Final Report

Assessment of Marketed and Marketable Surplus of Major Foodgrains in India

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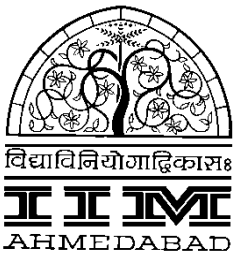

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Chapter 1

Introduction

Like most developing countries, India has been predominantly an agrarian economy, with the agriculture sector contributing the largest share to gross domestic product (GDP) as well as employment. At the time of independence, the share of agriculture in total GDP was more than half and 70 per cent of the population was dependent on the agriculture sector for their livelihood. The Indian economy has undergone structural transformation from an agriculture-based to knowledge-based, services and industrial economy in terms of contribution to the national GDP, but agriculture sector is still the mainstay as 263 million workers are wholly (about 118.7 million cultivators) or significantly (about 144.3 million agricultural workers) dependent on agriculture and allied activities for their livelihood (GoI, 2013).

The contribution of the agricultural sector to GDP has continued to decline over the years, while that of other sectors particularly services has increased. In TE1971-72, agriculture contributed about 33.5 per cent of the GDP, which declined to 24.7 per cent and 12.1 per cent in TE1991-92 and TE2012-13 (at 2004-05 prices), respectively (CSO, 2014). The pace of structural transformation of the economy has accelerated further in the post-reforms period. On the other hand, decline in the share of agricultural workers in total workforce has been relatively slower compared to the decline in the share of agriculture in GDP. As a result, the labour productivity in agriculture has increased at a slower pace compared to non-agricultural workers, which has led to increase in disparity in value added per worker between agriculture and non-agriculture sector. Moreover, the gap between agriculture and non-agriculture GDP has also increased significantly in the post-reforms period leading to growing disparity between rural and urban areas. Although the share of agricultural GDP has declined in almost all states, agriculture is still an important contributor to Gross State

Domestic Product (GSDP) in some states like Madhya Pradesh, Uttar Pradesh, Assam, and Bihar, where incidence of poverty is still high.

Indian agriculture witnessed a visible deceleration in growth rate of crop yields, as well as total agricultural output at national as well as most states during the post-liberalisation period, and this slowdown had caused widespread agrarian distress. For example, country achieved 4.8 per cent average annual rate of growth against a target of 4 per cent in agriculture during the 8th Plan (1992-93 to 1996-97) but declined to less than 2.5 per cent during the 9th and 10th Plan. Given the seriousness of the problem, several initiatives were taken by the central and state governments to reverse the decelerating growth of the agriculture sector. These initiatives have succeeded in reversing the slowdown in agriculture and the sector grew at about 3.7 per cent during the 11th Five Year Plan. The foodgrains production touched a new peak of about 265 million tonnes in 2013-14, an addition of about 55 million tonnes between TE2005-06 and TE2013-14.

Commercialisation of Agriculture

Agricultural transformation is a necessary part of the broader process of structural transformation, in which an increasing share of output and employment are generated by sectors other than agriculture, and Indian agriculture is no exception. Indian agriculture has become more commercial, and market-oriented. A number of dimensions can be examined to assess the extent of commercialisation. For example, an increase in share of production being marketed, greater use of market purchased inputs and services, shift towards production of high-value crops, diversification of agricultural exports, etc. High market prices, changing demand preferences for high-value agricultural products, adoption of new agricultural technologies (such as Bt cotton and hybrids in maize), increased investment in agriculture, and export opportunities, etc. are important drivers of agricultural commercialization and growth.

Diversification of Indian Food Basket

The Indian food consumption basket has become increasingly diversified and though cereals still dominate in rural areas, but its share in total food expenditure has declined from 38.3 per cent in 1993-94 to 24.7 per cent in 2011-12. On the other hand expenditure on fruits,

vegetables, milk, eggs, meat and fish, and beverages and processed food is rising. The NSSO data (NSS 68th round) shows that between 1993-94 and 2011-12, share of expenditure on milk and milk products increased from 15 per cent to 18.7 per cent, meat, egg and fish from 5.2 to 7.4 per cent, fruits and vegetables from 12.2 to 13.8 per cent and beverages and processed food from 6.6 to 11.9 per cent. In the case of urban areas, expenditure on milk and milk products is higher (20.3%) than expenditure on cereals (19%). The share of expenditure on beverages and processed food has increased from 13.2 per cent in 1993 to 18.4 per cent in 2011-12. This transformation of food consumption basket is driven by rising income, changing demographics, emergence of organized food retail and fast food chains.

Increasing Marketed Surplus Ratios

The proportion of agricultural production that is marketed by the farmers is an important indicator of commercialization of agriculture. As indicated in Table 1.1, Indian agriculture has become increasingly market oriented and monetized. In the early 1950s, about 30-35 per cent of foodgrains output was marketed, which has increased to more than 70 per cent in the recent years. The marketed surplus measured as a share of total production which is sold in the market is relatively higher in case of commercial crops than subsistence crops like jowar, bajra, ragi, etc. In case of rice and wheat, increase in marketed surplus ratios has been mainly driven by effective government procurement policy while in case of commercial crops like maize, vegetables, and oilseeds it was due to the efforts of the private sector. These trends show that the number of farmers depending on subsistence agriculture is declining, and an increasing number of farmers are selling part of their output in the market. Cotton, with 93 percent of total output sold, is the most monetized commodity, followed by sunflower, sesamum and soybean. In case of barley, bajra, arhar and ragi, less than 70 per cent of output is sold in the market. There have been significant increases in marketed surplus ratio of various foodgrains during the last decade. In case of rice, marketed surplus ratio increased by 15.5 percentage points (from 61.7% in 1999-00 to 77.2% in TE2011-12), wheat by 13.5 %, maize 16 %, barley 16.9 % and gram by 13.5 %.

Diversification of Agriculture

The value of output from the agriculture sector has diversified towards high-value commercial crops and livestock products. At the all-India level, the share of high-value

commodities/products (fruits and vegetables, livestock products, fisheries) has increased from about one-third in TE1983-84 to over 50 per cent in TE2011-12 (Sharma, 2011). The share of fruits and vegetables in the total value of agricultural output as increased from about 14 per cent to about 19.5 per cent and that of livestock from about 20 per cent to over 30 per cent during the same period. Among livestock products, the contribution of milk has increased at a faster rate, from 12.7 per cent in TE1983-84 to 20 per cent in TE2011-12 than meat (CSO, 2013). The above trends clearly indicate that farmers have responded to market signals and diversified into high-value agriculture under given technological, institutional, and infrastructural constraints. Similarly, Indian agricultural exports have also diversified towards high-value products. For example, the share of high-value agriculture in the total agricultural exports has increased.

Table 1.1: All-India marketed surplus ratio (MSR) of important agricultural commodities (1950–51 to 2011-12)

Crop	***1950–51***	***1999-00***	***2003–04***	***2004-05***	***2008–09***	***2009-10***	***2010-11***	***2011–12***
Rice	30.0	61.7	75.2	71.4	66.8	79.7	80.7	77.2
Wheat	30.0	56.5	67.7	63.3	70.9	72.3	73.2	70.0
Maize	24.0	67.3	62.5	53.4	85.5	86.8	86.0	83.3
Jowar	24.0	47.6	57.0	69.4	54.6	65.0	62.0	53.5
Bajra	27.0	61.7	43.4	56.1	57.8	70.3	67.4	67.5
Barley	-	42.9	37.3	57.7	51.8	67.9	73.8	59.8
Ragi	-	26.5	60.3	79.5	20.1	37.2	25.7	53.3
Arhar	50.0	63.5	80.3	93.8	75.4	76.5	73.8	81.5
Gram	35.0	71.8	82.2	85.8	74.2	89.5	86.7	85.3
Urad	-	90.5	85.2	76.8	60.8	70.4	63.6	70.0
Moong	-	74.6	68.1	85.9	82.5	82.5	81.5	87.3
Lentil	55.0	56.7	90.4	88.8	73.4	79.4	77.9	88.1
Groundnut	68.0	62.2	86.0	89.7	91.8	92.9	93.4	90.8

Rapeseed & Mustard	84.0	73.3	92.3	95.0	89.4	87.2	82.1	82.1
Soybean	-	92.5	97.2	98.3	77.3	91.8	95.7	94.4
Sunflower	-	99.2	90.9	87.4	65.2	99.6	99.6	65.6
Sesamum	-	86.1	99.7	91.3	83.7	94.7	83.2	92.8
Safflower	-	89.2	96.8	96.8	72.7	73.1	55.1	-
Nigerseed	-	94.7	98.8	98.2	94.5	88.6	83.7	94.7
Cotton	100.0	83.8	97.6	-	94.9	97.7	95.4	98.4
Jute	100.0	97.5	97.7	-	90.7	85.7	57.6	83.5
Onion	-	98.5	99.8	-	82.9	98.2	99.7	75.4
Potato	-	47.6	75.7	-	85.0	81.6	76.3	77.4

Sources: GoI (2013), Agricultural Statistics at a Glance, 2007, 2010 & 2012, Ministry of Agriculture, Government of India.

Relevance of the Study

A study of the behaviour of marketable and marketed surplus of foodgrains and factors affecting it can be of significant help in planning for agricultural development, designing appropriate procurement, storage, distribution and pricing policy. Recognizing the importance of reliable estimates of marketable and marketed surplus of food crops, government initiated an all India survey for estimation of marketable surplus and post-harvest losses of rice in 1972, which was subsequently extended to other major food crops. The last study, which was conducted by Directorate of Marketing and Inspection, Government of India, covered a period of three years (1996-97, 1997-98 and 1998-99), and the reports were published in 2002 (GoI, 2002). These estimates of marketable surplus and post-harvest losses have become obsolete as Indian agriculture has undergone significant transformation during the last decade. It is, therefore, important to understand how marketed surplus of foodgrains has changed in the recent years and responded to changes in production, prices and other variables including technology, institutions and infrastructure.

This study attempts to estimate marketed and marketable surplus of major food crops, namely, rice, wheat, maize, bajra, gram and tur in leading producing states and to identify and evaluate important factors which determine the level of marketed surplus for various categories of farms. It is expected that that results of this study would be useful to design effective food procurement, distribution and price policy.

Objectives of Study

The main objectives of the studies are:

1. Estimate marketable and marketed surplus of selected cereals (rice, wheat, maize, and bajra) and pulses (gram and tur) in selected states,
2. To estimate farm retention pattern of households for self-consumption, seed, feed, wages and other payments in kind, and
3. To examine the impact of various socio-economic, technological, institutional, infrastructure, and price factors on marketed surplus of major crops

Organization of the Study

The report is organized into nine chapters. Chapter 1 gives a brief overview of the changing role and importance of agriculture in the Indian economy, introduces the problem statement and describes the specific issues related to marketed and marketable surplus addressed in the study. Chapter 2 presents the coverage of study, methodology and techniques used for data collection and analysis. In Chapter 3, an overview of Indian rice economy covering trends in area, production, productivity and procurement is given. This chapter also presents empirical estimates of marketed and marketable surplus of rice and discusses factors which influence the marketed surplus using household data from selected states. The next chapter (chapter 4) discusses recent trends in growth behaviour of wheat and provides overview of socio-economic profile of wheat growers and estimates of marketed surplus and farm retention on various categories of farms from selected wheat growing states. Chapter 5 contains an analysis of performance of maize and presents empirical estimates of the marketed and marketable surplus of maize. Chapter 6 deals with a brief overview of bajra and marketed surplus estimates of selected states. In Chapter 7, we analyse the performance of gram and examine the marketed surplus ratios of gram on

various farm sizes. Estimates of marketed surplus of tur are discussed in Chapter 8. The summary and conclusions are presented in Chapter 9. This includes the summary results of the marketed surplus and farm retention pattern and some policy implications.

Chapter 2

Coverage, Sampling Design and Methodology

The main focus of the present study is estimation of marketed and marketable surplus of major foodgrains and response of marketed surplus to price and other exogenous variables. In this chapter, the conceptual and theoretical model of the marketed surplus of farm households and procedure for selection of crops, states, and sample households are discussed. This study is based on both primary and secondary data pertaining to major foodgrains namely rice, wheat, maize, bajra, gram and tur, grown in the country. In order to examine the trends in production and yield performance of the major foodgrains, secondary data on crop area, production and productivity were collected from different published sources. In order to estimate marketed surplus and farm retention pattern and to identify major factors influencing marketed surplus, primary data from the households growing selected crops were collected. The data on the socio-economic profile, operational holding, cropping pattern, crop production, farm retention, marketing, access to inputs and services, etc. were collected from farmers in the selected states.

Coverage and Sampling Design

Multi-stage stratified sampling method was used with major states producing selected crops as strata and districts, blocks, villages and households as primary, secondary, tertiary and the ultimate units of sample, respectively. Table 2.1 presents the share of major producing states in total production of selected crops, namely, rice, wheat, maize, bajra, maize, gram and tur during the TE2011-12. Given the constraints in data collection due to limited time and resources, the study was restricted to major producers of the crop as given in Table 2.2. In the first stage, states were selected based on their share in total production and importance of the crop in the state economy. Based on these criteria, West Bengal, Andhra Pradesh, Uttar Pradesh, Punjab and Haryana were selected for rice and Uttar Pradesh, Punjab, Haryana and Madhya Pradesh were selected for wheat. Andhra Pradesh, Karnataka,

Maharashtra and Rajasthan were selected for bajra crop and Madhya Pradesh, Rajasthan, Maharashtra and Karnataka for gram. For tur, Maharashtra, Karnataka, Uttar Pradesh and Madhya Pradesh were selected.

Table 2.1: Major producers (% share in total production) of selected foodgrains in India, TE2011-12

Crop	Major Producers
Rice	West Bengal (14.5%), Andhra Pradesh (13.0%), Uttar Pradesh (12.7%), Punjab (11.2%), Madhya Pradesh (1.8%), Orissa (6.7%), Tamil Nadu (6.5%), Chhattisgarh (5.6%), Bihar (4.8%), Assam (4.7%), Karnataka (4.1%), Haryana (3.7%), Maharashtra (2.7%)
Wheat	Uttar Pradesh (33.4%), Punjab (18.6%), Bihar (5.1%), Haryana (13.3%), MP (10.5%), Gujarat (4.0%), Rajasthan (9.2%)
Bajra	Uttar Pradesh (16.9%), Karnataka (2.8%), Haryana (12.1%), Maharashtra (10.0%), MP (3.3%), Gujarat (11.6%), Rajasthan (41.2%)
Maize	West Bengal (1.8%), Andhra Pradesh (17.2%), Punjab (2.4%), Orissa (1.1%), Bihar (7.5%), Tamil Nadu (6.4%), Karnataka (19.2%), Maharashtra (11.4%), MP (5.6%), Gujarat (3.6%), Rajasthan (8.1%).
Gram	Andhra Pradesh (8.9%), Uttar Pradesh (7.4%), Karnataka (7.2%), Haryana (1.0%), Maharashtra (13.8%), MP (42.7%), Gujarat (2.6%), Rajasthan (13.9%).
Tur	Andhra Pradesh (7.7%), Uttar Pradesh (10.7%), Orissa (4.4%), Karnataka (14.6%), Maharashtra (34.7%), MP (11.1%), Gujarat (9.7%),

Source: Computed from GoI (2011)

Table 2.2: List of selected crops and states (% share in total production) for the study

Crop	Selected States
Rice	West Bengal (15.2%), Andhra Pradesh (14.4%), Uttar Pradesh (13.2%), Punjab (11.1%) and Haryana (3.8%)
Wheat	Uttar Pradesh (35.4%), Punjab (19.5%), Haryana (13.4%) and Madhya Pradesh (8.1%) Rajasthan (9%)
Maize	Andhra Pradesh (21%), Karnataka (15.4%), Maharashtra (7.9%), Rajasthan (9.3%)
Bajra	Rajasthan (48.2%), Uttar Pradesh (14.7%), and Haryana (12.1%)
Gram	Madhya Pradesh (39.5%), Rajasthan (13.9%), Maharashtra (11%) and Karnataka (2.8%)
Tur	Maharashtra (26.7%), Karnataka (13.9%), Uttar Pradesh 12.7%) and Madhya Pradesh (11.4%)

Source: Computed from GoI (2011)

The individual state studies were conducted by the respective Agro-Economic Research Centres/Units (as given in Table 2.3) and the coordinated study was undertaken by the Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad. Since Agro-Economic Research Centre, Waltaire did not complete the study on time; Andhra Pradesh report was not included in the coordinated report.

In the second stage, appropriate number of districts were purposively selected from each state (depending upon the number of districts in the selected state) keeping in view the representative nature of the district and on the basis of importance of the crop in terms of production. The list of selected districts and participating Agro-Economic research Centres/Units for each selected crop is given in Table 2.3.

Table 2.3: List of selected districts and participating Agro-Economic Centres/Units

Crop	***Selected State***	***Selected Districts***	***Participating AER Centre/ Unit***
Rice	Haryana	Karnal	Delhi
	Punjab	Gurdaspur, Sangrur, and Ferozpur	Ludhiana
	U.P.	Shahjahanpur, and Barabanki	Allahabad
	West Bengal	Burdwan, Birbhum, and Murshidabad	Visva-Bharati, Santiniketan
Wheat	Rajasthan	Alwar, Chittorgarh, Churu, Hanumangarh, and Udaipur	Vallabh Vidyanagar, Anand
	M.P.	Hosangabad	Jabalpur
	U.P.	Shahjahanpur, Barabanki, Agra, and Budaun	Allahabad
	Haryana	Karnal, and Bhiwani	Delhi
	Punjab	Gurdaspur, Sangrur, and Ferozpur	Ludhiana
Maize	Karnataka	Devanagere, and Belgaum	ISEC, Bangalore
	Maharashtra	Nashik, and Aurangabad	Pune
	Rajasthan	Alwar, Chittorgarh, and Udaipur	Vallabh Vidyanagar, Anand
Bajra	Haryana	Bhiwani	Delhi
	Rajasthan	Alwar, Churu, Hanumangarh, and Udaipur	Vallabh Vidyanagar, Anand
	U.P.	Agra, and Budaun	Allahabad

Gram	Rajasthan	Alwar, Churu, Hanumangarh and Udaipur	Vallabh Vidyanagar, Anand
	Maharashtra	Amravati, and Latur	Pune
	Karnataka	Bijapur, and Gulbarga	ISEC, Bangalore
	M.P.	Vidisha	Jabalpur
Tur	U.P.	Fatehpur, and Hamirpur	Allahabad
	M.P.	Narshingpur	Jabalpur
	Maharashtra	Amravati, and Latur	Pune
	Karnataka	Bijapur, and Gulbarga	ISEC, Bangalore

Source: Field Survey.

In the next stage, appropriate numbers of blocks/talukas/villages from each district were selected purposively based on production of the crop. Finally, from each selected village, an appropriate number of farmers keeping in view the representative nature of different farm categories (Marginal 0-1 ha, Small 1-2 ha, Medium 2-10 ha; Large >10 ha) were selected randomly with the condition that a sufficient number of households in each category was obtained in each selected district. The final sample consisted of 42 districts, and 3963 households (918 rice producers, 1193 wheat growers, 358 maize farmers, 500 bajra growers, 553 gram producers and 441 tur farmers) spread over eight states. Table 2.4 presents the details of various categories of households selected from each state for the selected crop. This is one of the most comprehensive studies on marketed surplus estimation in the recent period.

Table 2.4: List of selected crops, states and farm category-wise sample size

States	**Marginal**	**Small**	**Semi Medium**	**Medium**	**Large**	**Total**
	<1 ha	**1-2 ha**	**2-4 ha**	**4-10 ha**	**>10 ha**	
Rice						
Haryana	58	79	34	23	6	200
Punjab	36	60	96	84	24	300
Uttar Pradesh	61	21	11	7	0	100
West Bengal	124	97	65	32	0	318
Total	***279***	***257***	***206***	***146***	***30***	***918***

Wheat						
Rajasthan	21	100	70	79	23	293
Madhya Pradesh	42	16	21	19	2	100
Uttar Pradesh	126	41	22	11	0	200
Haryana	86	110	59	36	9	300
Punjab	36	60	96	84	24	300
Total	***311***	***327***	***268***	***229***	***58***	***1193***
Maize						
Rajasthan	9	38	33	29	9	118
Maharashtra	37	37	20	6	0	100
Karnataka	40	43	39	14	4	140
Total	***86***	***118***	***92***	***49***	***13***	***358***
Bajra						
Haryana	21	31	27	18	3	100
Rajasthan	18	80	69	100	33	300
Uttar Pradesh	65	20	11	4	0	100
Total	***104***	***131***	***107***	***122***	***36***	***500***
Gram						
Rajasthan	11	28	46	95	32	212
Maharashtra	36	35	19	10	0	100
Karnataka	27	34	26	36	18	141
Madhya Pradesh	24	23	17	20	16	100
Total	***98***	***120***	***108***	***161***	***66***	***553***
Tur						
Uttar Pradesh	52	24	12	12	0	100
Madhya Pradesh	9	13	28	34	16	100
Maharashtra	33	42	20	5	-	100
Karnataka	19	39	33	36	14	141
Total	***113***	***118***	***93***	***87***	***30***	***441***
GRAND TOTAL	**991**	**1071**	**874**	**794**	**233**	**3963**

Source: Field Survey

Data Collection

Data used in this study come from the Household Survey conducted by participating Centres/Units, which was designed by the authors in collaboration with concerned Centres/Units in 2011-12. The survey covered a random sample of 3963 households spread over 42 districts and six states. The data relating to crop production, proportion of foodgrains production sold in the market, farm retention, and some of the major socio-economic, institutional, technological and other factors that might influence marketed surplus were collected from selected households. The household survey was conducted using a pre-tested questionnaire to interview the head of each household. The first part of the questionnaire included socio-demographic characteristics, land use and cropping pattern, whereas the second part had questions on crop production, retention, marketed surplus and access to markets, institutions, and infrastructure.

Conceptual Framework and Theoretical Model of the Study

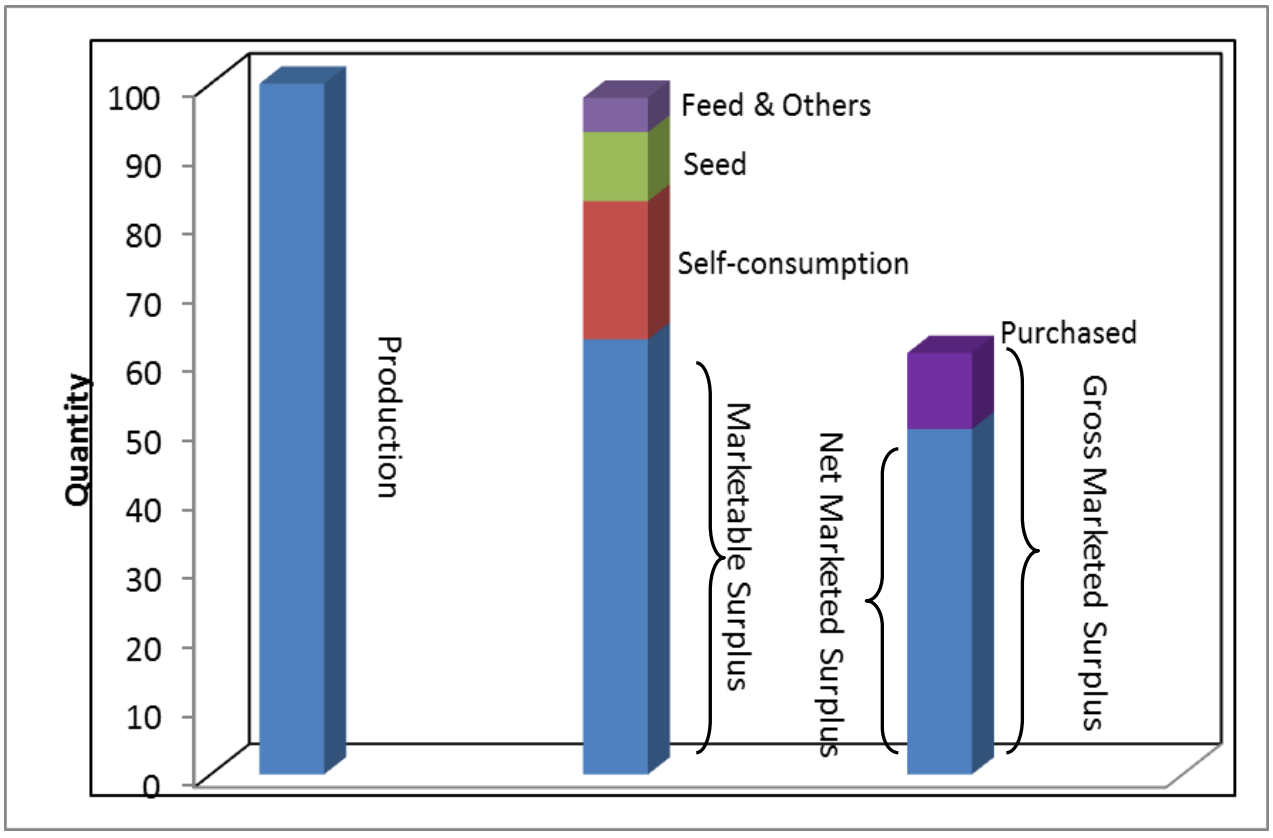
Most farm households produce a significant portion of the food crops for self-consumption and they also sell part of the produce in the market. There are well known studies on concepts of marketable and marketed surplus and Dharm Narain's study (1961) may be considered as a pioneering study. While many studies do not make distinction between marketable and marketed surplus and the terms are used interchangeably, he made a clear distinction between these two terms. Several economists including Dandekar (1965), Krishna (1965), Bhalerao and Lal (1965), Bardhan and Bardhan (1969), Bardhan (1970), Behrman (1966, 1968), Haessel (1975), Bansil (1961), Shah and Pandey (1976), Patnaik (1975), Nadkarni (1980) have written extensively on the subject during the 1960s and 1970s. However, there are few studies in the recent past which have comprehensively analysed marketable and marketed surplus issues.

The concept of marketed surplus has been used in a variety of ways and it is necessary to clearly define each one of these. In some of the earlier studies on foodgrains marketing in the developing countries, three concepts of marketed surplus have been generally used; gross marketed surplus, net marketed surplus and marketable surplus (Narain, 1961; Krishna, 1962; Krishnan, 1965; Raquibuzzaman, 1966; Sharma and Gupta, 1970; Farruk,

1970; Bhargava and Rustogi, 1972; Nadkarni, 1980, Rahman, 1980; Harriss, 1982; Hussein and Rajbanshi, 1985).

For the purpose of this study, marketable surplus has been estimated by subtracting total retention from total production. The retention consists of quantity kept for self-consumption, for seed purpose, for feed, and payments in kind to labourers, gifts, and others. Gross marketed surplus is calculated by estimating the total quantity of produce sold in the market without considering whether there is any buy back by those sellers later on. Net marketed surplus, on the other hand, excludes the amount of produce which is bought back. There could be five different types of farmers, (i) exclusive sellers who only sell and do not buy-back, (ii) exclusive buyers who buy and do not sell at all, (iii) net seller households whose sales are higher than purchases, (i.e. they are involved in both sales and purchases), (iv) net buyer farmers whose purchases are higher than their sales, and (v) non-participant farmers who neither sell nor buy. The net marketed surplus will be available from category (i) and (iii) farms.

Figure 2.1: Concepts of marketable and marketed surplus used in the study



The estimates assume the following forms:

- **Marketable Surplus** = Total Production – Total retentions
- **Gross Marketed Surplus** = Quantity actually Sold/Actual Sales
- **Net Marketed Surplus** = Actual Sales – Net Purchases

The entire amount of marketable surplus, which is available for sales, may not be actually sold in the market. Therefore, marketed surplus may be more, less or equal to the marketable surplus, depending upon the socio-economic conditions of the farmer, type of the crop, access to market, etc. Since marketed surplus represents actual sale by farmers, the difference between marketable and marketed surplus can reveal several patterns of sale, purchase and stockholding by various categories of farmers. If marketable surplus is higher than marketed surplus, it indicates that stocks are held by farmers who have better retention capacity in anticipation of fetching higher prices in future period or sometimes during emergencies (Acharya and Agarwal, 2004). On the other hand, if marketed surplus and marketable surplus are equal, it indicates that farmers are not in a position to hold back their stocks as they need cash for the next crop or other purposes. The marketed surplus is higher than marketable surplus, when the farmer retains a smaller quantity of the crop than his actual requirement for family, farm and other needs. It holds true especially for small and marginal farmers, who sell after harvest to meet immediate cash needs and buy back later mostly at higher prices. This situation of selling more than marketable surplus is termed as distressed or forced sale.

Determinants of Marketed Surplus

A major focus of the study is on the estimation of marketed surplus and the response of marketed surplus to prices and other exogenous variables. Therefore, it's important to define the concept and identify important determinants of marketed surplus. In this section, a theoretical model of marketed surplus response function has been discussed. Many studies have observed that marketed surplus of a crop depends on various price and non-price factors. Empirical studies of marketed surplus have found that farmers respond positively to price changes and this is consistent with economic theory. In addition to price, a number of other socio-economic, institutional, technological and infrastructure factors

influence marketed surplus. Among these are farm size and production, family size, wealth/income, risks, access to modern technology, markets, market information, etc.

A number of studies have reported that in most cases there exists a strong linear, and in some cases a strong non-linear relationship between the quantity sold and variables like farm size, quantity produced, family size, prices and socio-economic and institutional variables for different categories of farmers. The linear relation may be written as:

$$\mathbf{MS = \alpha + \beta_i X_i}$$

Where, MS denotes the marketed surplus and X_i (i = 1, 2, …., n) represents the independent variables influencing marketed surplus. We can describe this function as the marketed surplus function. The dependent variable, marketed surplus, is defined as sales as a share of total output per household. The independent variables include farm size (ha), family size (numbers), awareness about MSP (yes/no), access to regulated market (yes/no), distance of farm from main market (km), per household production of the crop (in quintals), source of off-farm income, access to institutional credit, access to roads, awareness about price support programme, access to market and market information and price received for the produce (Rs/qtl). We hypothesize that with the increase in farm size and production, higher income and output price and better access to various institutional and technological factors, marketed surplus should increase. Family size, distance from market, and poor access to infrastructure, on the other hand, are expected to have negative effect on the marketed surplus. We used multiple linear regression analysis to examine the impact of various factors on marketed surplus of selected crops. The model is estimated first for each of the four major farm size categories and then for all farms combined.

Chapter 3

Overview of Rice Economy: Production, Procurement and Marketed Surplus

Rice is the most important crop occupying about 22 per cent (43.2 million ha) of the total cultivated area in the country with a total production of over 102 million tonnes during TE2012-13. The crop sector contributed about 70.5 per cent of the total value of output from agriculture and allied activities in TE2012-13. Rice has the highest contribution (14.5%) to value of output, followed by wheat (10.4%) and cotton (5.2%). It has emerged as India's top agricultural export commodity with about 15.2 per cent of the total agricultural export value from 2011-12 to 2013-14.

Rice is an important food crop produced in all regions/states but its contribution to food-crop output varies from state to state (Table 3.1). For example, rice contributes more than 25 per cent to crop output in states like Tripura (40.4%), Chhattisgarh (38.7%), Manipur (37.9%), Punjab (31.8%), Odisha (29.1%), West Bengal (26.5%), Assam (25.9%), Meghalaya (25.7%) and Andhra Pradesh (25%). While in other states, such as Maharashtra, Madhya Pradesh, Kerala, Gujarat, Himachal Pradesh and Rajasthan, its contribution is less than 5 per cent. While rice is the staple food for majority of Indian population, its share in the diet varies across regions. Rice consumption per person per month has fallen in rural India from 6.38 kg in 2004-05 to 5.98 kg in 2011-12, a fall of about 8 per cent in 7 years. In urban India, it has fallen from 4.71 kg to 4.49 kg (a fall of about 5%) per person per month. The share of PDS purchases in consumption has, however, risen substantially. Per capita consumption of PDS rice has, in fact, doubled in rural India and risen by 66% in urban India since 2004-05.

The importance of rice consumption in the diet also differs across the different production regions. Households in the southern, eastern and north-eastern region have traditionally used more rice. The share of rice in total food expenditure is relatively higher in rural areas compared with urban areas. Rice expenditure constitutes more than 20 per cent of food expenditure in states like Manipur, Nagaland, Odisha, Assam, West Bengal, Chhattisgarh,

Tripura, Jharkhand, and Arunachal Pradesh in rural areas. While in urban areas, Manipur and Nagaland are the only states where share of rice expenditure is more than 20 per cent. The northern region has traditionally been wheat consuming region. For example, in Punjab and Haryana, one of the main rice producers, share of expenditure on rice is only 2-3 per cent. The relationship between income levels and the corresponding level of rice consumption shows that when household incomes grow, population in the higher income group spend less on rice while lower-income households increase rice consumption by substituting rice for coarse cereals.

Table 3.1: Share of rice in total value of output from agriculture and total food expenditure in major states: 2011-12

State	***Share (%) of rice in total value of agricultural output***	***Share (%) of rice in total food expenditure***	
		Rural	*Urban*
Andhra Pradesh	25.0	16.7	15.0
Arunachal Pradesh	22.1	20.0	15.5
Assam	25.9	23.8	17.5
Bihar	17.7	14.4	13.6
Chhattisgarh	38.7	21.8	16.0
Goa	17.8	9.3	8.6
Gujarat	3.7	4.5	3.9
Haryana	19.4	1.6	2.1
Himachal Pradesh	3.1	7.0	6.3
Jammu & Kashmir	9.7	12.2	10.4
Jharkhand	23.0	21.1	12.9
Karnataka	10.6	8.9	8.8
Kerala	3.9	10.4	9.7
Madhya Pradesh	3.9	5.4	4.3
Maharashtra	3.9	5.7	5.4
Manipur	37.9	36.0	33.6
Meghalaya	25.7	19.7	17.3
Mizoram	10.8	18.8	16.2
Nagaland	22.3	27.3	25.1

Odisha	29.1	24.8	16.8
Punjab	31.8	2.1	2.8
Rajasthan	1.2	0.8	1.6
Sikkim	5.6	15.6	16.8
Tamil Nadu	18.4	15.6	13.1
Tripura	40.4	21.1	18.4
Uttar Pradesh	12.9	8.7	6.1
Uttarakhand	11.1	8.0	7.8
West Bengal	26.5	23.1	12.6
All India	15.2	7.0	3.9

Source: CSO (2013) and NSSO (2013)

Trends in Area, Production and Yield

Table 3.2 summarizes the growth rates of cultivated area, production and yield of rice in four time periods from 1971-72 to 2011-12. The area under rice cultivation increased from 37.6 million ha in 1971-73 to 44.9 million ha in triennium ending (TE) 2001-02 but declined to 43.2 million ha during TE2012-13. Although the rice cultivated area declined during the period 1999-2012, total production increased from 89.3 million tonnes to 101.8 million tonnes during the same period. The rice yield has more than doubled during the last four decades, from 1120 kg/ha in 1971-73 to 2357 kg/ha in 2010-12.

Total rice production increased at an annual compound growth rate of 2.35 per cent during the period 1971-2012, of which yield accounted for nearly 84% and area 16% of the production growth rate. Rice production has continued to increase during the last four decades; however, the annual growth rate of production slowed to 1.86% during the 1990s (Table 4.1). Rice production (4.2%) and yield (3.58%) recorded the highest growth rate during the 1980s and the lowest (1.86% in production and 1.07% in yield) during the 1990s. However, growth rate picked up during the last decade. However variability in rice area, production and yield which declined during 1990s, increased marginally during the last decade.

Production of rice occurs in two main cropping seasons. The kharif crop has a large share (>85%) in production while rabi crop has a small share; and there has not been much change

in these shares during the last 2-3 decades. However, in some states like Andhra Pradesh (37.7%), Assam (22.7%), Karnataka (20.7%), Kerala (26.5%) and West Bengal (27.6%), share of rabi rice is much higher than national average.

Table 3.2: Average area (million ha), production (million tonnes), and yield (kg/ha) of rice in India: 1971-72 to 2012-13

	1971-72 to 1973-74	1981-82 to 1983-84	1991-92 to 1993-94	1999-00 to 2001-02	2010-11 to 2012-13
Area	37.6	40.1	42.3	44.9	43.2
Production	42.1	53.5	75.9	89.3	101.8
Yield	1120	1332	1745	1988	2357
CAGR (%)					
	1970s	**1980s**	**1990s**	**2000s**	**All Period**
Area	0.92***	0.60	0.78***	0.08	0.36***
Production	2.58*	4.20***	1.86***	2.10***	2.35***
Yield	1.65	3.58***	1.07**	2.03***	1.96***
Coefficient of Variation (%)					
Area	3.2	3.4	2.6	3.0	5.4
Production	12.6	14.3	6.4	9.7	27.7
Yield	9.7	11.6	4.2	8.5	23.5

Source: Author's calculation using MoA data (2013)

The distribution of rice area and production in major states is presented in Tables 3.3 and 3.4. Uttar Pradesh has the largest share (13.0%) in rice acreage, followed by West Bengal (12.4%), Odisha (9.8%), Andhra Pradesh (9.5%), Chhattisgarh (8.7%), Bihar (7.3%) and Punjab (6.6%). The top five states account for about 53 per cent of the total acreage in the country. Punjab, Haryana and Karnataka have consistently increased their share in rice acreage during the last three decades while Odisha, Tamil Nadu and West Bengal have marginally lost their share. Rice is the most important crop in states like Odisha (accounting for over 79 per cent of gross cropped area in the state), Jharkhand (81.6%), Chhattisgarh (66%), Assam (61.2%) and West Bengal (56.3%). Rice is an important crop in many other states such as Andhra Pradesh, Bihar, Punjab, and Tamil Nadu where share in total cropped

area is more than 30 per cent. At all India level, rice accounts for a little over 22 per cent of the total cropped area but this share has declined during the last decade from 24 per cent in TE2001-02 to 22.1 per cent in TE2011-12.

Table 3.3: Share of major states in area under rice in India: TE1983-84 and TE2011-12

State	Share in all-India acreage				Share in GCA in the state			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2011-12***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
Andhra Pradesh	9.7	8.7	9.0	9.5	29.3	28.7	30.7	30.1
Assam	5.7	6.0	5.8	5.9	65.3	65.5	64.4	61.2
Bihar + Jharkhand	12.3	11.3	11.3	9.7	47.1	49.0	40.7	39.8
Bihar	-	-	9.1	7.3	-	-	45.4	42.3
Jharkhand	-	-	3.3	2.5	-	-	72.5	81.6
Haryana	1.3	1.7	2.3	2.9	8.8	12.2	17.1	19.0
Karnataka	2.9	3.1	3.2	3.4	10.2	10.6	12.1	11.7
M.P. + Chhattisgarh	12.2	12.2	12.2	12.3	22.0	21.6	11.9	6.8
M.P.	-	-	6.6	3.7	-	-	9.4	7.1
Chhattisgarh	-	-	8.4	8.7	-	-	69.4	66.0
Odisha	10.5	10.7	10.0	9.8	60.3	46.7	53.7	79.2
Punjab	3.4	5.0	5.7	6.6	14.8	27.8	32.5	35.7
Tamil Nadu	5.6	5.2	4.7	4.4	32.3	31.2	33.0	32.9
U.P. + Uttarakhand	13.1	12.8	13.9	13.7	21.1	21.1	22.7	18.0
U. P.	-	-	13.4	13.0	-	-	23.6	21.9
Uttarakhand	-	-	0.7	0.7	-	-	25.0	24.9
West Bengal	12.8	13.6	13.1	12.4	67.5	66.8	62.1	56.3
All India	***100***	***100***	***100***	***100***	***22.6***	***22.9***	***24.0***	***22.1***

Source: GoI, various sources.

In terms of production, top five states account for 55 percent of the total rice production in the country. Among the major rice growing states in the country, West Bengal is the largest producer, accounting for 14.5 per cent of total rice production in the country. Other major

producers include Andhra Pradesh (13%), Uttar Pradesh (13%), Punjab (11.2%) and Odisha (6.7%).

