampled farmers. It was totally non-existent in Karnal district. However, land leased in by farmers in Bhiwani was small fraction of land operated by each category of farmer

TABLE 4.8

Characteristics of Operational Holdings on Sampled Farms in Karnal and Bhiwani Districts

A. Karnal   (ha/farm)

Farm Size	Owned Land		Leased- in Land		Leased- out Land		Average size of Operational Holding	
	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
Marginal	0.83	0.00	0.00	0.00	0.00	0.00	0.83	0.00
Small	1.62	0.00	0.00	0.00	0.00	0.00	1.62	0.00
Medium	3.02	0.00	0.00	0.00	0.00	0.00	3.02	0.00
Large	8.31	0.00	0.00	0.00	0.00	0.00	8.31	0.00
All Farms	2.60	0.00	0.00	0.00	0.00	0.00	2.60	0.00

B. Bhiwani   (ha/farm)

Farm Size	Owned Land		Leased- in Land		Leased -out Land		Average size of Operational Holding	
	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
Marginal	0.54	0.19	0.06	0.00	0.00	0.00	0.59	0.19
Small	0.61	0.73	0.25	0.00	0.00	0.00	0.86	0.73
Medium	1.31	1.31	0.58	0.00	0.00	0.00	1.89	1.31
Large	3.10	3.25	0.43	0.40	0.00	0.00	3.53	3.65
All Farms	1.16	1.13	0.30	0.06	0.00	0.00	1.47	1.19

Source: Ibid

The status of irrigation of farms plays an important role in productivity per unit of land. The entire land operated by the sampled farmers in Karnal was found irrigated. We had also sought information about source of irrigation during our survey. It may be observed from the table that major source of irrigation were tube wells in this district. In particular, tank irrigation was non-existent. (Table 4.9)

The sampled farmers in Bhiwani district combined different sources of irrigation. These were canal, tube well or both. Around 25 per cent of area was irrigated by canals. The remaining area was irrigated by electric and diesel tube wells. The diesel tube wells were used more by the farmers to irrigate their fields. The main reason could be poor availability of electricity. Farm size variations were common in use of different sources of irrigation. It may be observed that large farmers irrigated around 27 per cent of area by using diesel tube wells.

TABLE 4.9
Sources of Irrigation on Sampled Farms in Karnal and Bhiwani Districts

A. Karnal

Farm Size	Source of Irrigation (%)			
	Surface /Canal	**Tube Well / Ground-water**	**Tanks**	**Others**
Marginal	0.00	100.00	0.00	0.00
Small	0.00	100.00	0.00	0.00
Medium	0.00	100.00	0.00	0.00
Large	0.00	100.00	0.00	0.00
All Farms	0.00	100.00	0.00	0.00

B. Bhiwani

Farm Size	Source of Irrigation (%)					
	Canal	Electric Tube well	Canal+Electric Tube well	Diesel Tube well	Canal+Disel Tube well	Bore well
Marginal	19.23	3.85	3.85	46.15	23.08	3.85
Small	34.48	0.00	10.34	37.93	10.34	6.90
Medium	32.00	0.00	4.00	32.00	20.00	12.00
Large	6.67	0.00	0.00	26.67	46.67	20.00
All Farms	25.26	1.05	5.26	36.84	22.11	9.47

Source: Ibid

Crop Pattern

Climate of Haryana is suitable for growing a variety of crops but crop pattern in district Karnal was found highly skewed towards wheat and paddy. As indicated in Table 4.10 that wheat was the leading crop of rabi season, which occupied around 45% of GCA. Paddy emerged as the main crop of the kharif season with coverage of around 44% of GCA. All categories of farmers grew fodder in rabi as well as in kharif seasons. The share of GCA allocated to fodder varied between 2 and 10% by the farmers. The small farmers devoted higher proportion of GCA to fodder crops in comparison to other categories of farmers. It could be due to their higher requirement to feed animals owned by the farm families. Pulses and vegetables emerged as minor crops with less than 1% of GCA devoted to them.

Table 4.10
Cropping pattern on sampled farms in Karnal and Bhiwani districts

A. Karnal (area in ha)

Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Paddy	44.8	101.2	89.6	226.4	462
% to GCA	46.00	39.50	43.24	47.25	44.42
Jowar (fodder)	3.4	25.4	12	11.6	52.4
% to GCA	3.49	9.91	5.79	2.42	5.04
Pulses	0.4	2	2.4	1	5.8
% to GCA	0.41	0.78	1.16	0.21	0.56
Vegetables	0	0.4	0	0	0.4
% to GCA	0.00	0.16	0.00	0.00	0.04
Rabi					
Wheat	44.8	101	90	228	463.8
% to GCA	46.00	39.42	43.44	47.58	44.60
Barseem (fodder)	4	26.2	13	11.6	54.8
% to GCA	4.11	10.23	6.27	2.42	5.27
Pulses	0	0	0.2	0.4	0.6
% to GCA	0.00	0.00	0.10	0.08	0.06
Vegetables	0	0	0	0.2	0.2
% to GCA	0.00	0.00	0.00	0.04	0.02

Table 4.10 (Contd.)
B. Bhiwani

Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Paddy	1.6	4.2	4	1.2	11
% to GCA	3.76	4.35	2.52	0.57	2.16
Bajra	16.6	30.4	40	46.8	133.8
% to GCA	38.97	31.47	25.22	22.24	26.33
Jowar (fodder)	4	10.2	16.8	14.8	45.8
% to GCA	9.39	10.56	10.59	7.03	9.01
Cotton	0	2.6	12	23.6	38.2
% to GCA	0.00	2.69	7.57	11.22	7.52
Rabi					
Wheat	15.4	32.6	47.4	74	169.4
% to GCA	36.15	33.75	29.89	35.17	33.33
Mustard	2.6	10.6	19	1.6	33.8
% to GCA	6.10	10.97	11.98	0.76	6.65
Pulses	2.4	6	17.8	42.4	68.6
% to GCA	5.63	6.21	11.22	20.15	13.50
Sugarcane	0	0	1.6	6	7.6
% to GCA	0.00	0.00	1.01	2.85	1.50

Source: Ibid

The crop pattern on the sampled farms was found different in Bhiwani district. Like Karnal, wheat was the most important crop of rabi season occupying 33.33% of GCA. Bajra was the main crop during the kharif season. Pulses (gram), cotton and mustard were also grown by farmers and a sizeable proportion of area was devoted to these crops due to low requirement of irrigation. Farmers also grew fodder in order to feed their dairy animals. Further, paddy was observed a minor crop by occupying around 2% of GCA. It may be noted that proportion of GCA devoted to various crops grown by farmers varied significantly across the farm sizes. In a nutshell, Karnal emerged as the dominant case of wheat paddy rotation while crop pattern in Bhiwani was found diversified covering irrigated as well as rainfed crops.   (Table 4.10)

Productivity of Important Crops

Table-4.11 provides information about productivity of important crops grown by the sampled farmers in Karnal and Bhiwani districts. The yield of paddy on sampled farms in Karnal district was around 32 qtls/ha while it was lower in Bhiwani district (around 1 qtl/ha). The same was true for wheat as well. The yield of wheat on sampled farms in Karnal district was around 48 qtls/ha. On the other hand, it was around 41 qtls/ha in Bhiwani district. The productivity of mustard in Bhiwani on sampled farms ranged between 13 qtls/ha to 23 qtls/ha. It was found higher on medium farms in comparison to other categories of farms. The next crop, cotton showed a yield rate of around 38 qtls/ha on sampled farms and variations across farm sizes were common like other crops. It is worth mentioning that productivity of pulses was 9.32 qtls/ha on sampled farms in Bhiwani. It was above the national and state average. Therefore, policy makers should make all efforts to popularize pulses in this region by providing input and price support to the farmers.

Table 4.11
Productivity Of Important Crops On Sampled Farms In Karnal And Bhiwani Districts

A. **Karnal** (q/ha)

Seasons	Marginal	Small	Medium	Large	All Farms
Kharif					
Paddy	31.56	34.66	32.05	30.91	32.02
Jowar	657.35	440.12	442.08	500.86	468.11
Pulses	9.50	9.93	8.50	9.80	9.29
Vegetables	0.00	7.50	0.00	0.00	7.50
Rabi					
Wheat	49.41	47.20	47.33	48.12	47.89
Barseem	857.50	647.71	573.15	613.79	638.16
Pulses	0.00	0.00	10.50	9.50	9.83
Vegetables	0.00	0.00	0.00	300.00	300.00

B. Bhiwani

Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Paddy	20.00	21.90	13.25	23.33	18.64
Bajra	15.72	15.07	14.15	13.95	14.48
Jowar	0.00	0.00	0.00	0.00	0.00
Rabi					
Wheat	42.27	40.43	44.51	39.66	41.40
Mustard	16.92	15.47	23.26	13.13	19.85
Pulse	10.42	9.75	9.72	9.03	9.32
Cotton	0.00	33.46	37.17	38.26	37.59

Source: Ibid

Investment in Major Farm Assets

Land and other resources influence the level and pattern of farm management in farm households. We have collected data related to value of major farm assets owned by the surveyed households. We have earlier discussed about education. Now, we will focus our attention on assets. These included tractor, combine harvesters, threshing machines and tube wells. It may be observed from Table 4.12 that tractors followed by tube wells were the major farm assets in Karnal. The average investment per hectare by sampled farmers on these assets was Rs. 82060. These farmers also owned threshing machines and combine harvesters. The average investment per hectare at aggregate level by sampled farmers was Rs. 147703 in Karnal. It is revealing that small farmers invested more than large farmers.

Table 4.12
Level Of Investment On Farm Machinery By Sampled Farmers In Karnal And Bhiwani Districts

A. Karnal

Farm Size	Level of Investment (Rs/ha)				
	Tractors	Combined Harvester	Threshing Machine	Tube Well	Investment/ha
Marginal	4648.76	0.00	0.00	140909.10	145557.90
Small	77821.32	3605.02	78.37	75666.14	157170.90
Medium	100194.6	7198.44	3793.77	44795.72	155982.50
Large	92116.18	7033.20	9278.01	31161.83	139589.20
All Farms	82060.41	5569.45	5071.18	55001.92	147703.00

B.Bhiwani

Farm Size	Level of Investment (Rs./ha)				
	Tractors	Combined Harvester	Threshing Machine	Tube well	Investment/ha
Marginal	22727	0	3182	7818	33727
small	23882	0	3659	10264	37805
Medium	51475	563	9625	6650	68313
Large	33449	261	3136	5444	42291
All farms	36214	282	5188	6895	48579

Source: Ibid

The investment of sampled farmers in farm assets was found much lower in Bhiwani district in comparison to Karnal district. Tractor was the major asset. They also owned tube wells but per hectare level of investment was only Rs. 6895. It may be noticed that combine harvesters were not owned by marginal and small farmers. The average investment per hectare was Rs. 48579. Unexpectedly, medium farmers made higher investment in comparison to large farmers. (Table 4.12)

Livestock

It is common practice among farmers in Haryana to combine dairying with crop farming to fulfill domestic requirements of milk and its products and to supplement income. The sampled farmers owned milch animals worth Rs 112407 and Rs 93313 in Karnal and Bhiwani districts. Level of investment in livestock was higher in large farm category in comparison to other groups. Table 4.13 indicates that farmers preferred buffaloes over cattle and other livestock and therefore, investment in buffaloes constituted major component of total investment in livestock by farmers. It may be noted that large farmers invested in other livestock as well, which constituted 5.93 and 12.80 per cent of total value of livestock by sampled farmers in Karnal and Bhiwani.

TABLE 4.13
Per Farm Value of Livestock on Sampled Farms in Karnal and Bhiwani Districts
Karnal(Rs)

Farm Size	Level of Investment in Rs./Farm			
	Cattle	Buffalo	Others	Total value of livestock
Marginal	0	84983	2510	87493
Small	3608	102557	4447	110612
Medium	1471	113000	6574	121044
Large	0	135862	21138	157000
All Farms	1675	104065	6667	112407

B. Bhiwani

Farm Size	Level of Investment in Rs./Farm			
	Cattle	Buffalo	Other	Total value of livestock
Marginal	357	61179	2500	64036
small	6065	65161	3461	74687
Medium	2000	90240	8920	101160
Large	1875	116875	49625	168375
All farms	2780	78590	11943	93313

Source: Ibid

Section-3

Estimation of Marketed Surplus

In the preceding sections, we have presented the main features of the selected districts and socio-economic characteristics of the sampled farmers. Now, we will analyze main findings of the survey pertaining to crop losses, marketed surplus, factors affecting marketed surplus and results of regression analysis.