Punjab, which is not among top five states in rice acreage, ranks number four in production share mainly due to higher productivity. Uttar Pradesh, Punjab and Haryana are the only states which have increased their share in total rice production during the last three decades and one of the main drivers for their increased share has been strong government procurement system. However, after introduction of decentralized procurement policy, Chhattisgarh, Odisha, Andhra Pradesh and Karnataka have increased their share in total production due to improvement in procurement of rice in these states.

In Assam (96.9%), West Bengal (90.9%) and Odisha (90.6%), rice is the most important foodgrains crop and accounts for more than 90 per cent of total foodgrains production in the state. The share of rice in foodgrains production is more than 50 percent in states like Chhattisgarh (86.6%), Tamil Nadu (74.9%), Jharkhand (70.4%), and Andhra Pradesh (70.1%). However, during the last decade, rice has lost its share in foodgrains production in most of the states except in Punjab, Haryana, Assam and Chhattisgarh. At national level, the share of rice in total foodgrains production has declined from 48.7 per cent in TE2001-02 to 42.5 per cent in TE2011-12 mainly due to shifting food habits from foodgrains to high-value agriculture products such as fruits and vegetables, livestock products, etc.

Rice yields are lower in India compared to other rice producing countries such as China (6.74 t/ha), Indonesia (5.14 t/ha), and Vietnam (5.63 t/ha) as well as the world average (4.39 t/ha). Table 3.5 presents data on yield level in India as well as in individual states. Rice yields, which were low (about 1393 kg/ha on the average) during the early-1980s, witnessed a steady increase during the last three decades and reached a level of 2175 kg/ha in the recent period (2006-11) in India. Among the major rice producing states, Punjab has the highest yield (3949 kg/ha), followed by Andhra Pradesh (3134 kg/ha) and Haryana (3024 kg/ha), while Madhya Pradesh (933 kg/ha), has the lowest yield. Rice yield is lower in eastern states of Assam, Jharkhand, Chhattisgarh and Odisha.

Table 3.4: Changes in share of major states in rice production in India: TE1983-84 and TE2011-12

State	Share in all-India production				Share in foodgrains production in state			
	TE1983-84	*TE1993-94*	*TE2001-02*	*TE2011-12*	*TE1983-84*	*TE1993-94*	*TE2001-02*	*TE2011-12*
Andhra Pradesh	15.2	12.1	12.9	13.0	70.6	73.9	77.4	70.1
Assam	4.6	4.3	4.4	4.7	92.8	94.0	95.8	96.9
Bihar + Jharkhand	7.7	6.4	8.0	6.8	48.3	42.5	50.4	47.1
Bihar	-	-	6.0	4.8	-	-	44.8	41.5
Jharkhand	-	-	1.9	2.0	-	-	81.5	70.4
Haryana	2.4	2.5	3.0	3.7	19.7	19.4	20.2	21.7
Karnataka	4.2	4.0	4.0	4.1	40.5	34.7	36.5	32.0
M.P. + Chhattisgarh	7.5	7.2	6.2	7.4	29.4	30.6	30.7	30.7
MP	-	-	1.5	1.8	-	-	11.2	10.2
Chhattisgarh	-	-	4.2	5.6	-	-	85.7	86.6
Odisha	7.5	8.2	6.3	6.7	70.3	81.9	93.3	90.6
Punjab	7.8	9.4	10.0	11.2	29.4	34.9	35.4	39.2
Tamil Nadu	8.5	8.8	8.0	6.5	73.7	79.2	84.9	74.9
U.P. + Uttarakhand	11.4	12.9	14.6	13.3	22.9	26.2	28.7	26.4
U.P.	-	-	13.7	12.7	-	-	28.2	26.2
Uttarakhand	-	-	0.7	0.6	-	-	36.0	32.1
West Bengal	11.7	15.6	15.5	14.5	86.8	91.5	91.6	90.9
All India	***100.0***	***100.0***	***100.0***	***100.0***	***38.6***	***41.5***	***48.7***	***42.5***

Source: GoI, various sources

It is interesting to note that all states witnessed a positive growth in rice yield during the last three decades, but the rate of growth was highest during the decade of 1980s, which decelerated during 1990s and 2000s. Only one state witnessed a decline in rice yield between 1981-85 and 1986-90 and 1986-90 and 1991-95 periods, while number of states

with decline in crop yields between 1991-95 and 1996-00 and 1996-00 and 2001-02, increased to four. However this number declined to one between 2001-05 and 2006-11.

Table 3.5: Changes in rice yield by major producing states and all India average: 1981-2012

State	1981-85	1986-90	1991-95	1996-00	2001-05	2006-11
Andhra Pradesh	2092	2279	2495	2674	2927	3134
Assam	1081	1145	1322	1402	1490	1591
Bihar + Jharkhand	931	1132	1130	1486	1262	1550
Bihar	-	-	-	-	1254	1307
Jharkhand	-	-	-	-	1269	1793
Haryana	2561	2537	2650	2589	2823	3024
Karnataka	1923	1977	2342	2492	2661	2562
M.P. + Chhattisgarh	861	930	1098	1051	1029	1143
MP	-	-	-	-	861	933
Chhattisgarh	-	-	-	-	1198	1352
Odisha	999	1165	1386	1151	1366	1591
Punjab	3083	3200	3334	6218	3710	3949
Tamil Nadu	2107	2936	3052	2905	2622	3006
U.P. + Uttarakhand	1253	1602	1827	2588	1570	2028
U.P.	-	-	-	-	1986	2063
Uttarakhand	-	-	-	-	1905	1993
West Bengal	1349	1777	2055	2240	2513	2577
India	***1393***	***1622***	***1818***	***1913***	***1999***	***2175***

Source: GoI, various sources

Growth Rates in Area, Production and Yield

Growth rates of area, production, and productivity of rice in major producing states and at national level during different time periods were computed and the results are presented in Tables 3.6, 3.7 and 3.8. The Indian rice production grew at an annual compound growth rate of about 2.01 per cent during 1981-2012 (32 years) and can be disaggregated into area (0.27%) and yield (1.74%). In the long term, of the 2.01 per cent annual growth in rice

production, increase in yield accounted for more than 86 per cent of the growth in production while remaining less than 14 per cent came from area expansion. All major rice producing states recorded a positive significant growth rate in production during 1981-2011. Haryana had the highest growth rate (3.95%), followed by Punjab (3.28%), West Bengal (2.67%) and Karnataka (2.14%). The growth rates were highest during the eighties and the lowest during the 1990s in most of the states.

Table 3.6: Annual growth rates of rice production in selected states, 1981-82 to 2012-13

States	***1980s***	***1990s***	***2000s***	***All***
Andhra Pradesh	2.79	3.08**	3.45**	1.71***
Assam	2.43**	1.83**	2.78**	1.97***
Bihar + Jharkhand	6.13**	5.36	2.59	1.59***
Bihar	6.13**	3.85	2.25	-0.17
Jharkhand	-	-	3.69	-
Haryana	3.13*	4.56***	3.75***	3.95***
Karnataka	0.61	3.02***	2.65	2.14***
M.P. + Chhattisgarh	3.37*	-2.74	3.93*	1.88***
MP	3.37*	-9.04	4.55**	-4.37
Chhattisgarh	-	-	3.71*	-
Odisha	4.69*	-2.99*	2.08	1.60***
Punjab	5.65***	2.84***	2.04***	3.28***
Tamil Nadu	3.30*	0.82	1.99	0.11
U.P. + Uttarakhand	6.11***	3.53***	1.79	2.47***
U.P.	6.11***	3.24***	1.86	2.25
Uttarakhand	-	-	0.46	-
West Bengal	7.98***	1.47**	-0.33	2.67***
All India	***4.20******	***1.87******	***2.10******	***2.01*****

Source: Authors' computation using MoA data

The area under rice witnessed a marginal increment of 0.27 per cent per annum during 1981-2012. During the 1980s, almost all main rice producing states (except Tamil Nadu) recorded a positive growth in area expansion. However, during the last decade majority of states, namely, Bihar, Jharkhand, Chhattisgarh Madhya Pradesh, Odisha, Uttarakhand and

West Bengal witnessed negative growth rate in rice acreage. Haryana showed the highest growth rate (2.59%), followed by Andhra Pradesh (2.44%), Karnataka (1.38%) and Punjab (1.19%).

Rice yield recorded annual compound growth rate of about 1.74 per cent during 1981-82 and 2012-13 in the country. Sub-period growth rates indicate that rice productivity witnessed the highest growth rate of 3.58 per cent during the 1980s. However, the productivity of rice registered a much lower growth rate (1.08%) during the 1990s and improved (2.02%) during the last decade. During the 1980s, all major rice producing states showed a significant increase in rice yield but experienced deceleration in growth rate during the last two decades.

Table 3.7: Annual growth rates of rice area in selected states, 1981-82 to 2012-13

States	***1980s***	***1990s***	***2000s***	***All***
Andhra Pradesh	0.8	1.47*	2.44**	0.13
Assam	0.72**	0.35	0.09	0.20**
Bihar + Jharkhand	0.93	0.80*	-1.14	-0.41***
Bihar	0.93	-1.05	-0.94	-1.92
Jharkhand	-	-	-1.85	-
Haryana	2.56**	6.09***	2.59***	3.25***
Karnataka	0.22	1.51***	1.38	0.81***
M.P. + Chhattisgarh	0.43**	0.69***	-0.15	0.38***
MP	0.43**	-5.51	-0.19	-4.86
Chhattisgarh	-	-	-0.15	-
Odisha	0.49	-0.05	-0.83***	0.02
Punjab	4.89***	2.72***	1.19***	2.33***
Tamil Nadu	-2.52**	-0.09	0.12	-0.78***
U.P. + Uttarakhand	0.27	1.52***	0.14	0.53***
U.P.	0.27	1.23***	0.17	0.31
Uttarakhand	-	-	-0.64*	-
West Bengal	1.49***	0.09	-1.07***	0.21*
All India	***0.60***	***0.78******	***0.08***	***0.27******

Source: Authors' computation using MoA data

Table 3.8: Annual growth rates of rice yield in selected states, 1981-82 to 2012-13

States	***1980s***	***1990s***	***2000s***	***All***
Andhra Pradesh	1.98**	1.59**	0.99*	1.59***
Assam	1.70**	1.48***	2.69***	1.76***
Bihar + Jharkhand	5.14***	4.52	3.77*	2.01***
Bihar	5.14***	4.96	3.22	1.78***
Jharkhand	-	-	5.64***	-
Haryana	0.56	-1.44	1.13*	0.68***
Karnataka	0.39	1.49***	1.25	1.32***
M.P. + Chhattisgarh	2.92*	-3.41	4.09**	1.50***
MP	2.92*	-3.74	4.75**	0.51
Chhattisgarh	-	-	3.86*	-
Odisha	4.18*	-2.93**	2.94	1.58***
Punjab	0.73	0.12	0.84**	0.93***
Tamil Nadu	5.97***	0.91	1.87	0.89*
U.P. + Uttarakhand	5.82***	1.99**	1.66**	1.93***
U.P.	5.82***	1.99**	1.68**	1.94***
Uttarakhand	-	-	1.11**	-
West Bengal	6.40***	1.38***	0.75***	2.45***
All India	***3.58******	***1.08******	***2.02******	***1.74******

Source: Author's computation using MoA data

Growth in crop output is determined by the rate of growth in area under crop and its productivity level. The growth performance of states is analyzed by classifying states on the basis of the sign and statistical significance of their trends in area and productivity levels. There are nine types of association:

1. **AA:** Significant positive growth rate of area associated with significant positive growth rate of yield. This means that crop is either replacing other crops or is grown in newly cultivated areas and productivity of both existing and new acreage has increased.
2. **AB:** Significant positive growth rate of area associated with significant negative growth rate of yield. This means that crop is either replacing other crops or is

grown in newly cultivated areas and productivity of both existing and new acreage has declined.

3. **AC:** Significant positive growth rate of area associated with stagnant (either positive or negative) growth rate of yield. This means that crop is either replacing other crops or is grown in newly cultivated areas and productivity of both existing and new acreage has remained stagnant.
4. **BA:** Significant negative growth rate of area associated with significant positive growth rate of yield. This means that crop is being replaced by other crop and productivity has increased.
5. **BB:** Significant negative growth rate of area associated with significant negative growth rate of yield. This means that crop is being replaced by other crops and productivity has declined significantly.
6. **BC:** Significant negative growth rate of area associated with stagnant growth rate of yield. This means that crop is being replaced by other crops but yield has remained stagnant.
7. **CA:** Stagnant growth rate of area associated with significant positive growth rate of yield. This means that acreage is stagnant and yield has increased significantly.
8. **CB:** Stagnant growth rate of area associated with significant negative growth rate of yield. This means area under is stagnant and productivity has declined significantly.
9. **CC:** Stagnant growth rate of area associated with stagnant growth rate of yield. This means that both acreage and yield are stagnant.

For the improvement of rice economy, AA is the best situation while BB is the worst situation. BA would be preferred to AB, CA would be preferred to AC, and BC would be preferred to CB. The analysis of growth rates of rice acreage and yield levels shows different kinds of association and the results are given in Table 3.9.

The distribution of major rice growing states according to types of association between growth rates of area and yield is presented in Table 3.9[1].

Table 3.9: Classification of states according to growth in area and yield of rice

Type of association	1980s	1990s	2000s	1981-82 to 2012-13
AA	Assam, Madhya Pradesh, West Bengal	Andhra Pradesh, Karnataka, UP+Uttarakhand, Uttar Pradesh, India	Andhra Pradesh, Punjab, Haryana	Assam, Haryana, Karnataka, MP+Chhattisgarh, Punjab, UP+Uttarakhand, West Bengal, India
AB				
AC	Haryana, Punjab	Haryana, MP+ Chhattisgarh, Bihar+Jharkhand, Punjab		Uttar Pradesh
BA	Tamil Nadu		West Bengal, Uttarakhand	Bihar+Jharkhand, Tamil Nadu
BB				
BC			Odisha	
CA	Andhra Pradesh, Bihar, Odisha, Uttar Pradesh, India	Assam, West Bengal	Assam, Bihar+Jharkhand Madhya Pradesh, MP+Chhattisgarh, Chhattisgarh, Jharkhand, UP+Uttarakhand, Uttar Pradesh, India	Andhra Pradesh, Uttar Pradesh, Bihar, Odisha,
CB		Odisha		
CC	Karnataka	Bihar, Madhya Pradesh, Tamil Nadu	Bihar, Karnataka, Tamil Nadu	Madhya Pradesh

Source: Author's computation using MoA data

The Table shows that the number of states falling under AA category remained three during all the decades from 1980 to 2000s. West Bengal, which is one of the largest producer of

[1] *For comparison of states between different time periods, we have considered the undivided states of Bihar, Madhya Pradesh and Uttar Pradesh.*

rice in the country, moved from AA category during the 1980s to CA in the 1990s and BA during the last decade. Other two major producers, Punjab and Haryana, were in AC category during the 1980s and 1990s and shifted to AA category during the last decade. Andhra Pradesh, which was in CA category during the eighties moved to AA category during the 1990s and 2000s. Odisha moved from CB to BC category during the last two decades. Uttar Pradesh, an important producer of rice, moved from the best category (AA) in 1990s to CA category during the 2000s. None of the states were in the worst category of BB.

Table 3.10: Classification of states according to productivity levels and growth in productivity of rice in India

	Significant increase in yield	**Significant decline in yield**	**Stagnant yield with a positive sign**	**Stagnant yield with a negative sign**
1981-82 to 1990-91				
High Productivity	Andhra Pradesh, Tamil Nadu, West Bengal	-	Haryana, Karnataka, Punjab	-
Low Productivity	Assam, Bihar, Madhya Pradesh, Odisha, Uttar Pradesh	-	-	-
1991-92 to 2000-1				
High Productivity	AP, Karnataka, Uttar Pradesh, West Bengal		Tamil Nadu, Punjab	Haryana
Low Productivity	Assam, Bihar	Odisha	Bihar	Madhya Pradesh
2001-02 to 2012-13				
High Productivity	Andhra Pradesh, Haryana, Punjab, West Bengal, Chhattisgarh,	-	Karnataka, Tamil Nadu	-
Low Productivity	Assam, Madhya Pradesh, MP+Chhattisgarh, Uttar Pradesh, UP+Uttarakhand, Uttarakhand, Jharkhand, Bihar+Jharkhand	-	Bihar, Odisha,	-

1981-82 to 2012-13				
High Productivity	Andhra Pradesh, Haryana, Punjab Karnataka, Tamil Nadu, West Bengal	-	-	-
Low Productivity	Assam, Bihar, M.P., Odisha, U.P.	-	-	-

Source: Author's computation using MoA data

The analysis shows that the decade of the eighties was the best decade in terms of performance of the rice economy as eight states were in the preferred categories of AA, BA, and CA and this number reduced to five during the 1990s but increased during the last decade. Since scope for increasing area under rice is limited, steps are needed to improve crop yield particularly in the eastern region to increase production.

Trends in Rice Production and Procurement

Rice production in India crossed the mark of 100 million tonnes in 2011-12 and is expected to cross 106 million tonnes in 2013-14. The procurement of rice has also increased significantly during the last decade. The overall position regarding rice procurement over the years in the country as a percentage of production is presented in Table 3.11.

Rice procurement increased from about 21 million tonnes in 2000-01 to 35 million tonnes in 2011-12 with a slight decline to 34 million tonnes in 2012-13 and 31.3 million tonnes in 2013-14. Procurement as percentage of production has also increased during these years from about 24 percent in 2000-01 to about 33.7 per cent in 2011-12 and declined in the next three years and reached 29.9 per cent in 2013-14. It is estimated that government procures about 40 per cent of marketed surplus at national level. This varies from less than 5 per cent in Karnataka and Assam to over 90 per cent in Chhattisgarh (93%), Punjab (76%), Andhra Pradesh (68%) and Odisha (66%). Large scale procurement by government drives out the private sector from the market and thus restricts competition.

In order to understand the effectiveness of procurement policy, it is important to examine the amount of procurement in different states. Changing share of procurement as a

percentage of total production in various states and the trends in rice production and procurement are given in Tables 3.12 and 3.13.

Table 3.11: Trends in rice procurement and production *(million tonnes)* in India

Year	Production	Procurement	Procurement as % of production
2001-02	93.34	22.13	23.7
2002-03	71.82	16.42	22.8
2003-04	88.53	22.83	25.8
2004-05	83.13	24.68	29.7
2005-06	91.79	27.66	30.2
2006-07	93.36	25.11	26.9
2007-08	96.69	28.74	29.7
2008-09	99.18	33.68	33.9
2009-10	89.09	26.82	30.1
2010-11	95.98	32.35	33.7
2011-12	105.31	35.03	33.3
2012-13	105.24	34.04	32.3
2013-14[2]	106.54	31.84	29.9

Source: GoI (2015), data accessed from http://dfpd.nic.in/fcamin/policy/proc01012015.pdf

Table 3.12: Changing share (%) of major states in total rice procurement

State	Procurement (lakh tonnes)		Share in total Procurement. (%)	
	TE2002-03	TE2012-13	TE2002-03	TE2012-13
Punjab	74.0	83.1	37.6	24.1
Andhra Pradesh	54.1	78.8	27.5	22.9
Chhattisgarh	13.6	42.2	6.9	12.3
Odisha	10.2	29.8	5.2	8.7
Uttar Pradesh	14.9	27.3	7.6	7.9
Haryana	14.3	21.0	7.3	6.1
West Bengal	2.0	17.1	1.0	5.0
Bihar	0.9	12.7	0.5	3.7

[2] *Procurement as on January 1, 2015*

Tamil Nadu	8.8	12.1	4.5	3.5
Madhya Pradesh	2.0	6.8	1.0	2.0
Uttarakhand	1.7	4.3	0.9	1.3
Kerala	0.0	2.9	0.0	0.8
Karnataka	1.2	2.0	0.6	0.6

Source: GoI (2015), data accessed from http://dfpd.nic.in/fcamin/policy/proc01012015.pdf

Table 3.13: Trends in rice procurement and production in major states in India

State	Production (Million tonnes)		Procurement (lakh tonnes)		Procurement as % of Production	
	TE2002-03	TE2012-13	TE2002-03	TE2012-13	TE2002-03	TE2012-13
Andhra Pradesh	10.39	12.94	54.1	78.8	52.1	60.9
Bihar	5.24	5.93	0.9	12.7	1.7	21.4
Chhattisgarh	3.36	6.27	13.6	42.2	40.5	67.4
Haryana	2.63	3.74	14.3	21.0	54.4	56.2
Karnataka	3.16	3.84	1.2	2.0	3.8	5.2
Kerala	0.71	0.53	0	2.9	0.0	54.4
Madhya Pradesh	1.24	2.26	2.0	6.8	16.2	30.1
Odisha	5.01	6.64	10.2	29.8	20.3	44.9
Punjab	8.95	10.92	74.0	83.1	82.7	76.1
Tamil Nadu	5.84	5.77	8.8	12.1	15.1	21.0
Uttar Pradesh	11.38	13.48	14.9	27.3	13.1	20.3
Uttarakhand	0.57	0.57	1.7	4.3	29.7	74.8
West Bengal	14.02	14.23	2.0	17.1	1.4	12.0
All India	83.4	102.2	197.74	344.23	23.7	33.7

Source: GoI (2015), data accessed from http://dfpd.nic.in/fcamin/policy/proc01012015.pdf

It is interesting to note that total procurement has increased significantly in all states. Rice procurement has increased from about 19.8 million tonnes in TE2002-03 to 34.3 million tonnes in TE2012-13 at national level, an increase of over 74 per cent. Procurement of rice has also increased in all major rice producing states during the last decade. However, some states like Bihar, Chhattisgarh, Odisha and West Bengal have witnessed a substantial

increase in procurement. For example, in Chhattisgarh, procurement has increased from 13.6 lakh tonnes in TE2002-03 to 42.2 lakh tonnes in TE2012-13. Similarly, in Odisha it has increased from 10.2 lakh tonnes to 29.8 lakh tonnes, in Bihar from less than one lakh tonnes to 12.7 lakh tonnes and in West Bengal from 2 lakh tonnes to 17.1 lakh tonnes during the same period.

It is evident from procurement trends that rice procurement has become more diversified in terms of coverage of states during the last decade. The share of procurement in total production has also witnessed a steep increase in most of the states. In states like Andhra Pradesh (60.9%), Chhattisgarh (67.4%), Punjab (76.1%), Uttarakhand (74.8%), Haryana (56.2%), and Kerala (54.4%), large quantities of rice are procured by government. Procurement as percentage of production has increased from 23.7 per cent to 33.7 per cent between TE2002-03 and TE2012-13, and a similar trend was witnessed in major states. The number of states with higher than national average procurement (as a percentage of production) has increased from five (Uttarakhand, Chhattisgarh, Andhra Pradesh, Haryana and Punjab) in TE2002-03 to seven (Odisha, Kerala, Haryana, Andhra Pradesh, Chhattisgarh, Uttarakhand, and Punjab) in TE2012-13.

Marketed Surplus of Rice: An Empirical Analysis

Understanding the behaviour of marketed surplus and factors affecting it can help in designing sound policies related to agricultural marketing, pricing, buffer stocks, market infrastructure, etc. The marketable surplus of a crop depends on various price and non-price factors such as the availability of cultivated land under the crop, family size, income, risk and uncertainties.

In order to understand the pattern of marketed surplus of rice and variable affecting it, survey data collected from four major rice producing states, namely, West Bengal, Punjab, Uttar Pradesh and Haryana during 2011-12 was used. The survey data was collected from 3 districts (Burdwan, Birbhum, Murshidabad) of West Bengal, 3 districts (Gurdaspur, Sangrur, Ferozpur) of Punjab, 2 districts (Shahjahanpur, Barabanki) of Uttar Pradesh and Karnal district of Haryana. Total number of households selected for the study was 1018 following stratified sampling procedure to select representative sample households The households

were classified into five groups based on the size of land holding (marginal<1 ha, small: 1-2 ha, semi-medium: 2-4 ha, medium: 4-10 ha and large >10 ha).

General Characteristics

The average age of head of the household was 49.2 years with an average year of schooling of little over 7 years (Table 3.15). There was a positive association between education and farm size. On an average, 97.9 per cent of the households had crop farming as their main occupation. Almost all households were male headed. The average family size varied from about six for marginal farms to about eight for large farms. About three-fourth of sample households belonged to general category while share of backward and SC/ST farmers was the highest (about 40%) for small farms and the lowest for large farms. It is evident from the Table that crop production is the main source of income in the study area.

Table 3.14: Size-distribution of sample households in selected states

State	***Marginal***	***Small***	***Semi-Medium***	***Medium***	***Large***	***Total***
Haryana	58	79	34	23	6	200
Punjab	36	60	96	84	24	300
Uttar Pradesh	61	21	11	7	0	100
West Bengal	124	97	65	32	0	318
Total	226	237	265	221	69	1018

Source: Field Survey, 2011-12

Table 3.15: Socio-economic profile of sample households by size of farm in the study areas

Characteristics	***Marginal***	***Small***	***Semi-Medium***	***Medium***	***Large***	***All Farms***
Age (years)	47.2	50.3	48.3	50.4	51.4	49.2
Main Occupation (%)						
Crop farming	95.6	98.2	98.1	99.1	100.0	97.9
Dairy	0.0	0.0	0.4	0.0	0.0	0.1
Service	2.7	0.9	1.5	0.9	0.0	1.4
Others	1.8	0.9	0.0	0.0	0.0	0.6

Education (Avg. years of schooling)	5.3	7.1	7.8	8.3	9.3	7.3
Family Size (Nos.)	5.73	6.49	6.75	7.43	7.94	6.69
Male	3.09	3.46	3.61	4.05	4.20	3.60
Female	2.63	3.03	3.14	3.38	3.74	3.10
Social grouping (%)						
SCs	17.7	9.7	3.8	0.5	0.0	7.3
STs	1.3	0.4	0.0	0.0	0.0	0.4
OBCs	21.2	14.3	17.4	13.6	7.2	16.0
General	59.7	75.5	78.9	86.0	92.8	76.3
Gender (%)						
Male	98.7	100.0	100.0	100.0	100.0	99.7
Female	1.3	0.0	0.0	0.0	0.0	0.3

Source: Field Survey, 2011-12

Land Ownership Pattern

The pattern of land ownership of the sample households shown in Table 3.16 shows that average operational land holding in the study area was 3.57 ha per family with the size of holding ranging from 0.63 ha on marginal households to 17.61 ha on large households. The average farm size in selected states varied from 1.42 ha in Uttar Pradesh to 4.22 ha in Punjab.

Almost the entire operational land holding was irrigated in all states with groundwater as the main source of irrigation for all categories of households. This trend holds true for Punjab, Haryana and Uttar Pradesh except for in West Bengal, where nearly 60 per cent of the area was irrigated by surface water and about 40 per cent through groundwater. However, for different farm sizes, share of groundwater was the highest (72.5%) for large farms and the lowest (50.9%) for marginal farms, indicating low investment capacity of small and marginal farmers as groundwater irrigation is investment-intensive (Table 3.17). There was a positive association between farm size and leased-in land in the study area and all leased-in land was irrigated. The share of leased-in land in total operational holding varied from 3.9 per cent on small farms to 14.3 per cent on medium farms.

Table 3.16: Land ownership pattern (ha) of sample households in the survey areas

Farm Size	Total owned land (1)		Leased in land (2)		Leased-out land (3)		Total operational holding (1+2-3)		
	I	UI	I	UI	I	UI	I	UI	Total
Marginal	0.60	0.02	0.03	0.00	0.02	0.00	0.61	0.02	0.63
Small	1.51	0.07	0.06	0.00	0.09	0.02	1.47	0.05	1.53
Semi-Medium	2.86	0.06	0.24	0.00	0.11	0.02	2.99	0.05	3.04
Medium	5.22	0.03	0.87	0.00	0.02	0.00	6.06	0.03	6.09
Large	15.62	0.19	1.81	0.00	0.00	0.00	17.42	0.19	17.61
All farms	3.22	0.05	0.37	0.00	0.06	0.01	3.52	0.04	3.57
States									
Haryana	2.63	-	-	-	-	-	2.63	-	2.63
Punjab	3.26	-	0.99	-	0.03	-	4.22	-	4.22
Uttar Pradesh	1.42	-	-	-	-	-	1.42	-	1.42
West Bengal	1.67	0.11	0.12	0.00	0.04	0.00	1.75	0.05	1.80

Source: Field Survey, 2011-12

Table 3.17: Main source of Irrigation (%) on sample households

Farm category	Surface	Groundwater	Surface + Groundwater	Others
Marginal	38.4	50.9	10.7	0.0
Small	31.0	52.8	13.8	2.4
Semi-medium	31.0	52.8	13.8	2.4
Medium	17.5	68.0	3.0	11.5
Large	8.2	72.5	4.1	15.2
All Farms	28.8	56.6	10.3	4.4
States				
Haryana	-	82.5	17.5	-
Punjab	-	82.0	18.0	-
Uttar Pradesh	6.8	93.2	-	-
West Bengal	59.0	41.0	-	-

Source: Field Survey, 2011-12

Cropping Pattern

The cropping pattern depends on a large number of factors like climate, soil type, rainfall, availability of technology, irrigation facilities and other inputs, marketing and transport facilities, etc. The cropping pattern in the study area shows a heavy bias in favour of foodgrains across all size classes, which conforms to average cropping pattern situation in these states (Table 3.18). About 89 per cent of the gross cropped area was under foodgrains, mainly rice and wheat. Rice alone accounted for about 57 per cent of the total cropped area of sample farms followed by wheat (32%). Kharif rice accounted for about 83 per cent of the total rice acreage while rabi accounted for about 17 per cent of the area. The share of rice was the highest (66.2%) on marginal farms and the lowest on large farms (47%), while in case of wheat, small farmers allocated relatively smaller share of land (23.3%) compared with large farms (47.3%). Oilseeds accounted for about 1 per cent of the total cropped area.

Table 3.18: Cropping pattern on different categories of sample households

(% of GCA)

Season/Crop	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farm*
Kharif						
Rice	49.3	47.5	45.8	45.6	47.0	47.1
Pulses	0.0	0.2	0.2	0.4	0.1	0.17
Others	5.3	6.0	7.7	6.2	3.3	6.2
Rabi						
Wheat	23.3	31.7	32.5	37.7	47.3	32.02
Pulses	0.00	0.00	0.00	0.02	0.05	0.01
Rice	16.9	10.4	7.6	5.5	0.0	9.67
Oilseeds	2.2	1.1	1.1	0.4	0.0	1.16
Others	3.0	3.1	5.2	4.2	2.2	3.73

Source: Field Survey, 2011-12

Crop Yield

The average productivity on the farms varied from 4155 kg per ha in case of basmati rice to 4584 kg per ha for kharif rice. In the case of kharif rice, there was an inverse relationship between farm size and productivity, while in case of rabi crop and basmati rice, there was a

mixed trend. The productivity levels were much higher than the national average (2374 kg/ha in kharif and 3353 kg/ha in rabi) because almost 90 per cent of the study area was irrigated. The highest yield was recorded in Punjab (6945 kg per ha, followed by Uttar Pradesh (5673 kg/ha) and West Bengal (5296 kg/ha). There were no significant differences in yield between different farm sizes.

Table 3.19: Average productivity (kg/ha) of rice on sample households

Crop	*Marginal*	*Small*	*Semi-medium*	*Medium*	*Large*	*All Farm*
Kharif	5317	4632	4444	4243	3134	4584
Rabi	4916	3033	5137	5094	-	4405
Basmati	3972	4097	4228	4137	4194	4155
States						
Haryana	3156	3466	3205	3091		3202
Punjab	6458	6862	6869	7012		6945
Uttar Pradesh	5784	5423	5209	6087		5673
West Bengal						
Kharif	4916	5054	5136	5094	-	5021
Summer	5176	5359	5379	5387	-	5296

Source: Field Survey, 2011-12

Farm Machinery Investment

Farmer's investment in farm machinery and equipment is a major capital input in farm business and is a good indicator of resource endowment status. Investment pattern varied across farm categories (Table 3.20). The average investment on farm machinery for the sample farms was about Rs. 4,34,606 per ha. Tractors and implements accounted for the largest share (59.1%) in total investment, followed by combine harvester (23%) and tube wells (14.1%). The average investment was the highest on large farms and the lowest on marginal farms. Only medium and large farmers owned combine harvesters as investment cost was very high.

Livestock Ownership

Livestock ownership pattern on sample households is given in Table 3.21. The average number of animals ranged from 2.7 on marginal farms to 4.1 on semi-medium farms, with

an average of 3.4 animals per household. It may be interesting to note that the distribution of livestock is more egalitarian as compared to land ownership on sample farm households. The number of livestock affects marketed surplus of the crop as farmers retain part of the crop produce for animal feed.

Table 3.20: Farm machinery investments on the sample households

Farm Size	Farm machinery investment in Rs./ha.				
	Tractors & Implements	Combine Harvester	Threshing Machine	Tube Well	Average Investment
Marginal	129875	-	5093	22291	157259
Small	205950	-	7327	51956	265233
Semi-Medium	250795	276000	11965	64204	602964
Medium	351226	84667	17896	82407	536196
Large	694923	208125	120263	176377	1199689
All	256774	99917	16645	61272	434606

Source: Field Survey, 2011-12

Table 3.21: Livestock ownership (number) on different categories of sample households

Farm Size	Cattle	Buffalo	Others	Total
Marginal	1.1	0.6	1.0	2.7
Small	1.4	0.9	0.9	3.1
Semi-Medium	1.5	1.4	1.2	4.1
Medium	1.1	1.6	1.0	3.8
Large	0.8	1.8	1.2	3.8
All Farms	1.3	1.1	1.0	3.4

Source: Field Survey, 2011-12

Marketed Surplus and Farmers' Participation

In this section, we will first examine the behavioural pattern of marketed and marketable surplus of paddy farmers in selected states, and then the factors influencing marketed surplus. For the purpose of this study, marketable surplus has been estimated by subtracting total retention from total production. The retention consists of quantity kept for self-consumption, for seed purpose, for feed, payments in kind to labourers and others, and

other purposes including inventories for the next season. Gross marketed surplus is estimated by estimating the total quantity of produce sold in the market without considering whether there is any buy back by those sellers later on. Net marketed surplus, on the other hand, excludes the amount of produce which is bought back. There could be five different types of farmers, (i) exclusive sellers who only sell and do not buy-back, (ii) exclusive buyers who buy and do not sell at all, (iii) net seller farms whose sales are higher than purchases, (i.e. they are involved in both sales and purchases), (iv) net buyer farmers whose purchases are higher than their sales, and (v) non-participant farmers who neither sell nor buy. The net marketed surplus will be available from category (i) and (iii) farms. The estimates assume the following forms:

- Marketable Surplus = Total Production – Total retentions
- Gross Marketed Surplus = Quantity actually Sold/Actual Sales
- Net Marketed Surplus = Actual Sales – Net Purchases

Rice is the main crop in the study area, and farmers are producing for self-consumption or meeting their other requirements as well as for the market to varying degrees. Rice production, sales and retention pattern on the sample households are presented in Table 3.22.

At farm household level, average farm retention (self-consumption, seed, and other purposes) was 14.5 per cent but varied from less than one percent on large farms to 35.3 per cent on marginal farms. In the case of states, average farm retention was less than one percent in Punjab and the highest (37.4%) in West Bengal because rice is an essential part of the daily diet in the eastern and southern parts of India. More than 90 per cent of the total retention was for self-consumption. It is interesting to note that farmers after selling their produce also purchased for self-consumption. Since farmers need cash for next crop and other requirements, they (particularly small and marginal farmers) are forced to sell part of the grains after harvest and buy at a later date at a higher price.

In order to understand the response of farmers to higher prices, farmers were asked, if they will increase their sales and reduce self-consumption if they were given higher price. About one-third of the farmers responded positively, and they were willing to sell more in the market (Table 3.23). More than 40 per cent of the marginal and small households

mentioned that they would reduce consumption and sell more in the market. There was an inverse relationship between farm size and possibility of increased sale at higher price.

Table 3.22: Rice production, sales and retention pattern on sample households

(in qtls)

Farm Size	Production	Sales	Self-consumption		Seed (2)	Feed (3)	Others (4)	Total Retention (1+2+3+4)
			Retention (1)	Purchased				
Marginal	41.6	26.2	13.7	1.4	0.2	0.5	0.4	14.7
Small	87.8	65.0	21.9	1.6	0.4	0.6	0.3	23.2
Semi-medium	151.0	122.2	27.4	1.6	0.5	0.4	0.4	28.7
Medium	272.2	226.5	24.6	1.3	0.8	0.4	0.6	26.4
Large	478.7	345.3	0.7	0.0	2.9	0.1	0.6	4.4
All farms	152.9	119.3	20.6	1.4	0.6	0.5	0.4	22.1
States								
Haryana	74.0	48.6	0.7	0.3	1.4	0.0	0.0	2.1
Punjab	233.3	231.9	0.6	0.0	0.2	0.2	0.5	1.5
U.P.	70.8	53.7	12.4	0.0	0.5	1.4	2.3	16.3
West Bengal	152.7	108.7	55.3	3.9	0.5	0.7	5.7	57.1

Source: Field Survey, 2011-12

Table 3.23: Farmers willingness to increase sales at higher prices

	Marginal	Small	Semi-medium	Medium	Large	All
Willing to sell more (%)	48.9	43.2	24.3	18.7	3.8	32.5
If Yes, Source						
a. Less Retention for seed and feed.	41.3	36.8	42.1	48.6	50.0	42.4
b. Less Retention for self-consumption.	58.7	63.2	57.9	51.4	50.0	57.6

Source: Field Survey, 2011-12

Table 3.24 presents average marketable and marketed surplus statistics. A positive mean marketable surplus indicates that the average household is a net seller of rice, and a

negative mean marketable surplus indicates that the average household is a net buyer. Hence as the table shows, the average household is a net seller of rice. The survey findings show that more than 85 per cent of the total output produced in the selected states is offered as marketable surplus. The share of small and marginal farmers fall much below the average, while share of large farms is much higher than this average. It is also evident that marketable surplus increased in direct proportion to the size of land holding. In the case of marginal farmers, more than one-third of total production is kept for self-consumption.

The entire amount of marketable surplus, which is available for sales, may not be actually sold in the market. Therefore, there may be a considerable gap between marketable and marketed surplus due to various reasons according to different size of land-holdings. Since marketed surplus represents actual sale by farmers, the difference between marketable and marketed surplus can reveal several patterns of sale, purchase and stockholding by various categories of farmers. If marketable surplus is higher than marketed surplus, it indicates that stocks are held by farmers to be sold in the market, either when crop prices rise in future or during emergencies. On the other hand, if marketed surplus and marketable surplus are equal, it indicates that farmers are not in a position to hold back their stocks as they need cash for the next crop or other purposes. The gross marketed surplus (sales as a proportion of production) among the five groups of farms is marginally lower than marketable surplus with medium farms having the highest rate of surplus (83.2% of total production), followed by semi-medium (80.9%) and marginal farms (62.8%). The net marketed surplus as shown in Table 3.24 is, however, different and is lower than gross marketed surplus on marginal and small farms. The reason for this gap is that small farms sell their produce just after the harvest to meet credit requirements of the next crop and then buy back at a later date at a much higher price. A comparison of the share of respective groups in the total marketable surplus shows that marginal farmers contribute the minimum quantity (5%), whereas medium farms offer the highest share of marketable surplus accounting for about 38.3 per cent of total marketable surplus.

The results presented in Table 3.25 show that marketed surplus was the highest on large farms (99.1%) and the lowest on marginal farms (64.7%). On an average, 85.6 per cent of the total output was sold in the market. The share of small and marginal farmers in total

output was about 20.4 while their share in the marketed surplus was only 16.8, which indicate that small farmers retain relatively large quantity for self-consumption and other purposes. It is interesting to note that share of small and marginal farmers in total production and marketed surplus was higher than their share in total area under rice. The first three categories of farmers together constitute around 37 per cent of area but contribute 45.7 per cent of total output and 40.7 per cent of marketed surplus in the study area. The data also shows that proportion of farmers having marketed surplus among all groups of farms is quite high (96.8% on small farms to 100% on large farms). Both per household output and marketed surplus had a direct relationship with farm size.

Table 3.24: Average marketable surplus and gross and net marketed surplus of rice on different categories of households

	Marketable Surplus		**Gross Marketed Surplus**		**Net Marketed Surplus**	
	Quantity (qtl)	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***
Marginal	26.9	64.7	26.2	63.0	24.8	59.6
Small	64.6	73.6	65.0	74.0	63.4	72.2
Semi-medium	122.3	81.0	122.2	80.9	120.6	79.9
Medium	245.8	90.3	226.5	83.2	225.2	82.7
Large	474.3	99.1	345.3	72.1	345.3	72.1
All farms	130.8	85.5	119.3	78.0	117.9	77.1
States						
Haryana	67.4	95.5	67.4	95.5	67.1	95.1
Punjab	231.8	99.4	231.9	99.4	231.9	99.4
U.P.	54.5	77.0	53.7	75.8	53.7	75.8
West Bengal	95.6	62.6	61.8	40.5	57.9	37.9

Source: Field Survey, 2011-12

As Table 3.25 shows, Punjab and Haryana farmers are highly commercialised, producing a very high proportion (>97%) of their rice output for the market. West Bengal farmers, on the other hand, retain about one-third of their output for self-consumption. However, farmers' market participation was quite high in all states and varied from 94.7% in West Bengal to 100 per cent in Punjab and Haryana. One of the reasons for high retention in West Bengal is

that rice is the main staple food of the state and rice constitutes major food item particularly in rural areas accounting for about one-fourth of the total food expenditure. On the other hand, Punjab and Haryana are predominantly wheat consuming states. In addition, Punjab and Haryana have very strong market infrastructure and government procurement compared with West Bengal.

Table 3.25: Market participation by rice producers by size of farm

Farm Size	Marketed Surplus as % of Output	Share of Output	Share of Marketed Surplus	Share of Area Operated	Proportion of Farmers who Sold
Marginal	64.7	6.6	5.0	4.3	98.2
Small	73.6	13.8	11.8	10.7	96.8
Semi-Medium	81.0	25.3	23.9	22.0	97.5
Medium	90.3	36.3	38.3	34.6	99.5
Large	99.1	18.1	20.9	28.4	100.0
All Farm	85.6	100.0	100.0	100.0	98.0
States					
Haryana	97.2	10.5	12.0	39.5	100.0
Punjab	99.4	49.9	57.9	38.5	100.0
Uttar Pradesh	82.3	5.0	4.9	4.5	99.5
West Bengal	62.5	34.5	25.3	17.5	94.7
All	85.6	100.0	100.0	100.0	98.0

Source: Field Survey, 2011-12

The distribution of farmers presented in Table 3.26 show that about half of the sample farmers in West Bengal sold less than 60 per cent of the total output in the market while in Punjab (99.3%) and Haryana (97.5%), majority of the farmers sold more than 90 per cent of the produce in the market. In Uttar Pradesh, about 41 per cent of the farmers sold 70-80 per cent of produce in the market. These results clearly show that the level of market participation is very high in Punjab and Haryana compared with West Bengal and Uttar Pradesh.

Table 3.26: Distribution of gross marketed surplus in selected states

Qty Sold	Punjab	Haryana	UP	West Bengal	All
<60%	0.0	0.5	4.0	48.7	17.4
60-70%	0.0	0.0	26.0	6.3	5.2
70-80%	0.3	0.5	41.0	11.0	8.4
80-90%	0.4	1.5	18.0	11.9	6.5
90-100%	99.3	97.5	11.0	22.1	62.5

Source: Field Survey, 2011-12

Access to Markets and Market Information

In this section, we discuss farmers' access to markets and market information. Smallholder farmers face various marketing constraints that can either increase marketing costs or increase the market risks associated with market access and market information. High marketing costs are mainly due to poor transportation facilities, lack of reliable and timely market information, lack of competitive markets, etc. Over 60 per cent of the sample farmers had access to regulated markets while around 39 per cent sold their produce in unregulated markets. The pattern of market access gives a somewhat different picture when analysis is carried out by size of farm. In case of medium (76.2%) and large farms (100%), access to regulated markets was very high. The small and marginal farmers, on the other hand, have poor access to regulated markets (Table 3.27). The average distance covered to sell the produce was 5.3 km, with the highest for medium and large farmers (7 km) followed by semi-medium and the lowest for marginal farms, which indicates that marginal and small farmers preferred to sell their produce in the local market.

About one-third of the total marketed surplus was procured by government agencies, followed by private traders (30.2%) and processors (27.5%) (Table 3.28). Large farmers sold about 71.4 per cent of marketed surplus to government agencies while small farmers sold about 30.2 per cent to government agencies. The price paid by private traders and processors was significantly lower than the price paid by public agencies. However, large farmers received almost the same price from all agencies, showing their better bargaining power compared with small and marginal farmers, who received lower prices than large farmers.

Table 3.27: Sale pattern by type of market on selected households

Size of Farm	Sale in Local Market (%)	Distant Market (%)	Type of market (%)		Distance to market (Km)	Connected with Pucca road (%)
			Regulated	Unregulated		
Marginal	0.0	100.0	48.0	52.0	3.8	100.0
Small	0.0	100.0	48.6	51.4	4.6	100.0
Semi Medium	6.7	93.3	64.4	35.6	5.7	100.0
Medium	0.0	100.0	76.2	23.8	7.0	100.0
Large	0.0	100.0	100.0	0.0	7.0	100.0
All farms	1.7	98.3	61.1	38.9	5.3	100.0
State						
Haryana	-	-	-	-	-	-
Punjab	98.3	1.7	99.2	0.8	4.8	88.7
U.P.	67.0	33.0	-	-	-	100.0
West Bengal	88.4	2.5	0.0	100.0	1.8	-

Source: Field Survey, 2011-12

Table 3.28: Sale pattern by type of buyer on selected households

Farm Size	To whom and quantity sold in percent and Price in Rs.							
	Govt. Agencies		Pvt. Trader		Processor/Miller		Others	
	Qty.	Price	Qty.	Price	Qty.	Price	Qty.	Price
Marginal	39.1	1011	35.7	808	25.2	1080	0.0	0
Small	30.2	1085	32.0	827	37.8	1047	0.0	0
Semi Medium	25.3	1095	24.9	829	32.0	976	17.8	900
Medium	29.8	1104	30.2	834	28.9	990	11.1	847
Large	71.4	1068	9.5	1090	19.0	1050	0.0	0
All Farm	33.2	1077	30.2	842	27.5	1032	14.4	873
State								
Haryana	96.8	-	-	-	3.2	-	-	-
Punjab	99.2	1110	0.1	1090	0.7	1063	-	-
Uttar Pradesh	61.7	-	38.3	-	-		-	-
West Bengal	0.7	1080	68.4	824	30.2	1023	0.7	873

Source: Field Survey, 2011-12

However, there are large inter-state variations in market access. For example, due to effective government procurement policy in Punjab and Haryana, more than 96 per cent of the total marketed surplus of sample farmers was purchased by the government agencies. In contrast, in West Bengal more than 68% of the total paddy output marketed was sold to village-level traders, and less than 1 percent of the marketed surplus was procured by government agencies. The rice millers purchased about 30 per cent of the paddy output produced by the farmers but it must be mentioned here that the share of sale to rice miller does not reflect the true picture over time in case of West Bengal. The rice mills purchased less than 5 per cent of the surplus directly from the farmers, mainly larger farms. It was only during the year 2011-12 that the mills were forced to purchase specified quantities directly from the farmers at MSP under the new government regulations, which led to higher prices paid by rice millers compared with village-traders. It is also worth noting that the prices received by farmers in Punjab were much higher than West Bengal under all channels. Even in Punjab, price paid by trades and processors was below the price paid by government agencies.

Farmers' awareness of Minimum Support price (MSP) and sources of information, which are important factors influencing marketed surplus are presented in Table 3.29. More than 90 per cent of sample farmers in the study areas were aware of MSP, but the awareness was low in Uttar Pradesh (51%) than other states like Haryana (100%), Punjab (95.7%) and West Bengal (92.2%). It is surprising to note that the level of awareness of MSP was quite high in West Bengal but the farmers received much lower price than MSP, which could be due to lack of competition in the markets. Therefore, there is a need to create competitive markets through co-existence of public and private sector. It was also observed that awareness had a positive relationship with the size of farm.

A large number of farmers were not aware of futures and the awareness was largely confined to large farmers. There is a need to create awareness about benefits of the futures market and to utilize the price signals from the futures markets for acreage allocation and price risk management.

Market information plays an important role in risk management in agriculture. Therefore, improving market access for the farmers is of paramount importance. There are many

sources of information available to farmers and their access to information can play a significant role in improving marketing efficiency and farm income. In order to understand farmers' access to price information, the sample farmers were asked about various sources of information and results are presented in Table 3.29. The major sources of price information to the respondents were traders (27.4%), print media (15.3%), cooperatives (14.6%), private markets (9%) and APMC mandies (8.9%). Large farmers had better access to print and electronic media while small and marginal farmers mainly depended on traders.

Table 3.29: Farmers' awareness of minimum support price and sources of price information

Particulars	***Size of Farms***					
	Marginal	***Small***	***Semi-Medium***	***Medium***	***Large***	***All farms***
Aware of MSP (%)	74.0	94.1	95.7	96.8	100.0	90.5
Aware of Futures Trading (%)	0.0	0.0	0.0	2.1	15.1	1.3
Source of Information						
Trader	36.2	30.0	23.3	22.5	15.3	27.4
Print media	5.2	10.3	22.1	22.5	22.0	15.3
Cooperative Society	11.6	15.0	15.8	17.2	10.2	14.6
Visit to Market	10.8	11.6	7.1	7.4	5.1	9.0
APMC Mandi	3.0	15.5	9.9	6.9	8.5	8.9
Electronic media	9.9	4.7	6.3	8.8	11.9	7.6
Buyers in Village	12.9	2.6	1.6	2.5	0.0	4.7
Telephone	0.9	3.0	4.3	6.4	13.6	4.1
Radio	0.0	0.0	1.2	1.0	0.0	0.5
Others	9.5	7.3	8.3	4.9	13.6	8.0

Source: Field Survey, 2011-12

Determinants of Marketed Surplus of Rice: Regression Analysis

In this study, multiple linear regression model was used to analyze factors affecting marketed surplus. The analysis focuses on the role of household characteristics and various institutional, economic and infrastructure variables like access to market and market

information, output price, access to roads, awareness about price support programme, credit availability, etc. on marketed surplus. The dependent variable is marketed surplus as a percentage of total output per household. The independent variables include farm size (ha), family size (numbers), awareness about MSP (yes/no), access to regulated market (yes/no), distance of farm from main market (km) and price received for the produce (Rs/qtl). The model is estimated first for all farms combined and then for each of the four major farm size categories. Descriptive statistics of variables used in the analysis are given in Table 3.30.

Table 3.30: Descriptive statistics of farm household attributes by farm size

	Mean	Std. Dev.	Median	Min.	Max
Dependent Variable					
Marketed surplus (%)	82.0	27.20	96.7	0.0	100.0
Explanatory variables					
Farm size (ha)	3.6	4.94	2.4	0.1	70.0
Family size (no)	6.8	3.47	6.0	1.0	24.0
Price received (Rs/q)	982	222.27	1110	800	1180
Dummy for awareness of MSP (%)	0.9	0.3	1.0	0.0	1.0
Dummy for access to regulated market (%)	0.7	0.5	1.0	0.0	1.0
Distance to market (km)	4.5	5.28	3.0	0.0	60.0
	Yes	No	-	-	-
Awareness about MSP (%)	90.5	9.5	-	-	-
Access to Regulated Market (%)	68.3	31.7	-	-	-

Source: Field Survey, 2011-12

The estimated regression parameters of the marketed surplus model are shown in Table 3.31. All the variables except family size have positive signs and most are statistically significant, indicating that they have a positive impact on marketed surplus. The relationship between farm size and marketed surplus is positive and statistically significant, indicating that with an increase in farm size, marketed surplus also increases. This result holds for both

marginal and small farm-size categories while it is non-significant for medium and large farms.

The existence of an inverse relationship between family size and marketed surplus shows that higher the household family size, the lower was the marketed surplus of rice. However, coefficient was statistically significant for marginal and small farms and all farms. These results indicate that small and marginal farmers retain larger quantities of rice for self-consumption and other purposes. The results also show the important effect of price on marketed surplus. The higher the price of rice, the larger was the marketed surplus. The elasticity of marketed surplus of rice to its own price is about 0.08, implying that a 1 per cent higher price is likely to induce a 0.08 per cent larger marketed surplus. The regression coefficient was positive and significant for all categories of farms except large farmers.

Table 3.31: Factors influencing marketed surplus of rice in selected rice producing states

Factor	Farm Size				
	Marginal	**Small**	**Medium**	**Large**	**All**
Constant	-13.1848** (5.7726)	-9.4398 (13.3688)	0.5586 (5.5947)	97.9600*** (0.7181)	-11.8679*** (3.3728)
Farm Size	25.7363*** (6.2216)	10.6194** (5.0263)	0.3401 (0.3598)	-0.0003 (0.0072)	0.5615*** (0.1262)
Family Size	-1.7055*** (0.4754)	-0.7630* (0.4539)	-0.0064 (0.1783)	-0.0022 (0.0259)	-0.1990 (0.1736)
Price Received	0.0741*** (0.0049)	0.0837*** (0.0084)	0.0804*** (0.0046)	-0.0002 (0.0006)	0.0827*** (0.0029)
Awareness about MSP	-0.4829 (3.1764)	-1.1237 (6.5261)	0.8502 (3.3766)	-	3.5946* (2.0850)
Access to Regulated Market	13.2967** (2.7335)	0.0026 (4.6495)	5.3776*** (1.6760)	1.6254*** (0.1691)	9.8557*** (1.3326)
Distance to Market	-0.9796* (0.5895)	-0.5170* (0.4167)	0.2025 (0.1340)	0.0016 (0.0128)	0.4571*** (0.1277)
R^2	0.64	0.40	0.48	0.69	0.57

Figures in parentheses show standard error of regression coefficients.
****, ** and *: Statistically significant at the 1%, 5% and 10% level, respectively.*

Household's awareness of minimum support price (MSP) has positive and significant impact on marketed surplus and so do access to regulated markets. This is highly plausible, as given better access to regulated markets and procurement agencies; farmers will sell more

quantities. The longer the distance to a market, the lower was the marketed surplus in case of small and marginal farmers. In contrast, distance to market is not an important factor influencing marketed surplus on medium and large farms. This is plausible as, given lack of transport facilities and small volumes on marginal and small farm, farmers cannot take their produce to markets.

In sum, our analysis confirms the important positive effect of price, farm size, and market access on marketed surplus of rice. Family size matters too on marginal and small farms as marginal and smallholders are associated with lower marketed surplus. Our analysis, however, could not throw light on whether smallholders marketed lower proportions because they received lower farm gate prices and/or because their access to markets was more constrained.

The relative importance of factors in influencing marketed surplus as measured by standardized regression coefficients indicated that the price received by farmers was the most important factor, followed by access to regulated markets, farm size and awareness of MSP. Family size turned out to be the least important variable in influencing marketed surplus of rice. One of the main reasons could be low preference of consumers for rice particularly in Punjab and Haryana, thereby less retention for self-consumption.

Chapter 4

Overview of Indian Wheat Economy: Production, Procurement and Marketed Surplus

Wheat is the largest cereal crop in the world, occupying slightly over 16 per cent of the total cultivated acreage, whereas, rice, the second important crop accounts for over 11 percent of the cultivated acreage. Globally, India is the second largest producer of wheat (about 92 million tonnes) next only to China (120 million tonnes) with the highest area (29.6 million ha) under wheat among all the wheat producing countries in the world. Wheat production, acreage and yield by major producers of the world are presented in Table 4.1. India's share in global production was about 13.2 per cent during 2011-13 while China, the largest producer, accounted for about 17.3 per cent of global production. Currently, the world average wheat yield is around 3.2 t/ha but there is considerable variation between countries. Individual country rankings by production and acreage differ for some countries because of differences in wheat yields. China, however, leads in both categories and produces over 17 per cent of the world wheat total. India is first in terms of acreage but second in production and does not figure in the top five in terms of productivity.

In India, wheat is an important food staple and occupies about 15 per cent (29.6 million ha) of the total cultivated area with a total production of nearly 92 million tonnes during TE2012-13. The share of wheat in the total value of output from agriculture and allied activities was about 10.4 per cent in TE2011-12. Wheat is an important food crop produced in many regions/states but its contribution to crop output varies from state to state (Table 4.2). For example, wheat contributes more than one-fourth to crop output in states like Punjab (34.4%), Haryana (34%) and Uttar Pradesh (25.2%), while in many southern and eastern states, its contribution is negligible. While wheat is a major staple food for the majority of Indian population, its share in the diet varies across states. Per capita consumption of wheat showed a slight rise of about 0.1 kg per person per month in rural areas and a fall of 0.35 kg in urban areas between 2004-05 and 2011-12 (NSSO, 2014). The

share of wheat purchased from the public distribution system in total consumption has increased considerably in both rural (from 7.4% to 17.2%) and urban (from 3.9% to 9.7%) sectors.

Table 4.1: Wheat acreage, production and yield: Leading producers (Average 2011-13)

	Area (million ha)	Production (million tonnes)	Yield (t/ha)
China	24.2	120.1	4.96
India	29.5	91.8	3.11
United States of America	18.9	58.0	3.08
Canada	9.5	30.0	3.14
Australia	13.1	26.7	2.03
Pakistan	8.8	24.3	2.78
Turkey	7.8	21.3	2.73
Ukraine	6.3	20.3	3.21
Kazakhstan	13.7	15.5	1.14
Iran	6.8	13.4	1.96
Argentina	3.6	10.2	2.83
Egypt	1.3	8.9	6.60
Uzbekistan	1.4	6.7	4.79
World	***218.7***	***694.7***	***3.18***

Source: Data from FAOSTAT,http://faostat3.fao.org/faostat-gateway/go/to/home/E, September 2014

The importance of wheat consumption in the diet also differs across different regions (Table 4.2). Households in the southern, eastern and north-eastern regions have been traditionally consuming more rice and their share of wheat in total food expenditure is less than 5 per cent. However, share of wheat in total food expenditure is relatively higher in northern and central regions. Wheat expenditure constitutes more than 10 per cent of food expenditure in states like Madhya Pradesh, Rajasthan, Uttar Pradesh and Bihar. There is not much difference in wheat consumption expenditure in rural and urban areas. The relationship between income levels and the corresponding level of cereals consumption shows that with an increase in household income, population in the higher income group spend less on

cereals and more on high-value products such as fruits and vegetables, milk and dairy products, meat and eggs, fish, etc. while low-income households increase cereals consumption by substituting rice/wheat for coarse cereals.

Table 4.2: Share of wheat in total value of output from agriculture and total food expenditure in major states: 2011-12

State	***Share (%) of wheat in total value of agricultural output***	***Share (%) of wheat in total food expenditure***	
		Rural	*Urban*
Andhra Pradesh	0.0	1.3	2.5
Arunachal Pradesh	0.6	1.2	2.0
Assam	0.3	1.2	2.7
Bihar	15.3	9.7	10.2
Chhattisgarh	0.9	1.8	4.4
Goa	0.0	5.1	4.2
Gujarat	6.5	6.0	7.7
Haryana	34.0	8.9	7.3
Himachal Pradesh	10.3	7.9	7.2
Jammu & Kashmir	4.7	6.0	7.4
Jharkhand	2.0	7.5	8.9
Karnataka	0.7	2.4	3.4
Kerala	0.0	1.9	2.3
Madhya Pradesh	14.8	14.5	11.2
Maharashtra	2.7	6.9	6.6
Manipur	0.0	0.4	1.0
Meghalaya	0.1	1.3	2.6
Mizoram	0.0	0.6	1.5
Nagaland	0.2	0.6	1.1
Orissa	0.0	2.5	4.8
Punjab	34.4	9.4	9.2
Rajasthan	17.0	12.4	11.4
Sikkim	0.7	2.2	3.1
Tamil Nadu	0.0	1.4	2.1

Tripura	0.0	0.7	1.3
Uttar Pradesh	25.2	12.2	10.4
Uttarakhand	13.4	9.4	9.8
West Bengal	1.3	2.4	4.0
All India	***10.5***	***6.8***	***6.3***

Source: CSO (2013) and NSSO (2013)

Trends in Wheat Production, Acreage and Yield

Trends in wheat production, acreage and yield in the country from 1971 to 2012 are examined in this section. It is evident from Table 4.3 that wheat acreage and production have been increasing over the last four decades. In TE1973-74, wheat acreage and production in the country were 19.1 million ha and 24.3 million tonnes, respectively. In TE2012-13, wheat acreage and production had increased to 29.6 million ha and 91.8 million tonnes, respectively. During the same period, wheat productivity had more than doubled from 1274 kg/ha to 3094 kg/ha. It is important to examine the distribution of acreage rather than the level of acreage. As a percent of total cropped area, wheat acreage share increased from 11.5 percent in TE1973-74 to 15.3 percent in TE2012-13.

Table 4.3 also shows the production, yield and acreage growth trends of wheat during the last four decades and overall study period. Wheat production increased at an annual compound growth rate of 3.25 per cent during 1971-72 and 2012-13. This was due to a significant area expansion of 0.99 percent per year and a significant yield increase of 2.24 percent per year (Table 4.3). Growth in wheat production was the highest (4.91%) during seventies which decelerated to 3.39 percent per year during 1980s, 3.11 per cent during the 1990s and 3.13 per cent during the last decade. Wheat yield growth rates were particularly rapid during the 1970s and 1980s. Growth in wheat yield, 2.51 percent per year in the 1970s and 3.02 percent per year in the 1980s, slowed to 1.69 percent in the 1990s and 1.58 per cent in the first decade of the 2000s. During the last two decades, acreage expansion and yield improvement contributed almost equally to growth in wheat output while yield was the major source of growth in output during the 1980s. It was found that wheat production instability was mostly due to increased yield instability than instability in area. Higher yield instability is a cause of concern since more than 90 per cent of wheat acreage is irrigated.

Table 4.3: Average area (million ha), production (million tonnes), and yield (kg/ha) of wheat in India: 1971-72 to 2012-13

	1971-72 to 1973-74	1981-82 to 1983-84	1991-92 to 1993-94	1999-00 to 2001-02	2010-11 to 2012-13
Area	19.1 (11.5)	23.5 (13.3)	24.4 (13.2)	26.5 (14.1)	29.6 (15.3)
Production	24.3	41.9	57.6	72.9	91.8
Yield	1274	1783	2367	2750	3094
CAGR (%)					
	1970s	**1980s**	**1990s**	**2000s**	**All Period**
Area	2.34***	0.36	1.40***	1.53***	0.99***
Production	4.91***	3.39***	3.11***	3.13***	3.25***
Yield	2.51***	3.02***	1.69***	1.58***	2.24***
Coefficient of Variation (%)					
Area	8.04	3.05	5.11	5.23	12.03
Production	16.74	11.33	10.11	11.64	35.66
Yield	9.51	9.66	5.96	6.57	25.76

Note: figures in parentheses show share of wheat acreage in total cropped area
Source: Author's calculation using data from GoI (2013)

Table 4.4 shows the shares of different states in the national wheat production during the last three decades. Uttar Pradesh contributed the largest share with one-third of the total production, followed by Punjab with 18.6 per cent and Haryana with 13.3 per cent during TE2011-12. These three northern states together contributed around two-thirds of the total wheat production in the country. Madhya Pradesh is the fourth largest producer with 10.5 per cent share, followed by Rajasthan (9.2%) and Bihar (5.1%). These top six states contributed more than 90 percent of the total wheat production in the country. Punjab and Bihar have marginally lost their shares in national production while Haryana, Madhya Pradesh and Rajasthan have increased their shares. Wheat is an important foodgrains crop in many states such as Haryana (69.7%), Uttar Pradesh (64%), Madhya Pradesh (61.4%) and Punjab (58.8%) which accounts for more than half of the total foodgrains production in the country. Wheat is also an important crop in Rajasthan, Bihar and Uttarakhand constituting

more than 40 per cent of the foodgrains production. The share of wheat in foodgrains production has increased in Uttar Pradesh, Madhya Pradesh, Bihar and Uttarakhand during the last 2-3 decades while it has lost its share in states like Punjab, Haryana and Rajasthan. At national level, share of wheat in foodgrains production has increased from 30.3 per cent in early-1980s to 36.4 in TE2011-12. Madhya Pradesh, which witnessed the highest increase (from 45.7% to 61.4%) in wheat share during the last decade and with an increased irrigation (from 78.9% in 2004-05 to 87.1% in 2010-11) and additional bonus on wheat since 2007-08 by the State government have helped in increasing wheat production in the state.

Table 4.4: Share of major states in wheat production in India: TE1983-84 and TE2011-12

	Share in all-India production				**Share in food grains production in state**			
State	TE1983-84	TE1993-94	TE2001-02	TE2011-12	TE1983-84	TE1993-94	TE2001-02	TE2011-12
Bihar+ Jharkhand	6.0	6.6	6.3	5.3	29.7	33.4	32.4	33.7
Haryana	9.9	12.1	13.1	13.3	63.8	70.2	72.5	69.7
MP+ Chhattisgarh	9.1	9.9	9.0	10.6	27.9	31.8	36.7	39.8
Punjab	21.6	22.0	21.5	18.6	64.2	62.0	62.3	58.8
Rajasthan	8.1	7.6	8.5	9.2	39.7	47.4	53.8	47.5
UP+ Uttarakhand	35.1	35.2	35.7	34.4	55.2	54.3	57.4	61.8
Bihar	-	-	6.1	5.1	-	-	37.2	42.4
Jharkhand	-	-	0.2	0.2	-	-	5.1	7.7
MP	-	-	7.5	10.5	-	-	45.7	61.4
Chhattisgarh	-	-	0.1	0.1	-	-	2.1	2.2
U.P.	-	-	34.7	33.4	-	-	58.3	64.0
Uttarakhand	-	-	1.0	1.0	-	-	42.2	48.4
All India	***100.0***	***100.0***	***100.0***	***100.0***	***30.3***	***31.5***	***35.3***	***36.4***

Source: Author's calculation using data from GoI (2013)

In terms of area, Uttar Pradesh has the largest share (33.2%), followed by Madhya Pradesh (15.5%), Punjab (12.1%), Rajasthan (8.9%) and Haryana (8.6%). Madhya Pradesh, which has

the second largest area under wheat, ranks number four in terms of production while Haryana which is at number five in acreage shares, ranks number three in production shares. At all India level, share of wheat in total cropped area has increased from 13.3 percent in TE1983-84 to 15 per cent in TE2011-12. The share of wheat in total cropped area has increased in Madhya Pradesh, Haryana and Bihar, while it has remained almost constant in some states like Rajasthan and Uttar Pradesh.

Table 4.5: Share of major states in area under wheat in India: TE1983-84 and TE2011-12

	Share (%) in all-India acreage				**Share (%) in Total cropped area in state**			
State	*TE1983-84*	*TE1993-94*	*TE2001-02*	*TE2011-12*	*TE1983-84*	*TE1993-94*	*TE2001-02*	*TE2011-12*
Bihar+ Jharkhand	7.5	8.3	8.1	7.8	16.8	20.6	21.6	28.9
Haryana	7.2	7.9	8.8	8.6	29.3	33.4	37.8	38.9
MP+Chhattisgarh	15.2	15.6	14.8	15.9	16.0	15.8	15.9	20.0
Punjab	12.9	13.5	12.8	12.1	33.1	43.4	43.1	44.6
Rajasthan	8.5	8.3	9.1	8.9	10.7	10.5	12.2	10.8
UP+Uttarakhand	34.9	36.4	36.0	34.5	32.9	34.5	36.0	32.3
Bihar	-	-	7.9	7.4	-	-	26.4	29.1
Jharkhand	-	-	0.2	0.4	-	-	3.1	9.1
Madhya Pradesh	-	-	13.2	15.5	-	-	19.0	20.5
Chhattisgarh	-	-	0.3	0.4	-	-	1.6	2.0
Uttar Pradesh	-	-	34.9	33.2	-	-	36.4	37.9
Uttarakhand	-	-	1.4	1.3	-	-	31.0	33.0
All India	***100.0***	***100.0***	***100.0***	***100.0***	***13.3***	***13.2***	***14.2***	***15.0***

Source: Author's calculation using data from GoI (2013)

Important feature of wheat production in the country is that the wheat yields vary substantially across states, as shown by Table 4.6. Punjab and Haryana show the highest yields of 4513 and 4441 kg/ha, respectively. These are followed, after a significant gap, by Rajasthan, U.P., Uttarakhand and Bihar with 2982, 2935, 2156 and 2041 kg/ha respectively. Madhya Pradesh, one of the major producer, has much lower yield of 1876 kg/ha, even

lower than the national average (2904 kg/ha). Wheat yields have shown consistent improvement in almost all states during the last three decades with some decline in crop yields in Bihar, Punjab and Madhya Pradesh between 1996-2000 and 2001-05. Wheat productivity in all India increased by more than 50 percent from 1853 kg/ha in 1981-1986 to 2904 kg/ha 2006-2011. The highest increase (>14%) was observed between 1981-85 and 1986-90 and 1986-90 and 1991-95, while the lowest increase (0.5%) was witnessed between 1996-2000 and 2001-05. The average yield of wheat in India during 2011-13 was 3.1 tonnes/ha as against the global average of about 3.2 tonnes/ha, which is comparable to the global benchmark but much lower than countries like China, Egypt and Uzbekistan.

Table 4.6: Changes in wheat yield by major producing states and all India average: 1981-2012

State	1981-85	1986-90	1991-95	1996-2000	2001-05	2006-11
Bihar+Jharkhand	1502	1647	1943	2183	1791	2024
Haryana	2614	3143	3642	3945	3968	4441
MP+Chhattisgarh	1089	1308	1580	1698	1642	1855
Punjab	3154	3496	3912	4336	4268	4513
Rajasthan	1786	2084	2288	2534	2779	2982
UP+UK	1848	2076	2366	2627	2622	2905
Bihar	-	-	-	-	1793	2041
Jharkhand	-	-	-	-	1737	1663
M.P.	-	-	-	-	1645	1876
Chhattisgarh	-	-	-	-	976	1093
U.P.	-	-	-	-	2655	2935
Uttarakhand	-	-	-	-	1861	2156
All India	***1853***	***2113***	***2428***	***2648***	***2661***	***2904***

Source: Author's calculation using data from GoI (2013)

Tables 4.7, 4.8 and 4.9 show the annual growth rates of wheat production, area and yield for 1981 through 2012 for the major wheat producing states in the country. Aggregate wheat output in the country grew at an annual compound growth rate of 2.54 percent during 1981-2012 period and about 1.7 per cent of which came from increases in yield. The

production growth rate for 2000s at 3.13 percent per annum was somewhat above the 3.11 percent experienced during the 1990s but lower than 3.39 per cent for the 1980s.

Among major producers, Madhya Pradesh showed the highest growth rate (6.27%) during the last decade, followed by Rajasthan (4.79%) as against the national average of 3.13 per cent. Haryana, Punjab and Uttar Pradesh, the other three major producers, recorded lower than all-India growth rate. Majority of main producers, except Rajasthan and Madhya Pradesh, recorded the highest growth rates during the 1980s. During the 1980s, Haryana witnessed the highest growth rate (5.67%) while Rajasthan showed the highest growth rate (4.96%) during the 1990s. Wheat production growth rate in Uttar Pradesh declined from 3.45 per cent in 1980s to 2.82 per cent during 1990s and declined further to 2.41 per cent during the last decade. It is frightening to note that almost a similar trend was observed in other states like Haryana, Punjab and Bihar.

Table 4.7: Annual growth rates of wheat production in selected states, 1981-82 to 2012-13

State	1980s	1990s	2000s	All
Bihar+Jharkhand	4.69***	2.92***	2.76**	1.87***
Haryana	5.67***	4.18***	2.75***	3.45***
MP+Chhattisgarh	4.06***	2.68	6.23***	2.86***
Punjab	3.71***	2.56***	1.38***	1.92***
Rajasthan	2.11	4.96**	4.79***	3.36***
UP+ Uttarakhand	3.45***	2.98***	2.39***	2.45***
Bihar	4.69***	2.79**	2.50**	1.69
Jharkhand			9.41***	-
MP	4.06***	2.59	6.27***	2.79
Chhattisgarh			3.31**	-
UP	3.45***	2.82***	2.41***	2.31
Uttarakhand			1.83***	-
All India	3.39***	3.11***	3.13***	2.54***

Source: Author's calculation using data from GoI (2013)

The compound annual growth rates of area under wheat presented in Table 4.8 show that wheat acreage in the country grew at 0.83 percent during 1981 to 2012. The annual growth

rate of wheat acreage increased from 0.36 per cent during 1980s to 1.40 percent in the 1990s to 1.53 per cent during the last decade. During the last decade, Jharkhand recorded the highest growth rate (8.76%), followed by Rajasthan (3.51%), Madhya Pradesh (2.78%) and Haryana with a little over one percent growth rate. Rajasthan recorded the highest growth rate (3.47%) in the 1990s, followed by Haryana (2.55%), while in the 1980s, it was Bihar which recorded the highest growth rate. Punjab, Bihar and Uttar Pradesh showed deceleration in acreage growth rates during the last three decades. In contrast, Madhya Pradesh and Rajasthan showed increasing growth trends during the same period. It is interesting to note that area expansion has also contributed to the increased wheat production in the country, besides yield expansion.

Table 4.8: Annual growth rates of wheat area in selected states, 1981-82 to 2012-13

State	1980s	1990s	2000s	All
Bihar+Jharkhand	2.15***	0.81***	0.78**	0.77***
Haryana	1.39***	2.55***	1.07***	1.52***
MP+Chhattisgarh	0.34	1.31	2.87***	0.81***
Punjab	0.97***	0.42**	0.33***	0.51***
Rajasthan	-1.56	3.47**	3.51***	1.37***
UP+Uttarakhand	0.80**	0.96***	0.64***	0.71***
Bihar	2.15***	0.64**	0.43*	0.56
Jharkhand			8.76***	
MP	0.34	1.21	2.78**	0.71
Chhattisgarh			0.85	
UP	0.80**	0.73***	0.70***	0.53
Uttarakhand			-0.66**	
All India	0.36	1.40***	1.53***	0.83***

Source: Author's calculation using data from GoI (2013)

Table 4.9 presents the growth rates of wheat productivity at national level and major producers during the last three decades. The results show that wheat yields grew at an average annual rate of 1.7 per cent between 1981 and 2012. It is important to note that the

wheat yield growth rate of 1980s (3.02%), which declined to 1.69 percent during 1990s, declined further and reached 1.58 per cent during the last decade.

Wheat yield growth declined sharply in most states during the 2000s and 1990s compared with the preceding decade. For example, yield growth declined to 1.59 per cent during the 1990s from an annual rate of 4.23 per cent in the preceding decade in Haryana. In case of Punjab, one of the major wheat producing states, growth rate declined from 2.13 per cent in the 1990s to 1.04 percent during the last decade. In Uttar Pradesh, growth rate fell from 2.63 per cent in 1980s to 2.07 per cent in 1990s and 1.70 percent in 2000s. Madhya Pradesh showed a significant increase in wheat yield (3.39%) during the last decade compared to 1990s (1.37%). Yield has contributed to about two-third of the increase in wheat production in the country during the last three decades.

Table 4.9: Annual growth rates of wheat yield in selected states, 1981-82 to 2012-13

State	***1980s***	***1990s***	***2000s***	***All***
Bihar+Jharkhand	2.49***	2.10**	1.96**	1.09***
Haryana	4.23***	1.59***	1.67***	1.91***
MP+ Chhattisgarh	3.71***	1.35	3.27***	2.03***
Punjab	2.71***	2.13***	1.04**	1.40***
Rajasthan	3.73***	1.44	1.24***	1.97***
UP+ Uttarakhand	2.63***	2.00***	1.73***	1.73***
Bihar	2.49***	2.14**	2.07**	1.12
Jharkhand	-	-	0.60	-
MP	3.71***	1.37	3.39***	2.07
Chhattisgarh	-	-	2.44**	-
UP	2.63***	2.07***	1.70***	1.78
Uttarakhand	-	-	2.51***	-
All India	3.02***	1.69***	1.58***	1.70***

Source: Author's calculation using data from GoI (2013)

The classification of states according to growth in area and yield of wheat presented in Table 4.10 shows that all major wheat producing states showed a significant positive growth

rate of area associated with a significant positive growth rate of yield (AA) during 1981 and 2012. This shows that wheat is either replacing other crops or is grown in newly cultivated areas and productivity of both existing and new acreage has increased. However, the situation is slightly different during the three decades. During the 1980s, Madhya Pradesh and Rajasthan had stagnant area but significant positive growth rate of yield (CA). Other major producers had a significant growth in both area and yield (AA). In the next decade, Rajasthan showed significant positive growth rate in area and stagnant (either positive or negative) growth rate of yield (AC) indicating that wheat was either replacing other crops or was grown in newly cultivated areas but productivity of both existing and new acreage remained stagnant. Madhya Pradesh witnessed stagnation in both wheat acreage and productivity. However, during the last decade all major wheat producing states showed a significant positive growth rates in both area and crop yield. Several factors appear to have contributed to increase in area and yield but important ones include significant increases in wheat prices (from Rs. 650/q in 2005-06 to Rs. 1400/q in 2014-15), irrigation expansion (from about 88% to 92% during the last decade), improved seed replacement rate (13% in 2003 to about 30% in 2012), etc.

Table 4.10: Classification of states according to growth in area and yield of wheat

Type of association	1980s	1990s	2000s	1981-82 to 2012-13
AA	Bihar, Haryana, Punjab, UP, All India	Bihar, Haryana, Punjab, UP, All India	Bihar+Jharkhand, Bihar, Haryana, MP+Chhattisgarh, MP, Punjab, Rajasthan, UP+Uttarakhand, UP, All India	Bihar+Jharkhand, Haryana, MP+Chhattisgarh, Punjab, Rajasthan, UP+Uttarakhand, All India
AB				
AC		Rajasthan	Jharkhand	
BA			Uttarakhand	
BB				
BC				
CA	MP, Rajasthan		Chhattisgarh	
CB				
CC		MP		Bihar, MP, UP

For improvement of the wheat economy, AA is the best situation while BB is the worst situation. BA would be preferred to AB, CA would be preferred to AC, and BC would be preferred to CB. The analysis of growth rates of wheat acreage and yield levels show that wheat economy has performed exceedingly well during the last three decades.

Cross state comparisons of wheat productivity and growth in productivity for major producers are presented in Table 4.11. From 1981 through 2012, wheat productivity more than doubled. It is important to note that all major producing states have witnessed a significant increase in wheat yield during the last three decades. Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh from low-productivity and Punjab and Haryana from high-productivity category states, showed significant increases in wheat yield. Almost a similar trend was observed during the 1980s and 2000s, but wheat yield remained stagnant in Madhya Pradesh and Rajasthan during the decade of 1990s. However, Rajasthan and Uttar Pradesh shifted from low-productivity to high-productivity category during the last decade.