Availability of Selected Crops

Marketed surplus of food grains with farmers depends on availability which includes stocks from previous year and production in the current year. Table 4.14 provides information on availability of paddy and wheat with the sampled farmers in Karnal district. The beginning stock of paddy was 0.33 qtls. per farm at the aggregate level. It showed marginal variations across the farm size groups. Further, per farm production of paddy during the reference year was 73.96 qtls. After adding stock, availability of paddy could be noticed 74.29 qtls. per farm. The production of paddy per farm on marginal, small, medium and large farms was between 24.38 and 241.31 qtls. The disparity across the farm size was as high as ten times. It was primarily due to the large size of land owned and operated by big farmers despite low productivity of paddy on their farms in comparison to other categories.

Table 4.14
Availability of Paddy and Wheat on Sampled Farms in Karnal and Bhiwani Districts

A. Karnal (Qtls)

Farm Size	Beginning Stock	Production	Availability
		Paddy	
Marginal	0.34	24.38	24.72
Small	0.32	44.41	44.73
Medium	0.32	84.47	84.79
Large	0.32	241.31	241.63
All Farms	0.33	73.96	74.29
		Wheat	
Marginal	1.35	38.16	39.51
Small	1.58	60.34	61.92
Medium	2.39	125.29	127.68
Large	4.00	378.34	382.34
All Farms	2.00	111.06	113.06

Table 4.14 (Contd.)
B. Bhiwani

Farm Size	Beginning Stock	Production	Availability
Bajra			
Marginal	0.00	9.32	9.32
Small	0.00	14.77	14.77
Medium	0.00	22.64	22.64
Large	0.00	40.81	40.81
All Farms	0.00	19.38	19.38
Wheat			
Marginal	1.24	23.25	24.49
Small	1.31	42.52	43.83
Medium	1.81	84.40	86.21
Large	2.70	183.44	186.14
All Farms	1.64	70.14	71.78

Source: Ibid

Wheat is the main staple in the diet of people in Karnal district and therefore, average beginning stock with farmers was around 2 qtls. Large farmers possessed higher stocks in comparison to other categories. Further, per farm production was around 378 qtls. on large farms against around 38 qtls. on marginal farms. After adjusting beginning stock, per farm availability of wheat was around 113 qtls. Like production, large disparities were noticed in availability of wheat across farm sizes. As a result, large farmers exhibited availability of around 382 qtls/farm while marginal farmers indicated a small quantity of 40 qtls/farm. The beginning stock of wheat and production with the farmers in Bhiwani districts were found lower in comparison to Karnal district. But, overall results were on the similar lines.

The same table also depicts information on availability of bajra with the sampled farmers in Bhiwani district. The beginning stock of bajra was found nil with all groups of farmers. The per farm production of bajra during the reference year at the aggregate level was 19.38 qtls against only 9 qtls. at the marginal farms. Since, the stock from previous year was nil, availability became equal to current production.

Retention

The state of Haryana is characterized by three main staple food grains i.e. wheat, paddy and bajra. Wheat is the main staple diet and rice is gradually occupying an important position. Bajra can be regarded as an inferior cereal in relation to wheat and rice and can

be considered as the diet of the poor. As a result, these three cereals occupy an important position in terms of production and human consumption. Wheat and bajra are used as animal feed too. In such circumstances, consumption is one of the determinants of marketable surplus of the cereals.

The proportion of produce available for disposal in the market depends on the level of output and retention. Normally, farmers retain a part of the output for the following components of retention:

I. Retention for consumption of family.
II. Retention for meeting seed requirements of the next season.
III. Retention for animal feed.
IV. Retention for a part of payment of wages in kind to the hired agricultural laborers and others.
V. Retention for the payment of rent in kind in the case of leased in land.

The pattern of retention by the sampled farmers is presented in table 4.15. The per farm retention of paddy for domestic consumption by the farmers at the aggregate level was 0.66 quintals. Farm size variations were not wide since all categories retained less than one quintal for domestic consumption. In addition, some farmers purchased a small quantity from the market for domestic consumption. It may be noticed that small size farmers purchased higher quantity in comparison to large land owning classes. It could be due to low output in small categories and immediate sale of higher proportion of produce for cash income and thereby, retaining low quantity for family consumption. All categories also kept a part of produce to fulfill seed requirements. It may be pointed out that large farmers retained higher quantity of produce in comparison to other categories of farmers. Paddy was not used as animal feed or as a kind payment by the sampled farmers. The per farm retention of paddy by farmers for all purposes was 2.08 quintals and the highest could be noted in case of large farmers.

Table 4.15
Retention Pattern of Paddy and Wheat on Sampled Farms in Karnal and Bhiwani Districts

A. Karnal (qtl/ farm)

Farm Size	Self Consumption			Seed	Feed	Others	Payments in kind (Qtl)	Total Retention
	Retention	Purchased						
		Quantity	Price					
Paddy								
Marginal	0.60	0.31	6544	0.49	0.00	0.00	0.00	1.09
Small	0.81	0.43	6686	0.73	0.00	0.00	0.00	1.54
Medium	0.47	0.05	7968	1.65	0.00	0.00	0.00	2.12
Large	0.59	0.06	5614	4.89	0.00	0.00	0.00	5.48
All Farms	0.66	0.28	6646	1.42	0.00	0.00	0.00	2.08
Wheat								
Marginal	6.76	0.00	0.00	0.98	3.90	0.00	0.00	11.64
Small	7.86	0.00	0.00	1.41	5.89	0.13	0.49	15.78
Medium	8.79	0.00	0.00	2.72	6.29	0.00	8.71	26.51
Large	8.93	0.00	0.00	8.01	6.90	0.00	13.72	37.56
All Farms	7.86	0.00	0.00	2.47	5.53	0.05	3.67	19.58

B. Bhiwani

Farm Size	Self- Consumption			Seed	Feed	Others	Payments in Kind	Total retention
	Retention	Purchased						
		Quantity	Price					
Bajra								
Marginal	0.24	0.00	0.00	0.07	2.02	0.38	0.00	2.71
Small	0.22	0.00	0.00	0.00	2.07	0.31	0.00	2.60
Medium	0.27	0.00	0.00	0.00	2.52	0.43	0.00	3.22
Large	0.31	0.00	0.00	0.00	3.51	1.38	0.00	5.19
All Farms	0.25	0.00	0.00	0.02	2.40	0.53	0.00	3.20
Wheat								
Marginal	5.56	0.00	0.00	0.58	1.93	0.00	0.00	8.07
Small	5.70	0.00	0.00	1.07	2.99	0.00	0.00	9.76
Medium	6.06	0.00	0.00	1.96	3.26	0.16	0.00	11.44
Large	8.47	0.00	0.00	4.47	4.13	0.00	0.00	17.06
All Farms	6.19	0.00	0.00	1.70	2.94	0.04	0.00	10.87

Source: Ibid

Results further show that amount of wheat retained for domestic consumption by farmers in Karnal district was more than 10 times as compared to paddy since it is the main staple food grain consumed by population in the region. A comparison of wheat retained by different categories of farmers indicated that even the small and marginal farmers retained around 7 to 8 quintals for domestic consumption. None of the sampled farmers purchased wheat from the market due to sufficient stock at home.

In spite of the tendency of small and marginal farmers to sell larger share of produce in the market, to earn cash everyone retained wheat for seed and animal feed. Medium and large farmers kept aside 8.71 and 31.72 quintals for payments in kind. The per farm quantity of wheat retained by farmers was 19.58 quintals. Large farmers followed by medium farmers retained higher quantity than small category farmers in Karnal district.

The findings presented regarding retention of wheat by the sampled farmers in Bhiwani district were on the similar lines. All categories of farmers retained wheat for self consumption, seed requirement and animal feed. It may be observed that large and medium farmers retained higher quantity in comparison to others. It could be noticed that retention of wheat for each component was found lower than developed district of Karnal.

An analysis of the behavior of farmers pertaining to retention of bajra in Bhiwani district revealed that farmers retained on an average 25 kgs. for self consumption, 2.40 quintals for animal feed and 0.53 quintals for other purposes. The per farm retention for all components was 3.20 quintals. Clearly, lower size class retained less than the large size classes. None of the farmers purchased bajra from the market.

In a nutshell, wheat ranked first in terms of retention by all categories of the farmers. Domestic consumption followed by animal feed and seed was the major components of retention. The next crop, paddy was retained by farmers in smaller quantities for family consumption and seed. A small quantity of bajra was retained for domestic consumption and animal feed. All categories of farmers purchased a small quantity of paddy in Karnal district but none of farmers purchased wheat and bajra from the market in Bhiwani district.

Estimation of Crop losses

It is well known fact that agriculture is different from other forms of productive activities and is largely exposed to the seasonal elements of nature. Natural events have always had a say on the performance of agriculture in all countries. Weather is probably the biggest source of threat to crop cultivation among all perils. In India, the farmers are said to be at the mercy of the rain god even today despite the all round technological progress. The menace of biological pests is another major threat. Not only are the exposures beyond human control, the solutions to the problem, even if available, are not easy. The future of agriculture has to be about how human beings learn to cope with the perils of nature and protect the activity from calamities. In addition to natural factors, there are production losses of agricultural commodities during the harvest and transportation from farm to the sale point. These losses can be easily reduced by careful handling. We had gathered this information during the field survey and now we present empirical findings on crop losses during the harvest and transportation.

Production Losses during Harvest

We have worked out share of production lost for three selected crops on the sampled farms in Karnal and Bhiwani districts. Table 4.16 provides information on proportion of production lost on sampled farms during harvesting, threshing, winnowing and total loss for paddy, wheat and bajra in Karnal and Bhiwani districts. The total loss in case of paddy was 3.51 per cent of the production at the aggregate level. Around 2 per cent of paddy production was lost during harvesting while 1.04 and 0.64per cent losses of paddy accrued during threshing and winnowing. Most of the sampled farmers used combined harvesters for harvesting and threshing that resulted in some loss during these operations. Farm size variations were common. The proportion of loss was found higher on large farms in comparison to other categories of farms. In particular, losses were found minimum on the marginal farms. It could be due to their personal involvement in these activities.

It can be seen further that 3.59 per cent of wheat production was lost during harvesting, threshing and winnowing on sampled farms in Karnal district. It was found marginally lower on sampled farms in Bhiwani district. Like paddy, the minimum share of production loss was observed on marginal farms. It could be due to the reason that they take special care and handle the produce personally because a small loss also matters for them in terms of losing returns.

Bajra, the third selected crop for the study has also exhibited harvesting, threshing and winnowing losses on sampled farms in Bhiwani district. At the aggregate level, 3.99 per cent of production was lost during these operations. The share of harvesting losses was found higher than threshing and winnowing losses. The farm size variations in loss could be noticed at each level of operations. However, minimum share of bajra production was lost on marginal farms.

Table 4.16
Crop Losses on Sampled Farms in Karnal and Bhiwani Districts
A. Karnal

(Per cent of production)

Farm Size	Harvesting	Threshing	Winnowing	Total Loss
Paddy				
Marginal	1.50	0.80	0.48	2.78
Small	1.65	1.00	0.45	3.10
Medium	1.78	1.05	0.60	3.43
Large	2.01	1.11	0.78	3.90
All Farms	1.83	1.04	0.64	3.51
Wheat				
Marginal	1.50	0.81	0.35	2.66
Small	1.66	1.00	0.55	3.21
Medium	1.78	1.05	0.75	3.58
Large	2.01	1.11	0.82	3.94
All Farms	1.84	1.05	0.70	3.59

B. Bhiwani

Farm Size	Harvesting	Threshing	Winnowing	Total Losses
Bajra				
Marginal	1.92	0.61	0.62	3.15
Small	2.02	0.93	0.77	3.72
Medium	2.14	1.06	0.87	4.07
Large	2.28	1.10	1.13	4.51
All Farms	2.11	0.98	0.90	3.99
Wheat				
Marginal	1.10	1.31	0.44	2.85
Small	1.60	1.00	0.55	3.15
Medium	1.70	1.07	0.54	3.31
Large	1.92	1.36	0.63	3.91
All Farms	1.72	1.20	0.57	3.49

Source: Ibid

Crop losses during Transportation

We have worked out proportion of production lost during transportation and handling on the basis of information gathered from the sampled farmers during the field survey. Most of the selected farmers used tractor trolley as a mode of transport from field to market while produce was manually carried out from field to threshing floor. The information on proportion of produce lost by the sampled farmers during these operations by farm size is presented in Table 4.17. It may be noticed that around 3 per cent of paddy produce was lost by the farmers at the aggregate level. A mixed scenario emerged at the farm size level. None of the farm category lost less than one per cent of paddy during these operations. The results for crop losses during the transport for wheat crop were on similar lines in Karnal and Bhiwani districts. Each category of farmers incurred losses in transporting the produce from farm to market for sale purpose.