Table 4.11: Classification of states according to productivity levels and growth in productivity of wheat in India

	Significant increase in yield	**Significant decline in yield**	**Stagnant yield with positive sign**	**Stagnant yield with negative sign**
1981-82 to 1990-91				
High Productivity	Haryana, Punjab	-	-	-
Low Productivity	Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh	-	-	-
1991-92 to 2000-1				
High Productivity	Haryana, Punjab	-	Madhya Pradesh	Rajasthan
Low Productivity	Bihar, Uttar Pradesh	-	-	-
2001-02 to 2012-13				
High Productivity	Haryana, Punjab, Rajasthan, Uttar Pradesh+Uttarakhand, UP	-	-	-

Low Productivity	MP+Chhattisgarh, Madhya Pradesh, Bihar+Jharkhand, Bihar, Uttarakhand	-	-	-
1981-82 to 2012-13				
High Productivity	Haryana, Punjab	-	-	-
Low Productivity	Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh	-	-	-

Source: Author's calculation using data from GoI (2013)

Trends in Wheat Production and Procurement

Wheat production in India crossed the mark of 90 million tonnes in 2011-12 and is expected to reach nearly 96 million tonnes in 2013-14. The trends in wheat production, procurement and procurement as percentage of production from 2001-02 to 2013-14 are given in Table 4.12. Wheat production in the country was almost stagnant during the first-half of the last decade while procurement witnessed a declining trend. Wheat procurement declined from 20.63 million tonnes in 2001-02 to the lowest level of 9.23 million tonnes in 2006-07. The main reason for this declining trend was high foodgrains stocks with the government and gradual withdrawal of government from procurement. For example, wheat stocks in the central pool were over 41 million tonnes in July 2002 against minimum buffer stock norms of 14.3 million tonnes. India offloaded these excess stocks exporting about 7.4 million tonnes of wheat in 2002-03 and 7.2 million tonnes in 2003-04. However, increase in offtake of foodgrains in public distribution system and liquidation of stocks through exports necessitated imports of wheat during 2006-07. India imported about 5.4 million tonnes of wheat in 2006-07 and about 1.9 million tonnes in 2007-08 which concerned the policy makers and concerted efforts were made to increase wheat production and procurement. This led to a significant increase in wheat production as well as procurement. Indian wheat production increased from 75.8 million tonnes to 93.5 million tonnes between 2006-07 and 2012-13, while procurement increased from 9.2 million tonnes to 37.9 million tonnes during the same period. Wheat procurement as percentage of total production increased from about 12 per cent in 2006-07 to 40.6 per cent in 2012-13 but fell during 2013-14. Keeping in

view the commitment of the government to implement the National Food Security Act, there is a need to step up wheat production as well as procurement.

Table 4.12: Trends in wheat procurement and production in India

Year	Production (Million tonnes)	Procurement (million tonnes)	Procurement as % of production
2001-02	72.77	20.63	28.4
2002-03	65.76	19.05	29.0
2003-04	72.16	15.80	21.9
2004-05	68.64	16.80	24.5
2005-06	69.35	14.79	21.3
2006-07	75.81	9.23	12.2
2007-08	78.57	11.13	14.2
2008-09	80.68	22.69	28.1
2009-10	80.80	25.38	31.4
2010-11	86.87	22.51	25.9
2011-12	94.88	28.34	29.9
2012-13	93.51	37.92	40.6
2013-14	95.91	25.09	26.2

Source: GoI (2015), data accessed from http://dfpd.nic.in/fcamin/policy/proc01012015.pdf

The procurement of wheat as a percentage of production in major wheat producing states in the country between TE2001-02 and TE2011-12 is presented in Table 4.13. In TE2001-02, wheat procurement was mainly concentrated in Punjab and Haryana and share of government procurement as a percentage of production was 59.2 per cent in Punjab and 51.4 per cent in Haryana. It is evident from the Table that the share of government procurement has been rising over the years in all wheat producing states. Madhya Pradesh has recorded the highest increase of over 30 per cent, from six per cent in TE2001-02 to 37.5 per cent in TE2011-12. These results indicate that the government has almost a monopsony in wheat procurement and restricted participation of private sector.

As is evident from Table 4.14, the share of major states like Punjab, Haryana and Uttar Pradesh in total procurement was more than 90 per cent in TE2003-04, making them almost

a monopoly vis-à-vis other states. During the last decade, the share of traditional states like Punjab, Haryana and Uttar Pradesh has declined and the decline in share of these states has been compensated by an increase in share of Madhya Pradesh and Rajasthan. The share of Madhya Pradesh has increased from less than 2 percent to over 24 per cent during the last decade. This has happened primarily due to the state policy of additional bonus over the MSP. Madhya Pradesh has been giving Rs 100/qtl bonus to its farmers since 2007-08 which was further increased to Rs 150/qtl in 2013-14. Similarly, Rajasthan has also started giving bonus to wheat farmers since 2012-13. The results show that wheat procurement has diversified in terms of coverage of states but at an additional cost. This trend might lead to a situation observed in case of sugarcane, where there is a big difference between fair and remunerative price announced by the Central government and State Advised Price (SAP) announced by the State government and has led to a serious problem for both sugarcane growers and sugar industry.

Table 4.13: Trends in wheat production and procurement in major producing states

State	Production (Million tonnes)		Procurement (million tonnes)		Procurement as % of production	
	TE2001-02	TE2011-12	TE2001-02	TE2011-12	TE2001-02	TE2011-12
Bihar	4.58	4.68	0.04	0.41	0.9	8.8
Haryana	9.59	11.61	4.92	6.73	51.4	58.0
Madhya Pradesh	6.58	9.32	0.40	3.49	6.0	37.5
Punjab	15.65	16.31	9.27	10.63	59.2	65.2
Rajasthan	6.22	8.01	0.62	0.98	9.9	12.2
Uttar Pradesh	26.03	30.14	0.08	3.01	0.3	10.0

Source: GoI (2015), data accessed from http://dfpd.nic.in/fcamin/policy/proc01012015.pdf

The Central government has now asked state governments not to announce bonus over and above the minimum support price (MSP). The Food Corporation of India (FCI) will restrict procurement of foodgrains from states that announce bonus and will not give subsidy to states on procurement and distribution of surplus foodgrains. In the case of decentralised procuring (DCP) states, if they announce bonus over and above MSP, the Centre has decided to give subsidy only on foodgrains procured as required for PDS and welfare schemes.

Table 4.14: Changing share of major states in wheat procurement

State	Procurement (million tonnes)		Share in total Proc. (%)	
	TE2003-04	TE2013-14	TE2003-04	TE2011-12
Bihar	0.03	0.27	0.2	0.9
Haryana	5.81	7.01	30.8	23.1
Madhya Pradesh	0.31	7.31	1.6	24.1
Punjab	9.79	11.79	51.9	38.9
Rajasthan	0.37	1.80	1.9	5.9
Uttar Pradesh	1.92	2.12	10.2	7.0

Source: GoI (2015), data accessed from http://dfpd.nic.in/fcamin/policy/proc01012015.pdf

Marketed Surplus of Wheat: Distribution by Farm Size and Determinants

With a production of about 95 million tonnes annually, Indian wheat economy is now the second largest in the world. There is some evidence that rise in wheat production in the last 2-3 decades has led to a corresponding rise in the marketed proportion of production. However, no recent reliable information is available about the volume of aggregate marketed surplus of wheat. Available estimates on marketed surplus are based on macro estimates and are grossly inadequate and varying over time and space. In order to understand the pattern of marketed surplus of wheat in major producing states and important variables affecting it, the study was conducted in five major wheat producing states, namely, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Rajasthan during 2011-12. The study is based on the household data collected from 2 districts (Karnal and Bhiwani) of Haryana, 3 districts (Gurdaspur, Sangrur, Ferozpur) of Punjab, 5 districts (Alwar, Chittorgarh, Churu, Hanumangarh and Udaipur) of Rajasthan, 4 districts (Shahjahanpur, Barabanki, Agra and Budaun) of Uttar Pradesh and Hoshangabad district of Madhya Pradesh. Total number of households selected for the study was 1193 following a stratified sampling procedure to select representative sample households. The households were classified into five groups based on size of land holding (marginal<1 ha, small: 1-2 ha, semi-medium: 2-4 ha, medium: 4-10 ha and large >10 ha). The size distribution of sample households in selected states is given in Table 4.15.

Table 4.15: Size-distribution of sample households in selected states

State	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*Total*
Rajasthan	21	100	70	79	23	293
Punjab	36	60	96	84	24	300
Uttar Pradesh	126	41	22	11	0	200
MP	42	16	21	19	2	100
Haryana	86	110	59	36	9	300
Total	***311***	***327***	***268***	***229***	***58***	***1193***

Sources: Field Survey, 2011-12

Household Characteristics

In this section, information about household socio-demographic characteristics such as average age of the head of the household, average family size, characteristics of the household heads, household social composition as well as occupation status has been presented. Information on educational status is useful in studying the level of technology adoption and market participation. The number of average schooling years was 7.4 for all farm categories while it was higher for large farmers at 9.4 years than marginal and small farmers at about 6.4 years. There was a positive association between education and farm size. The findings show that the average age of household head was 47.7 years, and there was no significant difference in age of household among different categories. The survey revealed that about 97 per cent of the households had crop farming as their main occupation, and almost all households were male headed. The average household size in the study area has been estimated at 11.4. The results also indicate that the average household size is bigger on large farms than on small and marginal households. More than half of the sample households belonged to general category while the share of backward and SC/ST farmers was higher on marginal and small farms than on large farms. Almost all households were male dominated on all farm sizes.

Table 4.16: Socio-economic profile of sample farm households by size of farm in the study areas

Characteristics	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farms*
Age (years)	46.5	48.3	46.8	48.7	48.8	47.7
Main Occupation (%)						
Crop farming	95.9	98.1	96.6	97.0	97.4	97.0
Dairy	0.5	0.0	0.0	0.0	0.0	0.1
Service	2.7	1.5	3.0	3.0	2.6	2.6
Others	0.9	0.4	0.4	0	0	0.3
Education (Avg. years of schooling)	6.3	6.4	7.4	8.3	9.4	7.4
Family Size (Nos.)	10.2	10.2	11.2	12.5	13.8	11.4
Male	6.3	6.4	7.4	8.3	9.4	7.4
Female	3.8	3.8	3.8	4.2	4.4	4.0
Social grouping (%)						
SCs	17.7	7.6	5.1	2.0	1.7	6.9
STs	0.0	1.5	0.7	1.0	0.0	0.8
OBCs	46.4	42.4	34.3	34.2	31.3	38.0
General	35.9	48.5	59.9	62.8	67.0	54.4
Gender (%)						
Male	96.8	99.6	100.0	100.0	100.0	99.3
Female	3.2	0.4	0	0	0	0.7

Source: Field Survey, 2011-12

Land Ownership & Cropping Pattern

Table 4.17 presents the land ownership pattern of the sample households. The data shows that average operational land holding in the study area was 4.41 ha per family with the size of holding ranging from 0.17 ha for marginal households to 17.27 ha for large households. The average farm size in selected states varied from 1.42 ha in Uttar Pradesh to 6.28 ha in Madhya Pradesh. About 85 per cent of the total cropped area was irrigated in the sample

villages of all states and it varied from about 79 per cent on large farms to 93.8 per cent on small farms. While there was a positive association between farm size and leased-in land in the study area, there was an inverse relationship between farm size and leased out land. Almost all leased-in land was irrigated and the share of leased-in land in total operational holding was the highest (15.4%) on large farms and the lowest (3.7%) on small farms. In terms of states, the share of leased-in land was the highest (2.21ha) in Madhya Pradesh, followed by Punjab (0.99 ha).

Groundwater was the main source of irrigation (62.5%) for all categories of households. This trend holds true for all states except Madhya Pradesh, where nearly 83 per cent of the area was irrigated by surface water and about 17 per cent through groundwater. However, for different farm sizes, share of groundwater was the highest (71.9%) on marginal farms and the lowest (54.9%) on large farms (Table 4.18).

Table 4.17: Land ownership pattern of sample households in the survey areas

(ha)

Farm Size	Total owned land (1)		Leased-in-land (2)		Leased-out-land (3)		Total operational holding (1+2-3)		
	I	UI	I	UI	I	UI	I	UI	Total
Marginal	0.16	0.03	0.00	0.00	0.00	0.01	0.15	0.01	0.17
Small	1.53	0.13	0.05	0.01	0.07	0.04	1.51	0.10	1.61
Semi-Medium	2.55	0.37	0.27	0.01	0.08	0.05	2.74	0.33	3.08
Medium	4.68	0.97	0.83	0.03	0.08	0.06	5.42	0.94	6.36
Large	11.15	3.64	2.52	0.14	0.00	0.17	13.66	3.61	17.27
All farms	***3.24***	***0.72***	***0.53***	***0.02***	***0.06***	***0.05***	***3.72***	***0.69***	***4.41***
States									
Haryana	2.12	0.38	0.1	0.02	0.00	0.00	2.22	0.40	2.62
UP	1.42	-	-	-	-	-	1.42	-	1.42
Punjab	3.26	-	0.99	-	0.03	-	4.22		4.22
Rajasthan	1.83	2.80	0.09	0.18	0.07	0.02	1.83	2.79	4.62
MP	4.06	0.06	2.21	0.00	0.05	0.00	6.22	0.06	6.28

Source: Field Survey, 2011-12

Table 4.18: Main source of irrigation (%) on sample households

Farm category	Surface	Groundwater	Surface + GW	Others
Marginal	14.8	71.9	12.8	0.5
Small	17.0	61.7	18.7	2.6
Semi-medium	18.0	62.3	14.1	5.6
Medium	22.1	59.4	8.2	10.3
Large	24.1	54.6	12.8	8.5
All Farms	***18.8***	***62.5***	***13.3***	***5.4***
States				
Haryana	-	82.5	17.4	0.0
Uttar Pradesh	6.9	93.1		0.0
Punjab		61.0	18.0	21.0
Rajasthan	21.0	58.7	-	2.2
M.P.	82.9	17.1	0.0	0.0

Source: Field Survey, 2011-12

Cropping Pattern and Crop Yields

The cropping pattern in the study area is dominated by rice (21.4%) in kharif and wheat (39.2%) in rabi season, accounting for over 60 per cent of the gross cropped area (Table 4.19). The area under pulses during kharif season was lower (0.5%) than during rabi season (7%). The area under oilseeds was about 3.3 per cent and 2.3 per cent in kharif and rabi seasons, respectively. The area under wheat was the highest on marginal farms (47.9%) and the lowest (35.9%) on medium farms.

The average yield of wheat on sample households was 4113 kg per ha, significantly higher than the national average. The crop yields were significantly higher in Punjab and Haryana, at almost 5.3 t/ha and 4.6 t/ha, respectively (Table 4.20). By contrast, productivity in other states, namely, Uttar Pradesh, Rajasthan and Madhya Pradesh, was lower than the sample average but higher than the state average yields. The highest yield was recorded in Punjab (5342 kg/ha), followed by Haryana (4573 kg/ha), Uttar Pradesh (3661 kg/ha), Rajasthan (3586 kg/ah) and the lowest in Madhya Pradesh (3504 kg/ha). The ranking of sample states

based on sample household yield is the same as per state average yields. These results show that yield can be improved in Madhya Pradesh, Uttar Pradesh and Rajasthan.

Table 4.19: Cropping pattern *(% of GCA)* on sample households

Season/ Crop	Marginal	Small	Semi-Medium	Medium	Large	All Farm
Kharif						
Rice	22.8	21.0	24.1	20.8	20.8	21.4
Pulses	0.0	0.1	0.2	0.8	1.7	0.5
Oilseeds	0.5	0.7	1.3	3.3	17.1	3.3
Others	18.1	16.4	16	16.6	9.1	13.6
Rabi						
Wheat	47.9	41.1	39.3	35.9	41.3	39.2
Pulses	0.7	4.0	5.3	8.5	7.3	7.0
Oilseeds	0.8	3.8	3.1	3.3	0.9	2.3
Others	2.7	4.5	5.1	4	3.1	3.9

Source: Field Survey, 2011-12

Table 4.20: Average productivity (kg/ha) of wheat on sample households

State	Marginal	Small	Semi-Medium	Medium	Large	All Farm
Haryana	4703	4494	-	4639	4530	4573
UP	3644	3676.5	-	3663	3728	3661
Punjab	5251	5104	-	5234	5420	5342
Rajasthan	3175	3406	3981	3568	3400	3586
MP	3166	3522	-	3864	3463	3504
All	***3988***	***4041***	***3981***	***4194***	***4108***	***4133***

Source: Field Survey, 2011-12

Farm Machinery Investment

Farmer's investment in farm machinery and equipment is a major capital input in farm business. The investment pattern on different farm categories of sample households is given

in Table 4.21. The average investment on farm machinery for the sample farms was about Rs. 8,59,193 per ha. Combine harvester accounted for the largest share (46%) in total investment, followed by tractors and farm equipments (34.1%) and tube wells (13%). The average investment was the highest on semi-medium farms, followed by large and the lowest on small farms. Only semi-medium, medium and large farmers owned combine harvesters as investment cost was very high.

Table 4.21: Farm machinery investment on the sample households

Farm Size	Farm machinery investment (Rs./ha)				
	Tractors & Implements	Combine Harvester	Threshing Machine	Tube Well	Average Investment
Marginal	288950	-	28000	63885	380835
Small	202879	-	57400	96555	356834
Semi-Medium	257070	1380000	63600	113553	1814223
Medium	327031	101316	65902	130073	624322
Large	512593	274211	93750	184779	1065333
All	***293109***	***395294***	***59150***	***111639***	***859193***

Source: Field Survey, 2011-12

Livestock Ownership

Farmers retain part of their harvested grains for their own purposes including for animals as livestock feed. Therefore, it's important to study livestock ownership pattern on sample households. The average number of animals ranged from 2 on marginal farms to 4.3 on large farms, with an average of 3.3 animals per household (Table 4.22). The average number of animals owned by sample households varied from 1.5 in Uttar Pradesh to 5.7 in Punjab.

Table 4.22: Livestock ownership pattern (number/household) on sample households

Farm Size	Cattle	Buffalo	Others	Total
Marginal	0.5	1.1	0.4	2.0
Small	0.8	1.3	0.8	2.9
Semi-Medium	0.8	1.6	1.0	3.3
Medium	1.0	1.9	1.1	3.9

Large	1.0	2.1	1.2	4.3
All Farms	***0.8***	***1.6***	***0.9***	***3.3***
States				
UP	-	1.4	0.0	1.5
Punjab	1.1	2.7	1.9	5.7
Rajasthan	1.3	1.9	1.5	4.7
MP	2.0	1.0	0.0	3.0

Source: Field Survey, 2011-12

Marketed Surplus of Wheat and Farmers' Participation

In this section, we will first examine the behavioural pattern of marketed and marketable surplus of wheat farmers in selected states, and then various factors influencing marketed surplus.

Wheat is a main rabi crop in the study area, and farmers are producing for self-consumption or meeting their other requirements as well as for the market. The average production per household was the highest (274.4 q) on large farms, followed by medium (135.2 q), semi-medium (76.1q), small (36.2q) and the lowest (21.6q) on marginal farms (Table 4.23). Almost a similar trend was observed in case of sales and retention. At household level, average farm retention (self-consumption, seed, and other purposes) was 15.3 per cent of the total production but varied from 11.6 percent on large farms to 33.3 per cent on marginal farms. In the case of selected states, average farm retention was about 10 percent in Punjab and the highest (38.7%) in Rajasthan, which is evident as wheat is an essential part of the daily diet in the northern part of India. About 60 per cent of the total retention was for self-consumption, followed by for seed (21.4%) and feed purpose (12.9%). The retention for self-consumption was the highest (81.9%) on marginal farms and the lowest (41.7%) on large farms. It is interesting to note that farmers bought wheat from the market for self-consumption and the share was higher in case of marginal (14.5% of total consumption) and small (7%) farmers. Since small and marginal farmers need cash for next crop and other requirements and have poor access to institutional credit, they are forced to sell part of the grains after harvest and buy at a later date at a higher price.

Madhya Pradesh had the highest output per farm (210.6 q), followed by Punjab (203 q) and the lowest (47.5 q) output per farm was in case of Rajasthan. On an average, about 39 per cent of the total output was retained for domestic use in Rajasthan, while in Punjab only 10 per cent of the produce was retained for domestic use. The share of total output for self-consumption was the highest (81%) in Rajasthan and the lowest (30.2%) in Madhya Pradesh. The wheat growers in Madhya Pradesh kept more than one-third of the total produce retained for seed purpose because seed replacement rate is lower in the state compared with other states. In case of Punjab and Haryana, higher share of produce was kept for feed purpose as these states are the main milk producing states.

Table 4.23: Average wheat production, sales and retention pattern on sample households

(in qtls)

Farm Size	Production	Self-consumption		Seed (2)	Feed (3)	Others (4)	Total Retention (1+2+3+4)
		Retention (1)	Purchased				
Marginal	21.6	5.9	1.0	0.6	0.6	0.1	7.2
Small	36.2	6.6	0.5	0.9	1.0	0.3	8.8
Semi-medium	76.1	8.6	0.3	1.9	1.7	0.5	12.8
Medium	135.2	10.1	0.1	4.2	2.5	1.2	18.0
Large	274.4	13.3	0.2	11.9	4.4	2.3	31.9
All farms	***91.4***	***8.5***	***0.4***	***3.0***	***1.8***	***0.8***	***14.0***
States							
Haryana	97.4	7.3	0.0	2.2	4.7	1.3	16.7
Punjab	203.0	12.7	0.0	3.1	3.3	1.1	20.2
U.P.	44.6	8.7	0.0	1.1	1.1	0.1	11.0
M.P.	210.6	15.8	4.5	18.2	6.1	12.1	52.3
Rajasthan	47.5	14.9	2.8	1.1	1.7	0.7	18.4

Source: Field Survey, 2011-12

In order to understand the response of farmers to higher prices, farmers were asked, whether they would increase their marketed surplus if given higher output price. About 10 per cent of the farmers responded positively and expressed their willingness to sell more in

the market (Table 4.24). More than 90 per cent of the households reported that they would reduce retention for seed and feed purpose and sell more in the market. Only six per cent of the sample households expressed their desire to reduce retention for self-consumption and 2.4 per cent for change in consumption pattern. These findings are in line with a strong preference of wheat consumption in the selected states.

Table 4.24: Farmers willingness to increase sales at higher prices

	Marginal	**Small**	**Semi-medium**	**Medium**	**Large**	**All**
Willing to sell more (%)	20.0	14.0	6.1	4.8	8.5	10.3
If Yes, Source						
Less Retention for seed and feed	97.6	94.1	100.0	84.6	62.5	91.2
Less Retention for self-consumption	0.0	5.9	0.0	7.7	37.5	6.4
Change in consumption pattern	2.4	0.0	0.0	7.7	0.0	2.4

Source: Field Survey, 2011-12

Table 4.25 presents the average marketable and marketed surplus of wheat on sample households. The results show that 83 per cent of the total wheat output in the selected states is offered as marketable surplus. The share of small and marginal farmers is much below than the average, while the share of medium and large farmers is higher than this average. It is also evident that marketable surplus increased in direct proportion to the size of land holding. In the case of marginal farmers, a greater share of production is kept for self-consumption.

The data shows that there is a small gap between marketable and marketed surplus due to various reasons on different size of land-holdings. Since marketed surplus represents actual sale by farmers, there may be a difference between marketable and marketed surplus. The gross marketed surplus (sales as a proportion of production) on marginal farms is lower (61.2%) than marketable surplus (64.8%). The marketed surplus was the highest (86%) on large farms, followed by medium (82.6%), semi-medium (77.7%) and the lowest on marginal farms (61.2%).

The net marketed surplus as shown in the Table is, however, different and is lower than the gross marketed surplus on marginal and small farms. On the other hand, the gross and net marketed surplus ratios are the same on medium and large farms. The gap between gross and net marketed surplus on small and marginal farms is due to the fact that small and marginal farmers sell their produce after the harvest to meet their financial requirements for the next crop and other social obligations and then buy back at a later date, mostly at a much higher price.

Table 4.25: Average marketable surplus and gross and net marketed surplus of wheat on different categories of households

	Marketable Surplus		**Gross Marketed Surplus**		**Net Marketed Surplus**	
	Quantity (qtl)	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***
Marginal	15.9	64.8	15.0	61.2	13.8	56.3
Small	33.0	72.2	31.7	69.4	30.6	66.9
Semi-medium	76.2	79.9	74.0	77.7	73.5	77.1
Medium	159.8	84.7	155.8	82.6	155.5	82.5
Large	416.2	88.1	405.9	86.0	405.8	86.0
All farms	***100.9***	***83.0***	***98.1***	***80.7***	***97.4***	***80.1***
State						
Haryana	81.1	82.9	81.1	82.9	81.1	82.9
Punjab	182.8	90.1	182.8	90.1	182.8	90.1
U.P.	26.6	68.6	25.2	65.1	25.2	65.1
M.P.	158.3	75.2	173.9	82.6	169.4	80.4
Rajasthan	29.6	61.6	26.1	54.3	23.2	48.4

Source: Field Survey, 2011-12

It is interesting to note that marketable and marketed surplus ratios are same in case of Punjab and Haryana while in Uttar Pradesh and Rajasthan, marketed surplus is lower than the marketable surplus. This indicates that the farmers may be holding stocks due to low prices just after harvest because of the weak procurement system in the states and sell in the market, either when crop price rises in future or during emergencies. In case of Madhya Pradesh, gross marketed surplus (82.6%) is higher than marketable surplus (75.2%). In

Madhya Pradesh and Rajasthan, net marketed surplus is lower than gross marketed surplus thereby indicating that farmers sell their produce just after harvest due to high prices (state government bonus over and above MSP) and buy from the public distribution system at lower prices. The gross marketed surplus was the highest (90.1%) in Punjab, followed by Haryana (82.9%), Madhya Pradesh (82.6%) and the lowest (54.3%) in Rajasthan. Similar trend was also observed in case of net marketed surplus.

The share of various farm size groups in total output, marketed surplus, and area operated as well as farmers' participation in wheat marketing are given in Table 4.26. The results show that more than two-thirds of total output of sample households was contributed by medium and large farms while marginal farmers contributed about 5 per cent. A comparison of the shares of respective farm size groups in the total marketable surplus shows that marginal farmers contribute the lowest quantity (4.1%), whereas medium farms offered the highest share of marketable surplus accounting for about 35 per cent of the total marketable surplus. The share of small and marginal farmers in total output as well as marketed surplus was higher than their share in total area under wheat. More than 96 per cent of sample households participated in the marketing of wheat, and there was no significant difference among various farm categories. These results show that all farmers including small and marginal farmers have access to markets and the main reason for market access is effective government procurement system of wheat in all selected states.

Among various states, Punjab had the highest share in wheat output as well as in marketed surplus, followed by Haryana. The proportion of farmers selling wheat was lowest (84.6%) in Madhya Pradesh compared with other states, where it was almost 100 per cent.

The distribution of farmers presented in Table 4.27 shows that about 90 per cent of Punjab wheat producers and 70 per cent of producers in Haryana sold more than 70 per cent of the total output. On the other hand, less than 40 per cent of farmers in Rajasthan sold more than 70 per cent of their produce. Nearly 48 per cent of the farmers in Rajasthan sold less than 60 per cent of the total wheat produced and retained more than half of production, while this share was very low in Punjab (3%), Haryana (13.7%) and Madhya Pradesh (14%). These findings show that the level of market participation was very high in Punjab, Haryana and Uttar Pradesh compared with Rajasthan.

Table 4.26: Market participation by wheat producers by size of farm

Farm Size	Share of Output	Share of Marketed Surplus	Share of Area Operated	Proportion of Farmers who Sold
Marginal	5.0	4.1	2.7	96.4
Small	9.7	8.5	8.2	95.4
Semi-Medium	19.0	18.4	17.3	96.3
Medium	34.5	34.9	35.4	96.3
Large	31.9	34.1	36.3	97.3
All Farm	***100.0***	***100.0***	***100.0***	***96.2***
States				
Haryana	21.6	21.4	36.6	100.0
Uttar Pradesh	7.7	7.2	4.9	100.0
Punjab	45.0	48.4	23.6	99.7
Rajasthan	15.5	14.7	11.7	100.0
M.P.	10.3	8.2	23.2	84.6
All	***100.0***	***100.0***	***100.0***	***96.2***

Source: Field Survey, 2011-12

Table 4.27: Distribution of gross marketed surplus in selected states

Qty Sold	Punjab	Haryana	UP	Raj	MP	All
<60%	3.0	13.7	19.0	47.9	14.0	20.3
60-70%	7.3	16.3	17.5	15.1	25.0	14.7
70-80%	14.7	32.0	37.5	21.2	46.0	27.1
80-90%	39.3	30.3	23.0	12.3	15.0	25.7
90-100%	35.7	7.7	3.0	3.4	0.0	12.2

Source: Field Survey, 2011-12

Marketing Pattern by Type of Market and Buyer

Participation of farmers in markets is determined by various factors such as their asset position, access and proximity to markets, access to infrastructure, market information, etc.

In this section, we have analysed farmers' access to different markets e.g. regulated or unregulated, near or distant and market agencies like public, private, industry, etc.

Farmers' access to different markets varies widely across states and farm categories, as shown by the results from the survey data in Table 4.28. Majority of marginal and small farmers sold their produce in the local market as they had small volumes of marketed surplus while medium and large farmers sold their produce in the distant markets. About half of the sample farmers sold wheat in the regulated markets while remaining half sold their produce in unregulated markets. However, pattern of market access gives a somewhat different picture when analysis is carried out by size of farm. In case of marginal farms, about two-thirds sold in the regulated market while around 60 % of the large and more than 50% of the medium farmers sold in unregulated markets. The average distance covered to sell produce was 9.8 km, ranging from 9.3 km on small and semi-medium farms to 10.5 on medium farms but the difference was not significant.

Table 4.28: Sale pattern by type of market on selected households

Size of Farm	Sale in Local Market (%)	Distant Market (%)	Type of market (%)		Distance to market (Km)	Connected with Pucca road (%)
			Regulated	Unregulated		
Marginal	90.0	10.0	67.4	32.6	10.3	99.4
Small	67.6	32.4	46.8	53.2	9.3	97.8
Semi-Medium	46.7	53.3	50.0	50.0	9.3	95.8
Medium	52.6	47.4	48.0	52.0	10.5	96.9
Large	54.1	45.9	41.6	58.4	9.8	97.7
All farms	61.5	38.5	51.4	48.7	9.8	97.3

Source: Field Survey, 2011-12

More than 63 per cent of total marketed surplus was procured by government agencies, followed by private traders (20.4%) and less than 5 per cent by millers/processors (Table 4.29). Large farmers sold about 91 per cent of the marketed surplus to government agencies

while small farmers sold about 25.3 per cent to government agencies. The price paid by private traders and processors was lower than the price paid by public agencies. However, large farmers received marginally higher price from private traders and the prices received was also higher compared to small and marginal farmers, thereby indicating that large farmers had better bargaining power compared with small and marginal farmers.

Table 4.29: Sale pattern by type of buyer on selected households

Farm Size	To whom and quantity sold in percent and Price in Rs.							
	Govt. Agencies		Pvt. Trader		Processor/Miller		Others	
	Qty.	Price	Qty.	Price	Qty.	Price	Qty.	Price
Marginal	25.3	1262	17.4	1204	20.0	1285	37.4	1285
Small	71.6	1307	28.4	1225	0.0	0	0.0	0
Semi Medium	78.7	1299	21.3	1227	0.0	0	0.0	1285
Medium	70.0	1315	18.5	1276	0.0	0	11.5	1292
Large	90.8	1336	9.2	1364	0.0	0	0.0	0
All Farm	63.2	1298	20.4	1243	4.8	1285	11.6	892

Source: Field Survey, 2011-12

Access to Markets and Market Information

Farmers' awareness of Minimum Support Price (MSP), futures markets, credit facilities and sources of information, which are important factors influencing marketed surplus are presented in Table 4.30. About 73 per cent of the sample farmers in the study areas were aware of MSP, but the awareness was low in case of marginal farmers. Very few farmers, mainly large farmers, were aware of futures market. More than half of the sample households had access to institutional credit and kisan credit cards but small and marginal farmers had relatively poor access to credit. For example, 36.8 per cent marginal and 48.3 per cent small households had access to credit compared with more than 60 per cent of medium and around 57% of large farms. Similarly, only 42 per cent of the marginal farmers had kisan credit card in comparison to over 89 per cent in case of large farmers.

Market information plays an important role in risk management in agriculture. Therefore, improving market access for the farmers is important. Farmers use a variety of sources for

information and access to timely and reliable information can play a significant role in improving marketing efficiency and farm income. In order to understand farmers' access to price information, the sample farmers were asked about various sources of information and the results are presented in Table 4.30. The major sources of price information according to the respondents were traders (30.2), followed by print media (24.2%), visit to market (18.9%) and electronic media (14.1%). Large farmers had better access to print and electronic media while small and marginal farmers mainly depended on traders and other informal channels like visit to mandis.

Table 4.30: Farmers' awareness of minimum support price and sources of price information

Particulars	***Size of Farms***					
	Marginal	***Small***	***Semi-Medium***	***Medium***	***Large***	***All farms***
Aware of MSP (%)	37.1	70.2	84.6	84.6	87.2	72.7
Aware of Futures Trading (%)	0	0	0	2.2	11.7	1.6
Access to Credit (%)	36.8	48.3	61.3	64.1	57.4	54.2
Kisan Credit Card (%)	42.0	59.8	50.0	62.8	89.4	58.7
Sources of Information						
Traders	46.1	32.1	27.4	30.2	24.5	30.2
Print media	17.7	22.1	28.1	26.8	24.5	24.2
Visit to Market	16.8	27.1	14.8	15.4	17.3	18.9
Electronic media	12.1	8.7	12.3	14.4	19.3	14.1
Cooperative Society	4.7	8.4	10.6	9.7	6.1	8.4
Others	2.6	1.6	6.8	3.5	8.3	4.2

Source: Field Survey, 2011-12

Determinants of Marketed Surplus of Wheat

In order to examine impact of various price and non-price factors influencing marketed surplus of wheat, a linear regression model was used. The dependent variable was marketed surplus (% of total output) per household and independent variables included in the model were farm size, family size, price received by farmer, awareness about MSP, access to

regulated market, distance of farm from main market and access to institutional credit. The model is estimated for each of the four major farm size categories, marginal, small, medium and large and for all farms combined. The descriptive statistics of variables used in the analysis are given in Table 4.31.

The average marketed surplus of sample households varied from zero to 100 per cent. The farm size ranged from 0.13 ha to 28.3 ha. The average price received by sample households was Rs. 1210 per quintal and family size varied from one person to 32. The frequency distribution of awareness about MSP shows that most of the households (72.6%) were aware about MSP and only 27.4 per cent were not aware of MSP being announced by the government. Less than 60 per cent households had access to regulated markets and institutional finance.

Table 4.31: Descriptive statistics of farm household attributes by farm size

	Mean	Std. Dev.	Median	Min.	Max
Dependent Variable					
Marketed surplus (%)	82.0	24.0	84.4	0.0	100.0
Explanatory variables					
Farm size (ha)	3.18	3.48	2.00	0.13	28.33
Family size (no)	7.3	3.9	6.0	1.0	32.0
Price received (Rs/q)	1210	454	1285	1000	1500
Dummy for awareness of MSP (%)	0.7	0.4	1.0	0.0	1.0
Dummy for access to regulated market (%)	0.6	0.5	1.0	0.0	1.0
Distance to market (km)	8.7	7.4	6.0	0.0	60.0
	Yes	No	-	-	-
Awareness about MSP (%)	72.6	27.4	-	-	-
Access to Regulated Market (%)	59.5	40.5	-	-	-
Access to Credit (%)	58.1	41.9	-	-	-

Source: Field Survey, 2011-12

The estimated regression parameters of the marketed surplus model are shown in Table 4.32. As expected, variables like farm size, price, awareness about MSP and access to regulated market have positive signs while family size and distance to markets have negative signs and most of the variables are statistically significant, indicating that they significantly influence marketed surplus. The relationship between farm size and marketed surplus is positive and statistically significant, indicating that with an increase in farm size, marketed surplus ratio also increases. This result holds for all farm-size categories except for large farms where it is positive but non-significant.

The existence of an inverse relationship between family size and marketed surplus shows that, higher the household family size, the lower was the marketed surplus and higher retention for self-consumption and other purposes mainly for seed and feed. Farmers retained a significant portion of produce for self-consumption as wheat is a main staple food in these states.

The results show that wheat price has a positive and significant impact on marketed surplus. The higher the price of wheat, the larger was the marketed surplus on all farm categories. The elasticity of marketed surplus of wheat to its own price is about 0.05, implying that a 1 per cent higher price is likely to induce a 0.05 per cent larger marketed surplus. The household's awareness of minimum support price (MSP) had a positive and significant impact on marketed surplus on all farm sizes while it was positive but non-significant on large farms. Access to regulated markets also had a positive and significant impact on marketed surplus ratio on all farm categories. This is highly plausible, as given better access to regulated markets, procurement agencies and higher price; farmers will sell more quantities. The longer the distance to a market, the higher was the marketed surplus in case of small and marginal farmers. In contrast, distance to market was not an important factor influencing marketed surplus on large farms. This is plausible as, given lack of transport facilities and small volumes on marginal and small farm, farmers sell the whole quantity after harvest and if needed, purchase from the market in future. Access to institutional credit was also an important determinant of marketed surplus. The above results clearly indicate positive effect of price, farm size, and market access on and a significant negative impact of family size on marketed surplus of wheat. Marginal and smallholders had a relatively lower marketed surplus, compared with large farmers.

Table 4.32: Factors influencing marketed surplus of wheat in selected wheat producing states

Factor	Farm Size				
	Marginal	**Small**	**Medium**	**Large**	**All**
Constant	-9.9601 (9.8982)	-12.7595*** (5.3975)	-4.4195 (2.9974)	3.9395 (12.6335)	-9.4746*** (2.3290)
Farm Size	25.5780*** (4.9550)	9.8721*** (2.4190)	0.8822*** (0.3146)	0.5537 (0.490)	1.5778*** (0.1398)
Family Size	-0.2042 (0.2921)	-1.1363*** (0.2506)	-0.9108*** (0.170)	-1.1790*** (0.4174)	-0.7677*** (0.1232)
Price Received	0.0296*** (0.0073)	0.0483*** (0.0034)	0.0552*** (0.0021)	0.0537*** (0.0063)	0.0502*** (0.0018)
Awareness about MSP	8.9237*** (2.4133)	10.2088*** (1.9715)	11.1397*** (1.6934)	3.9985 (7.4175)	13.2723*** (1.1372)
Access to Regulated Market	5.5590*** (2.2153)	4.3902*** (1.5618)	10.2501*** (1.3534)	15.1417*** (4.4372)	7.6013*** (0.9754)
Distance to Market	0.4445*** (0.1387)	0.0381 (0.1125)	-0.3451*** (0.0859)	0.7783 (0.4795)	-0.0440 (0.0665)
Access to Credit	1.4932 (2.1732)	3.6403** (1.6246)	3.6478** (1.4404)	-0.0334 (4.7684)	4.9134*** (1.0153)
R^2	0.32	0.61	0.75	0.84	0.62

Figures in parentheses show standard error of regression coefficients.
****, ** and *: Statistically significant at the 1%, 5% and 10% level, respectively.*

The relative importance of factors in influencing marketed surplus as measured by standardized regression coefficients indicated that the price received by farmers was the most important factor, followed by awareness of MSP, farm size and access to regulated markets. Distance to market was the least important variable in influencing marketed surplus of wheat.

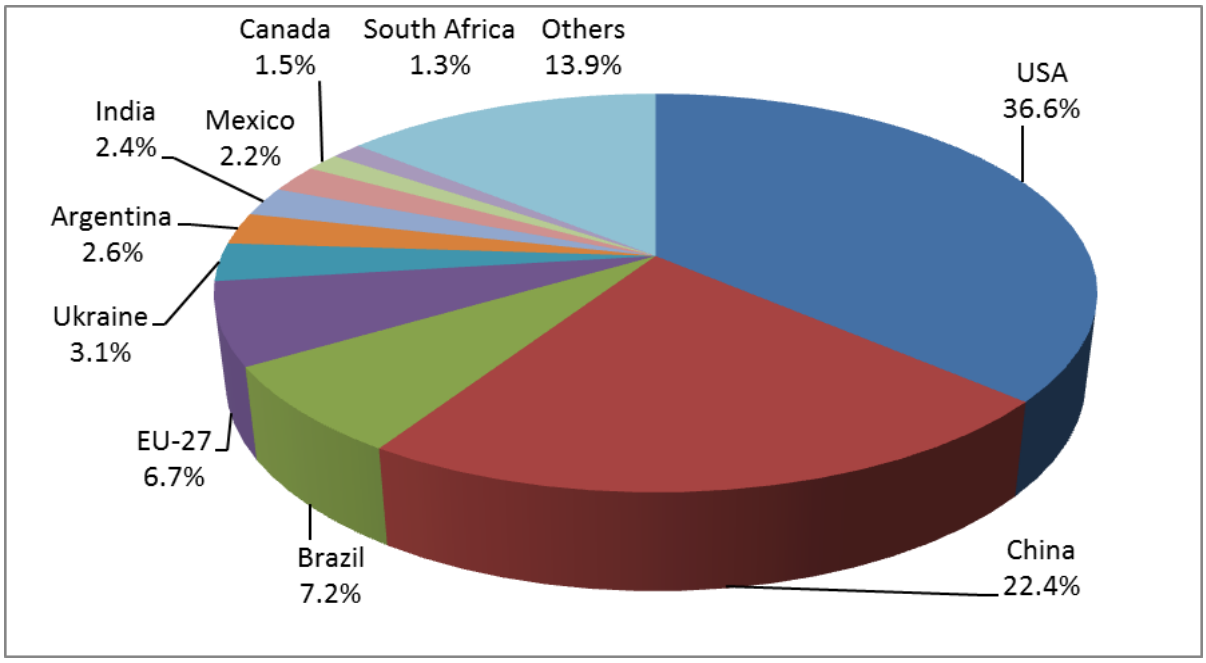
Chapter 5

Overview of Maize Economy: Production, Procurement and Marketed Surplus

Worldwide, maize is the most important cereal crop and ranks first in terms of production among cereals, just ahead of wheat and significantly ahead of rice. World production of maize in 2013-14 stood at about 967 million tonnes, with the largest producer, the United States, producing 36.6 per cent. China produces 22.4 per cent, the second largest producer in the world with 217 million tonnes, followed by Brazil (7.2%), EU-27 (6.7%) and Ukraine (Figure 5.1).

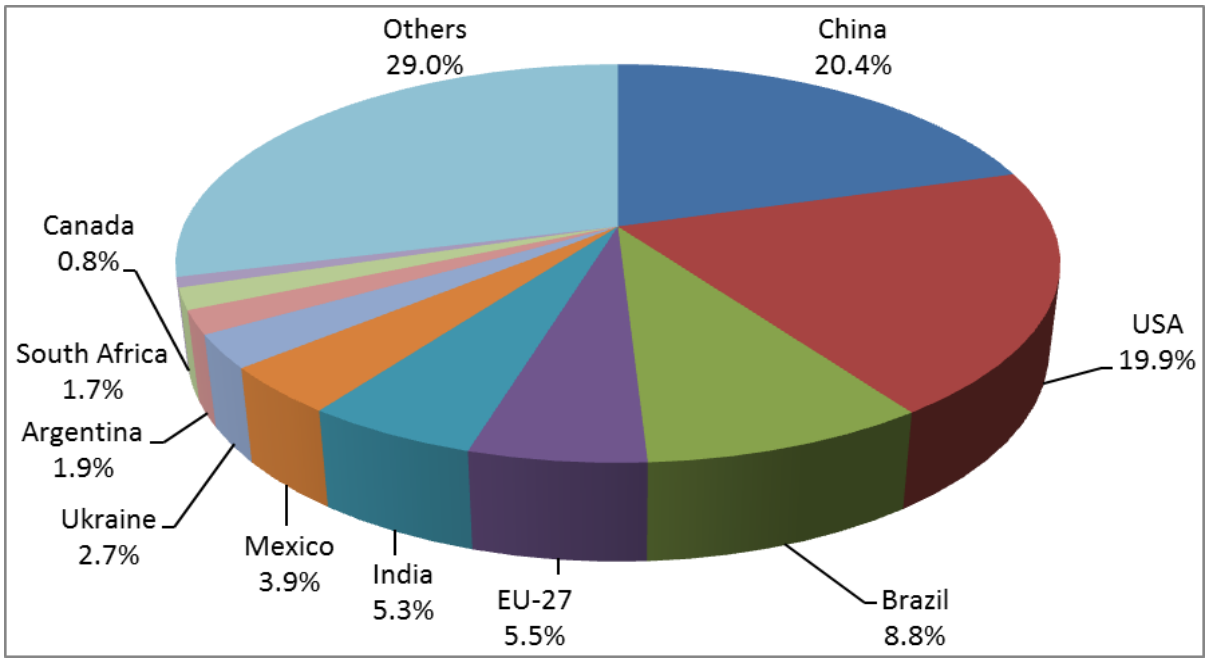
India is among the top ten producers of maize, ranking seventh in production with about 2.4 percent share in the global production. In terms of acreage, India ranked fifth in the world during 2012-13. Out of the ten major maize producing countries, the major maize producers like the United States (19.9%) and China (20.4) also have the largest area under maize. However, China ranks number one in acreage but second in production (Figure 5.2). Despite India's impressive position in acreage and production, it has a very small share in total world production and acreage. India produces about 2.4 percent of the world's maize production despite the fact that India accounts for over 5 percent of the world's area under maize. This highlights an important issue of low productivity levels of maize in the country. India not only has low yield levels compared to many other major producers of maize in the world, but also has a lower yield than the world average. Although Indian yield has improved during the last decade but is still less than half of the world average and about 25 percent of the US yields (Figure 5.3). Indian yields are even lower than Brazil, South Africa and Mexico. One of the main reasons for low yields in the country is that about three-fourth of maize is grown under rainfed conditions and about 25 percent area is under irrigated conditions, which has more or less remained stagnant during the last two decades (about 22% in early-1990s to 24% in recent years). The other reason for low yields is use of traditional varieties, which have typically very low yield levels.

Figure 5.1: World maize production, 2013-14



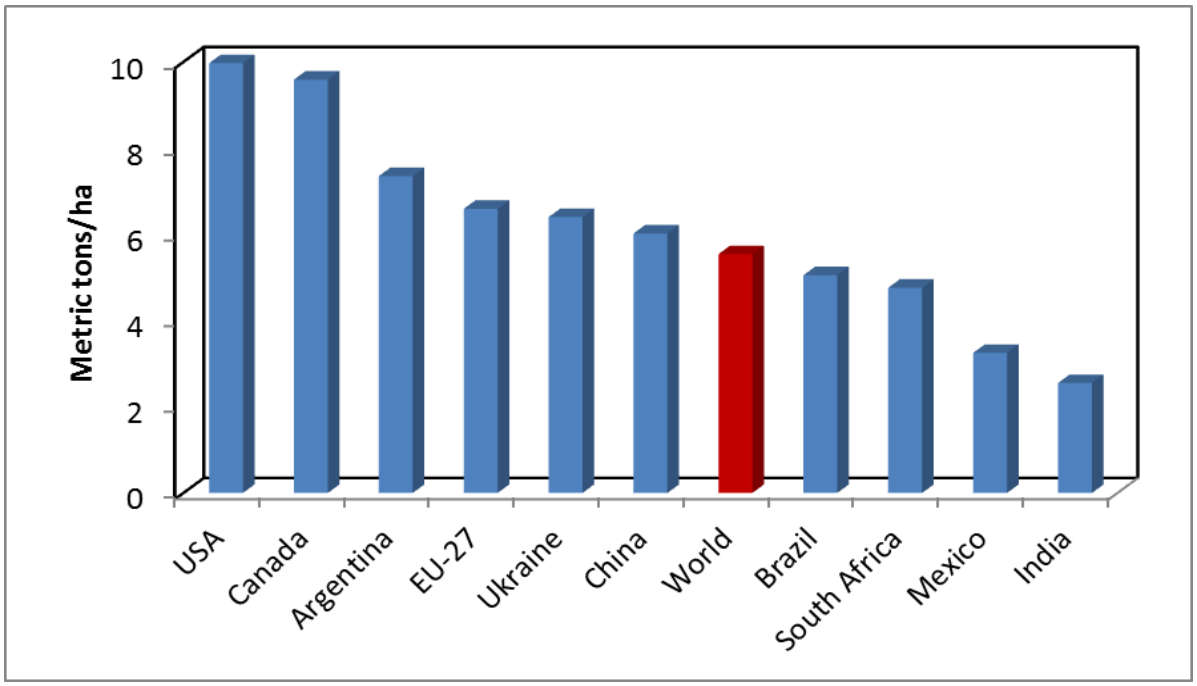
Source: The World of Maize 2005 (www.ncga.com)

Figure 5.2: World maize acreage, 2012-13



Source: USDA, Foreign Agricultural Service (http://apps.fas.usda.gov/psdonline/)

Figure 5.3: World maize yields, 2013-14



*Source: USDA, Foreign Agricultural Service (*http://apps.fas.usda.gov/psdonline/)

Trends in Area, Production and Yield

In India, maize ranked third (22.8 million tonnes) in volume among the cereals, next only to rice (105.7 million tonnes) and wheat (94.8 million tonnes), and contributed about 9.4 percent to the country's total cereals production in the TE2013-14 (MoA, 2014). Maize is grown in a wide range of production environments in the country. Total area under maize in the country has increased from 5.8 million ha in triennium ending (TE) 1973-74 to about 8.7 million ha in TE2012-13 (Table 5.1) while production increased from 5.7 million tonnes to about 21.9 million tonnes during the same period. The average yield of maize also increased from 986 kg per ha in TE1973-74 to 2528 kg per ha during TE2012-13 but is still much lower compared to the world average and major producers like the United States and China (4.93 t/ha).

Maize production in the country increased at an annual growth rate of 3.28 per cent during 1971-2012 while area and yield increased at 0.96 per cent and 2.34 per cent, respectively during the same period. Production of maize has continued to increase during the last four decades, with yield being a major contributor (>70%) to the increased production. Maize production increased at an annual compound growth rate of 1.4 per cent during the 1970s,

which accelerated to 2.6 per cent in the next decade and reached 5.88 per cent during the last decade, the highest in the last four decades. During the nineties, production of almost all cereals, including rice and wheat witnessed deceleration in growth rates but maize production exhibited an impressive positive and accelerated growth rate (3.74%) and performed better than other cereals. The growth rate in area under maize also increased from 0.07 per cent in 1980s to 1.17 per cent in the nineties and 2.62 per cent during the last decade. It must be noted that during the last two decades, in new non-traditional maize growing areas, more acreage has been brought under maize cultivation and the contribution of area was very close to the contribution of yield in increased production. The contribution of acreage has increased from less than five percent in 1970s and 1980s to about 45 per cent in the 2000s.

Table 5.1: Average area (million ha), production (million tonnes), and yield (kg/ha) of maize in India: 1971-72 to 2012-13

	1971-72 to 1973-74	1981-82 to 1983-84	1991-92 to 1993-94	1999-00 to 2001-02	2010-11 to 2012-13
Area	5.8	5.8	5.9	6.5	8.7
Production	5.7	7.2	9.3	12.3	21.9
Yield	986	1220	1551	1871	2528
CAGR (%)					
	1970s	**1980s**	**1990s**	**2000s**	**All Period**
Area	0.03	0.07	1.17***	2.62***	0.96***
Production	1.40	2.60	3.74***	5.88***	3.28***
Yield	1.36	2.52	2.55***	3.17***	2.34***
Coefficient of Variation (%)					
Area	2.50	2.01	3.81	9.00	14.10
Production	10.73	15.85	12.17	21.02	44.25
Yield	9.18	14.66	9.09	13.18	29.22

Source: Authors' calculations from GoI (2013)

Maize yields have also increased significantly during the last 3 decades. The compound annual growth rate in maize yields increased from less than 1.5 per cent in 1970s to 3.17 per cent in the 2000s. The variability in production of maize as measured by coefficient of

variation has increased during the last decade compared with 1990s and area variability has contributed more than yield variability. One of the reasons for high fluctuations in crop production and area is high dependence on rains particularly during kharif season.

Regional and Seasonal Trends and Patterns

Maize is endowed with a formidable capacity to adapt to a wide range of climatic conditions and is successfully grown in various parts of the country under different agro-climatic conditions ranging from hot-arid plains of Rajasthan and Gujarat to the humid climate of Assam and other hilly areas. There are three distinct seasons for the cultivation of maize, namely, kharif, rabi and spring. While an overwhelming share of maize is cultivated in kharif (monsoon) season, in Peninsular India and Bihar, it is grown during rabi (winter) season, and in certain parts of north India, maize is also grown during spring (zaid) season. However, data on spring maize are not at all available from the published sources. The government estimates provide information only about kharif and rabi seasons. The share of kharif maize has declined while that of rabi season crop has increased significantly during the last two decades. For example, share of kharif maize has reduced from over 92 per cent in early-1990s to about 75 per cent in TE2011-12 while that of rabi crop has increased from about 7.5 per cent to about 25 per cent during the same period. Rabi crop is grown in more favorable and irrigated environments and therefore productivity is also higher (3820 kg/ha) compared with kharif maize (2086 kg/ha).

Maize cultivation can also be classified into two production environments, namely, traditional maize growing areas, like Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, and Himachal Pradesh and non-traditional maize areas, including Karnataka, Tamil Nadu and Andhra Pradesh. In traditional areas, the crop is grown mainly as a subsistence crop to meet food needs while in non-traditional areas it is grown for commercial purposes, mainly to meet the feed requirements of the poultry sector.

Maize is grown under different agro-climatic conditions but production is concentrated in few states. An analysis of regional shifts in maize production during the last three decades provides interesting insights. Maize has experienced a marked regional shift in the production as well as acreage (Table 5.2 and 5.3). Traditionally, maize was grown in

northern states of Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan accounting for nearly two-thirds of total maize acreage and over half of the total production in TE 1983-84.

Table 5.2: Share of major states in maize production in India: TE1983-84 and TE2011-12

State	Share in all-India production				Share in food grains production in state			
	TE1983-84	TE1993-94	TE2001-02	TE2011-12	TE1983-84	TE1993-94	TE2001-02	TE2011-12
Traditional States								
Bihar+ Jharkhand	12.1	14.0	13.3	8.8	10.2	11.3	11.5	12.7
Bihar	-	-	12.2	7.5	-	-	12.6	14.3
Jharkhand	-	-	1.3	1.3	-	-	7.6	9.4
Gujarat	5.5	4.7	4.6	3.6	4.3	10.0	14.6	9.3
H.P.	6.8	6.8	5.8	3.2	47.0	47.5	51.3	48.9
J&K	5.4	5.6	4.2	2.5	31.6	36.2	40.7	34.4
MP+Chhattisgarh	12.8	13.1	12.3	6.5	6.6	6.7	8.4	5.5
M.P.	-	-	11.8	5.6	-	-	12.2	7.5
Chhattisgarh	-	-	0.8	0.8	-	-	2.3	2.9
Punjab	8.0	4.1	3.6	2.4	4.0	1.9	1.8	1.8
Rajasthan	12.4	9.8	9.4	8.1	10.3	9.8	10.0	9.6
UP+Uttarakhand	13.8	15.0	12.2	6.0	3.7	3.7	3.3	2.5
U.P.	-	-	12.2	5.7	-	-	3.4	2.5
Uttarakhand	-	-	0.5	0.2	-	-	3.2	2.3
Non-traditional States								
Andhra Pradesh	8.9	8.2	12.3	17.2	5.5	6.1	10.1	19.2
Karnataka	5.7	10.1	14.1	19.2	7.3	10.6	17.6	31.3
Maharashtra	1.8	2.9	3.6	11.4	1.2	2.1	3.9	16.9
Tamil Nadu	0.8	0.7	1.2	6.4	0.9	0.7	1.7	15.3
All India	100.0	100.0	100.0	100.0	5.1	5.0	5.9	8.3

Source: Authors' calculations from GoI (2013)

In contrast, as recently as in the TE2011-12, it is peninsular India that has emerged as a dominant maize-growing region accounting for about 43 per cent of the total production.

Three states, namely, Andhra Pradesh, Karnataka and Tamil Nadu increased their share in total acreage from less than 10 per cent in TE1983-84 to 27.4 per cent in TE2011-12 while production share increased from 15.4 per cent to 42.8 per cent during the same period.

Table 5.3: Share of major states in area under maize in India: TE1983-84 and TE2011-12

State	**Share in all-India acreage**				**Share in Gross Cropped Area in state**			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2011-12***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
Traditional States								
Bihar+ Jharkhand	13.9	11.8	11.1	9.9	7.8	7.2	7.3	10.8
Bihar			9.29	7.63			7.5	8.8
Jharkhand			1.76	2.32			5.5	15.2
Gujarat	5.4	6.1	6.2	5.9	2.9	3.4	3.8	4.2
Himachal Pradesh	5.0	5.2	4.6	3.5	30.2	31.9	31.4	31.1
J&K	4.7	5.0	5.0	3.6	27.7	27.5	29.5	27.1
MP+ Chhattisgarh	13.8	15.1	14.2	11.1	3.6	3.7	3.8	4.1
M.P.			12.96	9.87			4.1	3.8
Chhattisgarh			1.43	1.21			1.7	1.8
Punjab	5.4	3.1	2.5	1.6	3.4	2.5	2.1	1.7
Rajasthan	15.4	15.8	14.9	12.8	4.8	4.9	4.9	4.5
U.P.+ Uttarakhand	19.2	18.1	14.6	9.1	4.5	4.2	3.6	2.5
U.P.			14.06	8.79			3.6	2.9
Uttarakhand			0.54	0.33			2.9	2.4
Non-traditional States								
Andhra Pradesh	5.7	5.3	7.2	9.3	2.5	2.4	3.6	5.9
Karnataka	0.4	0.6	1.4	3.0	0.3	0.5	1.4	4.4
Maharashtra	2.8	5.1	9.5	15.1	1.4	2.4	5.1	10.2
Tamil Nadu	1.4	2.9	4.8	10.0	0.4	0.8	1.5	3.7
All India	100.0	100.0	100.0	100.0	3.3	3.2	3.5	4.4

Source: Authors' calculations from GoI (2013)

Maize production in Karnataka increased from about 405 thousand tonnes in TE1983-84 to about 3.85 million tonnes in TE2011-12. The state ranked first in maize production in the TE2011-12, although it had ranked 8th in TE 1983-84. The share of Karnataka in total maize production has increased from 5.7 per cent in TE1983-84 to about 10 per cent in TE1993-94 and reached 19.2 per cent in TE2011-12. Similarly, maize production has increased significantly in Andhra Pradesh, from about 632 thousand tonnes in TE1983-84 to about 3.5 million tonnes in TE2011-12 and its share in total production increased from 8.9 per cent to 17.2 per cent during the same period. In Tamil Nadu, maize production has increased from 55 thousand to about 1.3 million tonnes during the same period. In contrast, traditional maize-growing states have lost their share in total acreage as well as production during the last three decades. Uttar Pradesh, the largest producer of maize in the eighties lost its share from 13.8 per cent in TE1983-84 to about 6 per cent in TE2011-12. Similarly, in Madhya Pradesh, the second largest producer during the eighties, the share in total production declined from 12.8 per cent in TE1983-84 to about 6.5 per cent during the TE2011-12. Other states, which lost their shares, include Rajasthan, Bihar, Punjab, Himachal Pradesh, Gujarat and Jammu & Kashmir.

Indian maize yields are lower compared to other maize producing countries such as China, USA, Brazil as well as the world average, though there is a considerable regional variation among the yield levels of different producing states. Table 5.4 presents data on maize yield major producing states. Maize yields, which were low (about 1252 kg/ha) during the early-1980s, witnessed a steady increase during the last three decades and reached a level of 2284 kg/ha in the recent period (2006-11). However, a comparison of yield across major producing states shows considerable variations. The states that have higher than national average yield are large producers like Karnataka, Andhra Pradesh, Maharashtra, and Bihar. In this group, other states are Punjab, Himachal Pradesh and West Bengal. In contrast, important traditional maize growing states such as Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, have yield levels below the All-India average. The average yield in Andhra Pradesh is more than double that of Rajasthan, Uttar Pradesh and Madhya Pradesh. The average yield in the rabi season is much higher than kharif season as rabi crop is grown under irrigated conditions.

Table 5.4: Changes in maize yield of major producing states and all India average: 1981-2012

State	1981-85	1986-90	1991-95	1996-2000	2001-05	2006-11
Traditional States						
Bihar+ Jharkhand	1163	1482	1808	2107	2156	2158
Bihar					2323	2430
Jharkhand					1542	1337
Gujarat	1072	1200	1090	1388	1488	1298
Himachal Pradesh	1718	1792	2051	2135	2143	2334
Jammu and Kashmir	1504	1466	1718	1539	1531	1661
M.P.+ Chhattisgarh	1118	1276	1269	1379	1667	1298
M.P.					1721	1273
Chhattisgarh					1171	1509
Punjab	1785	1691	1953	2374	2641	3504
Rajasthan	966	1026	898	1108	1302	1519
U.P.+Uttarakhand	1073	1170	1297	1415	1424	1478
U.P.					1426	1480
Uttarakhand					1368	1410
Non-traditional States						
Andhra Pradesh	1697	1847	2505	3150	3376	4326
Karnataka	2439	2601	3030	2980	2480	2916
Maharashtra	1460	1154	1471	1410	1942	2502
Tamil Nadu	2232	1480	1607	1633	1502	4506
All India	1252	1371	1537	1769	1913	2284

Source: Authors' calculations from GoI (2013)

Among the major maize producing states, Tamil Nadu has the highest yield (4506 kg/ha), followed by Andhra Pradesh (4326 kg/ha), Karnataka (2916 kg/ha) and Maharashtra (2502 kg/ha), while Madhya Pradesh (1273 kg/ha), has one of the lowest yields in the country. In non-traditional maize growing states, crop yields are significantly higher than in traditional maize growing states. Maize productivity witnessed the highest increase (19.4%) during the last decade, from 1913 kg per ha in 2001-05 to 2284 kg per ha in 2006-11. Almost all states

except Madhya Pradesh witnessed an increase in yield during the last decade, with the highest increase in Chhattisgarh (28.9%), followed by Maharashtra (28.8%) and Andhra Pradesh (28.1%) between 2001-05 and 2006-11.

Growth Rates in Area, Production and Yield

Growth rates of area, production, and productivity of maize in major producing states and at national level during different time periods were computed and the results are presented in Table 5.5. Maize production in the country grew at an annual compound growth rate of about 3.92 per cent during 1981-2012 (32 years) while area and yield grew at 1.44 per cent and 2.45 per cent, respectively during the same period. In the long term, of the 3.92 per cent annual growth in maize production, increase in yield accounted for about 63 per cent of the growth in production while remaining 37 per cent came from area expansion. The relative contribution of yield towards increased production witnessed a steady decline during the last three decades from about 97 per cent in the 1980s to about 54 per cent during the last decade. The area under maize, as well as yield, recorded the highest growth rates (2.62% and 3.17%) during 2000s.

Maharashtra recorded the highest growth (11.67%) in maize production during 1981-2011. However, the state had registered the slowest growth rate in production during the 1980s, which accelerated during the next two decades. Other states which registered impressive growth in maize production were Karnataka (8.23%) and Andhra Pradesh (8.09%). Uttar Pradesh registered a continuous deceleration in maize production during the last two decades which became negative (-0.28%) in the last decade.

During the 1990s and 2000s, maize performed quite dismally in traditional maize growing states. However, maize production experienced impressive growths in non-traditional states like Karnataka, Andhra Pradesh and Tamil Nadu. Maize production increased at annual compound growth rate of 25.2 percent in Tamil Nadu, 10.04% in Andhra Pradesh and 11.11% percent in Karnataka, due to both area expansion and yield improvements during 2001-02 and 2012-13. The increase in maize production in these non-traditional states is mainly driven by impressive growth in the poultry industry of these states. Almost a similar pattern was observed in case of area under maize. Non-traditional states witnessed a

significant expansion in area under maize. For example, Maharashtra registered an impressive growth rate of 9.05 per cent, Karnataka 7.85 per cent and Andhra Pradesh 4.10 per cent during 1981-2012. All states except Karnataka showed significant positive growth rate in maize yields during the last three decades. Andhra Pradesh had the highest growth rate (3.84%), followed by Bihar (3.03%), and Maharashtra (2.41%).

Table 5.5: Annual growth rates of maize area, production and yield in selected states, 1981-82 to 2012-13

State	1980s	1990s	2000s	All
Area				
Andhra Pradesh	-1.27**	5.63***	5.39***	4.10***
Bihar+Jharkhand	-2.32**	-0.02	1.71***	0.70***
Karnataka	6.38***	10.53***	8.45***	7.85***
MP+ Chhattisgarh	1.13***	0.14	-0.24	0.60***
Maharashtra	3.77**	8.74***	10.42***	9.05***
Rajasthan	0.39	0.23	0.28	0.61***
UP+Uttarakhand	-0.09	-1.46***	-1.77**	-1.42***
Bihar	-2.32**	-0.76	1.05***	-0.54***
Jharkhand	-	-	4.05**	-
Madhya Pradesh	1.13***	-0.43	-0.40**	0.09
Chhattisgarh	-	-	1.09***	-
Uttar Pradesh	-0.09	-1.67***	-1.72**	-1.59***
Uttarakhand	-	-	-2.81***	-
All India	0.07	1.16***	2.62***	1.44***
Production				
Andhra Pradesh	-0.08	10.11***	10.04***	8.09***
Bihar+Jharkhand	3.10**	2.70**	2.77**	3.25***
Karnataka	7.24***	10.19***	11.11***	8.23***
MP+ Chhattisgarh	4.84*	2.64	-1.77	1.68***
Maharashtra	0.09	7.45	14.23***	11.67***
Rajasthan	3.57	2.97	3.28	2.81***
UP+Uttarakhand	3.94	0.23	-0.35	0.01

Bihar	3.10	2.29	2.69	2.48
Jharkhand	-	-	3.20	-
Madhya Pradesh	4.84	2.10	-2.55	1.14
Chhattisgarh	-	-	6.82	-
Uttar Pradesh	3.94	0.01	-0.28	-0.16
Uttarakhand	-	-	-2.07	-
All India	2.59	3.75***	5.88***	3.92***
Yield				
Andhra Pradesh	1.21	4.25***	4.41***	3.84***
Bihar +Jharkhand	5.54***	2.72**	1.04	2.53***
Karnataka	0.81	-0.31	2.45*	0.36
MP+ Chhattisgarh	3.67	2.5	-1.53	1.08***
Maharashtra	-3.55**	-1.19	3.45***	2.41***
Rajasthan	3.17	2.73	2.99	2.19***
UP+Uttarakhand	4.04	1.71	1.44	1.45***
Bihar	5.54***	3.07**	1.62	3.03***
Jharkhand	-	-	-0.82	-
Madhya Pradesh	3.67	2.54	-2.16	1.05**
Chhattisgarh	-	-	5.67***	-
Uttar Pradesh	4.04	1.71	1.46	1.45***
Uttarakhand	-	-	0.76	-
All India	2.52	2.39***	3.17**	2.45***

Source: Authors' calculations from GoI (2013)

Based on association of growth rates between area and yield, major maize producing states were categorised into nine categories (A indicates significant positive growth in area/yield, B indicates significant negative growth rate in area/yield and C indicates non-significant positive/negative growth rate) and the results are presented in Table 5.6. AA (significant positive growth rate in both acreage and yield) is the best situation for maize economy while BB (significant negative growth rate in both acreage and yield) is the worst condition. BA would be preferred to AB, CA would be preferred to AC, and BC would be preferred to CB.

The distribution of major maize producing states according to types of association between growth rates of area and yield shows that none of the major states was under AA category during the 1980s, while in 1990s Andhra Pradesh moved from BC category to AA and the number of states in AA category increased to five during the last decade (Table 5.6). Karnataka, which is the largest maize producer in the country, moved from AC category during the 1980s and 1990s to AA in the 2000s. Other major producer, Maharashtra, was in AB category during the 1980s and AC category during the 1990s and moved to AA category during the last decade. However, traditional maize growing states like Bihar, Madhya Pradesh and Uttar Pradesh did not show any impressive growth. Rajasthan moved from CC category during the eighties and nineties to AA category during 2000s. Uttar Pradesh, an important producer of maize in the eighties, has remained in the non-preferred categories. However, it is encouraging to note that none of major states were in the worst category, BB.

Table 5.6: Classification of states according to growth in area and yield of maize

Type of association	1980s	1990s	2000s	1981-82 to 2012-13
AA		Andhra Pradesh, All India	Andhra Pradesh, Maharashtra, Rajasthan, All India, Karnataka, Chhattisgarh	MP+ Chhattisgarh , Bihar, Andhra Pradesh, Maharashtra, All India, Rajasthan
AB	Maharashtra			
AC	Karnataka, MP	Karnataka, Maharashtra	Bihar+Jharkhand, Bihar, Jharkhand	Karnataka,
BA	Bihar			Uttar Pradesh
BB				
BC	Andhra Pradesh,	Uttar Pradesh	Madhya Pradesh, UP+Uttarakhand, Uttar Pradesh, Uttarakhand	
CA		Bihar		Madhya Pradesh
CB				
CC	UP, Rajasthan, All India	Madhya Pradesh, Rajasthan	MP+Chhattisgarh, Rajasthan	

Source: Authors' calculations from GoI (2013)

An attempt is made to cross-categorise states according to their yield levels and growth rates in yield during different periods and to examine their movement from one yield category to another as a result of differential rates of growth recorded during various periods. These results are presented in Table 5.7.

Table 5.7: Classification of states according to productivity levels and growth in productivity of maize in India

	Significant increase in yield	Significant decline in yield	Stagnant yield with positive sign	Stagnant yield with negative sign
1981-82 to 1990-91				
High Productivity	Bihar		Andhra Pradesh, Karnataka	
Low Productivity		Maharashtra	Rajasthan, MP, UP	
1991-92 to 2000-1				
High Productivity	Andhra Pradesh, Bihar,			Karnataka
Low Productivity			Rajasthan, MP, UP	Maharashtra
2001-02 to 2012-13				
High Productivity	Andhra Pradesh, Karnataka, Maharashtra		Bihar	Bihar +Jharkhand
Low Productivity	Chhattisgarh		Rajasthan, UP+Uttarakhand, Uttar Pradesh, Uttarakhand	Madhya Pradesh, MP+Chhattisgarh Jharkhand
1981-82 to 2012-13				
High Productivity	Bihar+Jharkhand, Andhra Pradesh		Bihar, Karnataka	
Low Productivity	Rajasthan, Maharashtra, MP, MP+Chhattisgarh, Uttar Pradesh, UP+Uttarakhand			

Source: Authors' calculations from GoI (2013)

During the first period of 1981-82 to 1990-91, only Bihar in the high productivity category recorded significant positive growth while other high-productivity states, Andhra Pradesh and Karnataka, showed non-significant positive growth rates. In case of low productivity

states, Maharashtra witnessed a significant negative growth rate while other states like Rajasthan Madhya Pradesh and Uttar Pradesh had non-significant positive growth rates. During the 1990s, the number of states having significant positive growth rates in crop yield increased to two (Andhra Pradesh and Bihar) and the number further increased to four, (Andhra Pradesh, Karnataka, Maharashtra and Chhattisgarh) during the last decade. All other states recorded stagnation (non-significant positive/negative growth rate) in maize yields. None of the major producers recorded a significant decline in maize yields during the last two decades.

The above results clearly show that performance of maize economy has improved significantly during the last decade and non-traditional states have performed much better than the traditional maize growing states. Both yield improvement and area expansion contributed to this production growth in the country.

Marketed Surplus: Household and Farm Characteristics

This section examines the organization and behavior of the marketed surplus of maize and factors affecting it. Using household data from 358 maize producers surveyed by participating Agro-Economic Research Centres/Units in selected districts of three states namely, Karnataka, Maharashtra and Rajasthan during 2011-12 (Table 5.8), we provide a description of the socio-economic characteristics, land use pattern, and other relevant information. This will provide a foundation for understanding the pattern and behavior of maize marketed surplus.

Table 5.8: Size-distribution of sample households in selected states

State	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*Total*
Karnataka	40	43	39	14	4	140
Maharashtra	37	37	20	6	0	100
Rajasthan	9	38	33	29	9	118
Total	**86**	**118**	**92**	**49**	**13**	**358**

Source: Field Survey, 2011-12

General Characteristics

Table 5.9 presents data on socio-economic characteristics of sample maize farmers. Over 98 per cent of the households were male-headed. Household headship may influence decision making on production and marketing of crops, as men take most decisions regarding the household and/or farm. Household size depicts availability of labour as well as consumption requirements. The average household had 6.6 members ranging from about 5.3 on marginal households to 9.6 on large farms.

Table 5.9: Socio-economic profile of sample farm households by size of farm in the study areas

Characteristics	***Marginal***	***Small***	***Semi-Medium***	***Medium***	***Large***	***All Farms***
Age (years)	45.2	47.9	49.1	49.5	45.7	47.6
Main Occupation (%)						
Crop farming	97.9	98.1	95.5	93.3	100.0	96.8
Dairy	0.0	0.0	0.0	2.2	0.0	0.3
Service	1.1	1.9	3.4	4.4	0.0	2.3
Others	1.1	0.0	1.1	0.0	0.0	0.6
Education (Avg. years of schooling)	3.96	3.94	5.42	5.60	10.42	4.8
Family Size (Nos.)	5.34	6.19	7.09	8.22	9.58	6.57
Male	2.76	3.32	3.56	4.31	4.75	3.41
Female	2.59	2.87	3.53	3.91	4.83	3.16
Social grouping (%)						
SCs	14.9	16.0	12.4	20.0	25.0	15.6
STs	12.8	17.0	10.1	6.7	0.0	12.1
OBCs	48.9	33.0	52.8	28.9	50.0	42.5
General	23.2	33.9	24.8	44.4	25.0	29.8
Gender (%)						
Male	95.7	100	100	100	100	98.8
Female	4.3	0	0	0	0	1.2

Source: Field Survey, 2011-12

Most farmers (96.8%) had crop farming as their main occupation. The average age of head of the household was 47.6 years indicating that the relatively young segment of the rural population was engaged in maize cultivation. Farmers with higher formal education are more likely to adopt new technologies and linked to markets. The sample households had average years of schooling of little over 4.8 years. There was a positive association between education and farm size. Less than 30 per cent of the sample households belonged to general category, while the share of backward and SC/ST farmers was higher.

Land Ownership Pattern

The pattern of land ownership of the sample households shown in Table 5.10 shows that the average farm size in the study area was 2.95 hectares, ranging from 0.73 ha on marginal households to 15.22 ha on large households. Less than half of the operational land holding was irrigated in all states with groundwater as the main source of irrigation for all categories of households. The share of irrigated area was the highest (64.4%) on marginal households and the lowest (22.9%) on large farms. Land leasing was not very common and the share of leased-in land in total operational holding was about 2.7 per cent and that of leased-out was about one per cent.

Table 5.10: Land ownership pattern of sample households in the survey areas

(ha)

Farm Size	***Total owned land (1)***		***Leased in land (2)***		***Leased-out land (3)***		***Total operational holding (1+2-3)***		
	I	UI	I	UI	I	UI	I	UI	Total
Marginal	0.47	0.26	0.00	0.00	0.00	0.00	0.47	0.27	0.73
Small	0.90	0.62	0.00	0.02	0.01	0.01	0.89	0.64	1.53
Semi-Medium	1.42	1.18	0.01	0.16	0.01	0.00	1.42	1.34	2.76
Medium	2.89	3.34	0.02	0.08	0.09	0.01	2.81	3.40	6.21
Large	3.58	11.55	0.00	0.21	0.10	0.01	3.48	11.74	15.22
All farms	1.34	1.56	0.01	0.07	0.02	0.01	1.33	1.63	2.95

Source: Field Survey, 2011-12

Groundwater was a major source of irrigation in the area and accounted for about 48 per cent of total irrigated area. However, for different farm sizes, share of groundwater was the

highest (88.8%) on large farms and the lowest (37.3%) on marginal farms, indicating low investment capacity of small and marginal farmers as groundwater irrigation requires large investment (Table 5.11). Surface irrigation accounted for about 19 per cent of the total irrigated area while the share of other sources was about one-third and was an important source of irrigation on small and marginal farms.

Table 5.11: Main source of Irrigation (%) on sample households

Farm Category	*Surface*	*Groundwater (GW)*	*Others*
Marginal	22.7	37.3	40.0
Small	15.7	45.7	38.6
Semi-medium	23.1	53.9	23.1
Medium	10.3	51.7	37.9
Large	-	88.8	11.1
All Farms	18.8	47.9	33.4

Source: Field Survey, 2010-11

Cropping Pattern

The area under kharif crops accounts for 70.7 per cent of the total cropped area in the study area (Table 5.12). About 50 per cent of the gross cropped area was under foodgrains, mainly maize and pulses. Pulses accounted for more than one-third of the total cropped area of sample farms followed by oilseeds (about 19%) and maize with about 14 per cent of area. The share of maize was the highest (21.2%) on small farms and the lowest on medium farms (9.6%). Since the selected states were predominantly rainfed, oilseeds and pulses were important crops on sample households. Pulses accounted for more than one-third of the total cropped area on all farm categories except for semi-medium households. The share of oilseeds ranged from 14.3 per cent for medium farms to 22.9 per cent for small farms.

Crop Yields

The average productivity of maize on the surveyed households varied from 2489 kg per ha in case of large farmers to 3338 kg per ha on marginal farmers (Table 5.13). The highest yield of kharif maize was observed in Karnataka (3692 kg per ha), followed by Maharashtra (2888 kg/ha) and the lowest in Rajasthan (2179 kg/ha). The yield in Karnataka and Maharashtra was higher than the national average while Rajasthan had lower yield. The

main reason for this low productivity in Rajasthan was the lack of irrigation facilities as less than one percent of the maize area was under irrigation, while in Karnataka and Maharashtra about 40 per cent and 13 per cent of the maize area was irrigated. The average productivity of maize under irrigated conditions was significantly higher (3468 kg/ha) than unirrigated maize (2913 kg/ha) on sample farmers.

Table 5.12: Cropping pattern on sample households

(% of GCA)

Crop	***Marginal***	***Small***	***Semi-Medium***	***Medium***	***Large***	***All Farm***
Kharif	***67.6***	***70.2***	***74.1***	***69.3***	***68.8***	***70.7***
Rice	0.9	0.5	0.8	2.5	0.0	0.7
Maize	21.2	13.3	12.0	9.6	12.7	13.3
Pulses	12.1	17.3	15.0	19.1	18.2	16.9
Oilseeds	18.6	22.7	18.9	13.9	17.1	18.6
Others	14.8	16.4	27.4	24.2	20.8	21.2
Rabi	***32.5***	***29.8***	***26***	***30.7***	***31.3***	***29.3***
Wheat	3.0	1.7	4.4	1.5	2.8	2.7
Maize	0.7	0.1	0.3	3.2	1.4	0.7
Pulses	20.6	21.6	12.6	18.4	18.9	18.4
Oilseeds	0.1	0.2	0.2	0.4	0.4	0.3
Others	8.1	6.2	8.5	7.2	7.8	7.2

Source: Field Survey, 2011-12

Table 5.13: Average productivity (kg/ha) of maize on sample households

Crop	***Season***	***Marginal***	***Small***	***Semi-medium***	***Medium***	***Large***	***All Farm***
Karnataka	Kharif	3941	3844	3978	3373	-	3692
	Rabi	3397	3373	3123	2599	-	2970
Maharashtra		2892	1997	2886	2697	-	2888
Rajasthan		2491	2239	1880	2265	2489	2179
All	***Kharif***	***3338***	***2748***	***2988***	***2634***	***2489***	***2969***

Source: Field Survey, 2011-12

Marketed Surplus and Farmers' Participation

This section presents a comprehensive overview of maize production and marketing patterns, examines how these patterns vary across states and among different farm sizes and estimate the role of various price and non-price factors in influencing marketed surplus. Table 5.14 shows maize production and on-farm consumption of maize in major maize producing states and farm categories.