We had also computed share of bajra production lost during the transport on sampled farms in Bhiwani district. Like wheat and paddy, each category of farmers lost a small proportion of bajra production during the transportation from field to threshing floor and from field to market. The losses however, were found minimum on the marginal farms.

Table 4.17
Crop Losses during Transport on Sampled Farms in Karnal and Bhiwani Districts

A. Karnal   (Per cent of production)

Farm Size	Field to Threshing Floor	Field to Market
Paddy		
Marginal	1.13	1.55
Small	1.11	1.51
Medium	1.24	1.73
Large	1.39	1.85
All Farms	1.27	1.72
Wheat		
Marginal	1.14	1.54
Small	1.11	1.49
Medium	1.23	1.72
Large	1.38	1.85
All Farms	1.27	1.72

B.Bhiwani

Farm Size	Field to Threshing Floor	Field to Market
Bajra		
Marginal	1.00	1.59
Small	1.26	1.72
Medium	1.27	1.81
Large	1.54	2.50
All Farms	2.11	1.99
Wheat		
Marginal	1.00	1.58
Small	1.00	1.22
Medium	1.33	1.93
Large	1.58	2.31
All Farms	1.34	1.92

Source: Ibid

Storage losses

We have observed earlier that all categories of households stored selected food grains primarily for family consumption, seed and feed purposes in Haryana. It was reported by the respondents during the survey that all of them stored food grains for the entire year till the arrival of the next harvest in steel bins.

Table 4.18
Characteristics of Storage on Sampled Farms in Karnal and Bhiwani Districts

A. Karnal

Farm Size	Subsidy Received (%)	Weighted Average Subsidy (Rs.)	Storage Facility Perceived adequate (%)	Additional Storage to be Created	
				Yes (%)	No (%)
Paddy					
Marginal	0	0	0	100	0
Small	0	0	0	100	0
Medium	0	0	0	100	0
Large	0	0	0	100	0
All Farms	0	0	0	100	0
Wheat					
Marginal	0	0	0	100	0
Small	0	0	0	100	0
Medium	0	0	0	100	0
Large	0	0	0	100	0
All Farms	0	0	0	100	0

B. Bhiwani

Farm Size	Subsidy Received (%)	Weighted Average Subsidy (Rs.)	Storage Facility Perceived adequate (%)	Additional Storage to be Created	
				Yes (%)	No (%)
Bajra					
Marginal	0	0	0	100	0
Small	0	0	0	100	0
Medium	0	0	0	100	0
Large	0	0	0	100	0
All Farms	0	0	0	100	0
Wheat					
Marginal	0	0	0	100	0
Small	0	0	0	100	0
Medium	0	0	0	100	0
Large	0	0	0	100	0
All Farms	0	0	0	100	0

Source: Ibid

Respondents informed that they clean and dry the grain before storage to save the grain from variety of losses which occur if produce is not handled carefully before storage. It is extremely important to save agricultural produce from pests, rodents and fungus during storage by taking proper precautionary measures.

It was observed that households stored wheat and paddy in substantial quantity for the next year and small quantities were taken out in bits at frequent intervals for family consumption as per the family requirement. Since, produce was stored in steel containers with light lids, no storage losses were reported by the respondents for the selected crops of paddy, wheat and bajra in Karnal as well as in Bhiwani districts of Haryana.

Table 4.18 presents characteristics of storage on sampled farms in Karnal and Bhiwani districts. It is self explanatory since none of the farmers received any subsidy for storage purpose. Every one wished to create an additional storage capacity and advocated for a subsidy to purchase more steel bins.

Estimation of Marketable and Marketed Surplus of Selected Crops

At the outset, it would be useful to define the concept of marketable and marketed surplus used in this study. Marketable surplus represents the surplus available for disposal after meeting out requirements of family consumption, seed, feed, kind payments and miscellaneous uses during the reference year. Thus, excess of stock over retention is referred as marketable surplus. Further, marketed surplus refers to that part of marketable surplus which is actually disposed off by the farmers during the reference year. It was estimated by deducting the retentions from total availability.

Table 4.19 presents the status of marketable and marketed surplus of paddy, wheat and bajra on the sampled farms during 2011-12. At the overall level, marketable surplus of paddy in Karnal district was 13481 qtls. which translates into per farm surplus of 67 qtls. The repurchases of paddy by different category of farmers and at the aggregate level were marginal and therefore, its impact was insignificant. As expected, large farmers followed by medium farmers indicated higher surplus in comparison to small and marginal farmers who devoted low area to paddy due to tiny pieces of land. This implies that marketable surplus of paddy is primarily concentrated in the hands of large land owning classes which constitute low proportion in number. Further, 68 per cent of small and marginal farmers contributed around one third in the marketable surplus of paddy. It may be noted that marketable and marketed surplus were found almost similar because respondent farmers in Haryana did not withhold the stock of paddy for future sale due to easy access to procurement facilities by the central and state agencies at the assured prices. They sold entire stock to government agencies at the minimum support price. The higher marketed surplus

with medium and large farmers also could be due to commercialization of agriculture in the state that has led to change over from kind to money wages.

Table 4.19 also presents marketable and marketed surplus of wheat with the sampled farmers in Karnal and Bhiwani districts. The marketable surplus of wheat with the sampled farmers was 17974 and 5617 qtls. in Karnal and Bhiwani districts at the overall level. The large and medium farmers contributed around 73 and 75 per cent of the total in both the situations. The remaining one fourth was contributed by the small and marginal farmers. This is largely due to the disparities in area owned, cultivated and devoted to this crop by different categories of farmers. The large and medium farmers cultivated around 343.8 and 161.16 ha. in Karnal and Bhiwani. None of the farmers reported repurchase of wheat due to sufficient stock. Like paddy cultivators, wheat producers disposed off entire stock of wheat once again to government agencies due to availability of procurement facilities at the assured prices in the state. This resulted in equal marketable and marketed surplus of wheat.

Table 4.19 also presents information on marketed and marketable surplus of the third selected crop, which is bajra grown by the sampled farmers in Bhiwani district. At the aggregate level, marketable surplus of bajra was around 1476 qtls. which translates into per farm marketable surplus of 14.76 qtls. Although, a large share (65%) of marketable surplus was contributed by the medium and large farmers, it was found lower by 8 to10 per cent in comparison to paddy and wheat. It could be due to higher yield rate of bajra on small and marginal farms and their low share in retention for domestic use. Like superior cereals, paddy and wheat, farmers did not withhold any stock for future sale and sold the entire stock to the private traders/ commission agents due to the absence of procurement facility by the government agencies. This tendency was found uniform for all categories of farmers. Otherwise also, small and marginal farmers sell their produce after the harvest due to cash requirements to purchase other items required by them.

Table 4.19
Marketable and marketed surplus of selected crops in Karnal and Bhiwani districts

A. Karnal   (qtls)

Farm Size	Marketable Surplus			Marketed Surplus	
	Total	Per farm		Total	Per farm
		Before repurchase	After repurchase		
Paddy					
Marginal	1294.28 (9.60)	22.32	22.01	1294.28 (9.60)	22.32
Small	3211.10 (23.82)	40.65	40.22	3211.10 (23.82)	40.65
Medium	2627.21 (19.49)	77.27	77.22	2627.21 (19.49)	77.27
Large	6348.68 (47.09)	218.92	218.86	6348.68 (47.09)	218.92
All Farms	13481.26 (100.00)	67.41	67.13	13481.26 (100.00)	67.41
Wheat					
Marginal	1498.65 (8.34)	25.84	NA*	1498.65 (8.34)	25.84
Small	3408.29 (18.96)	43.14	NA	3408.29 (18.96)	43.14
Medium	3457.47 (19.24)	101.69	NA	3457.47 (19.24)	101.69
Large	9609.86 (53.46)	331.37	NA	9609.86 (53.46)	331.37
All Farms	17974.27 (100.00)	89.87	NA	17974.27 (100.00)	89.87

B. Bhiwani

Farm Size	Marketable Surplus		Marketed Surplus	
	Total	Per Farm	Total	Per Farm
Bajra				
Marginal	170.05 (11.52)	6.07	170.05 (11.52)	6.07
Small	346.53 (23.48)	11.18	346.53 (23.48)	11.18
Medium	445.22 (30.17)	17.81	445.22 (30.17)	17.81
Large	514.05 (34.83)	32.13	514.05 (34.83)	32.13
All Farms	1475.86 (100.00)	14.76	1475.86 (100.00)	14.76
Wheat				
Marginal	424.51 (7.56)	15.16	424.51 (7.56)	15.16
Small	985.33 (17.54)	31.78	985.33 (17.54)	31.78
Medium	1730.54 (30.81)	69.22	1730.54 (30.81)	69.22
Large	2476.59 (44.09)	154.79	2476.59 (44.09)	154.79
All Farms	5616.97 (100.00)	56.17	5616.97 (100.00)	56.17

Source: Ibid, NA*: Not Applicable

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In a nutshell, a positive relationship emerged between farm size and marketed surplus on sampled farms irrespective of the type of food grain (Patnaik, 1975; Sharma, 1972; Gulati, 1980). Like earlier studies which emphasized that size of land holding is one of the main factors governing marketed surplus of food grains in the country was found true in this case study. The higher proportion of marketed surplus of paddy could be due to the reason that it does not form the main stable diet of the population in Haryana.

Table 4.20 summarizes the overall results on proportion of availability of selected crops consumed, retained for other purposes and sold in the market. The marketed surplus of food-grains was found relatively low up to size class of 2 ha. but the proportion steadily increased thereafter. This phenomena could be attributed to low production on their farms and a part of output retained for consumption and animal feed. Our findings on marketed surplus of wheat, paddy and bajra on sampled farms corroborate with secondary data results that were 97 per cent for paddy and around 81-84 per cent for wheat and bajra (Agricultural Statistics at a Glance, 2011) in Haryana.

Table 4.20
Share of Marketed Surplus on Sampled Farms in Karnal and Bhiwani

Karnal

Farm size	Availability	Consumption	Seed	Feed	Other payments	Loss from Field to Market	Marketable	Marketed
Paddy								
Marginal	100.00	2.38	1.99	0.00	0.00	1.52	94.11	94.11
Small	100.00	1.82	1.64	0.00	0.00	1.50	95.05	95.05
Medium	100.00	0.55	1.94	0.00	0.00	1.73	95.78	95.78
Large	100.00	0.24	2.02	0.00	0.00	1.85	95.88	95.88
All Farms	100.00	0.88	1.91	0.00	0.00	1.71	95.49	95.49
Wheat								
Marginal	100.00	17.11	2.47	9.86	0.00	1.49	69.07	69.07
Small	100.00	12.69	2.28	9.50	0.20	1.45	73.86	73.86
Medium	100.00	6.89	2.13	4.93	0.00	1.69	84.36	84.36
Large	100.00	2.34	2.10	1.80	0.00	1.83	91.94	91.94
All Farms	100.00	6.95	2.18	4.89	0.04	1.69	84.26	84.26

Bhiwani

Farm size	Availability	Consumption	Seed	Feed	Other payments	Loss from Field to Market	Marketable	Marketed
Bajra								
Marginal	100.00	2.56	0.77	21.69	4.10	1.59	69.30	69.30
Small	100.00	1.52	0.00	14.02	2.10	1.72	80.65	80.65
Medium	100.00	1.18	0.00	11.15	1.91	1.81	83.95	83.95
Large	100.00	0.77	0.00	8.59	3.37	2.50	84.77	84.77
All Farms	100.00	1.31	0.10	12.38	2.74	1.99	81.47	81.47
Wheat								
Marginal	100.00	22.72	2.35	7.87	0.00	1.50	65.56	65.56
Small	100.00	13.00	2.44	6.83	0.00	1.18	76.55	76.55
Medium	100.00	7.02	2.28	3.78	0.19	1.89	84.84	84.84
Large	100.00	4.55	2.40	2.22	0.00	2.28	88.55	88.55
All Farms	100.00	8.63	2.37	4.10	0.06	1.88	82.97	82.97

Source: Ibid

Factors Affecting Marketed Surplus

It is a common experience that extent of marketed surplus differs from region to region, year to year and crop to crop in the same region. We have noticed that it varied from holding to holding within the same area and year. Normally, marketed surplus would depend on socio-economic, institutional, infrastructural and technological factors. These factors influence marketed surplus of different crops in a variety of ways. Therefore, it is not possible to generalize factors that determine magnitude of marketed surplus. However, above mentioned factors seem to play an important role in determining the extent of marketed surplus of the selected three crops i.e. paddy, wheat and bajra in Haryana.

Socio –Economic Factors

According to some literary evidences, farm size is one of the important factors influencing magnitude of the marketed surplus of agricultural commodities. Normally, larger the farm size, higher is the marketed surplus. We have already seen that bulk of the marketed surplus of the selected crops was generated by the medium and large category of farmers. The small and marginal farmers with their low level of production essentially generated low marketed surplus of food grains after fulfilling their family requirements and other obligations. Our present study has found positive relationship between farm size and marketed surplus of paddy, wheat and bajra in Karnal and Bhiwani districts. The large farmers contributed 47 and 53% share in the marketed surplus of paddy and wheat against around 10 and 8% by the marginal farmers in Karnal district. The same could be noticed for wheat and bajra in Bhiwani district

Education of the head of the household also plays an important role in augmenting production through adoption of innovations and commercialization of agriculture. In our sample, marginal, small, medium and large farmers attended school for 7 and 8 years that is inadequate. It does not show any impact on marketed surplus on the sampled farms. The caste of sampled households represented as general, OBC and SC did not show any influence on marketed surplus of selected crop. The nature of crops grown plays important role in determining the size of marketed surplus. Normally, food grain crops would have lower proportion of production as marketed surplus in comparison to cash crops which are produced by the farmers for commercial purpose. In case of food grain crops, farmer is a producer as well as consumer and therefore, sizeable proportion of his production is retained for domestic consumption. We have observed that proportion of

marketed surplus was higher in case of paddy due to low self consumption by the farmers. On the other hand, farmers retained 6.95 and 8.63 per cent of wheat for self consumption in Karnal and Bhiwani at the overall level. Thus, consumption habits of farm families influence marketed surplus of a particular crop. For instance, a large share of paddy output is marketed by the sampled farmers because rice is not a staple food grain of farm families in Haryana.

Another important factor governing behavior of marketed surplus is kind payments to the hired laborers. With the commercialization of agriculture, kind payments reduced while nominal wages increased in Haryana. As regards, practice of payment of wage to hired agricultural workers in kind is not uniform in all areas. In some areas, share of wage payment in kind is higher while in others vice-a-versa is true. In Haryana, payments to hired agricultural labourers are made in cash for most of the agricultural operations except in the harvesting season, when payments are made in kind plus cash. This practice leaves higher quantity of produce as marketed surplus.

Further, payments either in kind or cash will not be the same to hired labourers where female, male and child labourers are engaged at various stages of agricultural operations. Male labourers generally get higher wages than that of female and child labourers while female labourers would get more than that of child labourers. The difference in wages is based on the assumption that productivity of male labourers is higher in comparison to female and child agricultural labourers. Thus, component of kind payment to hired labourers appear to be a crucial factor influencing marketed surplus in particular at medium and large size farms.

In brief, socio-economic factors such as size of farm, cash requirement of farmers, nature of crops cultivated, consumption habits of population and payments in kind to hired agricultural labourers are likely to affect quantum of marketed surplus of agricultural commodities. But in this case study, farm size and consumption were found to be the major socio-economic factors influencing the marketed surplus of selected food-grains in Haryana.

Institutional Factors

It has been a remarkable journey for Haryana to move its agriculture to the present level of production of foodgrains with its contribution of 27.69 and 5.21% in national pool of wheat and rice procurement for the distribution under the PDS. In order to achieve these levels, the state has adopted various institutional interventions as the key drivers to guide the agricultural sector. The adoption of technology (HYVs and chemical fertilizers) could be successful due to the continued

thrust on irrigation and extension. The agricultural growth in this period was mainly supported by institutional credit, subsidized input supply and incentive schemes through provision of minimum support prices.

The presence of institutional facilities in Haryana facilitated better management at the farmers end. A perusal of Table 4.21 indicates that there were 164 cooperative societies per lakh of population with 258 members of all societies per thousand of population. Each society had average working capital per head of Rs. 35822 during the year 2009-10. Among the selected districts, Bhiwani was observed far ahead than Karnal by indicating 110 cooperative societies which constituted 67.07 % of the total societies in the state. However, number of members of all societies per thousand of population and working capital per head were found much smaller than the state level. Karnal was observed far behind except for number of members per thousand of population. In addition, each district had Central Cooperative Bank and its branches to facilitate credit related needs of agriculture.

Table 4.21
Institutional Factors in Selected Districts and Haryana

SI NO.		KARNAL	BHIWANI	HARYANA
I	**Co-Operative Societies in Selected Districts and Haryana**			
	No. of Societies per lakh of population	82	110	164
	No. of members of all societies per thousand of population	254	150	258
	Average Working Capital per head	1309	1859	35822
II	**Central Co-Operatives Banks in Selected Districts and Haryana**			
	No. of Banks	1	1	19
	No. of Branches	44	40	594
	Membership (thousand)	598	1133	9529
III	**Number of Markets**			
	Regulated markets	10	7	106
	Sub-yards	8	9	178
	Avg. No. villages served/ regulated market	42	63	64
	Avg. Area served/ regulated market (Sq. Kms.)	254	683	417

Source: Registrar, Co-operatives Societies, Haryana & Department of Economic and Statistical Analysis, Haryana

Table 4.22
Credit Related Details of Sampled Farmers in Karnal and Bhiwani Districts

A. Karnal

	Size of farms				
Factors	Marginal	Small	Medium	Large	All Farms
Access to Credit (%)	100.00	100.00	100.00	100.00	100.00
Source					
Private Money Lender	0.00	0.00	0.00	0.00	0.00
Commission Agent	27.78	34.15	39.13	33.33	34.00
Relatives and Friends	16.67	7.32	8.70	0.00	8.00
Commercial Bank	44.44	43.90	39.13	55.56	45.00
Miller	5.56	0.00	0.00	0.00	1.00
Co-operative society	5.55	14.63	13.04	11.11	12.00
Purpose					
Crop Loan	55.56	73.17	65.22	55.56	65.00
Investment Loan	16.67	7.32	17.39	16.67	13.00
Consumption	27.77	19.51	17.39	27.77	22.00
Problem in getting loan from bank (Yes %)	24.14	26.58	23.53	13.79	23.50
Have Kisan Credit Card (%)	27.59	25.32	17.65	13.79	23.00

B. Bhiwani

	Size of farms				
Factors	Marginal	Small	Medium	Large	All Farms
Access to Credit (%)	100.00	100.00	100.00	100.00	100.00
Source					
Private Money Lender	6.25	0.00	0.00	0.00	1.69
Commission Agent	25.00	23.53	40.00	36.36	30.51
Relatives and Friends	12.50	17.65	13.33	0.00	11.86
Commercial Bank	25.00	35.29	26.67	36.36	30.51
Miller	0.00	0.00	0.00	0.00	0.00
Co-operative society	25.00	17.65	13.33	18.18	18.64
Others	6.25	5.88	6.67	9.09	6.78
purpose					
Crop Loan	60.00	52.94	66.67	54.55	58.62
Investment Loan	6.67	11.76	6.67	18.18	10.34
Consumption	33.33	35.29	26.67	27.27	31.03
Problem in getting loan from bank (Yes %)	12.07	10.13	11.76	10.34	11.00
Have Kisan Credit Card (%)	15.52	11.39	35.29	34.48	20.00

Source: Field Survey

Marketing of Agricultural Produce in Haryana

Now we analyse marketing of agricultural produce in Haryana. The Royal Commission on Agriculture (1928) pointed out that there was no common yardstick to measure the quality of produce, the weights and measures were un-standardized and the private market operators exploited the farmers. It recommended enactment of market legislation to curb rampant malpractices and realize better returns. In that context, the Haryana state being a part of undivided Punjab enacted the Punjab Agriculture Produce Markets Act, 1939. This act was further amended in 1961 and operational in the state as per Manual of Haryana State Agricultural Produce Marketing Law published by Haryana State Agricultural Marketing Board, Panchkula. According to model APMC rules, 2007 circulated by the Ministry of Agriculture, Government of India, Haryana has notified the rules for contract farming only under the state APMC Act. Under this act, all the markets of the state have been regulated. The transactions in these markets are conducted under set rules on regulations. A large number of market committees were set up by the state government to supervise the functioning of agricultural produce markets. The Haryana State Agricultural Marketing Board was established in 1969 under this market Act to guide, supervise and control the market committees of the state for better and efficient marketing of agricultural produce.

Table- 4.23
Status of Regulated Markets in Haryana (2009-10)

District	Number of Regulated markets	Number of Sub-yards	Average number of villages served per regulated market	Average area served per regulated market (Sq.Kms.)
Ambala	7	9	69	225
Panchkula	3	3	75	299
Yamunanagar	7	10	88	253
Kurukshetra	7	13	58	219
Kaithal	7	16	39	331
Karnal	10	8	42	254
Panipat	5	4	36	254
Sonepat	3	9	107	707
Rohtak	3	4	49	582
Jhajjar	2	3	126	917
Faridabad	2	3	69	358
Palwal	4	1	N.A.	N.A.
Gurgaon	4	4	88	346
Mewat	4	3	N.A.	N.A.
Rewari	2	6	200	791
Mahendragarh	4	8	92	465
Bhiwani	7	9	63	683
Jind	6	10	51	450
Hissar	6	22	45	664
Fatehabad	7	15	35	360
Sirsa	6	18	54	713
Total	**106**	**178**	**64**	**417**

Source: Statistical Abstract of Haryana, 2009-10

It is evident from Table 4.23 that Haryana has unevenly spread net work of regulated markets across the districts. The highest number of regulated markets was observed in Karnal district while Jhajjar, Faridabad and Rewari districts have shown as low as two markets each. In the table, information is also presented on average number of villages served per regulated market. In Rewari, each regulated market covered 200 villages that is too high. It implies that most of the farmers have to carry their agricultural produce for sale to far off to the regulated market which increased cost of transport, wastage of energy and time.

The Haryana State Agricultural Marketing Board (HSAMB) has been facilitating and addressing the marketing problems of farmers in Haryana with the following objectives.

- Better value for the farmer's produce.
- Set up efficient marketing services.
- Integrate diversification of crops and promote judicious and profitable use of land resources.
- Introduce knowledge and technology based interventions.
- Improve skill sets and awareness of the farmers.
- Develop quality control and standards in agriculture sector.

The primary objective of the Board was to set up a modern integrated marketing infrastructure, improve accessibility to the markets and to provide the farmers with opportunities to achieve better value for their produce. By adopting a philosophy of "Samridh Kissan, Hamari Pehchan", this organization endeavors to assist farmers, thus helping them to reap a rich future by achieving better value. Hence, Haryana State Agriculture Marketing Board with 3000 employees, headed by a chairman and a Chief administrator as CEO, strives for one solitary aim to support, promote and enhance the agriculture production and marketing keeping interest of the farmers in mind.

The vision of the HSAMB is to bring ample number of opportunities and set up efficient and knowledge based marketing systems and services to increase the net income in the agriculture segment. In turn, creating a prosperous and progressive farmer.

We had collected credit related details of sampled farmers in Karnal and Bhiwani districts during the course of field survey and these are depicted in Table 4.22. It may be noticed that all farmers had access to credit facilities in district Karnal. The commercial banks followed commission agents were the main sources of credit utilized by the farmers irrespective of farm size. It may be pointed out that around 17% marginal farmers took loan from relatives and friends. Out of these loans, around two third were crop loans at the aggregate level. In addition, 22 percent were consumption loans. It is a serious concern that only 13 per cent of loans were raised for investment in agriculture. The respondents (23.50%) reported that they faced problems in getting loan from banks due to lengthy, time and energy consuming elaborate procedures. around one fourth of respondents had Kisan Credit Card which could be utilized to raise loan from banks. The problems faced by farmers in raising loans were reported in Karnal. Around one fifth of them had Kisan Credit Cards which could be utilized in times of need. In Bhiwani too, all respondents had access to credit facilities. Like Karnal, commission agents, commercial banks and cooperative societies were the main sources utilized by the farmers. Around 59 per cent of loans were raised for crops. Some loans were raised for consumption. The share of loans raised for investment purpose was as poor as 10 per cent at the overall level. It was between 7 to 18 per cent across different farm sizes.

In order to provide food security to billion plus population of the country through increased production of food-grains, the government of India continued incentive schemes through the procurement of food-grains at Minimum Support price (MSP). As a result, the production of wheat and paddy increased significantly between 1980-81 and 2009-10 due to assured market at MSP. This phenomenon pushed the marketed surplus of food-grains. Table 4.24 provides the details of wheat and paddy procurement during the years 2009-10 and 2005-06. The Hafed followed by state government agencies procured 35.73 and 21.85 per cent of wheat from farmers, respectively. In case of rice also, Hafed was the largest buyer at the state level. Karnal contributed 10.38 and 15.20 per cent of total wheat and paddy procurement in the state. The contribution of Bhiwani was around 2 per cent of total wheat procurement in the state. It is essential to point out that procurement of wheat and rice has increased significantly during the last five years due to favourable policies.