At farm household level, average farm retention (self-consumption, seed, and other purposes) was 9.1 per cent but varied from 6.7 per cent on medium farms to 18.8 per cent on large farms. In the case of states, average farm retention was only 1.7 per cent in Maharashtra while in Rajasthan farmers retained about 19 per cent of maize for household use because maize was a part of their diet. More than half of the total retention was for self-consumption while 29 per cent was kept for animal feed. However, there were regional patterns. For example, in Rajasthan about three-fourth of total retention was for food purpose while in Maharashtra about 88 per cent was kept for feed purpose. In Karnataka about half of the total retained output was for food purpose and 35.7 per cent was for feed purpose. Since most of the farmers used hybrids, retention for seed purpose was negligible.

Table 5.14: Maize production and retention pattern (in qtls) on sample households

Farm Size	Production	Self-consumption		Seed (2)	Feed (3)	Others (4)	Total Retention (1+2+3+4)
		Retention (1)	Purchased				
Marginal	26.5	1.8	0.0	0.0	1.2	0.4	3.5
Small	37.3	2.3	0.1	0.1	1.2	0.6	4.2
Semi-medium	62.9	3.3	0.1	0.1	1.1	0.8	5.3
Medium	110.2	3.4	0.4	0.3	2.9	0.3	7.3
Large	51.4	6.9	0.0	1.7	0.8	0.2	9.7
All farms	51.4	2.6	0.1	0.1	1.4	0.5	4.9
States							
Karnataka	93.0	4.3	0.0	0.0	3.1	1.4	8.8
Maharashtra	29.5	0.1	0.0	0.0	0.4	0.0	0.5
Rajasthan	20.5	2.9	0.4	0.4	0.2	0.0	3.9

Source: Field Survey, 2011-12

In order to understand the farmers' responses to higher prices, farmers were asked if they will increase their marketed surplus and reduce self-consumption of maize if they were offered higher price. More than one-fourth of the farmers responded positively, and they were willing to sell more in the market (Table 5.15). About 64 per cent of the households mentioned that they would reduce quantities kept for seed and feed purpose while 28.2 per cent were willing to reduce consumption.

Table 5.15: Farmers willingness to increase sales at higher prices

	Marginal	Small	Semi-medium	Medium	Large	All
Willing to sell more (%)	22.3	31.1	21.3	26.7	50.0	26.3
If Yes, Source						
a. Less retention for seed and feed	66.7	66.7	58.8	66.7	50.0	64.1
b. Less retention for self-consumption	23.8	30.3	35.3	16.7	33.3	28.2
c. Changes in consumption pattern	9.5	3.0	5.9	16.7	16.7	7.7

Source: Field Survey, 2011-12

Average marketable and marketed surplus of maize on different categories of farmers are presented in Table 5.16. It is evident from the Table that average household is a net seller of maize. The survey findings show that more than 90 per cent of the total output produced in the selected states was offered as marketable surplus. The share of small and marginal farmers was below the average, while share of medium and semi-medium households was higher than this average.

The entire amount of marketable surplus, which is available for sales, may not be actually sold in the market. Therefore, there can be a gap between marketable and marketed surplus due to various reasons on different size of land-holdings. Since marketed surplus represents actual sale by farmers, the difference between marketable and marketed surplus can reveal different patterns of sale, purchase and stockholding by various categories of farmers. The gross marketed surplus (sales as a proportion of production) on small and marginal farmers was much lower than marketable surplus. The percentage of marketed surplus was highest on the medium households, and has been estimated at 93.3 percent of

total maize production, followed by semi-medium (91.1%) and the lowest on marginal farms (79.9%). The net marketed surplus was almost equal to the gross marketed surplus, which indicates that farmers do not buy maize from the market for home consumption. The marketable and marketed surplus was highest (>98%) in Maharashtra and the lowest (>80%) in Rajasthan. These trends clearly indicate that Maharashtra maize growers produce maize primarily for the markets.

Table 5.16: Average marketable surplus and gross and net marketed surplus of maize on different categories of households

Farm size	Marketable Surplus		Gross Marketed Surplus		Net Marketed Surplus	
	Quantity (qtl)	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***
Marginal	23.0	86.8	21.2	79.9	21.2	79.9
Small	33.1	88.7	31.2	83.7	31.1	83.4
Semi-medium	57.6	91.6	57.3	91.1	57.2	90.9
Medium	102.9	93.4	102.9	93.3	102.5	93.0
Large	41.7	81.1	45.3	88.2	45.3	88.2
All farms	46.5	90.5	45.4	88.3	45.3	88.1
State						
Karnataka	84.2	90.5	80.4	86.5	80.4	86.5
Maharashtra	29.0	98.3	28.9	98.1	28.9	98.1
Rajasthan	16.6	81.0	17.7	86.4	17.3	84.4

Source: Field Survey, 2011-12

A comparison of the share of respective groups in the total marketed surplus shows that marginal farmers contributed the minimum quantity (10.4%), whereas medium households offered the highest share of marketable surplus accounting for about 53.1 per cent of the total marketed surplus. It is interesting to note that small and marginal farmers accounted for about 23 per cent of total operated area but contributed 31.6 per cent to total maize output and 30.5 per cent of total marketed surplus. On the other hand, share of medium and large famers in total output as well as marketed surplus was lower than their share in

total operated area. All categories of maize growers sold output in the market, which shows that maize farmers are commercial farmers who produce for the market.

Table 5.17: Market participation by maize producers by size of farm

Farm Size	Share (%) of Output	Share (%) of Marketed Surplus	Share (%) of Area Operated	Proportion of Farmers who Sold
Marginal	11.3	10.4	6.9	100.0
Small	20.3	20.1	16.3	100.0
Semi-Medium	29.4	28.9	25.8	100.0
Medium	23.7	24.2	32.1	100.0
Large	15.4	16.5	19.0	100.0
All Farm	100.0	100.0	100.0	100.0

Source: Field Survey, 2011-12

The distribution of farmers presented in Table 5.18 shows that more than 56 per cent of the households sold more than 90 per cent of maize output in the market, while 14.4 per cent sold less than 60 per cent. About one-third of the sample farmers in Rajasthan sold less than 70 per cent of the total output in the market, while in Maharashtra, majority of the farmers (89%) sold more than 90 per cent of the produce in the market. In Rajasthan, more than two-thirds of the farmers sold more than 80 per cent of produce in the market while 20.8 per cent sold less than 60 per cent. These results clearly show that the level of market participation is very high in Maharashtra compared with Karnataka and Rajasthan.

Table 5.18: Distribution of gross marketed surplus in selected states

Quantity Sold	Karnataka	Maharashtra	Rajasthan	All
<60%	19.5	0	20.8	14.4
60-70%	9.1	0	13.2	7.8
70-80%	8.4	0	24.5	11.4
80-90%	5.8	11	17.9	10.3
90-100%	57.1	89	23.6	56.1

Source: Field Survey, 2011-12

Access to Markets and Market Information

Table 5.19 below shows the characteristics of the maize sale patterns by the type of market. The data in the Table indicates that 55.5 per cent of maize farm households sold in the village, while remaining 44.5 per cent sold in the distant markets. There are regional variations. For example, more than 80 per cent of the produce in Maharashtra is sold in distant markets while in Rajasthan majority of the farmers (84.7%) preferred to sell in the village/on-farms. In case of Maharashtra, 57.8 per cent of the produce was sold within the village while remaining 44.5 per cent was sold in the distant market.

About 10 per cent of the sample farmers had access to regulated markets while around 90 per cent sold their produce in unregulated markets. The pattern of market access gives a different picture when analysis is carried out by size of farm. In case of large farmers access to regulated markets was significantly higher (33.3%) than small (9.1%) and marginal farmers (6.1%). In case of states, Karnataka farmers had better access to regulated markets compared with Maharashtra and Rajasthan because Karnataka Food and Civil Supplies Corporation Limited and Karnataka State Cooperative Marketing Federation Limited procure maize from farmers directly, while in other states, government procurement is either absent or negligible.

Table 5.19: Sale pattern by type of market on selected households

Size of Farm	Within Village (%)	Outside Village (%)	Type of Market (%)		Distance to market (Km)	Connected with Pucca road (%)
			Regulated	Unregulated		
Marginal	39.5	60.5	6.9	93.1	5.4	91.1
Small	51.5	48.5	9.1	90.9	5.9	89.4
Semi-medium	63.9	36.1	11.4	88.6	4.7	87.6
Medium	83.3	16.7	11.6	88.4	3.1	92.4
Large	40.0	60.0	33.3	66.7	9.1	99.0
All farms	55.5	44.5	10.3	89.3	5.2	90.1
State						
Karnataka	57.8	42.2	20.0	80.0	5.3	-
Maharashtra	19.6	80.4	-	100.0	7.6	-
Rajasthan	84.7	15.3	7.0	93.0	3.5	-

The average distance to market varied from about 3.1 km on medium households to 9.1 km on large farms. In case of Rajasthan, farmers travelled less distance (3.5 km) as they sold large share of produce locally while Maharashtra farmers travelled the longest distance (7.6 km). More than 90 percent of the households had access to pucca road.

The types of maize buyers include government agencies, private traders, feed mills and others. The numbers in Table 5.20 indicate that more than 80 percent of the maize farm households sold to private traders and a small share (19.1%) was sold to the government agencies. The direct procurement by feed mills and other agencies is negligible. However, price paid to farmers was higher (Rs. 1064/q) by government agencies than private traders (Rs. 1024/q). However, there was no significant difference in prices received by various categories of maize producers. Regarding the location of sale, private traders usually purchased maize on the farm or from within the village but paid relatively lower price. In contrast, in order to sell to government agency, farmer transported produce to mandies.

Table 5.20: Sale pattern of maize by type of buyer on selected households

Farm Size/State	To whom and quantity sold in percent and Price in Rs.					
	Govt. Agencies		Pvt. Trader		Others	
	% Sold	Price	% Sold	Price	% Sold	Price
Marginal	7.7	1033	92.3	1021	-	-
Small	10.6	1042	86.6	1013	2.8	1043
Semi Medium	15.0	1099	85.0	1050	-	-
Medium	27.7	1040	72.3	1007	-	-
Large	36.1	1109	63.9	1013	-	-
All Farm	***19.1***	***1064***	***80.3***	***1024***	***0.6***	***1043***
State						
Karnataka	26.0	1075	73.8	1047	0.2	1080
Maharashtra	-	-	97.7	1042	2.3	1025
Rajasthan	7.6	1147	92.4	954	-	-

Source: Field Survey, 2011-12

There are large inter-state variations in market access. For example, in Karnataka, about three-fourth of the produce was sold to private traders while in Maharashtra (97.7%) and Rajasthan (92.4%) more than 90 per cent was sold to private traders. Farmers in Karnataka received higher price compared with Maharashtra and Rajasthan. Higher prices in Karnataka and Maharashtra were mainly driven by poultry industry in the states.

Farmers' awareness of Minimum Support price (MSP) and sources of information, which are important factors influencing access to markets are presented in Table 5.21. Less than half of the sample farmers in the study areas were aware of MSP, but the awareness was quite high (83.3%) for large households.

There are many sources of information available to farmers and their access to information can play a significant role in improving marketing efficiency and farm income. The data on farmers' access to price information are presented in Table 5.21. The major sources of price information to the respondents were traders (60.7%), APMC mandies (21.1%), and print media (9.6%). Small and marginal farmers were mainly dependent on traders for market information while medium and large farmers had better access to print and electronic media.

Table 5.21: Farmers' awareness of minimum support price and sources of price information

Particulars	***Size of Farms***					
	Marginal	***Small***	***Semi-Medium***	***Medium***	***Large***	***All farms***
Aware of MSP (%)	31.9	40.6	53.9	66.7	83.3	46.5
Source of Information						
Trader	61.2	66.4	56.6	62.7	25.0	60.7
APMC Mandi	23.7	21.7	22.1	7.8	33.3	21.1
Print media	5.9	7.0	11.5	19.7	25.0	9.6
Telephone	5.9	4.9	8.0	5.9	8.3	6.2
Electronic media	3.3	-	1.8	3.9	8.4	2.4

Source: Field Survey, 2011-12

Determinants of Marketed Surplus of Maize

This section presents results of econometric analysis of the determinants of marketed surplus of maize using OLS technique. Multiple linear regression models were employed to identify the factors affecting marketed surplus and the analysis was done separately for marginal, small and medium farmers and for all farms combined. We could not undertake analysis for large farm households as number of observations was small (12). The independent variables included in the model were farm size (ha), family size (numbers), price received for the produce (Rs/qtl), distance of farm from main market (km) and number of livestock as sample households kept maize for feed purpose. Descriptive statistics of variables used in the analysis are given in Table 5.22.

Table 5.22: Descriptive statistics of farm household attributes by farm size

Dependent Variable	***Mean***	***Std. Dev.***	***Median***	***Min.***	***Max***
Marketed surplus (%)	82.7	19.6	89.2	0.0	100.0
Explanatory variables					
Farm size (ha)	2.7	3.1	1.8	0.1	22.3
Family size (no)	6.6	3.6	6.0	1.0	32.0
Price received (Rs/q)	1007	184	1000	750	1800
Distance to market (km)	5.4	6.6	1.5	0.0	40.0
Livestock (number)	4.2	4.7	3.0	0.0	40.0

Source: Field Survey, 2011-12

The estimated regression parameters of the marketed surplus model are shown in Table 5.23. All the explanatory variables had expected signs and statistically significant at one per cent level of significance. The farm size had a positive and statistically significant impact on marketed surplus, indicating that with an increase in farm size, marketed surplus turned negative.

The existence of an inverse relationship between family size and marketed surplus shows that larger the household family size, lower was the marketed surplus of maize. However, coefficient was statistically non-significant for small farms.

The significant effect of price on marketed surplus was evident from the results. The higher the price of maize, the larger was the marketed surplus. Price was the most important (ranked number 1) factor influencing marketed surplus of maize.

The distance to market had positive impact on the marketed surplus in case of all farm category and overall sample. The positive sign of distance variable may be due to the fact that farmers sold their produce after harvest as public procurement of maize was weak and farmers do not take risk of storing the produce and sell later on. Number of livestock affected marketed surplus negatively, indicating that with increase in livestock size, farmers retained larger quantities of maize for feed purposes.

Table 5.23: Factors influencing marketed surplus of maize in selected maize producing states

Factor	Farm Size				
	Marginal	**Small**	**Medium**	**All**	**Rank (All)**
Constant	53.8154	35.8969	42.0178	40.1851 (5.3899)	
Farm Size	19.7368*** (2.3973)	-1.4059 (5.1730)	1.8070*** (0.8185)	0.74451*** (0.3093)	4
Family Size	-1.6701*** (0.7450)	-0.6478 (0.5175)	-0.8699*** (0.3832)	-0.8819*** (0.2691)	3
Price Received	0.0179 (0.0173)	0.0535*** (0.0068)	0.0429*** (0.0077)	0.0449*** (0.0049)	1
Distance to Market	0.6208*** (0.2791)	0.5484*** (0.2160)	0.3929*** (0.2422)	0.56498*** (0.1361)	2
Livestock	0.0461 (0.4215)	-0.8295 (0.6012)	-0.9046*** (0.3333)	-0.4762*** (0.2087)	5
R^2	0.22	0.48	0.39	0.32	
Number of Observations	94	107	133	346	-

Figures in parentheses show standard error of regression coefficients.
****, ** and *: Statistically significant at the 1%, 5% and 10% level, respectively.*

The above results show the important positive effect of farm size, maize prices, and distance to market on marketed surplus of maize. Family size and livestock population have adverse effect on marketed surplus of maize as farmers retained maize for home consumption and

for feed purposes. The relative importance of factors in influencing marketed surplus indicated that the price received by farmers was the most important factor, followed by distance to market, family and farm size. Livestock size turned out to be the least important variable in influencing marketed surplus of maize.

Chapter 6

Overview of Bajra Economy: Production, Procurement and Marketed Surplus

Bajra, which was the second most important millet of India after sorghum in terms of area and production till early-2000s, has thereafter occupied the first position. It accounts for about 8.6 per cent of the area planted to cereals in the country, and over 4 per cent of the country's cereal grain production. India is the largest producer of bajra in Asia. The share of bajra in total cereals acreage as well as production has declined during the last four decades from 12.2 per cent and 6.7 per cent during the TE1971-72 to 8.6 per cent and 4.2 per cent in the TE2012-13, respectively. However, the performance has slightly improved during the last decade when its share in total cereals production increased from 3.6 per cent in TE2001-02 to 4.2 per cent in TE2012-13. This was mainly due to improvement in yield, from 736 kg per ha to 1149 kg per ha during the same period. Bajra, which is also the most important coarse cereal, accounts for nearly one-third of coarse cereals acreage and about 23.4 per cent of total production.

The total area under bajra increased from about 9.5 million hectares in early-1950s to 13.93 million hectares in 1973-74, the largest acreage under the crop during the last six decades. After the introduction of green revolution technology, there has been a continuous decline in area under bajra in the country but production has increased by over 60 per cent mainly due to an increase in productivity from about 440 kg per hectare in mid-70s to 1155 kg in 2010-12, an increase of 125 per cent. The highest production (12.11 million tonnes) of bajra was achieved in 2003-04, immediately after a severe drought in 2002-03 with a corresponding increase in productivity from 610 kg per ha in 2002-03 to 1141 kg per ha in 2003-14.

In India, bajra is cultivated as a dual purpose crop (food as well as feed) on more than 8.5 million hectares of area with a production of about 11 million tonnes, ranking it number four among all cereals. Bajra is mainly grown during rainy season (Kharif) in the states of

Rajasthan, Uttar Pradesh, Gujarat, Haryana, Maharashtra, Madhya Pradesh and Karnataka. Bajra accounts for 15 to 62 per cent of the total cereal consumption in some of the major bajra growing states such as Maharashtra, Gujarat and Rajasthan and it accounts for 20 to 62 per cent of the iron and 16 to 55 per cent of zinc intake from all food sources (Parthasarathy Rao, et. al. 2006). It is also the cheapest source of these micronutrients as compared to other cereals and vegetables. Despite the importance of bajra in regional food habits, per capita consumption has declined from 0.39 kg per month in 2004-05 to 0.24 kg in 2011-12 in rural areas and from 0.1 kg per month to 0.08 kg per month in urban areas (NSSO, 2014). The fall in per capita consumption of coarse cereals including bajra has been much higher, particularly in the rural areas, than decline in per capita consumption of rice and wheat.

Area, Production, and Productivity Trends

The total area under bajra has declined over time from 12.5 million ha in 1971-73 to 8.5 million ha in 2010-12, registering a decline of over 30 per cent over the past four decades, at an annual compound growth rate of -0.83 per cent. This is mainly due to diversion of area under bajra to other crops because of higher profitability of alternative crops and improved access to irrigation in some areas. Despite a sharp decline in the area, the production of bajra which increased during the 1970s, remained stagnant during 1980s and 1990s, but improved during the last decade. The production of bajra increased from about 5.6 million tonnes in 1971-73 to 60.2 million tonnes in 1981-83 and remained at the same level during 1991-93, further increasing to 6.9 million tonnes during 1999-2001 and 9.8 million tonnes in 2010-12. Bajra recorded a negative (-0.08%) growth rate in production during the 1970s, which increased to 1.35 per cent in 1980s and reached a level of 2.16 per cent during the last decade. Average yield of bajra more than doubled during the last four decades. The average productivity increased from 441 kg per ha in 1971-73 to 531 kg in 1981-83 and reached a level of 1155 kg per ha in 2010-12. The productivity witnessed an accelerated growth rate during the last four decades. Increase in productivity was the sole driver of increased production. The production (2.16%) and productivity (3.22 %) recorded the highest growth rate during the last decade while the growth rate was the lowest during the 1970s. The variability in both production and productivity has remained fairly high. The

major reason for high variability in production and productivity of bajra is the extremely low coverage of irrigation facilities (about 8-9%). The variability in area has been relatively small compared with productivity and production variability.

Table 6.1: Average area (million ha), production (million tonnes), and yield (kg/ha) of bajra in India: 1971-72 to 2012-13

	1971-72 to 1973-74	***1981-82 to 1983-84***	***1991-92 to 1993-94***	***1999-00 to 2001-02***	***2010-11 to 2012-13***
Area	12.5	11.5	10.2	9.4	8.5
Production	5.6	6.2	6.2	6.9	9.8
Yield	441	531	601	736	1155
CAGR (%)					
	1970s	**1980s**	**1990s**	**2000s**	**All Period**
Area	-1.20	-0.93	-1.06*	-1.02	-0.83***
Production	-0.08	1.35	1.58	2.16	1.71***
Yield	1.12	2.30	2.67	3.22*	2.49***
Coefficient of Variation (%)					
Area	7.96	8.74	5.10	7.80	11.63
Production	23.52	27.65	20.75	23.42	31.25
Yield	19.17	23.42	18.45	19.09	35.47

Source: Author's calculation using data from GoI (2013)

Changing Shares of Bajra vis-à-vis Other Foodgrains

In India, the area under total coarse cereals has declined by about 20.4 million ha from a peak of 46.9 million ha to 26.5 million ha and that of kharif coarse cereals decreased from 36.9 million ha to 21.4 million ha, a decline of 15.5 million ha between triennium ending 1969-70 to 2012-13. However, the area under bajra declined from 12.45 million ha to 8.54 million ha during this period. Significant reduction in area under sorghum from 16.3 million ha in TE1969-70 to 6.3 million ha in TE2012-13 has been a major contributor to the declining area under coarse cereals in the country. The relative share of bajra in total and seasonal acreage under foodgrains, total cereals and coarse cereals during the last four decades are presented in Table 6.2. The share of bajra in total foodgrains acreage in the country has

declined from 10 per cent to 7.3 per cent and that of total cereals from 12.2 per cent to 8.6 per cent between triennium ending 1978-79 and 2011-12, whereas its share in the coarse cereals has increased from about 27 per cent in early-1980s to 32.3 per cent in TE2011-12. Since bajra is mainly grown during the kharif season, it is important to examine the changing importance of bajra in acreage allocation during kharif season. Although the share of bajra in total foodgrains acreage has declined during the last four decades, it has maintained its share (15-16%) in kharif cereals. On the other hand, it has increased its share in kharif coarse cereals significantly from 32.4 per cent in TE1978-79 to 42.6 per cent in TE2011-12. Bajra has become the most important kharif coarse cereal crop (8.54 million ha), followed by maize (7.29 million ha) and jowar (2.82 million ha) in terms of area. However, area under maize has increased significantly during the last one and half decade due to introduction of hybrid seeds, increase in area under irrigation and rising industrial demand of mainly poultry feed and starch, for maize. Total area under maize has surpassed bajra acreage in 2012-13. The area under coarse cereals has also shifted to pulses and oilseeds especially soybean during kharif season mainly in Madhya Pradesh and Maharashtra. For example, in Madhya Pradesh alone, the area under soybean has increased from less than one million hectares in early-1980s to about 5.7 million hectare in 2011-12 and area in the country under soybean has increased from about one million hectare to over 10 million hectares in the same period.

Table 6.2: Share of bajra in total and seasonal area under foodgrains, cereals and coarse cereals in India: 1978-2011

Period	*Total*			*Kharif*		
	Foodgrains	*Cereals*	*Coarse Cereals*	*Foodgrains*	*Cereals*	*Coarse Cereals*
TE1978-79	10.0	12.2	27.2	13.5	15.4	32.4
TE1983-84	8.9	10.9	27.1	14.0	16.0	34.2
TE1993-94	8.3	10.3	29.2	12.0	15.4	37.5
TE2003-04	7.7	9.3	31.7	12.8	15.0	41.0
TE2011-12	7.3	8.6	32.3	12.8	15.2	42.6

Source: Author's calculation using data from GoI (2013)

Data on the share of bajra as percentage of total foodgrains, cereals and coarse cereals production as well as a percentage of kharif foodgrain, kharif cereals and kharif coarse cereals are given in Table 6.3. The contribution of bajra to total production of foodgrains and cereals has declined. Its share in foodgrains has fallen from about 6 per cent in TE1978-79 to 3.8 per cent in TE2011-12 and from 6.7 per cent to 4.2 per cent in total cereals production during the same period. However, it is interesting to note that its share in coarse cereals has consistently increased since-early-1980s, thereby indicating the sustainability of bajra among coarse cereals. Bajra has been able to maintain its importance in kharif season as its share in total kharif foodgrains as well as cereals production has remained almost stable at about 7-8 per cent. Contribution of bajra in total production of kharif coarse cereals has increased by about 8 percentage points, from 22.2 per cent in TE1978-79 to 30.4 percent in TE2011-12, making bajra an important coarse cereals crop during kharif season. The increasing share of bajra in total acreage as well as production of total coarse cereals and kharif coarse cereals shows importance of the crop as an important coarse grain crop in the country. With the increasing production, marketed surplus of bajra has also shown an increasing trend over the years but producers face various price and market risks as government procurement is very weak.

Table 6.3: Share of bajra in total and seasonal production of foodgrains, cereals and coarse cereals in India: 1978-2011

Period	*Total*			*Kharif*		
	Foodgrains	*Cereals*	*Coarse Cereals*	*Foodgrains*	*Cereals*	*Coarse Cereals*
TE1978-79	6.0	6.7	22.7	7.3	7.7	22.2
TE1983-84	4.0	4.4	17.1	7.7	8.2	23.8
TE1993-94	3.5	3.8	19.5	6.1	6.6	24.1
TE2003-04	3.4	3.6	22.0	7.9	8.3	31.8
TE2011-12	3.8	4.2	23.4	7.6	8.0	30.4

Source: Author's calculation using data from GoI (2013)

The regional distribution of crops provides valuable information about the dimension of their importance. The distribution of bajra area and production in major states are presented in Tables 6.4 and 6.5. According to the tables, Rajasthan alone accounts for 57.4

per cent of the acreage and 41.2 per cent of bajra production in the country. If four other states, namely, Uttar Pradesh, Haryana, Gujarat and Maharashtra are added, these top five states account for over 93 per cent of acreage and about 92 per cent of bajra production in the country. Rajasthan has increased its share in national acreage as well as production during the last three decades while Maharashtra and Gujarat have lost their shares. Uttar Pradesh has slightly improved its position while Haryana has marginally lost its share. Bajra is an important coarse grain crop in Rajasthan accounting for 21.7 per cent of total cropped area but has lost its share (from 26.3% in TE1983-84 to 21.7% in TE2011-12) to other crops. The share of bajra in total cropped area has significantly declined for all major producing states during the last three decades.

The share of Rajasthan in total production has increased from 25.2 per cent in TE1983-84 to 41.2 percent in TE2011-12. Other two states, which have improved their share in national production, were Uttar Pradesh and Haryana. On the other hand, Gujarat has lost its share from 23.2 per cent to 11.6 per cent during the same period. Maharashtra has also lost its share during the last two decades. Bajra accounted for 22.1 per cent and 13.7 per cent in total foodgrains in Rajasthan and Gujarat, respectively in TE2011-12, whereas in Haryana and Maharashtra, it accounted for about 6 per cent. Bajra has lost its share in foodgrains production in all major producing states except Rajasthan.

Table 6.4: Share of major states in area under bajra in India: TE1983-84 and TE2011-12

State	Share in all-India acreage				Share in Total cropped Area in state			
	TE1983-84	*TE1993-94*	*TE2001-02*	*TE2011-12*	*TE1983-84*	*TE1993-94*	*TE2001-02*	*TE2011-12*
Rajasthan	42.7	45.7	48.5	57.4	26.3	24.3	23.1	21.7
Maharashtra	14.3	18.4	17.5	10.7	7.9	9.0	7.7	4.2
U.P.	8.6	7.9	9.1	9.8	4.0	3.1	3.2	2.9
Gujarat	12.3	11.9	10.1	8.8	13.3	11.3	9.0	6.6
Haryana	7.2	5.6	6.3	6.7	14.3	9.9	9.6	9.4
All India	***100.0***	***100.0***	***100.0***	***100.0***	***6.5***	***5.5***	***5.0***	***4.7***

Source: Author's calculation using data from GoI (2013)

It is quite evident from the above trends that there is a high concentration of bajra crop in certain regions, therefore, regional growth implications of the performance should be quite

obvious. Most of the bajra growing areas in the states are among the most backward and poverty ridden pockets which indicates the importance of the crop in addressing poverty issue. It's also a well-recognized fact that bajra constitutes a major staple food of the low-income strata of the community in these areas. However, the production performance has not been encouraging in most of the regions.

Table 6.5: Share of major states in bajra production in India: TE1983-84 and TE2011-12

State	Share in all-India production				Share in food grains production in state			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2011-12***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
Rajasthan	25.2	27.1	34.4	41.2	18.1	18.2	20.6	22.1
U.P.	12.6	14.8	16.4	16.9	2.9	2.4	2.5	3.1
Haryana	8.4	7.5	9.9	12.1	7.9	4.7	5.2	6.6
Gujarat	23.2	17.5	14.1	11.6	15.5	25.0	25.5	13.7
Maharashtra	11.6	21.0	14.7	10.0	6.9	10.2	9.0	6.7
All India	***100.0***	***100.0***	***100.0***	***100.0***	***4.4***	***3.4***	***3.4***	***3.8***

Source: Author's calculation using data from GoI (2013)

It is important to note that in spite of decline in bajra area, the production has increased by almost 40 per cent i.e. from about 6.9 million tonnes in TE2000-01 to 9.8 million tonnes in TE2012-13 and exceeding 10 million tonnes in 2010-11 and 2011-12. Yield of bajra has almost doubled from about 500 kg per ha in 1981-85 to 987 kg per ha in 2006-12. Haryana has recorded the highest increase (195%), followed by Rajasthan (157%), Maharashtra (135%) and the lowest (41.1%) in Gujarat during the same period. There has been a significant increase in crop yield during all sub-periods, the highest being during the 1990s. The average productivity in Rajasthan, the largest producer of bajra in the country, was the lowest (750 kg/ha) among all major producers. Average bajra yield was the highest in Haryana (1781 kg/ha), followed by Uttar Pradesh (1621 kg/ha) and Gujarat (1581 kg/ha).

Although average productivity of bajra is low compared with other crops but productivity gains have been much higher in bajra compared to other kharif food grain crops, kharif cereals and kharif coarse cereals. Yield of bajra has increased from 736 kg per ha in TE2001-02 to 993 kg per ha in TE2011-12, about 35 per cent increase while the increase in yield of

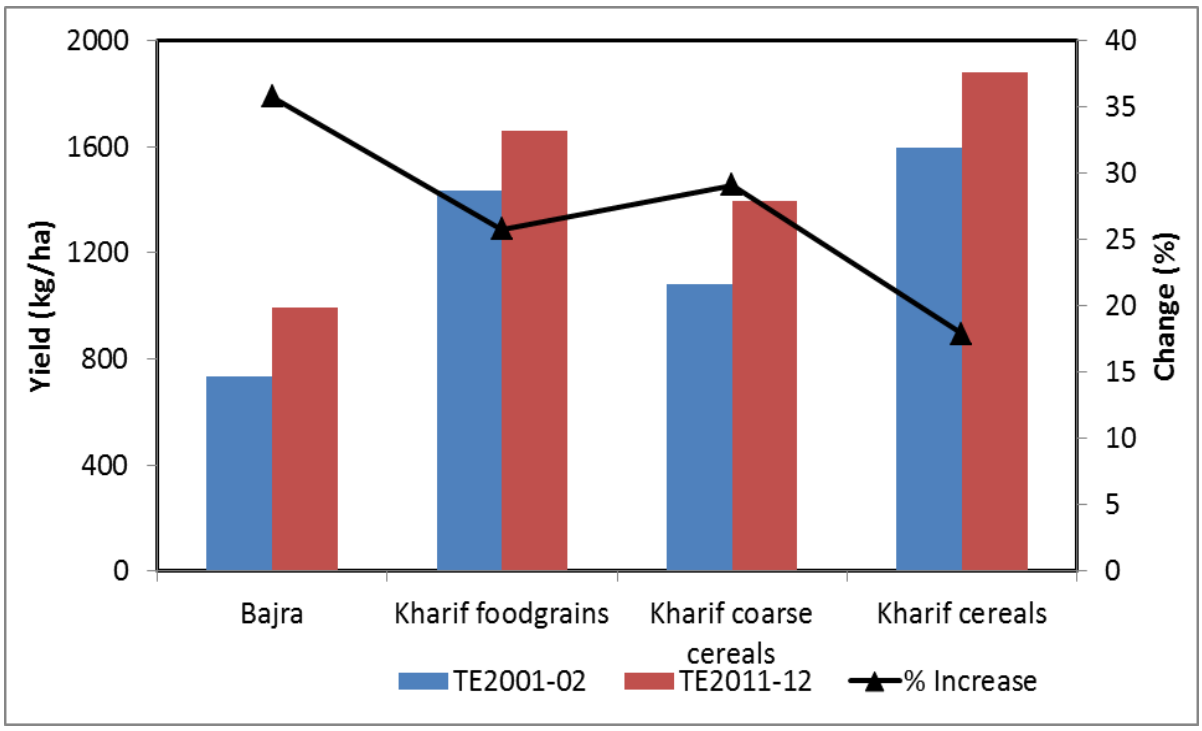
kharif coarse cereals was about 29 per cent and that of kharif foodgrains and kharif cereals about 16-17 per cent. This shows that bajra is contributing significantly to the productivity gains of foodgrains, cereals and coarse cereals in kharif season (Figure 6.1). The increase in yield of bajra is mainly attributed to the use of hybrids of pearl millet with short duration maturity and suitable for rainfed conditions and has been primarily driven by private sector.

Table 6.6: Changes in bajra yield by major producing states and all India average: 1981-2012

State	1981-85	1986-90	1991-95	1996-2000	2001-05	2006-12
Gujarat	918	826	935	1114	1229	1581
Haryana	603	693	870	1142	1277	1781
Maharashtra	367	487	658	729	693	864
Rajasthan	292	336	368	437	664	750
Uttar Pradesh	817	976	1130	1345	1334	1621
India	***501***	***539***	***616***	***729***	***856***	***987***

Source: Author's calculation using data from GoI (2013)

Figure 6.1: Comparative productivity trends of bajra vis-à-vis other food crops in India



Source: Author's calculation using data from GoI (2013)

Growth Trends in Area, Production, and Productivity

An overview of performance of bajra is given by Table 6.7, which presents the compound annual rates of growth of acreage, production, and yield in major producing states during 1981-82 to 2012-13. Similar analysis is presented for the different decades between 1981 and 2012. It is quite evident from Table 6.7 that bajra acreage has declined during this period, as indicated by the significant negative compound rate of growth (-0.88%). However, in terms of compound growth rates of production and yield, the performance of bajra has been much better and yield increased at an annual growth rate of 2.94 per cent while output increased at 2.04 per cent during the last four decades. Analysis of the bajra output growth shows that output growth has accelerated from 1.35 per cent during the 1980s to 1.58 per cent during the 1990s, it further increased to 2.16 per cent during the last decade at all-India level. Yield per hectare played a significant role in this respect and was the only contributor to bajra output growth as area under bajra witnessed declining trend.

Haryana, Rajasthan, and Uttar Pradesh which registered significant bajra output growth during the 1990s, continued their performance during the last decade. Rajasthan recorded the highest growth rate in output(4.42%), followed by Haryana (3.6%) and Uttar Pradesh (2.59%) during the last four decades. In the states of Maharashtra and Gujarat, bajra output growth decelerated during the last two decades. However, all states except Rajasthan recorded significant negative growth rate in bajra acreage during the last four decades, with Gujarat along with Maharashtra having the highest growth rate (-2.04%). Area under bajra has been replaced by crops like groundnut and cotton in Gujarat and soybean and groundnut in Maharashtra. Rapid yield growth during the last three decades primarily due to adoption of hybrids has driven growth in bajra output. In the last decade, growth in yield increased to 3.22 per cent and all states except Gujarat, witnessed acceleration in growth rates compared with the 1990s. Haryana recorded the highest growth rate (4.56%), followed by Rajasthan (4.37%) and Maharashtra (2.91%) during the last four decades. Bajra is by and large rain-fed crop, and its performance is always influenced by the vagaries of nature.

To accelerate the pace of growth in production, it is important to understand major sources of growth in the sector. Area expansion and/or rising yields are the principal sources of growth in production.

Table 6.7: Compound annual growth rates (%) of bajra area, production and yield in selected states, 1981-82 to 2012-13

Period	Gujarat	Haryana	Maharashtra	Rajasthan	Uttar Pradesh	All India
Area						
1980s	-2.28	-3.68*	2.23**	0.10	-2.67***	-0.93
1990s	-2.78***	0.59	-0.58	-1.13	0.94*	-1.06*
2000s	-3.28**	-0.77	-5.82***	0.55	0.61	-1.02
All	***-2.04******	***-0.92******	***-2.04******	***0.05***	***-0.11***	***-0.88******
Production						
1980s	-4.05	-1.30	7.34	5.73	1.35	1.35
1990s	-0.81	5.52	0.17	2.03	4.14**	1.58
2000s	-1.20	4.14*	-3.48	4.95	4.82***	2.16
All	***-0.09***	***3.60******	***0.81***	***4.42******	***2.59******	***2.04******
Yield						
1980s	-1.81	2.47	4.99	5.62	4.13**	2.30
1990s	2.02	4.90	0.75	3.19	3.17**	2.67
2000s	2.15	4.95***	2.49*	4.37	4.18***	3.22*
All	***1.99******	***4.56******	***2.91******	***4.37******	***2.70******	***2.94******

Source: Author's calculation using data from GoI (2013)

For the development of bajra economy, significant increase in area as well as yield is the best situation while significant decline in area as well as yield is the worst situation. Since scope for area expansion is limited and in fact area under bajra has declined during the last 3-4 decades, significant increase in yield would be a better strategy. The results of analysis of growth rates of bajra area and yield show different kinds of association and the results are given in Table 6.8. It is evident from the Table that there was an improvement during the last decade. For example, during 1980s, Maharashtra was the only state which recorded significant increase in area and stagnant yield while Uttar Pradesh witnessed significant

increase in yield but lost area under the crop. All other major bajra producing states witnessed either stagnation or decline in area and/or yield. The situation remained almost the same during the 1990s. However, during the last decade, two important states, namely, Haryana, and Uttar Pradesh had significant increase in yield but a stagnant decline in area. Gujarat had significant decline in area and stagnant yield under bajra, while Maharashtra was in the BA category.

Table 6.8: Classification of states according to growth in area and yield of bajra

Type of association	***1980s***	***1990s***	***2000s***	***1981-82 to 2012-13***
AA	-	UP	-	-
AB	-	-	-	-
AC	Maharashtra	-	-	-
BA	U.P.		Maharashtra,	Gujarat, Haryana, Maharashtra, India
BB	-	-		-
BC	Haryana	Gujarat, All India	Gujarat	-
CA	-	-	Haryana, UP, India	Rajasthan, UP,
CB	-	-	-	-
CC	Gujarat, Rajasthan, India	Haryana, Maharashtra, Rajasthan,	Rajasthan	-

Source: Author's calculation using data from GoI (2013)

The distribution of states according to productivity level and growth in productivity of bajra indicates that Uttar Pradesh from high productivity category was the only state which had significant increase in yield during 1980s and 1990s, while all other states had stagnant growth rate in yield. Maharashtra moved from low productivity category during 80s to high productivity category during 90s with insignificant growth in yields. Last decade showed a significant improvement in bajra economy and three states, Haryana and Uttar Pradesh from high productivity and Maharashtra from low productivity category, registered significant growth rates in crop yield while Gujarat remained in stagnant but positive in yield category. Rajasthan, the largest producer of bajra in the country had positive but non-

significant growth rate. The above results show that bajra economy has improved during the last decade but there is more scope to improve its performance, mainly through improvement in productivity particularly in Rajasthan.