Table 4.24
Procurement of Wheat and Paddy by Agency, 2009-10

('000 Tonnes)

SI No.	Agency	Karnal		Bhiwani		Haryana	
		Wheat	Rice	Wheat	Rice	Wheat	Rice
I	State Govt.	194 (26.98)	147 (34.34)	39 (27.85)	-	1513 (21.85)	948 (33.66)
II	FCI	145 (20.16)	8 (1.86)	15 (10.71)	-	931 (13.44)	43 (1.52)
III	Hafed	268 (37.27)	196 (45.79)	86 (61.42)	-	2474 (35.73)	1040 (36.93)
IV	HWC	11 (1.52)	49 (11.44)	-	-	678 (9.79)	180 (6.39)
V	Rice Millers	-	6 (1.40)	-	-	-	90 (3.19)
VI	Agro	79 (10.98)	20 (4.67)	-	-	696 (10.05)	278 (9.87)
VII	Confed	22 (3.05)	2 (0.46)	-	-	632 (9.12)	236 (8.38)
2009-10	Total	719 (100.00)	428 (100.00)	140 (100.00)	-	6924 (100.00)	2815 (100.00)
2005-06	Total	352	283	25	-	2229	2356
%age Change		104.26	51.24	460	-	210.63	19.52

Source: Ibid

After analyzing some aspects related to marketing of wheat, paddy and bajra on sampled farmers, perceptions of farmers about marketing of these crops at the grass root level should be known and understood. In order to capture this aspect, some questions were included in the questionnaire and related queries have been answered on this basis.

The information regarding price of the produce is the most important determinant in the selection of the market. We have presented responses of the farmers regarding awareness of MSP and future trading. It is amply clear that farmers in the district Karnal as well as Bhiwani were fully aware about the MSP, irrespective of category. We have also enquired from respondents about awareness of future trading and its adoption by selected farmers. None of the small and marginal farmers knew about the future trading. A small fraction of medium and large farmers knew about future trading but none of them used it to sell their produce in order to earn more profits.

Table 4.25
Awareness of MSP and Sale Possibility with Increase in Price of Food Grains in Karnal and Bhiwani Districts

A. Karnal

Policy	Size of farms				
	Marginal	Small	Medium	Large	All Farms
Aware of MSP	100.00	100.00	100.00	100.00	100.00
Aware of Future Trading (%)	0.00	0.00	11.76	27.59	6.00
Used Futures (%)	No	No	No	No	No
Futures Helped in Price Risk Management (%)	-	-	-	-	-
Sale possibilities	-	-	-	-	-
Yes (%)	-	-	-	-	-
If yes, Sources	-	-	-	-	-
a. Less Retention for seed and feed	-	-	-	-	-
b. Less Retention for Self Consumption	-	-	-	-	-
c. Change in Consumption Pattern	-	-	-	-	-

B. Bhiwani

Policy	Size of farms				
	Marginal	Small	Medium	Large	All Farms
Aware of MSP	100.00	100.00	100.00	100.00	100.00
Aware of Future Trading (%)	0.00	0.00	8.00	18.75	5.00
Used Futures (%)	No	No	No	No	No
Futures Helped in Price Risk Management (%)	-	-	-	-	-
Sale possibilities	-	-	-	-	-
Yes (%)	-	-	-	-	-
If yes, Sources	-	-	-	-	-
a. Less Retention for seed and feed	-	-	-	-	-
b. Less Retention for Self Consumption	-	-	-	-	-
c. Change in Consumption Pattern	-	-	-	-	-

Source: Ibid

Infrastructural Factors

The presence of infrastructure such as electricity, road connectivity, storage facilities and availability of communication, etc. facilitate better management of marketed surplus and help in obtaining higher net returns for their produce by lowering the cost. Normally, marketed surplus of agricultural commodities should increase with extension and availability of these facilities.

In Haryana, all villages were electrified by the year 2009-10 and electricity consumption for agriculture in state has increased several folds during the past few decades. Currently, around 40%

of total electricity is consumed by the agricultural sector. The increased use of electricity helped in boosting the cropping intensity but it has created the problem of declining water table in the major tube well irrigated areas in Haryana. Farmers reported during the survey that availability of electricity in the villages to accomplish agricultural operations is a serious constraint in view of its erratic and uncertain supply which results in burning of motors. Owing to these reasons, there is a shift from electric engines to diesel operated engines.

Haryana enjoys excellent road connectivity. The road length per lakh population in Haryana and selected districts of Karnal and Bhiwani was 114, 110 and 163 respectively during 2009-10. Moreover, 99.89 per cent of villages were connected with metalled roads in the state. In selected districts too, all villages were connected with metalled roads.

Haryana state has storage facilities for 267000 tonnes of agricultural produce and capacity of state owned ware houses was 61.83 thousand tonnes. The Haryana State Agricultural Marketing Board (HSAMB)) has established Covered Shed Storage capacity of 7,97,300 metric tonnes. The food storage capacity of Godowns is 4, 26, 850 metric tonnes. In addition, 22 covered sheds are under construction with additional storage capacity of 12850 metric tonnes. Table 4.27 provides information on capacity of state owned storage during 2009-10. Hafed and State Warehousing Corporation together capacity than others.

Table 4.26
Infrastructural Factors in Selected Districts and Haryana

SI NO.		KARNAL	BHIWANI	HARYANA
I	**Percentage Of Villages Connected With Metalled Roads**			
	1980-81	96.47	99.53	97.31
	1990-91	99.20	99.76	98.99
	2000-01	99.20	99.76	98.99
	2009-10	99.76	100	99.89
II	**Number of Cold Storage**	27	-	198
	Capacity of cold storage('000 tonnes) (1998-99)	29	-	2.67
	Capacity of State Owned warehouses ('000 tonnes) (2009-10)	7.45	90	61.83

Source: Registrar, Co-operatives Societies, Haryana & Department of Economic and Statistical Analysis, Haryana

Table 4.27
Capacity of State Owned Storages, 2009-10

('000 T)

Store	Storage
FCI a. Owned	11
b. Agri. Refinance Development Corp.	-
Food and Supply Department	2.96
Confed	-
Hafed	25.21
State Warehousing Corporation	11.89
Central Warehousing Corporation	4.75
ARDC (with HWC)	-
Food and Supply Bins	-
Haryana Agro Industries Corp.	1.74
Others (Marketing board)	4.26
TOTAL	61.83

Technological Factors

Technology will drive future growth of agriculture in India by pushing the levels of productivity of various crops grown by the farmers. Producers try to increase production through extensive and intensive methods by adopting improved technology. Since, scope of area expansion is limited in Haryana, increase in production will have to be achieved by raising productivity. The productivity largely depends on adoption of high yielding varieties, availability of irrigation and use of fertilizer/pesticides/tractors.

We have earlier observed that 70 and 98 per cent of cultivated area of paddy and wheat was under improved varieties in the state during 2009-10. In the selected districts of Karnal and Bhiwani, coverage of HYV seeds of paddy was 76 and 99 per cent respectively whereas these ratios were 52 and 97 for wheat. In case of bajra too adoption was found excellent with 98 per cent of cultivated area under HYV seeds. On sampled farms, around 98 per cent of cultivated area under wheat was covered by HYV seeds while in case of bajra; it was fully covered by HYV seeds. However, it was around 72 per cent in case of paddy in Karnal district. The results pertaining to area of major crops under the HYV seeds are almost similar except that low coverage of cultivated area of rice under the improved varities.

The availability of irrigation is essential for achieving better yield rates from improved varieties. In Haryana, 81 per cent of GCA was recorded irrigated. The share of area irrigated by tubewells

(55.61%) was higher than canals (44.28%). The sources like tanks were found nonexistent. In the selected district of Karnal, 99% of GCA was irrigated during 2009-10 whereas it was observed much lower in case of Bhiwani (52%). The availability of irrigation affected crop intensity and that is why crop intensity in Haryana and district Karnal was 182 and 209 whereas it was 196 in Bhiwani. The operational holdings of sampled farmers in district Karnal were fully irrigated irrespective of farm size. On the other hand, 50-60% of operated area on the sampled farms in Bhiwani was irrigated.

We have already discussed about the use of inputs such as fertilizer, pesticides and irrigation at the macro level in Haryana in the Section-1. Although, questionnaire canvassed to the farmers for primary data collection does not contain any information on the use of these inputs. It is expected that sampled farmers must have used these inputs given the levels of productivity achieved by them.

The use of Information Communication Technology (ICT) in agricultural sector for obtaining information related to price and related indicators is picking up in Haryana. The government has created the following facilities for the farmers.

Computerization

With the assistance of the Directorate of Marketing & Inspection Department, Ministry of Agriculture, Government of India, computers in 106 Market Committees and 25 sub yards have been provided. Necessary basic training/software training has already been imparted to about 1000 officers and field staff. Information on daily arrivals is being sent by all Market Committees to AGMARK NET.

New Initiatives and Schemes

Modernization and Remodeling of Existing Markets

In phase one, markets are being modernized and remodeled with a budget of 500 million rupees. Pack Houses, cooling & ripening chambers, sorting/grading lines, etc. are being provided besides promoting agri-business activities through Agri-Business & Information Centres (ABICs).

Setting up of Agri-Business & Information Centres

Two ABICs have been opened at Sirsa and Hisar. These provide information on market, agronomic practices and organize seminars, workshops, buyer-seller meets, etc. These centres also

house the Agriculture Development Officers and provide regular training to farmers and help in improving the quality of the agricultural products. It is planned to have ABICs at all District Headquarters in the next three years.

During the course of survey, we had collected information about the sources of price information from respondents. The producers collected information through various modes. The sources of trader, APMC mandi, telephone and print media were used by approximately 65 per cent of respondents in Karnal district. It may be pointed out that electronic media was not a popular medium to gather price information.

The scenario about the sources of price information in district Bhiwani was different. The print media followed by APMC mandi, visit to market, telephone and trader were resorted by around 75 per cent of sampled farmers. Further, differences were noticed across the farm size category. In particular, small and marginal farmers depended more on traders to obtain price related information in district Karnal while 24 per cent of large farmers used telephone to collect information. The findings regarding Bhiwani district shows that print media was more popular than other sources among marginal farmers but large farmers depended relatively more on traders for eliciting information.

Table 4.28
Percentage of Cropped Area under HYV seeds on sampled farms in Karnal and Bhiwani Districts
A. Karnal

Name of the Crop	Farm Size				
	Marginal	Small	Medium	Large	All Farms
Rice	54.6	51.8	53.2	54.7	53.6
Wheat	97.1	97.4	97.9	98.8	97.8
Bajra	98.9	100.0	99.5	100.0	99.6
Gram	100.0	100.0	99.8	100.0	100.0
Mustard	80.0	85.0	82.0	95.0	85.5

B. Bhiwani

Name of the Crop	Farm Size				
	Marginal	Small	Medium	Large	All Farms
Rice	72.6	68.8	70.9	73.5	71.5
Wheat	98.5	99.0	96.8	98.8	98.3
Bajra	100.0	100.0	99.5	100.0	99.9
Gram	100.0	100.0	99.8	100.0	100.0
Mustard	80.0	85.0	82.0	88.6	83.9

Source: Ibid

Table 4.29

Source of Price Information for Respondent Farm Households in Karnal and Bhiwani Districts

A. **Karnal**

	Farm Size				
	Marginal	**Small**	**Medium**	**Large**	**All Farms**
Source					
Trader	22.41	18.99	20.59	20.69	20.50
Print Media	15.52	17.72	11.76	6.90	14.50
Radio	0.00	6.33	0.00	0.00	2.50
APMC Mandi	29.31	16.46	11.76	6.90	18.00
Telephone	15.52	15.19	11.76	24.14	16.00
Visit to Market	3.45	7.59	8.82	10.34	7.00
Buyers in Village	0.00	0.00	11.76	0.00	2.00
Cooperative society	6.90	8.86	8.82	10.34	8.50
Others	6.90	8.86	2.94	10.34	7.50
Electronic Media	0.00	0.00	11.76	10.34	3.50

B. **Bhiwani**

	Farm Size				
Source	Marginal	Small	Medium	Large	All Farms
Trader	0.00	16.13	4.00	37.50	12.00
Print Media	35.71	35.48	24.00	0.00	27.00
Radio	0.00	0.00	4.00	12.50	3.00
APMC Mandi	14.29	9.68	20.00	25.00	16.00
Telephone	0.00	12.90	16.00	25.00	12.00
Visit to Market	35.71	9.68	24.00	0.00	19.00
Buyers in Village	0.00	0.00	0.00	0.00	0.00
Cooperative society	7.14	6.45	4.00	0.00	5.00
Electronic Media	7.14	9.68	4.00	0.00	6.00

Source: Ibid

Determinants of Marketed Surplus

Finally, we have carried out regression analysis to ascertain the determinants of the marketed surplus of selected food-grain crops in Haryana. We have tried to gauge the impact of variations in stock, production, consumption, retention for other purposes, crop losses and farm size on the marketed surplus of paddy, wheat and bajra. The analysis based on primary data would be useful in formulation of policies for increasing marketed surplus of these food grains in Haryana which are also important staple food grains in India. Price is an important factor influencing marketed surplus through area allocation and production of agricultural commodities but it could not be

included in this exercise since sampled farmers sold produce of main crops i.e. paddy and wheat at the minimum support price, which is uniform in all cases. For empirical analysis, double log function was used to identify the determinants influencing marketed surplus. In the model, marketed surplus of the crop (y) was used as dependent variable and above mentioned six variables as independent variables. Before carrying out this exercise, problems of heteroscedasticity were tested using White's test (1980). The details of the test are provided in chapter-II.

We begin with presenting the regression results (Table 4.30) of paddy which is the most important kharif crop in irrigated areas of the state. The variables with statistically significant influence on marketed surplus of paddy are production and stock. Production with a coefficient of 1.11 emerges as an important determinant of marketed surplus of paddy. The coefficients of other variables such as consumption and crop losses though negative were found statistically significant. Thus, elasticity of production with respect to marketed surplus was found positive and higher (1.11) in comparison to other variables. This implies that one per cent change in production would increase marketed surplus by 1.11 per cent if it is accompanied by reduction in level of consumption and crop losses. The responsiveness of stock was found very low since farmers stock low quantity of paddy for consumption. The regression coefficient of farm size is negative and insignificant.

This favors a policy of increasing production of paddy by expanding area or by enhancing production through improvement in yield rates. The scope of former is limited while latter can be executed by innovation in crop varieties and their diffusion at the farmers' field through efficient extension. The selected independent variables explained 99 per cent variation in marketed surplus of paddy on sampled farms in Karnal district.

We had also carried out this exercise separately for marginal, small, medium and large group of farmers cultivating paddy in Karnal district of Haryana. It may be noticed that value of regression coefficients and significance of selected independent variables was found different across various farm categories. For marginal farmers, production and stock were found statistically significant. Of these, production emerged as the key variable with coefficient of 1.15 in increasing marketed surplus of paddy. The regression coefficient of consumption with negative value was found to be significant. The regression results for other categories of farmers' viz. small, medium and large were on the same pattern with some variation in statistical significance of included variables. It

may be pointed out that elasticity of production was observed to be higher in comparison to other independent variables in each case. Thus, production emerged as the key determinant of marketed surplus of paddy in each group. The included variables explained at least 97 per cent variation in the marketed surplus of paddy.

Table 4.30
Regression Results of Paddy-Karnal

Farm Size	Intercept	Stock	Production	Consumption	Other Pay	Losses	Farm Size	Adjusted R^2
Marginal	-0.5659 (0.03)**	0.0311 (0.00)***	1.1544 (0.00)***	-0.0646 (0.00)***	-0.0159 (0.67)	-0.1254 (0.12)	-0.0237 (0.65)	0.97
Small	-0.4286 (0.00)***	0.0076 (0.00)***	1.1093 (0.00)***	-0.0192 (0.00)***	-0.0176 (0.03)**	-0.0836 (0.00)***	-0.0105 (0.50)	0.99
Medium	-0.3845 (0.00)***	0.0039 (0.00)***	1.0980 (0.00)***	-0.0044 (0.00)***	-0.0191 (0.00)***	-0.0749 (0.00)***	-0.0023 (0.49)	0.99
Large	-0.3899 (0.00)***	0.0022 (0.00)***	1.0997 (0.00)***	-0.0043 (0.00)***	-0.0202 (0.00)***	-0.0779 (0.00)***	-0.0004 (0.88)	0.99
All	-0.4267 (0.00)***	0.0221 (0.00)***	1.1142 (0.00)***	-0.0353 (0.00)***	0.0007 (0.95)	-0.0893 (0.00)***	-0.0196 (0.43)	0.99

#: Figure in bracket is p-value
*Significant at 1%level of significance, ** Significant at 5% level of significance, *** Significant at 10% level of significance, otherwise insignificant.

Wheat is the most important food grain crop of rabi season in Haryana. It is grown for self consumption and commercial purpose. This crop has dominant share in GCA in terms of area allocation. The regression results presented in table 4.31 show that elasticity of production with respect to marketed surplus of wheat was high (1.55). It implies that one per cent change in production would increase marketed surplus by 1.55 per cent. The elasticity of production was observed to be even higher in case of marginal farmers. The stock was another variable which was statistically significant in all cases. The elasticities of consumption, retention for other purposes and crop losses were negative. In other words, marketed surplus of wheat would increase if consumption, retention for other purposes and crop losses decrease. The regression coefficient of farm size, although shown as important factor in some studies was found to be low, negative and significant at overall level. However, it was positive and insignificant in case of marginal and medium farmers. The included six variables explained at least 95 per cent variation in each size

group. The higher elasticity of production with respect to marketed surplus reiterates the role of production of wheat in the state in augmenting marketed surplus.

Table 4.31
Regression Results of Wheat-Karnal

Farm Size	Intercept	Stock	Production	Consumption	Other Pay	Losses	Farm Size	Adjusted R^2
Marginal	-2.9507 (0.00)***	0.0634 (0.01)**	1.9927 (0.00)***	-0.2969 (0.00)***	-0.1111 (0.00)***	-0.4822 (0.01)***	0.0955 (021)	0.95
Small	-1.8961 (0.00)***	0.0732 (0.06)*	1.6512 (0.00)***	-0.1811 (0.00)***	-0.2274 (0.00)***	-0.2765 (0.04)**	-0.0819 (0.34)	0.97
Medium	-0.8928 (0.01)**	0.0282 (0.00)***	1.2918 (0.00)***	-0.1033 (0.00)***	-0.1124 (0.00)***	-0.1584 (0.07)*	0.0400 (0.53)	0.99
Large	-0.5625 (0.00)***	0.0208 (0.00)***	1.1430 (0.00)***	-0.0268 (0.00)***	-0.0395 (0.00)***	-0.0763 (0.00)***	-0.01849 (0.57)	0.99
All	-1.8000 (0.00)***	0.0391 (0.04)**	1.5547 (0.00)***	-0.1706 (0.00)***	-0.1276 (0.00)***	-0.2012 (0.03)**	-0.1215 (0.08)*	0.98

#: Figure in bracket is p-value
*Significant at 1%level of significance, ** Significant at 5% level of significance, *** Significant at 10% level of significance, otherwise insignificant.

We have also carried out the regression analysis for wheat in Bhiwani district. Like Karnal, elasticity of production with respect to marked surplus was higher in comparison to other independent variables in each size group. The value of regression coefficient ranged between 1.01 and 1.31. The coefficients of consumption and retention for other purposes were low, negative and significant in most of the cases. It may be pointed out that coefficient of farm size was positive and statistically significant in small and medium categories but it was insignificant for marginal and large farmers and also at the overall level. The coefficient of multiple determinations was above 96 per cent in all groups which implies that given variables explained 96 to 99 per cent of variation in the marketed surplus of wheat in Bhiwani (Table 4.32).

Table 4.32
Regression Results of Wheat-Bhiwani

Farm Size	Intercept	Stock	Production	Consumption	Other Pay	Losses	Farm Size	Adjusted R^2
Marginal	-0.9861 (0.16)	0.2371 (0.00)***	1.3099 (0.00)***	-0.2907 (0.00)***	-0.3646 (0.00)***	0.4916 (0.6)*	-0.3437 (0.02)	0.96
Small	0.1571 (0.75)	0.0313 (0.00)***	1.0104 (0.00)***	-0.1425 (0.00)***	-0.2712 (0.00)***	0.1200 (0.56)	0.2505 (0.00)***	0.99
Medium	-0.4118 (0.12)	0.0064 (0.50)	1.1402 (0.00)***	-0.1162 (0.00)***	-0.1062 (0.00)***	-0.0705 (0.32)	0.1105 (0.02)**	0.99
Large	-0.9985 (0.03)**	0.0495 (0.01)***	1.2689 (0.00)***	-0.0575 (0.00)***	-0.0648 (0.02)**	-0.1128 (0.13)	-0.0433 (0.53)	0.99
All	-0.9930 (0.00)***	0.0570 (0.12)	1.3199 (0.00)***	-0.1456 (0.00)***	-0.1455 (0.00)***	-0.1311 (0.08)*	0.0665 (0.28)	0.99

#: Figure in bracket is p-value
*Significant at 1%level of significance, ** Significant at 5% level of significance, *** Significant at 10% level of significance, otherwise insignificant.

Finally, we have elicited the results of regression analysis carried out for bajra, third selected crop for the study (table 4.33). None of the producers had bajra stock from previous year and therefore this variable is omitted from the regression model carried out for bajra. It could be observed that elasticity of production (1.84) with respect to marketed surplus of bajra at the overall level was higher than other independent variables. Like paddy and wheat, coefficients of consumption and retention for other purposes were negatively related to the marketed surplus in most of the groups except for consumption in case of medium farmers. It may be noted that consumption and losses were insignificant at the overall level. Further, farm size showed positive and statistically insignificant values for medium farm size class and at the overall level but was statistically significant in case of small and large farmers. The value of the coefficient in case of large farmers was as high as 7.90 and therefore, farm size emerged as dominant factor determining the marketed surplus of bajra in this category in Bhiwani. The included five variables explained between 85 to 99 per cent variation in the marketed surplus of bajra in different farm size groups of farmers in Bhiwani.

Table 4.33
Regression Results of Bajra-Bhiwani

Farm Size	Intercept	Production	Consumption	Other Pay	Losses	Farm Size	Adjusted R^2
Marginal	-1.2692 (0.58)	1.4000 (0.10)*	-0.2335 (0.04)**	-0.3276 (0.00)***	0.4031 (0.63)	-0.0888 (0.52)	0.85
Small	-0.6047 (0.10)*	1.1033 (0.00)***	-0.1318 (0.00)***	-0.2064 (0.00)***	-0.1597 (0.05)**	0.3590 (0.03)**	0.99
Medium	-0.4000 (0.39)	1.1111 (0.00)***	0.0298 (0.40)	-0.1896 (0.00)***	0.0639 (0.60)	0.0200 (0.80)	0.99
Large	15.8218 (0.04)**	-5.3199 (0.07)*	-0.1755 (0.54)	-0.3861 (0.18)	-0.7055 (0.70)	7.8996 (0.01)**	0.87
All	-2.4560 (0.09)*	1.8448 (0.00)***	-0.0824 (0.23)	-0.3600 (0.00)***	-0.5644 (0.26)	0.1684 (0.33)	0.90

#: Figure in bracket is p-value
*Significant at 1%level of significance, ** Significant at 5% level of significance, *** Significant at 10% level of significance, otherwise insignificant.

In a nutshell, production was most dominant and statistically significant factor in determination of the marketed surplus of two major food grains (paddy and wheat) in Haryana on sampled farms. The responsiveness of stock for wheat and paddy was positive and statistically significant but low value of coefficient indicates marginal response. The other three variables i.e. consumption, retention for other purposes and losses showed negative and low response in most of the cases, although insignificant in some cases. The coefficient of farm size was negative and insignificant in case of paddy in Karnal but negative and significant for wheat at the overall level. Among the determinants of marketed surplus of bajra in Bhiwani district, production was the major factor at the aggregate level but farm size emerged as a key factor in case of large farms. To conclude, production has emerged as the main factor in boosting marketed surplus of paddy, wheat and bajra in Karnal and Bhiwani districts of Haryana. Hence, we need a policy to augment production through raising productivity by innovation in existing technology.

Chapter-5

Summary and Conclusions

This chapter aims to present the main findings of the study and to draw policy implications. The conclusions of earlier studies suggest that marketed surplus of food grains is influenced by farm size, price, production, cropped area, yield and quantity retained for consumption and other purposes. But, parameters such as beginning stock and crop losses which influence marketed surplus remain less explored. Further, it is essential to have an understanding of determinants of marketed surplus including crop losses of a particular crop; from the point of view of the food management policy. This study endeavors to bridge the research gap in literature by covering issues related to marketed surplus of food grains from production to disposal. In addition, the study has examined factors affecting the marketed surplus of food grain crops.

5.1 Objectives and Research Methodology

We have selected three food grain crops for in-depth study. In view of urgency to augment the marketed surplus of food grains to fulfill the rising demand and to contain food prices, it is imperative to analyze factors affecting marketed surplus a fresh, based on grass root level primary data. The research input related to losses is an urgent need to draw policy for food management through innovative models. In order to achieve this objective, the study seeks to analyze the related issues. The specific objectives of the study are as under:

    (i)   To estimate the magnitude of marketed and marketable surplus of wheat, paddy and bajra.

    (ii)   To estimate the retention of above mentioned crops for consumption, seed, feed, wages and other payments in kind.