Table 6.9: Classification of states according to productivity levels and growth in productivity of bajra in India

Association	*Significant increase in yield*	*Significant decline in yield*	*Stagnant yield with positive sign*	*Stagnant yield with negative sign*
1981-82 to 1990-91				
High Productivity	U.P.		Haryana	Gujarat
Low Productivity			Maharashtra, Rajasthan	
1991-92 to 2000-1				
High Productivity	U.P.		Haryana, Gujarat Maharashtra	
Low Productivity			Rajasthan	
2001-02 to 2012-13				
High Productivity	Haryana, U.P.		Gujarat	
Low Productivity	Maharashtra		Rajasthan	
1981-82 to 2012-13				
High Productivity	Gujarat, Haryana, U.P.			
Low Productivity	Maharashtra, Rajasthan			

Source: Author's calculation using data from GoI (2013)

Marketed Surplus: Household and Farm Characteristics

Most small farmers in rainfed area are dependent on the production of subsistence crops, and it is worthwhile to determine the extent and nature of their marketed and marketable surplus of these crops. How does marketed surplus vary with size of farm? What proportion of total output does the farmer market and how important is his contribution to the total

marketed surplus of the economy? Answers to these questions and information about the marketed and marketable surplus of subsistence farmer are important because it will affect his response to changes in the marketing system or programmes to increase agricultural production. In this chapter, we have attempted to estimate the extent and nature of the marketed and marketable surplus and marketed surplus functions for bajra crop. The study is concerned with the primary data collected from about 500 farmers from Rajasthan, Haryana and Uttar Pradesh.

Table 6.10: Size-distribution of sample households in selected states

State	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*Total*
Haryana	21	31	27	18	3	100
Rajasthan	18	80	69	100	33	300
Uttar Pradesh	65	20	11	4	0	100
Total	104	131	107	122	36	500

Source: Field Survey, 2011-12

Household Characteristics

Household and farm level characteristics of bajra producing households are reported in Table 6.11. The average age of head of the household was 46.5 years with an average year of schooling of 5.8 years. Medium and large farmers were more educated compared with small and marginal farmers. Majority of sample households (94.8%) had crop farming as the main occupation and proportion of farmers having other income from other sources including services was relatively higher for medium and large farmers. Almost all households (99%) were male headed. The average family size varied from about 7.4 on marginal farms to about 9 on large farms. About two-thirds of sample households belonged to other backward classes and SC/ST and this share was higher for small and marginal households.

Land Ownership and Cropping Pattern

The average operational holding varied from 0.63 ha on marginal farms to 16.39 ha on large farms with an average of 4.55 ha (Table 6.12). Unlike wheat and rice farmers, area under

irrigation was much lower (43.3%) but was higher than the national average. About 56.5 per cent of total operational holding was unirrigated and ranged from 14.3 per cent on marginal farms to 70.6 per cent on large farms. Since bajra is mainly grown under rainfed conditions, land leasing was not very common. The share of leased-in land was about 5.7 per cent while leased-out land accounted for about 1.3 per cent of the area.

Table 6.11: Socio-economic profile of sample farm households by size of farm in the study areas

Characteristics	***Marginal***	***Small***	***Semi-Medium***	***Medium***	***Large***	***All Farms***
Age (years)	45. 5	44.8	46.5	47.6	49.8	46.5
Main Occupation (%)						
Crop farming	98.1	97.1	92.7	93.2	91.8	94.8
Dairy	0.9	0.0	0.0	0.0	0.0	0.2
Service	0.9	2.9	7.3	6.8	8.2	5.0
Others						
Education (Avg. years of schooling)	2.13	5.05	6.39	7.66	7.82	5.8
Family Size (Nos.)	7.4	7.9	7.5	8.2	9.0	7.9
Male	4.1	4.3	3.9	4.2	4.8	4.2
Female	3.3	3.6	3.6	4.0	4.2	3.7
Social grouping (%)						
SCs	15.3	16.2	17.7	8.7	6.1	13.3
STs	0.0	1.9	0.9	2.2	2.0	1.4
OBCs	53.1	59.0	48.7	46.4	51.0	51.3
General	31.6	22.9	32.7	42.8	40.8	34.0
Gender (%)						
Male	95.9	99.0	100.0	100.0	100.0	99.0
Female	4.1	1.0	0.0	0.0	0.0	1.0

Source: Field Survey, 2011-12

Groundwater was the main source of irrigation in the study area and accounted for 73 per cent of the total irrigated area while share of surface irrigation was 26.4 per cent (Table 6.13). The share of surface irrigation had a direct relationship with the farm size.

Table 6.12: Land ownership pattern of sample households in the survey areas

(ha)

Farm Size	***Total owned land (1)***		***Leased in land (2)***		***Leased-out land (3)***		***Total operational holding (1+2-3)***		
	I	UI	I	UI	I	UI	I	UI	Total
Marginal	0.53	0.09	0.00	0.00	0.00	0.00	0.53	0.09	0.63
Small	1.20	0.42	0.03	0.00	0.00	0.01	1.23	0.41	1.64
Semi-Medium	1.49	1.43	0.13	0.00	0.00	0.00	1.63	1.43	3.06
Medium	2.59	3.65	0.37	0.11	0.14	0.05	2.82	3.70	6.52
Large	4.47	10.98	0.35	0.58	0.00	0.00	4.82	11.57	16.39
All farms	***1.84***	***2.50***	***0.17***	***0.09***	***0.04***	***0.02***	***1.97***	***2.57***	***4.55***

Source: Field Survey, 2011-12

Table 6.13: Main source of irrigation (%) on sample households

Farm category	***Surface***	***Groundwater (GW)***	***Others***
Marginal	3.8	96.2	0.0
Small	18.0	81.9	0.0
Semi-medium	33.8	66.2	0.0
Medium	42.5	55.1	2.2
Large	37.1	62.9	0.0
All Farms	***26.4***	***73.0***	***0.6***

Source: Field Survey, 2011-12

Bajra during kharif and wheat during rabi season were the major foodgrain crops grown in the study area and accounted for 23.9 per cent and 24.5 per cent of gross cropped area, respectively (table 6.14). Pulses accounted for 2.9 per cent during kharif and 17 per cent during rabi season. The share of oilseeds in total cropped area was about 7.8 per cent. Small (24.3%) and marginal farmers (42.5%) had a higher share of cropped area under bajra, indicating bajra to be a poor man's crop.

The productivity of bajra on the sample farms of the selected states have been given in Table 6.15. The average productivity per hectare was 1526 kg per ha and across different farm sizes, it varied from lowest 1077 kg on large farmers to the highest 1819 kg in case of marginal farmers. Comparison of yield data of bajra across selected states reveals significant

inter-state variations. The highest yield (2221 kg/ha) was recorded in Uttar Pradesh, followed by Haryana (1448 kg/ha) and the lowest (956 kg/ha) in Rajasthan. An inverse relationship between farm size and crop productivity was observed in Haryana and Rajasthan and also for the entire sample.

Table 6.14: Cropping pattern *(% of GCA)* on sample households

Crop	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farm*
Kharif						
Bajra	42.5	24.3	22.5	16.5	15.1	23.9
Pulses	0.6	1.4	3.0	5.8	5.1	2.9
Oilseeds	0.2	1.9	1.1	0.6	1.2	1.1
Others	7.8	21.3	22.4	24.2	16.2	20.9
Rabi						
Wheat	43.9	26.5	22.4	15.7	15.3	24.5
Pulses	1.8	12.5	18.2	26.7	39.6	17.0
Oilseeds	2.1	8.1	7.6	7.5	2.6	6.7
Others	1.2	3.9	2.8	2.9	4.9	3.2

Source: Field Survey, 2011-12

Table 6.15: Average productivity *(kg/ha)* of bajra on sample households

Crop	*Marginal*	*Small*	*Semi-medium*	*Medium*	*Large*	*All Farm*
Haryana	1572	1507	1415	1395	-	1448
Rajasthan	1549	1545	833	944	776	956
Uttar Pradesh	2221	2286	2319	2069	-	2221
All	***1819***	***1807***	***1543***	***1477***	***1077***	***1526***

Source: Field Survey, 2011-12

Marketed Surplus and Farmers' Participation

In this section, we will first examine the behavioural pattern of marketed and marketable surplus of bajra farmers in selected states, and then the factors influencing marketed surplus. We have defined marketed surplus as the part of farm output which is actually sold

in the market irrespective of the needs for home consumption and other requirements, such as payment in kind to labour/landlord, animal feed, etc. Marketable surplus is the residual left with the producer after meeting all other requirements. The marketable surplus may be more than the marketed surplus if, for example, the producer carries over stocks to next year and more importantly, marketed surplus may be more than marketable surplus if farmer is forced to buy back some produce for consumption later in the season. There is ample evidence that indicates existence of distress sale by small farmers.

An analysis of production and retention pattern of bajra on different categories of farmers is presented in Table 6.16. The average production per household on sample households was 16.7 quintals and varied from 10.4 quintals for marginal farmers to 35.9 quintals for large farms. Out of the average quantity produced by sample farmers, 4.4 quintals of produce was retained for household requirements for various purposes. More than two-thirds of the total produce retained for household requirement was for self-consumption and 27.3 per cent for feed purposes. Marginal farmers retained a higher proportion of the produce for household requirements compared with large farmers. The share of produce retained for household requirements was higher in Rajasthan (30.3%) and Uttar Pradesh (27.3%) and since bajra is a staple food in Rajasthan and parts of Uttar Pradesh, about 80.9 and 68.8 per cent was for consumption purpose, respectively in the two states. On the other hand, Haryana farmers retained mainly for feed purpose with a small proportion of produce retained for household use.

The marketable and marketed surplus patterns for sample households are given in Table 6.17. It is evident from the Table that marketable surplus of sample farmers is 73.5 per cent of total production. As the land holding size increases, the percentage of marketable surplus also increases. The large farmers had 80.4 per cent marketable surplus compared with 67.5 per cent on marginal households. The marketed surplus of bajra was lower than marketable surplus for all categories of households. In case of small and marginal farmers, net marketed surplus was lower than gross marketed surplus thereby indicating that small and marginal farmers go for distress sales and are forced to buy back some produce for consumption later in the season at a higher price. Marketable, as well as marketed surplus, were highest in case of Haryana, followed by Uttar Pradesh and the lowest in Rajasthan.

Table 6.16: Bajra production and retention pattern (in qtls) on sample households

Farm Size	*Production*	*Self-consumption*		*Seed (2)*	*Feed (3)*	*Others (4)*	*Total Retention (1+2+3+4)*
		Retention (1)	*Purchased*				
Marginal	10.4	2.3	0.2	0.0	1.0	0.1	3.4
Small	13.9	2.5	0.3	0.1	1.3	0.1	3.9
Semi-medium	15.6	2.6	0.3	0.0	1.2	0.1	4.0
Medium	20.3	3.7	0.2	0.1	1.5	0.3	5.6
Large	35.9	5.9	0.3	0.1	1.0	0.1	7.1
All farms	***16.7***	***3.0***	***0.3***	***0.1***	***1.2***	***0.2***	***4.4***
States							
Haryana	19.4	0.3	0.0	0.0	2.4	0.5	3.2
Rajasthan	15.5	3.8	0.4	0.1	0.7	0.1	4.7
U.P.	17.6	3.3	0.0	0.1	1.4	0.0	4.8

Source: Field Survey, 2011-12

Table 6.17: Average marketable surplus and gross and net marketed surplus of bajra on different categories of households

Farm Size	**Marketable Surplus**		**Gross Marketed Surplus**		**Net Marketed Surplus**	
	Quantity (qtl)	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***
Marginal	7.0	67.5	6.2	60.2	6.0	57.8
Small	10.0	71.8	9.2	66.2	9.0	64.4
Semi-medium	11.7	74.7	10.8	68.7	10.4	66.7
Medium	14.8	72.8	13.8	67.9	13.6	66.9
Large	28.9	80.4	26.6	74.1	26.3	73.2
All farms	***12.3***	***73.5***	***11.3***	***67.7***	***11.0***	***66.1***
State						
Haryana	16.2	83.5	16.2	83.5	16.2	83.5
Rajasthan	10.8	69.5	9.8	63.4	9.4	60.6
U.P.	12.8	72.9	10.9	61.7	10.9	61.7

Source: Field Survey, 2011-12

As Table 6.17 shows, Haryana bajra farmers are highly commercialized, producing a very high proportion (83.5%) of their output for the market. Rajasthan farmers, on the other hand, retain more than 30 per cent of their output for self-consumption. However, farmers' market participation was quite high for all categories of farms and varied from about 90 per cent on large farms to 99 per cent on marginal farms. It is also interesting to note that small and marginal farmers account for about 22.4 per cent of total area under the crop but their share in total output and marketed surplus was 34.7 per cent and 32.9 per cent, respectively. Medium farmers contributed the highest share in both production and marketed surplus, and the share of marginal farmers was the lowest. Market participation of farmers was 100 per cent in Haryana and Uttar Pradesh while in Rajasthan, about 87 per cent farmers sold their produce in the market.

Table 6.18: Market participation by bajra producers by size of farm

Farm Size	***Share in total output***	***Share in total Marketed Surplus***	***Share in total area operated***	***Proportion of farmers who Sold***
Marginal	12.9	11.5	7.6	99.0
Small	21.8	21.4	14.8	94.3
Semi-Medium	20.1	20.4	22.7	90.9
Medium	29.7	29.8	35.0	91.3
Large	15.5	17.0	19.9	89.8
All Farm	100.0	100.0	100.0	92.4
States				
Haryana	21.1	19.2	5.1	100.0
Rajasthan	55.7	52.1	65.7	87.3
U.P.	23.2	28.6	29.2	100.0

Source: Field Survey, 2011-12

The distribution of farmers presented in Table 6.19 shows that more than half of the sample farmers sold more than 70 per cent of the total output in the market while 32.7 per cent sold less than 60 per cent of the produce. In case of Haryana, more than 60 per cent of the farmers sold more than 80 per cent of the produce in the market while in Uttar Pradesh,

less than 15 per cent bajra growers sold more than 80 per cent of the produce in the market. These trends clearly show that the level of market participation is very high in Haryana compared with Uttar Pradesh and Rajasthan.

Table 6.19: Distribution of gross marketed surplus of bajra in selected states

Quantity Sold	*Haryana*	*Rajasthan*	*Uttar Pradesh*	*All*
<60%	14.0	37.0	47.0	32.7
60-70%	7.0	11.7	30.0	16.2
70-80%	18.0	15.3	11.0	14.8
80-90%	42.0	20.0	8.0	23.3
90-100%	19.0	16.0	4.0	13.0

Source: Field Survey, 2011-12

Access to Market and Market Information

Improved access to markets, institutional finance, and reliable and timely market information is of critical importance to smallholder subsistence farmers and are a prerequisite for enhancing their incomes. In this section, we analyse bajra producer's access to markets, infrastructure and market information. Table 6.20 shows the data on farmer's access to different types of markets and roads collected from sample households. More than half of the farmers had access to regulated markets while 74 per cent of the farmers sold their produce in the local market. The pattern of market access gives a somewhat different picture when analysis is carried out by size of farm. Small and marginal farmers preferred local and regulated markets while large farmers sold their produce in distant markets. Average distance to market varied from 12 km on small farms to 14.9 km on large farms. Almost all villages were connected with metelled roads.

About 15.6 per cent of the total marketed surplus was procured by government agencies, while about 85 per cent was sold to private traders and other buyers (Table 6.21). Large farmers had better access to government agencies while majority of the small and marginal farmers sold to private traders. The government agencies paid slightly higher price (Rs.

878/q) than private sector (Rs. 857/q). The large farmers received higher price than small and marginal farmers under both market channels, showing their better bargaining skills.

Table 6.20: Sale pattern by type of market on selected households

Size of Farm	*Sale in Local Market (%)*	*Distant Market (%)*	*Type of market (%)*		*Distance to market (Km)*	*Connected with Pucca road (%)*
			Regulated	*Unregulated*		
Marginal	84.6	15.4	81.1	18.9	13.9	98.8
Small	78.9	21.1	61.4	38.6	12.0	99.6
Semi Medium	56.0	44.0	47.3	52.7	13.7	97.7
Medium	77.1	22.9	45.5	54.5	14.4	99.0
Large	73.3	26.7	21.4	78.6	14.9	98.3
All farms	***74.0***	***26.0***	***53.8***	***46.2***	***13.7***	***98.7***

Source: Field Survey, 2011-12

Table 6.21: Sale pattern by type of buyer on selected households

Farm Size	*Type of buyer and proportion (%) of produce sold*			
	Govt. Agencies		*Pvt. Traders and Others*	
	Qty.	*Price (Rs/q)*	*Qty.*	*Price (Rs/q)*
Marginal	16.3	812	83.7	809
Small	19.1	875	80.9	860
Semi Medium	11.1	889	88.9	854
Medium	11.5	922	88.5	876
Large	28.4	900	71.6	928
All Farm	***15.6***	***878***	***84.4***	***857***

Source: Field Survey, 2011-12

About half of the farmers had access to institutional credit and Kisan Credit Card (KCC), however, small and marginal farmers had poor access to credit (Table 6.22). Traders were the most important source of information (55.6%) to the farmers, followed by print media (20.7%) and visit to markets. Large farmers had relatively better access to other forms of communication such as telephone, and other electronic media.

Table 6.22: Farmers' awareness of minimum support price and sources of price information

Particulars	*Size of Farms*					
	Marginal	*Small*	*Semi-Medium*	*Medium*	*Large*	*All farms*
Access to credit (%)	14.3	31.4	45.5	60.1	65.3	50.0
Have KCC (%)	18.4	27.6	48.2	59.4	61.2	49.0
Source of Information						
Trader	60.2	51.0	56.0	56.6	52.1	55.6
Print media	20.4	22.6	18.1	21.7	20.8	20.7
Visit to Market	16.3	13.2	8.6	4.9	8.3	10
APMC Mandi	2.0	10.4	5.2	9.8	8.3	7.2
Telephone	0	1.9	0.9	4.9	8.3	2.7
Electronic media	0	0.9	6.9	1.4	2.1	2.3
Radio	1.0	0	0.9	0.7	0	0.6
Others	0	5.3	0.9	4.9	9.1	2.7

Source: Field Survey, 2011-12

Determinants of Marketed Surplus of Bajra

An agricultural household model was used with farm-level data to estimate the impact of important variables on marketed surplus of bajra. A multiple linear regression model was used to examine the impact of variables such as farm size, family size, age of household, access to regulated market, distance to market and awareness about price support programme on the marketed surplus. Descriptive statistics of variables used in the analysis are given in Table 6.23. Marketed surplus value ranged from zero to 99.2 per cent with an average of 67.7 per cent. Awareness about MSP as well as access to regulated market was much lower among bajra farmers compared with rice and wheat farmers; mainly because government procurement of bajra was negligible.

The estimated regression parameters of the marketed surplus yield model are presented in Table 6.24. R-square (R^2), which measures the explanatory power of the regression model,

was relatively low. However, household characteristics and other variables affecting marketed surplus had anticipated signs and were mostly statistically significant.

Table 6.23: Descriptive statistics of farm household attributes by farm size

	Mean	***Std. Dev.***	***Median***	***Min.***	***Max***
Dependent Variable					
Marketed surplus (%)	67.7	24.6	66.0	0.0	99.2
Explanatory variables					
Farm size (ha)	3.4	3.9	2.0	0.2	30.0
Family size (no)	8.0	4.5	7.0	0.0	32.0
Dummy for awareness of MSP (%)	0.4	0.5	0.0	0.0	1.0
Dummy for access to regulated market (%)	0.4	0.5	0.0	0.0	1.0
Distance to market (km)	9.5	9.7	8.0	0.0	50.0
Awareness about MSP (%)	40.8				
Access to Regulated Market (%)	44.3				

Source: Field Survey, 2011-12

All the variables except family size and age of head of household had positive signs, indicating their positive impact on marketed surplus. The impact of farm size on marketed surplus was positive and statistically significant indicating that with an increase in farm size, marketed surplus of bajra also increases. Family size had an inverse relationship with marketed surplus but was statistically non-significant. The inverse relationship between family size and marketed surplus shows that larger the household family size, lower was the marketed surplus. Young and educated farmers are expected to contribute to higher production and marketed surplus. The age of household heads had positive and significant effect on marketed surplus for the combined sample and small and marginal farmers.

The results show the significant effect of farmers' awareness about MSP on marketed surplus. The higher awareness, the larger was the marketed surplus. The regression coefficient was positive and statistically significant for small and marginal categories of farmers. Household's access to regulated marketed had positive and significant impact on

marketed surplus. Distance to the market was positive and statistically significant for the combined sample and for small and medium categories. Households far away from the market find it difficult to store produce and sell their produce to village traders who buy it directly from farmers at low prices after the harvesting season.

Table 6.24: Factors influencing marketed surplus of bajra on different farm sizes

Factor	***Farm Size***				
	Marginal	***Small***	***Medium***	***Large***	***All***
Constant	38.3754 (8.6527)	72.0037 (11.5527)	60.8843 (8.3520)	46.8918 (28.3527)	57.3603*** (4.3660)
Farm Size	29.1671*** (8.1948)	-0.6014 (5.9626)	-0.0487 (0.9836)	0.7806 (1.0741)	0.8218*** (0.3036)
Family Size	-0.0826 (0.5006)	-0.6127 (0.5446)	-0.5874 (0.4133)	-0.3848 (0.9969)	-0.3047 (0.2612)
Age of Household	-0.2714*** (0.1529)	-0.3036*** (0.1445)	-0.0947 (0.1439)	-0.0796 (0.4142)	-0.1859*** (0.0851)
Awareness about MSP	16.9498*** (4.4417)	6.7778*** (3.9510)	5.4588 (4.3021)	2.3898 (11.0475)	12.7090*** (2.3069)
Access to Regulated Market	6.1100 (5.1014)	4.5699 (4.4918)	13.3093*** (5.5160)	35.2136*** (11.1415)	7.1415*** (2.7322)
Distance to Market	0.2819 (0.2454)	0.5493*** (0.2175)	0.6447*** (0.3066)	0.8920 (1.0578)	0.4340*** (0.1484)
R^2	0.31	0.2400***	0.22	0.39	0.18

Figures in parentheses show standard error of regression coefficients.
****, ** and *: Statistically significant at the 1%, 5% and 10% level, respectively.*

The analysis confirms the important positive effect of farm size, access to market access and awareness about MSP on marketed surplus of bajra. Family size and age of household had negative impact on marketed surplus. The relative importance of factors in influencing marketed surplus as measured by standardized regression coefficients indicated that the access to market was the most important factor, followed by awareness of MSP and farm size. Age of household and family size turned out to be less important variables in influencing marketed surplus of bajra.

Chapter 7

Gram Economy of India: Analysis of Acreage, Production, Productivity and Marketed Surplus

India is one of the largest producer, consumer as well as importer of pulses in the world. It accounts for about 35 percent of the world acreage and nearly 20 percent of the world pulses production. More than two-thirds of the global chick pea and pigeon pea production is in India. India accounts for almost 70 per cent of chickpea acreage, about three-fourths of pigeon pea acreage, and over 40 per cent of lentil area in the world (FAOSTAT, 2014). India imported about 3.4 million tonnes of pulses during the TE2013-14. Indian imports have more than doubled during the last decade, from about 1.59 million tonnes in TE2005-06 to 3.42 million tonnes in TE2013-14. The domestic production of pulses in the country has not kept pace with population growth and as a result per capita net availability of pulses has declined from about 25 kg per year in early-1960s to about 14-15 kg in TE2012 as against the recommended level of about 24 kg per year.

Pulses are grown in an area of about 24.7 million hectares with an annual production of 17-18 million tonnes. Pulses are grown during both kharif and rabi seasons, however, the production during rabi season contributes about two-thirds to the total production in the country. Pulses production has been slowly shifting from kharif to rabi and share of rabi crops has increased from 61.5 per cent of total production in TE2003-04 to 65.2 per cent in TE2011-12. On the other hand, share of kharif pulses has declined from 38.5 percent to 34.8 per cent during the same period. In terms of acreage shares, rabi crops account for 54 per cent of the total pulses acreage in the country while kharif crops account for 46 per cent. The share of rabi crops in total production is higher than their share in crop acreage mainly due to higher productivity of pulses during the rabi season (815 kg/ha) compared with kharif season (506 kg/ha). Tur is the most important kharif crop while gram is a major rabi crop. Other pulses like moong and urad are grown in both kharif as well as rabi seasons.

Gram is the most important pulses crop in India and accounts for approximately 35 percent of the total pulses acreage and about 46 per cent of total production in the country. Tur is the second important crop with an estimated share of 16.6 per cent in total acreage and 15.9 per cent share in total production during TE2012-13. Urad accounts for 13.3 per cent of production, moong about 8.6 per cent and lentil about 5.8 of total production in the country. In this chapter, we provide an overview of gram acreage, production, productivity and marketed surplus estimates in major producing states.

Trends in Area, Production and Yield of Gram

Trends in area, production and yield of gram and their growth rates in four time periods from 1971-72 to 2012-13 are summarized in Table 7.1. The area under gram cultivation increased from 7.5 million ha in 1971-73 to 8.7 million ha in TE2012-13 but witnessed a declining trend during the post-reforms period. The average area under gram declined from 7.5 million ha in TE1981-82 to 6.1 million ha in TE1993-94 and reached 5.9 million ha in TE2001-02 but the trend reversed during the last decade. Although area under gram cultivation declined during the period 1991-2001, total production increased from 4.5 million tonnes to 4.8 million tonnes during the same period. Gram production reached a record level of 9.53 million tonnes in 2013-14 and is expected to decline to 8.28 million tonnes as per the second advance estimates for 2014-15. The gram yield increased significantly during the last four decades, from 607 kg/ha in 1971-73 to 953 kg/ha in 2010-12. The last decade witnessed the highest increase in yield rates (17.7%), from 810 kg/ha in TE2001-02 to 953 kg/ha in TE201213, followed by the period between 1981-83 and 1991-93 (12%) and the lowest (8.1%) during the 1970s.

Total gram production increased at an annual compound growth rate of about one per cent (1.05%) during the period 1971-2012, which was mainly driven by yield as area under pulses has remained constant during the same period. Gram production recorded negative growth rate during the 1970s and 1980s (the green revolution period) but started showing some improvement during the last two decades. The annual growth rate of production became positive (1.19%) during the 1990s and reached at 5.51 per cent during the last decade. Gram production (5.51%) and yield (2.10%) recorded the highest growth rate during the last decade. The growth rates in gram acreage, as well as production, were negative during the

seventies and eighties as focus of government was mainly on cereals after introduction of the green revolution in late-1960s. About 30 per cent of gram acreage is under irrigation and as a result, variability in production has been on a higher side contributed mainly by acreage variability.

Table 7.1: Average area (million ha), production (million tonnes), and yield (kg/ha) of gram in India: 1971-72 to 2012-13

	1971-72 to 1973-74	***1981-82 to 1983-84***	***1991-92 to 1993-94***	***1999-00 to 2001-02***	***2010-11 to 2012-13***
Area	7.5	7.5	6.1	5.9	8.7
Production	4.6	4.9	4.5	4.8	8.3
Yield	607	656	735	810	953
CAGR (%)					
	1970s	**1980s**	**1990s**	**2000s**	**All Period**
Area	-0.81	-1.42	0.24	3.35***	0.02
Production	-0.64	-0.51	1.19	5.51***	1.05***
Yield	0.17	0.92	0.95	2.10***	1.03***
Coefficient of Variation (%)					
Area	7.66	9.71	14.71	12.70	11.83
Production	17.56	13.04	18.83	19.10	20.84
Yield	13.03	7.41	7.34	7.82	14.10

Source: Author's calculation using data from GoI (2013)

Gram is the primary pulse crop in states like Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Andhra Pradesh and Uttar Pradesh, and these states account for about 94 per cent of the total acreage and production of gram in the country (Tables 7.2 and 7.3). Madhya Pradesh occupied the largest share in crop acreage (38.9%) as well as production (42.7%), followed by Rajasthan (16%), Maharashtra (14.7%) and Karnataka (10.7%) in TE2011-12. Maharashtra was at number three in terms of acreage but ranked number two in production due to better yields. It is evident from the Table that Madhya Pradesh, Maharashtra, Karnataka and Andhra Pradesh have improved their shares in acreage as well as production while Rajasthan and Uttar Pradesh have lost their shares during the last three

decades. Uttar Pradesh was the largest loser as it lost its share from 19.8 per cent in total area under gram during TE1983-84 to 6.9 per cent in TE2011-12 and from 24.8 per cent to 7.4 per cent in production during the same period.

Table 7.2: Share of major states in area under gram in India: TE1983-84 and TE2011-12

State	***Share in all-India acreage***				***Share in gross cropped area in the State***			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2011-12***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
M.P.	29.1	37.1	41.8	38.9	9.8	9.5	10.0	14.4
Rajasthan	24.5	20.1	14.7	16.0	9.8	6.4	4.4	5.7
Maharashtra	6.2	9.3	13.3	14.7	2.2	2.7	3.7	5.5
Karnataka	2.0	3.8	6.6	10.7	1.3	1.9	3.2	7.2
A.P	0.8	1.2	3.7	7.0	0.4	0.6	1.7	4.4
U.P.	19.8	17.3	14.1	6.9	5.9	4.1	3.1	1.9
Others	17.6	11.2	5.8	5.8	-	-	-	-
All India	***100.0***	***100.0***	***100.0***	***100.0***	***4.2***	***3.3***	***3.2***	***4.4***

Source: Author's calculation using data from GoI (2013)

Table 7.3: Share of major states in gram production in India: TE1983-84 and TE2011-12

State	***Share in all-India production***				***Share in foodgrains production in the State***			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2011-12***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
M.P.	30.2	40.1	46.8	42.7	10.8	10.1	12.6	14.2
Maharashtra	3.7	7.4	9.7	13.8	1.7	2.6	4.1	8.0
Rajasthan	25.0	16.4	12.5	13.7	14.3	8.0	5.2	6.3
A.P.	0.5	1.0	4.8	8.9	0.2	0.4	1.5	3.9
Karnataka	1.3	2.1	4.8	7.2	1.1	1.1	2.4	4.5
U.P.	24.8	20.9	15.9	7.4	4.6	2.5	1.7	1.2
Others	14.5	12.1	5.5	6.3		-	-	-
All India	***100.0***	***100.0***	***100.0***	***100.0***	***3.5***	***2.5***	***2.3***	***3.2***

Source: Author's calculation using data from GoI (2013)

Madhya Pradesh and Maharashtra were the major gainers as their share in gram acreage and production had increased. Gram was an important crop in Madhya Pradesh and accounted for 14.4 per cent of total foodgrains production in TE2011-12. In other states, share of gram in total foodgrains production ranged from about one percent in Uttar Pradesh to 8 percent in Maharashtra. Gram has increased its share in total foodgrains acreage and production in Madhya Pradesh, Maharashtra, Karnataka and Andhra Pradesh.

Trends in gram yield during the period 1981-2011 are summarized in Table 7.4. Andhra Pradesh (1234 kg/ha), Madhya Pradesh (948 kg/ha) and Uttar Pradesh (907 kg/ha) have higher crop yields compared with the national average of 873 kg/ha. The all India average yield increased from 674 kg per ha in 1981-95 to 873 kg per ha in 2006-11, an increase of about 30 per cent. Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra have recorded higher increases in gram yields compared with the national yield increase. Gram yield has more than tripled in Andhra Pradesh (from 390 kg/ha in 1981-85 to 1234 kg/ha in 2006-11) and more than doubled (from 375 kg to 792 kg) in Maharashtra. The highest increase (10.1%) in gram yield was observed between 1986-90 and 1991-95 and the lowest during 1996-00 and 2001-05 and the three major producers, namely, Karnataka, Madhya Pradesh and Rajasthan witnessed a reduction in gram yields during this period. Gram yields have shown impressive improvement in most of the states during last decade due to various interventions such as good quality seed, frontline demonstrations, nutrient and pest management implemented under NFSM, increase in procurement prices of pulses, etc.

Table 7.4: Changes in gram yield by major producing states and all India average

State	1981-85	1986-90	1991-95	1996-00	2001-05	2006-11
Andhra Pradesh	390	486	674	773	1188	1234
Karnataka	409	353	437	533	506	577
M.P.	669	705	808	918	883	948
Maharashtra	375	471	570	571	588	792
Rajasthan	695	635	671	719	668	725
U.P.	833	818	901	888	941	907
All India	674	683	752	801	801	873

Source: Author's calculation using data from GoI (2013)

Growth Rates in Area, Production and Yield of Gram

Growth rates of area, production, and productivity of gram in major producing states and at the national level during the last four decades were computed, and the results are presented in Table 7.5. The gram production in the country grew at an annual compound growth rate of about 1.57 per cent during 1981-2012 (32 years), while crop acreage and yield recorded 0.42 percent and 1.14 per cent growth rates, respectively. In the long term, of the 1.57 per cent annual growth in gram production, increase in yield accounted for about three-fourth of the growth in production while remaining one-fourth came from area expansion. All the main gram producing states except Rajasthan and Uttar Pradesh recorded a positive significant growth rate in production during 1981-2012. Andhra Pradesh had the highest growth rate (15.74%), followed by Karnataka (7.81%), Maharashtra (6.12%) and Madhya Pradesh (2.9%). In most of the major producing states, growth rates were higher during the 1990s and 2000s compared to the 1980s. In Andhra Pradesh, area expansion contributed about two-thirds while yield contributed the remaining one-third. On the other hand, in Madhya Pradesh, area and yield both contributed equally. In Rajasthan and Uttar Pradesh, decline in area under gram led to a reduction in crop production. During the eighties, except for Maharashtra, all other states had either stagnant or negative growth rate in gram yields but the situation improved marginally during the nineties. Karnataka and Madhya Pradesh witnessed a significant positive growth rate in gram yield and during the last decade, the number of states with a significant positive growth rate increased to three.

During the 1980s, Maharashtra showed significant positive growth rates in area and yield (AA), indicating that gram either replaced other crops or was grown in newly cultivated areas and productivity of both existing and new acreage increased (Table 7.6). This is the best situation for improvement of the crop. However, the state shifted to a category of significant positive growth rate of area associated with stagnant (either positive or negative) growth rate of yield, indicating that crop was either replacing other crops or grown in newly cultivated areas but productivity of both existing and new acreage remained stagnant. The number of states in AA category increased to two (Madhya Pradesh and Maharashtra) during the last decade.

Table 7.5: Annual growth rates of gram area, production and yield in selected states, 1981-82 to 2012-13

Period	*A.P.*	*Karnataka*	*M.P.*	*Maharashtra*	*Rajasthan*	*U.P.*	*India*
Area							
1980s	2.28	5.66***	0.76	4.72***	-5.22	-1.80**	-1.42
1990s	12.42***	5.64**	0.59	5.25**	-0.90	-3.33***	0.24
2000s	7.14***	8.22***	1.83***	4.85***	5.90**	-3.92***	3.35***
All	10.55***	5.99***	1.42***	3.44***	-1.19*	-3.48***	0.42*
Production							
1980s	6.98	1.44	1.70	9.78**	-5.95	-1.66	-0.51
1990s	15.64**	10.71**	2.26	5.68	0.10	-3.26***	1.19
2000s	7.19***	11.06***	4.43**	9.19***	7.96**	-2.83	5.51***
All	15.74***	7.81***	2.90***	6.12***	-0.81	-2.96***	1.57***
Yield							
1980s	4.60	-3.99***	0.93	4.84*	-0.77	0.30	0.92
1990s	2.86	4.80**	1.80*	0.41	1.00	-0.09	0.95
2000s	0.05	2.62*	2.44*	4.13***	1.95	1.14	2.10***
All	4.70***	1.71***	1.49***	2.59***	0.39	0.58***	1.14***

Source: Author's calculation using data from GoI (2013)

Table 7.6: Classification of states according to growth in area and yield of gram

Type of association	1980s	1990s	2000s	1981-82 to 2012-13
AA	Maharashtra	Karnataka	MP, Maharashtra, All India	Karnataka, Andhra Pradesh, MP, Maharashtra, All India
AB	Karnataka		Karnataka	
AC		Andhra Pradesh Maharashtra	Andhra Pradesh, Rajasthan	
BA				UP
BB				
BC	UP	UP	UP	Rajasthan
CA		MP		

CB				
CC	Andhra Pradesh, MP, Rajasthan, All India	Rajasthan, All India		

Source: Author's calculation using data from GoI (2013)

In order to study the distribution of states in different productivity ranges (high and low) and growth rate in productivity, major producers were classified according to different types of classification, namely, high/low productivity states having significant increase, significant decline, and stagnant yield with positive/negative sign. The distribution of states is presented in Table 7.7.

Table 7.7: Classification of states according to productivity levels and growth in productivity of gram in India

	Significant increase in yield	**Significant decline in yield**	**Stagnant yield with positive sign**	**Stagnant yield with negative sign**
1981-82 to 1990-91				
High Productivity			MP, UP	
Low Productivity		Karnataka, Maharashtra	Andhra Pradesh	Rajasthan
1991-92 to 2000-1				
High Productivity	Madhya Pradesh			Uttar Pradesh
Low Productivity	Karnataka		A.P., Rajasthan, Maharashtra	
2001-02 to 2012-13				
High Productivity	Madhya Pradesh		Uttar Pradesh	Andhra Pradesh
Low Productivity	Maharashtra	Karnataka	Rajasthan	
1981-82 to 2012-13				
High Productivity	A.P., M.P., U.P.			
Low Productivity	Karnataka, Maharashtra		Rajasthan	

Source: Author's calculation using data from GoI (2013)

It is evident from the above Table that gram productivity has improved during the last two decades. For example, during the 1980s, none of the states recorded significant increase in yield and while Karnataka and Maharashtra had negative growth, remaining states had stagnant growth in productivity. In the 1990s, Madhya Pradesh from high-productivity category and Karnataka from low-productivity category recorded significant increases in yield and none of the states had significant negative growth rate. During the last decade, Madhya Pradesh and Maharashtra had significant increases in gram yield, while Karnataka showed negative growth and all other major producing states had stagnation in productivity growth. These trends clearly indicate that there is a scope for improving gram productivity.

Marketed Surplus: Household and Farm Characteristics

In this section, we estimate the marketable and marketed surplus of gram and identify the major factors influencing marketed surplus of gram in India. Primary household data were collected from gram growers spread over four major gram producing states, namely, Maharashtra, Madhya Pradesh, Uttar Pradesh and Karnataka during 2011-12. For the present study, two districts (Amravati and Latur) from Maharashtra, two districts (Bijapur and Gulbarga) from Karnataka, five districts (Alwar, Chittorgarh, Churu, Hanumangarh and Udaipur) from Rajasthan and one district, Vidisha from Madhya Pradesh were selected. Total number of households selected for the study was 554. Stratified sampling procedure was followed to select representative sample households from five farm-size groups based on size of land holding (Table 7.8).

A description of the socio-economic characteristics, land use pattern, and other relevant information are given in this section to provide a foundation for understanding the pattern and behavior of gram marketed surplus.

General Characteristics

Table 7.9 presents data on the socio-economic profile of the sample households. Almost all households were male-headed with an average of 7.2 members ranging from about 6.1 on marginal farms to 9.7 on large farms. The household size shows availability of labour as well as consumption requirements and therefore, is an important factor influencing marketed surplus of foodgrains.

Table 7.8: Size-distribution of sample households in selected states

State	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*Total*
Maharashtra	34	39	17	10	-	100
MP	25	25	25	25	-	100
Karnataka	28	42	22	49	-	141
Rajasthan	5	35	46	95	32	213
Total	***92***	***141***	***110***	***179***	***32***	***554***

Source: Field Survey, 2011-12

Table 7.9: Socio-economic profile of sample farm households by size of farm in the study areas

Characteristics	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farms*
Age (years)	45.0	45.0	44.8	48.5	48.8	46.4
Main Occupation (%)						
Crop farming	94.9	95.8	93.5	95.0	95.5	94.9
Service	3.1	1.7	6.5	5.0	4.5	4.2
Others	2.0	2.5	0.0	0.0	0.0	0.9
Education (Avg. years of schooling)	6.2	6.2	7.2	7.8	9.3	7.2
Family Size (Nos.)	6.1	6.9	6.5	7.7	9.7	7.2
Male	3.3	3.8	3.5	4.0	5.2	3.9
Female	2.8	3.0	3.0	3.6	4.4	3.3
Social grouping (%)						
SCs	26.0	27.0	27.0	22.0	17.0	24.1
STs	9.0	4.0	4.0	4.0	2.0	4.5
OBCs	46.0	53.0	50.0	56.0	64.0	53.2
General	19.0	16.0	20.0	18.0	18.0	18.2
Gender (%)						
Male	94.9	98.3	100.0	100.0	100.0	98.7
Female	5.1	1.7	0.0	0.0	0.0	1.3

Source: Field Survey, 2011-12

Most farmers (94.9%) had crop farming as their main occupation. The average age of head of the household was 46.4 years which indicates that the selected households were relatively younger. Farmers with higher education are more likely to adopt new technologies and have better market access. The sample households had average years of schooling of little over 7 years. There was a positive association between level of education and farm size. Less than 20 per cent of the sample households belonged to general category, while the share of backward and SC/ST farmers was higher. This indicates that pulses are mainly grown by resource poor households.