    (iii)   To analyze crop losses in harvesting and other operations.

    (iv)   To examine the role of various factors such as institutional, infrastructural, socio-economic in influencing marketed surplus.

The study was conducted in the state of Haryana. It is based on published and unpublished sources of secondary and primary data. The relevant information about the state and districts was obtained from various issues of the Statistical Abstract of Haryana, Government of Haryana, Panchkula.

The scope of the study is confined to three food grain crops i.e. wheat, paddy and bajra. Two districts namely, Karnal and Bhiwani with significant share in the acreage and production of these crops in the state were selected for in-depth study. The selection of respondents is based on multistage sampling design. At the first and second stage, major producing districts and blocks in these districts were selected. At the third stage, villages were selected on the same criterion. A questionnaire was canvassed to the farmers growing these crops. All farm size categories in the sample i.e. marginal (less than one hectare) small (1-2 hectares), medium (2-4 hectares), and large (more than 4 hectares) were covered. The primary data pertaining to the year 2011-12 were collected from 300 farmers (200 in Karnal +100 in Bhiwani). In view of the main objective of the study, it is found necessary to compare the marketable and marketed surplus of selected three food grain crops and their determinants.

The study is analytical in nature. The methodology followed for each aspect is different. For measuring the district wise growth rates of area, production and yield of wheat, paddy and bajra for the period 1980-81 to 2008-09, semi-log function was used. The marketable surplus is computed by subtracting the retention for consumption, feed, seed and payments in kind, crop losses and repurchases by the producer from availability which accounted stock from previous year plus current production. The marketed surplus refers to that portion of the produce which is actually marketed by the farmer.

In order to find the determinants of marketed surplus, a double log regression model was used with marketed surplus as dependent variable and six independent variables such as stock, production, consumption, other payments, crop losses and farm size for paddy and wheat. In case of bajra, last year stock with farmers was nil and therefore, remaining farm variables were used in regression.

Now, we present main findings of the study

I.   Main Findings

(a) Macro Level Findings

(i)   Population, Literacy, Workers and Structural Transformation in State Economy

Haryana is located on the northwestern side of the Indian union adjoining Delhi. The state extends from 27°3' to 31°9' of north latitude and 74°6' of east longitude. It is bounded by the states of Punjab and Himachal Pradesh in the north, by Delhi and Uttar Pradesh in the east and by Rajasthan in the South and West. Haryana has a total surface area of 44,212 square kilometers and is one of the smallest states of the Indian union.

The total population of Haryana was 2.53 crore persons in 2011. The sex ratio was 877, which is significantly lower than the all India level. The density of population defined as number of persons per square kilometer was 573 persons against 382 at the all India level. It is due to the proximity of Delhi and availability of employment opportunities in the primary, secondary and tertiary sectors.

The literacy rate in Haryana was 76.64 per cent and a little higher than all India level (74.04 per cent) in 2011. Among males, 85.38 per cent and among females 66.77 per cent were literate during 2011. The contribution of women is important for the growth of the economy in Haryana. Therefore, it is essential to provide substantial educational facilities to women in the region. They should be motivated for this purpose.

In Haryana, 39.76 per cent of population was workers. Among males, this proportion was 50.47 per cent while it was 27.30 per cent among females. Work participation rate of population in the state is marginally higher than the all India level. It could be attributed to relatively higher work participation rate of female population.

Economic development of a region depends on proportion of working force engaged in primary, secondary and tertiary sectors. Agriculture is the main source of employment in Haryana and around 52 per cent of workers earned their livelihood from this sector in 2001. Like all India, proportion of workers was highest in agriculture followed by other workers and household industry workers.

The economy of Haryana has recorded significant growth between 1980-81 and 2010-11 at current prices (14.45 per cent per annum). It has been contributed by primary, secondary and tertiary

sectors. The sectoral analysis reveals that primary sector contributed 53.78 per cent to the state income during 1980-81. Its share declined to 20.92 per cent in 2010-11. The secondary sector's contribution has increased from 19.46 per cent during 1980-81 to 29.07 per cent during 2010-11. Tertiary sector contributed a share of 26.76 per cent in 1980-81 and it raised to 50.01 percent in 2010-11, a rise of almost 23 percentage points.

Thus, composition of the GSDP of Haryana reveals that share of primary sector is continuously declining whereas the shares of secondary as well as tertiary sectors are continuously rising. It implies that state economy is shifting from agriculture to manufacturing and service sectors, which is a sign of structural change.

(ii) Agricultural development in Haryana

Agricultural development has been commendable in Haryana. But, it should be accelerated further because it employs more than 50 per cent of workers and provides livelihood security to the major proportion of population in the rural areas.

Land use Pattern

Land use pattern in Haryana indicates that net sown area occupies dominant proportion of land and covered around 80 percent of the reported area in the state. Out of this area, 84 per cent was sown more than once during 2010-11. It was found higher due to impressive development of irrigation in the state. Since, progress on this front in the state is commendable, a substantial increase was noticed in crop intensity between 1980-81 and 2010-11. The percentage of net irrigated area to net area sown in Haryana was around 82 per cent and it has been constantly rising during the referred years. Thus, land use pattern has shown some change but it is not perceptible in Haryana during the study period. It is essential to mention that share of forest land has dropped from 3 per cent in 1980-81 to 0.89 per cent in 2010-11. This is likely to affect sustainability of agriculture by affecting rainfall, temperature and overall climate.

Agricultural land in Haryana is well irrigated since around 82 per cent of net sown area was irrigated in 2010-11. The major sources of irrigation are tube-wells and canals. The share of tube-wells has increased by almost 13 per cent while it has declined by 22 per cent for canals. It could be due to insufficient availability of canal water with great uncertainty.

Operational Holdings

Average size of operational holdings in Haryana was 2.25 hectares. Around 68 per cent of holdings are marginal and small. The share of area operated by these holders was around 23 per cent. The remaining 32 per cent holders operated almost 77 per cent of area. The tiny size of small and marginal holdings generates low income from crop husbandry. Although, they opt for mixed farming by combining several economic activities, urgent policy initiatives are needed for the development of small holdings.

Crop Pattern

Crop pattern in Haryana reveals that wheat (38.66%) followed by rice (19.13%), bajra (10.16), rape and mustard (8.40 %) and cotton (8.15 %) are the principal crops of the state. In addition, sugarcane and small millets are also grown by the farmers. The fact remains that crop pattern in Haryana was dominated by food grains, which occupied 72.54% of GCA in 1980-81. The share of food grains dropped to 72.47% in 2010-11. The proportion of area under wheat and rice has increased significantly during the reference period while pulses have indicated a decline of almost 12 per cent. It appeared that traditional crops like pulses and small millets lost substantially.

Input Use

The utilization of HYV seeds, fertilizers, pesticides, tractor and tube wells play an important role in boosting the agricultural development of a region. Haryana has been using these inputs for a long time. The consumption of fertilizer was high. The nitrogenous fertilizers are preferred over phosphatic and potassic fertilizers.

As a result, agricultural output per hectare in Haryana at current prices in 2008-09 was Rs. 93906 during 2009-10. Haryana has a good network of metalled roads. Potential of organic farming in Haryana is excellent. In view of rising demand for organic products, state should exploit this opportunity. Lack of infrastructural facilities in remote areas creates problems for the cultivators. Especially power sector needs improvement. It is not available round the clock in rural areas and it hinders agricultural operations. Massive investment is needed to address this shortcoming. Government should give priority to this aspect to boost growth of agriculture in the state.

(iii)   District-wise Growth of Area, Production and Yield of Selected Crops:

In Haryana, production of paddy and wheat has risen at the rate of 4.01 and 3.81 per cent per annum during 1980-81 to 2008-09. In case of paddy, growth was largely driven by area expansion since productivity growth was found poor. The area as well as yield contributed to the production growth of wheat. Bajra, a largely rain fed crop of Haryana has shown an increase of 3.35 per cent per annum in production despite negative acreage growth and hence, production growth was contributed primarily by appreciable yield growth.

Productivity of important food grain crop of Haryana i.e. paddy has shown marginal growth. There is a need for urgent action so that yield of paddy could be improved. This is possible by adoption of high yielding variety seeds on the scale as recorded for wheat. The full adoption of recommended farm practices would maximize benefits.

Large variations were noticed in the growth of acreage, production and yield of paddy, wheat and bajra across the districts. Mewat registered around 14 per cent growth in production of paddy in comparison to other districts during the reference period. It was largely driven by area expansion which grew at the commendable rate of 12.70 per cent per annum. The yield however, increased at the slow rate of 1.78 per cent per year. It was discouraging to note that an impressive growth rate of yield (6.95%) in the first sub-period turned low in the second sub-period. This impacted growth of production in the overall period. Owing to this reason, it dropped from a highly appreciable rate of 21.80 per cent to 6.38 per cent per annum.

Wheat with highest share in area allocation in most of the districts in Haryana has exhibited maximum growth in production in relatively dry district of Bhiwani. The contribution of area expansion was more than double in comparison to yield which grew at the rate of 1.91 per cent per annum between 1980-81 and 2008-09.

Mahendergarh was much ahead of other districts in the growth of bajra production. It increased at the rate of 7.82 per cent per year during the reference period. The first sub-period appeared to be far superior in comparison to the second sub-period. It is encouraging to note that this impressive growth in Mahendergarh was primarily driven by yield. The contribution of acreage was low since it increased at the marginal rate of 0.79 per cent per annum during this period.

In view of problems arising out of rice-wheat rotation, it would be prudent to work out ways to break away from wheat-rice crop pattern. Moreover, Haryana is facing problem of poor yield growth of paddy and over exploitation of water resources and the answer lies in crop diversification. Also, most of the rice eating states have become self sufficient in the production of rice and wheat and buffer stocks at the Centre are more than the requirement. In these circumstances, Haryana should focus rigorously on promotion of pulses and horticultural crops through easy availability of certified seeds of area specific varieties and remunerative prices for the growers by way of marketing reforms. The time has come when crop diversification appears to be way out for sustainability of agriculture in Haryana.

(iv)   Socio-Economic Characteristics of Sampled Districts

For better understanding of the marketed surplus, one has to look into main indicators related to population and workers, agricultural development and infrastructural development at the district level.

Sampled Districts:

(i)   The total population of Karnal and Bhiwani districts was 15.06 and 16.29 lakh persons during 2011. Surprisingly 69.73 per cent population in Karnal was found rural based. Literacy rate was marginally different from state level i.e. 76.04 and 76.70 for Karnal and Bhiwani, respectively. The share of agricultural workers in total workers in selected districts was between 50 and 64 per cent. The share of non-agricultural workers in Karnal was 50 per cent whereas it was lower in Bhiwani (35 per cent). It seems that growing work opportunities in these districts did not benefit population. Thus, composition of workers in farm and non-farm sectors was markedly different.

Results revealed wide disparities in number and operated area by different categories of farmers in Karnal, Bhiwani and Haryana. The small and marginal farmers formed around 60 per cent in number but cultivated less than 19 per cent of operated area. Thus, small and marginal farmers (owning less than 2 ha.) dominated in number but remained impoverished due to operating tiny pieces of land. In contrast, large farmers, though handful in number controlled land and therefore, produced more and enjoyed a better status by owning and operating land which is major asset in rural areas.

Cropping pattern of Karnal, Bhiwani and Haryana revealed that wheat and rice were the major crops constituting around 88 per cent of GCA in Karnal district. Sugarcane was also grown on 2.97 per cent of GCA. Thus, the agricultural economy of Karnal district was dominated by wheat paddy rotation. The cropping pattern in Bhiwani district was dominated by rain-fed crops since around 27 per cent of GCA was devoted to bajra. The other crops like oilseeds and pulses enjoyed significant share in GCA. The important staple food grain of the population is wheat that was grown on 21 per cent of GCA in Bhiwani.

At the state level, wheat, paddy, bajra, oilseeds and cotton were the major crops cultivated by the farmers. However, agricultural economy of the state like Karnal district was skewed towards food grain crops.

Findings from secondary data show that yield rates of superior cereals i.e. paddy and wheat in Karnal district were found higher in comparison to Bhiwani and the state. This was true for oilseeds and sugarcane. But, productivity of pulses in Bhiwani was above Karnal and Haryana.

(ii)   A comparison of important indicators of agricultural development revealed wide disparities across the selected districts. The irrigation status, yield rates of important crops, input use were analysed to gauge the disparities. Out of the selected districts, Karnal appeared to be much ahead in agricultural development than Bhiwani.

(iii)   The infrastructural development of selected districts was distinctively different. Although Karnal is one of the most developed districts of Haryana, is not found rich in infrastructure like roads.

 (b)   **Micro Level Findings**

   (i)   **Socio-Economic Characteristics of Sampled Farmers**

For better understanding of marketed surplus, we have looked into main indicators related to population and workers, educational status of the head of households, farm size, nature of land ownership, cropping pattern and sources of irrigation, farm assets. The efficiency and success of farming is influenced to a significant degree by the socio-economic background of the households. In addition, these characteristics influence adoption of improved technology and marketing behavior.

The average size of the family of selected farm households was 7 and 6 persons in Karnal and Bhiwani districts. A positive correlation emerged between farm size and average size of family. The large farmers in selected districts indicated an average size of family 9 and 6 persons against 7 and 6 persons by marginal households. The literacy rate of the head of households was not found to be impressive; however head of large farm households indicated higher level of schooling years in Karnal district. These farmers owned a variety of farm assets.

Land and other resources influence the level and pattern of farm management in farm households. The nature of land ownership influences crop pattern, adoption of technology and innovation. At the aggregate level, average land owned by selected farmers in Karnal and Bhiwani districts was 2.60 and 2.66 hectares. The practice of leasing-in land was prevalent but land was not leased out. Like the state, cropping intensity was found to be higher in each group.

Climate of Haryana is suitable for growing a variety of crops but crop pattern in district Karnal was found highly skewed towards wheat and paddy. Wheat was the leading crop of rabi season, which occupied around 45% of GCA. Paddy emerged as the main crop of the kharif season with coverage of around 44% of GCA. All categories of farmers grew fodder in rabi as well as in kharif seasons. The share of GCA allocated to fodder crops varied between 2 and 10% by the farmers. The small farmers devoted higher proportion of GCA to fodder crops in comparison to other categories of farmers. It could be due to their higher requirement to feed animals owned by the farm families. Pulses and vegetables emerged as minor crops with less than 1% of GCA devoted to them.

The crop pattern on the sampled farms was found different in Bhiwani district. Like Karnal, wheat was the most important crop of rabi season occupying 33.33% of GCA. Bajra was the main crop during the kharif season. Pulses (gram), cotton and mustard were also grown by farmers and a sizeable proportion of area was devoted to these crops due to low requirement of irrigation. Farmers also grew fodder crops in order to feed their dairy animals. Further, paddy was observed a minor crop by occupying around 2% of GCA. Further, proportion of GCA devoted to various crops grown by farmers varied significantly across the farm size. Thus, Karnal emerged as the dominant case of wheat paddy rotation while crop pattern in Bhiwani was found diversified covering irrigated as well as rainfed crops.

Findings about productivity of important crops grown by the sampled farmers in Karnal and Bhiwani districts show that yield of paddy on sampled farms in Karnal district was around 32 qtls/ha while it was lower in Bhiwani district (around 1 qtl/ha). The same was true for wheat as well. The yield of wheat on sampled farms in Karnal district was around 48 qtls/ha. On the other hand, it was around 41 qtls/ha in Bhiwani district. The productivity of mustard in Bhiwani on sampled farms ranged between 13 qtls/ha to 23 qtls/ha. It was found higher on medium farms in comparison to other categories of farms. The next crop, cotton showed a yield rate of around 38 qtls/ha on sampled farms and variations across farm sizes were common like other crops. It is useful to mention that productivity of pulses was 9.32 qtls/ha on sampled farms in Bhiwani. It was above the national and state average. Therefore, policy makers should make all efforts to popularize pulses in this region by providing input and price support to the farmers.

Tractors followed by pump sets were the major farm assets owned by selected farmers in Karnal. The average investment per hectare by sampled farmers on these assets was Rs. 82,060. Some of the farmers owned combined harvesters. On an average, farmerss invested Rs. 1, 47,703 per hectare. Unexpectedly, small farmers invested more than other groups. The investment of sampled famers in farm assets was found much lower in Bhiwani district in comparison to Karnal district. Tractor was the major asset. Some of them owned tube-wells but investment was low. The average investment per hectare was Rs. 48,579. The medium farmers made higher investment in comparison to large farmers.

It is a common practice among farmers in Haryana to combine dairying with crop farming to fulfill domestic requirements of milk and its products and to supplement family income. The sampled farmers owned milch animals worth Rs. 1,12,407 and Rs. 93,313 in Karnal and Bhiwani districts. As expected, level of investment in livestock was higher in large farm category in comparison to other groups.

(ii) **Empirical Findings regarding Marketed Surplus**

Availability

The per farm production of paddy during 2011-12 on marginal, small and medium and large farms was between 24 and 241 qtls while the availability was between 25 and 242 qtls/farm after adding stock from previous year. At the aggregate level, per farm availability was 74.29 qtls. during the reference year.

The per farm production of wheat in Karnal and Bhiwani districts on sampled farms was around 111 and 70 qtls. Further, production on large farms was several times higher in comparison to small and marginal farms. After adding the carry over stock of previous year, per farm availability of wheat was around 113 and 72 qtls in selected districts. It may be pointed out beginning stock of wheat in all categories of farmers was higher than paddy because wheat is the main staple food grain of the population and therefore, farmers store for domestic requirement for the entire year.

The per farm production of bajra was recorded 19.38 qtls in Bhiwani. The production of bajra on marginal, small, medium and large farms ranged between 23 and 183 qtls. The beginning stock was nil and therefore, net availability was equal to the production.

Retention

The proportion of produce available for disposal in the market depends largely on the level of output and retention. The sampled farmers retained a portion of output for consumption, seed and feed requirements, payment of wages in kind to hired labourers. The per farm retention of paddy on sampled farms for consumption in Karnal district was 0.66 qtls. Farmers reported that paddy was not used as animal feed or as a kind payment. The per farm retention by farmers for all purposes was 2.08 qtls. and the highest could be noticed on large farms.

The amount of wheat retained by farmers for consumption was much higher than paddy since it is the main staple food grain consumed by the population in this region. Even, small and marginal farmers retained a higher quantum of 7-8 qtls in Karnal and around 6 qtls. in Bhiwani. Each category retained wheat for seed, feed and kind payments. Findings suggest that per farm retention of wheat for all purposes were around 20 and 11 qtls in Karnal and Bhiwani districts.

The analysis of the behaviour of farmers pertaining to retention of bajra in Bhiwani district revealed that farmers retained on an average 25 kgs for consumption, 2.40 qtls for animal feed and 0.53 qtls for other purposes. The per farm retention of bajra for all purposes was 3.20 qtls and large farmers retained higher quantity than other categories.

Crop Losses

The sampled farmers incurred crop losses during various operations of harvesting and after harvesting up to sale point. The share of harvesting losses in paddy on sampled farms varied between a narrow range of 1.50 and 2.01 per cent. The losses were particularly found low on

marginal and small farms due to personal care taken by these groups. Farmers also made such losses in case of wheat and bajra too.

The farm households owned steel bins and stored food grains after cleaning and drying in order to save grain from variety of losses. Food grains were gradually withdrawn for day to day requirement for consumption, seed, feed and other needs. The sampled farmers did not report any losses in storage of selected food grains.

Marketable and Marketed Surplus

Results suggest that marketable surplus of selected food grains was found skewed towards land owning medium and large farmers. The per farm marketable surplus of paddy in Karnal district was 67.41 qtls. during 2011-12. The per farm quantity marketed by large farmers was around 219 qtls. against 22 qtls. by marginal farmers. Thus, marketable surplus of paddy was found primarily concentrated in hands of large land owning classes which constituted low proportion in number and higher share in cultivated area. The respondent farmers did not withhold stocks of paddy for future sale due to easy access to procurement facilities provided by the central and state agencies. Farmers sold entire marketed surplus at the minimum support price. The higher marketed surplus with medium and large farmers also could be due to commercialization of agriculture in the state that has led to change over from kind to money wages.

The marketable surplus of wheat on sampled farmers in Karnal and Bhiwani was 17974 qtls and 1477 qtls respectively. Unlike paddy, contribution of medium and large farmers was far greater in comparison to small and marginal farmers. The share of produce marketed was relatively low up to size class of 2 ha. but the proportion steadily increased thereafter. This phenomenon could be attributed to low production and a portion of output retained for domestic consumption and animal feed by these groups. The entire marketable surplus of wheat was disposed off to procurement agencies at the MSP and hence, marketable and marketed surplus were the same.

Results further show that aggregate marketed surplus of bajra with sampled farmers was 1476 qtls which translates into per farm marketable surplus of 14.76 qtls. Although, a large share (65%) of marketable surplus was contributed by medium and large farmers, it was found at least lower by 10% in comparison to wheat and paddy. The proportion of sales to total output of bajra increased with the increase in the size of holdings. This is indicative of the market orientation of higher size

groups. Farmers sold the entire stock to commission agents/ private traders in the absence of procurement facility in the district.

In a nutshell, a positive relationship emerged between farm size and contribution to marketed surplus on sampled farms irrespective of the type of foodgrain. This finding corroborates with some of the earlier studies that size of land holding has positive relationship with marketed surplus of food grains in the country.

Factors affecting marketed surplus

The appreciable marketed surplus of paddy and wheat was largely facilitated by infrastructural, institutional and technological factors. The support was provided to the farmers by provision of institutional credit, expansion in irrigation network, subsidized input supply and price incentives through provision of minimum support prices. The road connectivity and provision of electricity in all villages facilitated adoption of improved technology for paddy, wheat and bajra, which is responsible for present levels of yield rates of selected crops in Haryana. The institutional factors like support of marketing board, network of regulated markets and procurement facilities further incentivized farmers to increase production which helped in higher marketed surplus. Among socio-economic factors, farm size played a positive role while agriculture as a main occupation, age, education and gender of the head of households of respondents did not show any association with the level of marketed surplus.

Determinants of Marketed Surplus

The results of regression analyses carried out to ascertain the determinants of marketed surplus of selected food grain crops in Haryana show that regression coefficient of production in case of paddy was positive, greater than 1 and statistically significant at the overall level and showed high influence on marketed surplus of paddy. The negative coefficients of consumption, retention and crop losses in most of the cases implied that probability of increase in marketed surplus would decline with increase in these parameters. This is understandable since increased domestic consumption, retention for other purposes and crop losses will reduce the quantum of the produce for disposal in the market. The model explained 99% variation in the marketed surplus of paddy at the overall level.

The findings of regression model carried out for wheat in Karnal and Bhiwani indicated that independent variables included in the analyses explained 98 and 99 per cent variation in the marketed surplus of wheat in the selected districts. Production with elasticity coefficients of 1.55 and 1.32 was identified as the most important policy variable favorably influencing the marketed surplus of wheat in Haryana. Once again, elasticity coefficients of domestic consumption, retention for other purposes and crop losses were found negative and indicative of unfavorable impact on dependent variable. The results of regression analysis carried out for bajra were on the similar lines with some variations. Once again, production, with regression coefficient 1.84, emerged as the key variable that will positively influence marketed surplus of bajra in Haryana.

II.   Policy Implications

This study aimed at providing current evidence on marketable and marketed surplus of major food grains in Haryana and to identify the pathways for accelerating quantum and share of produce to be marketed. Haryana has a great potential of increasing marketed surplus through increased production by raising yield rates in relatively less irrigated areas. The following policy prescriptions are suggested to achieve the goal.

1. The productivity of paddy has reached to saturation level in major growing districts such as Karnal. Since, there is extremely limited scope of area expansion in these areas, priority may be accorded to R & D in yield raising innovative technologies to further increase production.

2. There is a good potential of increasing quantum of marketed surplus of wheat and bajra through increase in production by raising yield at least to the state level in districts with limited irrigation availability by facilitating adoption of technology with full package of practices. All efforts should be made to exploit this potential.

3. Irrigation availability is a primary factor for increasing marketed surplus of food grains in Haryana. At present, farmers rely on tube-well due to inadequate availability of canal water. This has increased cost of cultivation at one hand and has depleted the water level on the other hand. This calls for better management and expansion in surface irrigation facilities through investment and monitoring.

4. Provision of institutional credit for small and marginal farmers is an utmost requirement. They should be provided credit for agricultural purposes on easy terms and conditions by expanding institutional sources of credit.

5. Looking at the inadequacy of storage facilities in the state, farmers should be encouraged to create storage facilities at the village level through formation of cooperatives.

6. Findings of the study indicate limited use of electronic media by famers to elicit information. The state should make all efforts to provide facilities to the farmers to utilize information communication technology in the crucial areas such as market/price information, weather forecast and modified agricultural marketing.

At the end, marketed surplus of major food grains in Haryana can be increased through incentivizing farmers by providing technological, credit and price support.

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<u>Action taken on Comments from the Coordinator of the study</u>

All comments of the Coordinator were taken into consideration while finalizing the report. These comments have been incorporated and the action taken is as under:

1. – Regarding adoption of methodology

     - The same methodology is used

2. - Incorporated

3. - Suggested table included in Chapter-II

4. - Incorporated

5. - Incorporated

6. - Problems of Heteroscedasticity in primary data tested before regression analysis.