Land Ownership Pattern

The pattern of land ownership of the sample households shown in Table 7.10 shows that the average farm size in the study area was relatively large (5.80 ha) with the size of holding ranging from 0.92 ha for marginal households to 20.83 ha for large households. Dryland farming was predominant in the study area and nearly 60 per cent of the total operational land holding was unirrigated. The share of irrigated area was the highest (69.9%) on small households and the lowest (51.4%) on large farms. Land leasing was not very common in the study area. Surface irrigation accounted for more than half of the irrigated area while share of underground water was about 40 per cent (Table 7.11).

Table 7.10: Land ownership pattern of sample households in the survey areas

(ha)

Farm Size	Total owned land (1)		Leased in land (2)		Leased-out land (3)		Total operational holding (1+2-3)		
	I	UI	I	UI	I	UI	I	UI	Total
Marginal	0.38	0.56	0.00	0.00	0.01	0.01	0.37	0.55	0.92
Small	0.56	1.23	0.04	0.01	0.07	0.01	0.53	1.23	1.76
Semi-Medium	1.28	2.32	0.01	0.04	0.01	0.02	1.28	2.34	3.62
Medium	2.52	4.31	0.14	0.30	0.13	0.11	2.53	4.51	7.04
Large	9.76	9.90	0.36	0.96	0.00	0.15	10.12	10.71	20.83
All farms	2.30	3.30	0.10	0.20	0.10	0.10	2.40	3.40	5.80

Source: Field Survey, 2011-12

Table 7.11: Main source of irrigation (%) on sample households

Farm category	Surface	Groundwater (GW)	Others
Marginal	52.4	35.7	11.9
Small	46.3	41.5	12.2
Semi-medium	54.5	45.5	0.0
Medium	53.2	39.0	7.8
Large	57.5	42.5	0.0
All Farms	52.9	40.5	6.5

Source: Field Survey, 2011-12

Cropping Pattern

The area under kharif crops accounted for 69 per cent of the total cropped area in the study area (Table 7.12). About one-third of the total cropped area was under pulses and gram accounted for 17.5 per cent of the cropped area. Oilseeds accounted for about 18.4 per cent of the total cropped area of sample farms. Rice was not an important crop in the study area and occupied nearly one percent of the total area. The area under wheat was 6.8 per cent and large farmers had the highest area under wheat. Since the selected areas were predominantly rainfed, pulses, oilseeds and coarse cereals were important crops grown on the sample farms.

Crop Yields

The major concern for pulses has been low yield levels because most of the area under pulses is rainfed. The average productivity of gram was 949 kg per ha and ranged from 847 kg per ha in case of large farms to 973 kg per ha for semi-medium farmers (Table 7.13). The highest yield of gram was recorded in Madhya Pradesh (1124 kg/ha), followed by Maharashtra (971 kg/ha) and the lowest in Rajasthan (843 kg/ha). The yield in Madhya Pradesh and Maharashtra was comparatively higher than other states. The main reason for low productivity in Rajasthan and Karnataka was lack of irrigation facilities as only 27 per cent of the gram area in Rajasthan and 12-13 per cent in Karnataka was under irrigation, while in Madhya Pradesh 48.6 per cent area was irrigated in 2010-11.

Table 7.12: Cropping pattern on sample households

(% of GCA)

	Marginal	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farm*
Kharif	***74.6***	***72.3***	***70.9***	***65.5***	***61.5***	***69.0***
Rice	0.8	0.4	0.6	1.6	2.2	1.2
Pulses	10.7	16.0	13.7	16.4	14.0	14.1
Oilseeds	16.6	21.2	18.8	15.9	18.2	18.1
Others	46.4	34.7	37.9	31.6	27.2	35.6
Rabi	***25.5***	***27.7***	***28.9***	***34.5***	***38.3***	***31.0***
Wheat	3.6	2.9	7.0	8.1	12.2	6.8
Gram	17.8	20.0	12.7	17.2	19.9	17.5
Other pulses	0.3	0.4	1.1	1.1	1.4	0.9
Oilseeds	0.1	0.2	0.3	0.5	0.5	0.3
Others	3.7	4.2	7.9	7.6	4.4	5.5

Source: Field Survey, 2011-12

Table 7.13: Average productivity (kg/ha) of gram on sample households

Crop	*Marginal*	*Small*	*Semi-medium*	*Medium*	*Large*	*All Farm*
Maharashtra	971	953	977	994	-	971
MP	1120	1090	1432	1253	-	1224
Karnataka	846	794	958	917	-	897
Rajasthan	885	915	808	844	847	843
All	***959***	***920***	***973***	***929***	***847***	***949***

Source: Field Survey, 2011-12

Marketed Surplus and Farmers' Participation

The state-wise and farm category-wise estimates of gram production and retention for farm-family consumption are presented in Table 7.14. The total quantity of gram retained for farm-family consumption was estimated at 0.9 quintals per household, which worked out to about 3.9 percent of total production. Large farmers retained larger quantity (1.4q

per household) than small (60 kg) and marginal farmers (50 kg). Farmers retained about 7 percent of total production for seed purpose as they used their own seed because seed replacement rate in gram is less than 20.9 per cent in the country. The seed replacement rate is about 10 per cent in Madhya Pradesh, 12.5 per cent in Rajasthan, 17 per cent in Uttar Pradesh and about 21 per cent in Maharashtra.

Table 7.14: Gram production and retention pattern on sample households

(in qtls)

Farm Size	Production	Self-consumption		Seed (2)	Feed (3)	Others (4)	Total Retention (1+2+3+4)
		Retention (1)	Purchased				
Marginal	5.8	0.5	0.0	0.3	0.0	0.1	0.8
Small	9.8	0.6	0.0	0.5	0.0	0.1	1.3
Semi-medium	18.1	0.9	0.0	1.1	0.1	0.1	2.2
Medium	26.5	1.3	0.0	1.6	0.1	0.2	3.1
Large	72.8	1.4	0.0	6.8	0.4	0.7	9.3
All farms	***22.9***	***0.9***	***0.0***	***1.6***	***0.1***	***0.2***	***2.8***
States							
Maharashtra	10.5	0.7	0.1	0.3	0.0	0.1	1.0
MP	37.3	0.7	0.0	5.7	0.3	0.5	7.2
Karnataka	21.5	0.7	0.0	1.2	0.0	0.4	2.2
Rajasthan	22.9	1.3	0.0	0.6	0.1	0.0	2.0

Source: Field Survey, 2011-12

At farm household level, average farm retention (self-consumption, seed, and other purposes) was 12.2 per cent and varied from 11.7 per cent on medium farms to 13.8 per cent on marginal farms. In case of states, average farm retention was 8.8 per cent in Rajasthan, while in Madhya Pradesh, farmers retained about 19.3 per cent of gram for household use because seed replacement rate in Madhya Pradesh is one of the lowest. Nearly 60 per cent of the total retention was for seed purpose while 32 per cent was kept for self-consumption. However, there were regional differences. For example, in Rajasthan and Maharashtra more than two-thirds of the total retention was for food purpose while in

Madhya Pradesh, about 80 per cent was kept for seed purpose. In Karnataka, about half of the total output was retained for seed and 32 per cent for food purpose.

Average marketable and marketed surplus of gram on different categories of farm households are presented in Table 7.15. It is evident from the Table that average household was a net seller of gram. The survey findings show that 87.6 per cent of the total output produced in the selected states was offered as marketable surplus. The shares of small and marginal farmers were slightly below the average, while share of medium and semi-medium households were higher than this average. In case of states, Rajasthan had the highest (91.2%) marketable surplus while Madhya Pradesh had the lowest (80.7%) marketable surplus. Sometimes, the entire amount of marketable surplus which is available for sale, may not be actually sold in the market due to various reasons. Therefore, there may be a gap between marketable and marketed surplus on different size of land-holdings. Since marketed surplus represents actual sales by farmers, the difference between marketable and marketed surplus can reveal different patterns of sale, purchase and stockholding by various categories of farmers.

There was no significant difference between marketable and marketed surplus (sales as a proportion of production) for different categories of households. The marketed surplus was highest (88.7%) on large farms, followed by semi-medium (87.1%) and the lowest on marginal farms (85%). The net marketed surplus was almost same as gross marketed surplus, which indicates that farmers did not buy gram from the market for home consumption. However, in case of Madhya Pradesh, marketed surplus was higher (88.4%) than marketable surplus (80.7%), thereby indicating that farmers in the state had distress sales and sold more quantity without keeping adequate quantities for home consumption due to poor economic conditions. In other states, marketed surplus was lower than marketable surplus because farmers preferred to keep more quantity for self-consumption purpose to mitigate price risk because pulses have high price variability.

A comparison of the share of respective farm groups in the total marketed surplus showed that marginal farmers contributed the minimum quantity (4.5%), whereas large households offered the highest share (38%) to the marketable surplus (Table 7.16). The small and marginal farmers accounted for 9.3 per cent of total operated area but contributed 14.4 per

cent to total output and 13.5 per cent of total marketed surplus. On the other hand, share of medium and large farmers in total output as well as marketed surplus was lower than their share in total operated area. All categories of gram growers sold output in the market, which showed that farmers produced for the market.

The distribution of farmers presented in Table 7.17 shows that about three-fourths of the households sold more than 80 per cent of gram output in the market, while 7.5 per cent sold less than 60 per cent. About 13.3 per cent to sample farmers in Rajasthan sold less than 60 per cent of the total output in the market while 55.5 per cent sold more than 90 per cent of the produce in the market. In Karnataka, more than 80 per cent of the gram growers sold more than 80 per cent of their produce in the market while in case of Maharashtra, 63 per cent sold more than 80 per cent. These results clearly show that the level of market participation is very high in Karnataka, Maharashtra and Rajasthan.

Table 7.15: Average marketable surplus and gross and net marketed surplus of gram on different categories of households

Farm Size/ State	**Marketable Surplus**		**Gross Marketed Surplus**		**Net Marketed Surplus**	
	Quantity (qtl)	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***	***Quantity (qtl)***	***% of Total Production***
Marginal	5.0	86.5	4.9	85.0	4.9	84.7
Small	8.6	87.1	8.5	86.7	8.5	86.5
Semi-medium	15.9	87.8	15.7	87.1	15.7	86.9
Medium	23.5	88.4	22.8	85.9	22.7	85.7
Large	63.5	87.2	64.6	88.7	64.6	88.7
All farms	20.1	87.6	19.9	87.2	19.9	87.0
States						
Maharashtra	9.5	90.2	5.7	85.2	5.7	84.4
MP	30.1	80.7	33.0	88.4	33.0	88.4
Karnataka	19.2	89.6	19.0	88.3	19.0	88.3
Rajasthan	20.9	91.2	19.3	84.4	19.3	84.3

Source: Field Survey, 2011-12

Table 7.16: Market participation by gram producers by size of farm

Farm Size	Share (%) of Output	Share (%) of Marketed Surplus	Share (%) of Area Operated	Percentage of Farmers who Sold
Marginal	4.5	4.2	2.6	100.0
Small	9.9	9.3	6.7	100.0
Semi-Medium	14.8	15.0	12.1	100.0
Medium	32.7	34.0	37.5	100.0
Large	38.0	37.5	41.1	100.0
All Farm	100.0	100.0	100.0	100.0
States				
Maharashtra	11.4	8.4	7.4	100.0
MP	40.5	26.7	18.6	100.0
Karnataka	23.3	27.0	28.4	100.0
Rajasthan	24.7	37.9	45.7	100.0

Source: Field Survey, 2011-12

Table 7.17: Distribution of gross marketed surplus of gram in selected states

Quantity Sold	Maharashtra	Madhya Pradesh	Karnataka	Rajasthan	All Farm
<60%	9.0	1.0	6.8	13.3	7.5
60-70%	5.0	7.0	1.9	2.8	3.7
70-80%	13.0	34.0	10.5	9.6	14.8
80-90%	29.0	41.0	38.3	18.8	30.2
90-100%	44.0	17.0	42.6	55.5	43.8

Source: Field Survey, 2011-12

Access to Markets and Market Information

Table 7.18 shows the characteristics of the gram sales by the type of market. The data indicates that the majority of gram growers sold their produce in unregulated markets and a small proportion of households (18.8%) sold in the regulated markets. The average price received in unregulated markets was higher than regulated markets on all categories of farms except large farms.

The average distance to market was high for all categories of farms and varied from about 12.5 km on medium households to about 17.5 km on marginal and small farms.

Table 7.18: Sale pattern of gram by type of market on selected households

Farm Size	To whom and quantity sold in percent and Price in Rs.				Distance (km)
	Regulated Markets		Unregulated Markets		
	% Households	Price	% Households	Price	
Marginal	31.3	2732	68.8	2881	17.3
Small	18.8	2834	81.2	3187	17.4
Semi Medium	11.8	2911	88.2	3399	13.2
Medium	12.0	2858	88.0	3095	12.5
Large	30.9	3129	69.1	3112	15.4
All Farm	18.8	2850	81.2	3135	15.1

Source: Field Survey, 2011-12

Table 7.19: Farmers' awareness of minimum support price and sources of price information

Particulars	***Size of Farms***					
	Marginal	***Small***	***Semi-Medium***	***Medium***	***Large***	***All farms***
Aware of MSP (%)	18.9	24.5	31.9	32.6	30.0	28.2
Source of Information						
Trader	56.5	48.3	66.7	69.8	62.8	61.3
APMC Mandi	25.0	35.0	20.0	16.8	29.4	24.3
Print & Electronic media	18.5	16.7	13.3	13.4	7.8	14.5

Source: Field Survey, 2011-12

Farmers' awareness of Minimum Support price (MSP) and sources of information, which are important factors that influence access to markets, are presented in Table 7.19. Less than 30 per cent of the sample farmers in the study area were aware of MSP, and there was a positive association between farm size and MSP awareness. Traders were the main source of price information (61.3%) to the respondents, followed by visit to APMC mandies and electronic and print media. Print media, particularly local newspapers, was an important

source of information about price for small and marginal farmers. Therefore, there is a need to strengthen various channels of information to provide timely and reliable information to farmers.

The above results clearly indicate that total marketed surplus for gram was higher when compared with rice and wheat. The average marketed surplus was estimated to be about 87 percent and ranged from 85 per cent on marginal farms to 88.7 per cent on large farms. More than 80 per cent of total sales were in unregulated markets and prices received were higher on large households compared with small and marginal farms and were mainly dependent on traders for market information. The level of awareness about MSP was quite low, particularly among small and marginal farmers. This clearly established the need for strengthening market information system.

Chapter 8

Tur Economy of India: Analysis of Acreage, Production, Productivity and Marketed Surplus

Tur is grown on an area of about 5.5 million ha with an output of nearly 4.3 million tonnes globally. The cultivation is primarily confined to developing countries, mostly in Asia and Africa. Asia accounted for about 85 per cent of the world acreage and 83 per cent of the total world tur production while Africa's share in world acreage and production was about 13 and 15 per cent, respectively during TE2012 (FAO, 2014).

India is the world's largest producer of tur and accounts for about 63 per cent of the total global production. Myanmar is the second largest producer of tur with about 20 per cent of global production followed by other producers like Malawi (5%), Kenya (2.2%), and Uganda (2.1%). In terms of acreage, India has about 73 per cent of the global crop acreage, followed by Myanmar (11.6%) and Malawi (3.6%). In terms of productivity, India's position is lower (671 kg/ha) than the world average (777 kg/ha) and much lower than other producers like Myanmar (1320kg/ha) and Malawi (1100 kg/ha). India is also a major consumer of tur and imports about 3-4 lakh tonnes every year and more than 95 per cent of imports are from Myanmar, Malawi and Tanzania.

In India, tur is grown on about 4.1 million ha with a production of about 2.8 million tonnes. Like other pulses, tur is mainly grown under rainfed conditions and only 4 per cent of the area is under irrigation. Although tur can be grown under diverse agro-climatic conditions, more than three-fourth of total cropped area in the country is concentrated in the semi-arid tropics. Maharashtra has the largest acreage (about 31%) under the crop, followed by Karnataka (19.2%), Andhra Pradesh (about 12%), Madhya Pradesh (13.2%) and Uttar Pradesh (about 8%). The top five states account for nearly 85 per cent of the total tur area and production. Tur is a protein rich staple food and contains about 22 percent protein, which is almost three times that of cereals.

Production Performance

Tur production in the country increased from about 1.7 million tonnes in TE1973-74 to 2.8 million tonnes in TE2012-13 amounting to about 70 per cent increase in about four decades. During the same period, acreage under the crop increased from about 2.5 million ha to just over 4 million ha, representing an increase of about over 65 per cent. Yield, on the other hand, increased very marginally by about 2 per cent during the same period (Table 8.1). These statistics indicate that tur did not record significant growth in either production or yield, as further illustrated by Figure 8.1. The crop has experienced consistently high inter-annual acreage as well as yield variability over time. Most of the increase in production was due to increased land as yield increased marginally from 682 kg per ha (1971-73 average) to 698 kg per ha (2010-12). The compound annual growth rates of area, production and yield of tur for the period 1971-2012 are also presented in Table 8.1.

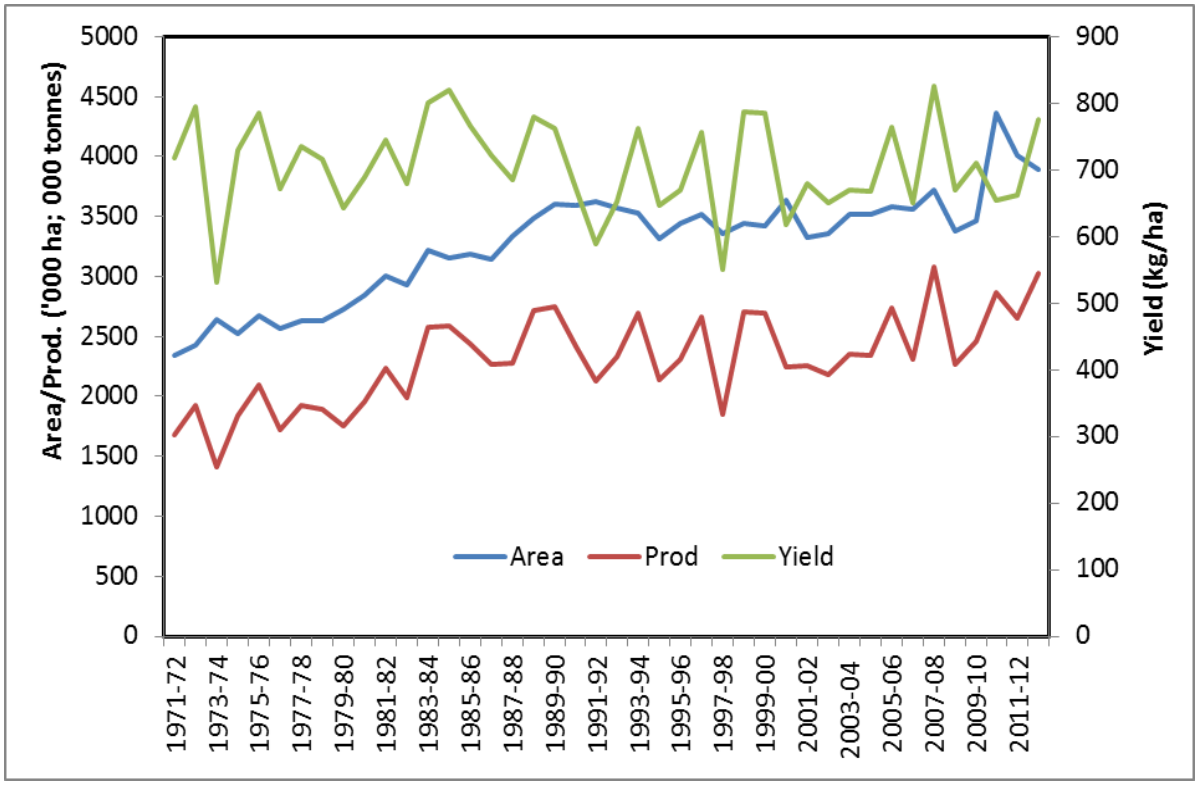
Table 8.1: Average area ('000 ha), production ('000 tonnes), and yield (kg/ha) of tur in India: 1971-72 to 2012-13

	1971-72 to 1973-74	**1981-82 to 1983-84**	**1991-92 to 1993-94**	**1999-00 to 2001-02**	**2010-11 to 2012-13**
Area	2472	3050	3578	3462	4089
Production	1673	2267	2385	2400	2846
Yield	682	742	667	695	698
CAGR (%)					
	1970s	**1980s**	**1990s**	**2000s**	**All Period**
Area	1.59***	2.22***	-0.22	1.63***	1.04***
Production	1.30	1.70	0.73	2.22**	0.94***
Yield	-0.29	-0.51	0.95	0.57	-0.11
Coefficient of Variation (%)					
Area	5.53	7.16	3.10	8.65	13.77
Production	10.46	9.79	12.59	11.54	16.11
Yield	10.75	6.98	12.60	8.04	9.91

Source: Author's calculation using data from GoI (2013)

It is evident from the above Table that growth performance of the crop was not impressive during the last four decades as the crop production registered an annual growth rate of less than one per cent (0.94%) while area grew by nearly 1.04%. The growth rate in yield was negative. However, performance has differed during different decades. The estimates of decadal growth rate of area and production reveals that the growth rate in production was the highest (2.22%) during the last decade, while acreage growth was the highest (2.22%) during the 1980s. Tur yield witnessed a negative growth rate during the 1970s and 1980s but improved marginally during the last two decades, but growth rate was less than one per cent.

Figure 8.1: Trends in Tur area, production and yield in India: 1971-72 to 2012-13



Source: GoI (2014)

Over the 2010-12 period, on average 2.85 million tonnes of tur was annually produced in the country. A more disaggregated distribution of tur acreage and production in India are shown in Tables 8.2 and 8.3. At the state level, Maharashtra had the largest share in production (32.9%) with 937.7 thousand tonnes, followed by Karnataka which produced 416.4 thousand tonnes (14.6%), Madhya Pradesh at 283 thousand tonnes (10%) and Gujarat which produced about 267 thousand tonnes (9.4%) (Table 8.2). While, Andhra Pradesh,

Gujarat, Karnataka and Maharashtra have increased their shares in total production during the last three decades, Uttar Pradesh and Madhya Pradesh have lost their shares in national production. For example, Andhra Pradesh has increased its share from 2.6 per cent to 7.8 per cent; Karnataka has increased its share from 7.7 to 14.6 per cent and Maharashtra from 19.3 to 32.9 per cent during the same period. Tur is not a principal foodgrains crop in most of the states as its share in total foodgrains production varied from about one percent to about 7 percent in all major producing states.

Table 8.2: Share of major states in tur production in India: TE1983-84 and TE2011-12

State	Share in all-India production				Share in foodgrains production in state			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2012-13***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
Maharashtra	19.3	23.8	32.0	32.9	4.3	4.5	6.8	6.8
Karnataka	7.7	5.8	9.7	14.6	3.1	1.6	2.4	3.2
U.P.	28.0	23.2	21.0	11.3	2.4	1.5	1.1	0.6
M.P.	19.5	15.3	10.7	10.0	3.2	2.0	1.4	1.3
Gujarat	8.5	13.4	8.1	9.4	2.1	7.4	5.1	3.4
A. P.	2.6	4.2	7.8	7.8	0.5	0.8	1.3	1.1
All India	100.0	100.0	100.0	100.0	1.6	1.3	1.2	1.1

Source: GoI (2014)

In terms of acreage, Maharashtra accounts for about one-third of the total cropped area, followed by Karnataka (18.9%), Andhra Pradesh (13%) and Madhya Pradesh (12.7%). Andhra Pradesh, Karnataka and Maharashtra have increased their share while Madhya Pradesh, Uttar Pradesh and Gujarat have lost their shares in total acreage. Tur is an important crop in Maharashtra and Karnataka with more than 5 per cent share in total cropped area while in other states the share in total cropped area is 1-2 per cent. Uttar Pradesh and Gujarat have lost their shares in total acreage during the last three decades.

Table 8.3: Share of major states in area under tur in India: TE1983-84 and TE2011-12

State	Share in all-India acreage				Share in Total cropped Area in state			
	TE1983-84	***TE1993-94***	***TE2001-02***	***TE2012-13***	***TE1983-84***	***TE1993-94***	***TE2001-02***	***TE2011-12***
Maharashtra	23.1	28.6	30.4	30.3	3.4	4.9	4.9	5.3
Karnataka	12.4	12.2	15.1	18.9	3.3	3.5	4.4	6.0
Andhra Pradesh	8.2	8.9	13.1	13.0	1.9	2.5	3.5	3.9
Madhya Pradesh	16.8	11.7	10.0	12.7	2.3	1.8	1.4	2.2
Uttar Pradesh	16.5	14.8	11.7	7.9	2.0	2.1	1.5	1.0
Gujarat	8.6	11.5	9.7	6.1	2.5	3.8	3.2	2.2
All India	100.0	100.0	100.0	100.0	1.7	1.9	1.8	2.0

Source: Author's calculation using data from GoI (2013)

The average grain yield of tur for the period 2006-2011 was about 696 kg per ha. This yield is significantly lower than the potential yield for improved varieties. There are significant variations in the yield over the years as well as states. In the period 2006 to 2011, Gujarat had the highest yield (966 kg/ha), followed by Uttar Pradesh (860 kg/ha) and the lowest yield of 444 kg per ha was in case of Andhra Pradesh. The all India average yield witnessed a declining trend from 762 kg per ha in 1981-85 to 696 kg per ha in 2006-11. Madhya Pradesh and Uttar Pradesh also witnessed a decline in yield. Although Andhra Pradesh had the lowest yield, it recorded the highest increase in yield (77.6%) between 1981-86 and 2006-11. Other notable producers such as Gujarat, Karnataka and Maharashtra also recorded improvements in crop yield.

During the 1980s and early-1990s most of tur producing states experienced decline in yield. Madhya Pradesh witnessed a consistent decline in yield since early-1990s. These trends clearly show that tur productivity has remained low and low productivity has been a major constraint to the expansion of tur production. There is a need to improve productivity by promoting the use of improved varieties, better disease management and provision of other inputs and services to farmers.

Table 8.4: Changes in tur yield by major producing states and all India average: 1981-2012

State	1981-85	1986-90	1991-95	1996-2000	2001-05	2006-11
Andhra Pradesh	250	214	315	356	456	444
Gujarat	745	651	740	760	818	966
Karnataka	473	390	368	447	478	539
Madhya Pradesh	850	1024	847	792	755	662
Maharashtra	619	602	552	655	696	757
Uttar Pradesh	1351	1268	1029	1180	1036	860
India	762	724	664	700	686	696

Source: Author's calculation using data from GoI (2013)

Growth Rates in Area, Production and Yield of Tur

In this section, we estimate growth rates in the production, area, yield of tur in major producing states during the last three decades and the results are presented in Table 8.5. Tur production in the country increased at an annual compound growth rate of about 0.40 per cent during 1981-2012 while area grew at 0.60 per cent and yield registered a decline(-0.20%) during the same period. Area expansion has been a major source of increase in production during the last three decades. The results also indicate that the compound annual growth rate in the tur production during the last decade was higher (2.22%) than the annual growth rate in production during the 1980s and 1990s. Also, the last decade registered the higher annual rates of growth in area (1.63%) than 1990s. However, performance differs among states. For example, Andhra Pradesh recorded the highest growth rate (5.47%), followed by Karnataka (2.98%) and Maharashtra (2.65%) during 1981-2012 period. On the other hand, Uttar Pradesh and Madhya Pradesh had significant negative growth rates. During the 2000s, Karnataka registered the highest growth rate (7.14%) in tur production while Gujarat and Maharashtra also had significant positive growth rates. However, during the 1990s, all major tur producing states except Karnataka had either significant negative or stagnant growth rate. Gujarat and Uttar Pradesh had negative growth rate in tur acreage during the last three decades. The growth trends clearly show that performance of tur has not been very encouraging in Gujarat, Madhya Pradesh and Uttar Pradesh during the last three decades.

Table 8.5: Annual growth rates of tur area, production and yield in selected states, 1981-82 to 2012-13

State	1980s	1990s	2000s	All
Area				
Andhra Pradesh	4.78***	4.69***	1.23	2.49***
Gujarat	5.19***	-2.05**	-2.28***	-0.73**
Karnataka	3.37***	2.83	3.97***	1.99***
MP+Chhattisgarh	-2.05***	-2.02**	4.65***	-0.34
Maharashtra	4.12***	0.34	1.50**	1.61***
Uttar Pradesh	-0.59	-3.22***	-1.99***	-1.73***
MP	-	-	5.28***	-0.95***
Chhattisgarh	-	-	0.08	0.40
All India	2.22***	-0.22	1.63***	0.60***
Production				
Andhra Pradesh	2.93	7.33	1.18	5.47***
Gujarat	4.71	-4.61	2.49**	0.68
Karnataka	-0.22	8.57*	7.14**	2.98***
MP+Chhattisgarh	0.97	-3.64**	2.37	-1.85***
Maharashtra	3.1	4.61	2.48*	2.65***
Uttar Pradesh	-1.08	-0.9	-3.28**	-3.09***
MP	-	-	2.45	-2.30***
Chhattisgarh	-	-	1.34	1.82
All India	1.7	0.73	2.22*	0.40*
Yield				
Andhra Pradesh	-1.76	2.52	-0.05	2.92***
Gujarat	-0.46	-2.61	4.88***	1.42**
Karnataka	-3.47**	5.59	3.05	0.97*
MP+Chhattisgarh	3.09	-1.38	-2.71	-1.37***
Maharashtra	-0.98	4.25	0.96	1.02**
Uttar Pradesh	-0.5	2.39**	-1.32	-1.39***
MP	-	-	-2.69	-1.36***
Chhattisgarh	-	-	1.26	1.42
All India	-0.51	0.95	0.57	-0.20

Source: Author's calculation using data from GoI (2013)

Classification of states according to yield level and growth rate in productivity is presented in Table 8.6. It is evident from the Table that none of the major tur producing states had a significant increase in yield during the 1980s. Karnataka from low productivity category states had significant negative growth rate in crop yield while other states had stagnant positive or negative growth rates. During the 1990s, Uttar Pradesh witnessed a significant increase in tur yield, and other states had stagnant positive/negative growth rate. During the last decade, Gujarat from high productivity category was the only state which recorded significant positive growth rate in yield. Tur is an important legume crop in the semi-arid regions of the country and the second most important pulse crop but has low crop productivity. Therefore, concerted efforts are needed to improve productivity.

Table 8.6: Classification of states according to productivity levels and growth in productivity of tur in India

Productivity Level	Significant increase in yield	Significant decline in yield	Stagnant yield with positive sign	Stagnant yield with negative sign
1981-82 to 1990-91				
High	-	-	Madhya Pradesh	Uttar Pradesh
Low	-	Karnataka	Maharashtra	Gujarat, A.P.
1991-92 to 2000-1				
High	Uttar Pradesh	-	-	Gujarat, M.P.
Low	-	-	Andhra Pradesh, Karnataka, Maharashtra	-
2001-02 to 2011-12				
High	Gujarat	-	Uttar Pradesh	Madhya Pradesh
Low	-	-	Karnataka, Maharashtra	Andhra Pradesh
1981-82 to 2011-12				
High	Gujarat, U.P.	M.P.	-	-
Low	Andhra Pradesh, Karnataka, Maharashtra	-	-	-

Source: Author's calculation using data from GoI (2013)

Marketed Surplus: An Empirical Analysis

This section examines the organization and behavior of the marketed surplus of tur using household data from 441 tur producers surveyed by participating Agro-Economic Research Centres (AERCs) in four major tur producing states, namely, Maharashtra, Madhya Pradesh, Uttar Pradesh and Karnataka during 2011-12 (Table 8.7). The study is based on the survey data collected from two districts (Amravati and Latur) from Maharashtra, two districts (Bijapur and Gulbarga) from Karnataka, two districts (Fatehpur and Hamirpur) from Uttar Pradesh and one district (Narshingpur) from Madhya Pradesh.

Table 8.7: Size-distribution of sample households in selected states

State	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*Total*
Maharashtra	33	42	20	5	-	100
Madhya Pradesh	9	13	28	34	16	100
Karnataka	19	39	33	36	14	141
Uttar Pradesh	52	24	12	12	-	86
Total	***113***	***118***	***93***	***87***	***30***	***441***

Source: Field Survey, 2011-12

In order to understand the pattern and behavior of marketed surplus, a description of the socio-economic characteristics, land use pattern, and other relevant information are discussed in this section.

General Characteristics

Table 8.8 presents data on socio-economic characteristics of sample tur farmers. About 96 per cent of the sample households were male-headed. The average age of head of the household was 46.6 years, and there were no significant differences in the ages among different farm categories. The average household size varied from 5.6 members in marginal households to 9.5 in large households. Crop farming was the main source of occupation on all categories of households. The sample households had average years of schooling of 6.6 years and there was a positive association between education and farm size. Farmers with higher level of education are more likely to adopt new technologies and are linked to

markets. The share of OBC category farmers was the highest (45.4%), followed by SC category (27%) and general category (21.5%).

Table 8.8: Socio-economic profile of sample farm households by size of farm in the study areas

Characteristics	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farms*
Age (years)	47.0	46.8	46.7	47.5	41.6	46.6
Main Occupation (%)						
Crop farming	96.5	99.2	98.9	100.0	100.0	98.6
Service	1.8	0.0	0.0	0.0	0.0	0.5
Others	1.8	0.8	1.1	0.0	0.0	0.9
Education (Avg. years of schooling)	5.2	6.2	7.7	7.4	8.1	6.6
Family Size (Nos.)	5.6	6.2	7.1	7.3	9.5	6.7
Male	2.9	3.4	3.6	4.0	5.3	3.6
Female	2.8	2.8	3.5	3.3	4.2	3.1
Social grouping (%)						
SCs	22.1	29.7	25.8	25.3	43.3	27.0
STs	8.8	5.9	5.4	3.4	6.7	6.1
OBCs	53.1	40.7	44.1	49.4	26.7	45.4
General	16.0	23.7	24.8	21.8	23.3	21.5
Gender (%)						
Male	94.7	94.1	96.8	97.7	100.0	95.9
Female	5.3	5.9	3.2	2.3	0.0	4.1

Source: Field Survey, 2011-12

Land Ownership Pattern

The pattern of land ownership of sample households is presented in Table 8.9. The average farm size in the study area was 3.41 hectares and the size of holding ranged from 0.69 ha on marginal farms to 15.6 ha on large households. About 55 per cent of operational land holding was irrigated in all states. The share of irrigated area was the highest (61.5%) on medium farms and the lowest (42.4%) on small farms. The incidence of land leasing was

relatively higher on medium and large farms and share of leased-in land was about 15.2 per cent. On the other hand, leasing-out was not common for sample households.

Table 8.9: Land ownership pattern of sample households in the survey areas

(ha)

Farm Size	***Total owned land (1)***		***Leased in land (2)***		***Leased-out land (3)***		***Total operational holding (1+2-3)***		
	I	*UI*	*I*	*UI*	*I*	*UI*	*I*	*UI*	*Total*
Marginal	0.36	0.33	0.00	0.00	0.00	0.00	0.36	0.33	0.69
Small	0.61	0.88	0.03	0.01	0.00	0.03	0.64	0.87	1.51
Semi-Medium	1.42	1.32	0.05	0.02	0.02	0.05	1.46	1.28	2.74
Medium	2.84	2.09	0.86	0.29	0.00	0.06	3.70	2.32	6.02
Large	5.11	6.54	3.24	0.71	0.00	0.00	8.35	7.25	15.60
All farms	1.46	1.46	0.41	0.11	0.00	0.03	1.87	1.54	3.41

Source: Field Survey, 2011-12

Cropping Pattern

The area under kharif crops accounted for 67.4 per cent of total cropped area in the study area (Table 8.10). About 70 per cent of total cropped area was under foodgrains. Tur accounted for 36 per cent of the total cropped area on sample farms. The share of tur was the highest (39.8%) on small farms and the lowest on marginal farms (33.5%). Wheat was an important crop during rabi season, and its share in total cropped area was 17.2 per cent. Marginal farmers allocated relatively large share of land to wheat. Other pulses accounted for 8.3 per cent of the total cropped area. Total pulses accounted for about 45 per cent of total cropped area.

Crop Yield

The average productivity of tur on the surveyed households varied from 838 kg per ha in case of small farmers to 928 kg per ha on semi-medium farms (Table 8.11). The highest yield was observed in Madhya Pradesh (1040 kg/ha), followed by Maharashtra (898 kg/ha) and the lowest in Uttar Pradesh (825 kg/ha). The yields in Karnataka, Maharashtra and Madhya Pradesh were higher than the sample average while Uttar Pradesh had a lower yield.

Table 8.10: Cropping pattern on sample households

(% of GCA)

Crop	*Marginal*	*Small*	*Semi-Medium*	*Medium*	*Large*	*All Farm*
Kharif						
Cereals	12.0	7.1	6.2	5.0	3.7	7.5
Tur	33.5	39.8	36.1	33.7	36.4	36.0
Oilseeds	13.4	19.8	20.1	19.4	22.2	18.3
Others	4.8	7.1	3.9	7.0	3.7	5.6
Rabi						
Wheat	22.7	12.7	16.9	16.7	16.3	17.2
Pulses	10.2	6.8	7.8	8.3	9.2	8.3
Others	3.5	6.7	9.1	10.0	8.5	7.2

Source: Field Survey, 2011-12

Table 8.11: Average productivity (kg/ha) of tur on sample households

Crop	*Marginal (≤1 ha)*	*Small (1-2 ha)*	*Semi-medium (2-4 ha)*	*Medium & Large (>4 ha)*	*All Farm*
Karnataka	746	701	745	882	839
M.P.	910	950	1260	1040	1040
Maharashtra	835	943	838	957	898
U. P.	861	830	834	791	825
All	846	838	928	922	895

Source: Field Survey, 2011-12

The main reason for low productivity of tur was lack of irrigation facilities as less than five percent of tur area was under irrigation at national level. The average productivity of tur under irrigated conditions was significantly higher than unirrigated areas on sample farmers.

Marketed Surplus and Farmers' Participation

This section presents an overview of tur production and marketing patterns and examines how these patterns vary across states and among different farm sizes. Table 8.12 shows tur production and on-farm consumption in selected states and farm categories.

The average farm retention (self-consumption, seed, and other purposes) was about 9.5 per cent but varied from 5.1 per cent on large farms to 15-16 per cent on small and marginal farms. In the case of states, average farm retention was lower (7.3%) in Karnataka while in Uttar Pradesh, farmers retained about 24 per cent of tur for household use because tur is main pulse in their diet. More than 57 per cent of the total retention was for self-consumption while nearly 43 per cent was kept for seed purpose. However, there were regional patterns. For example, in Uttar Pradesh 83.3 per cent of total retention was for food purpose while in Karnataka and Madhya Pradesh, less than half was kept for food purpose. In Maharashtra, about two-thirds of total retained output was for food purpose and 16.7 per cent was for seed purpose. The retention for seed purpose was higher in Karnataka due to lower seed replacement rates in the state (13%) while in Maharashtra, the seed replacement rate was higher (31%), so retention for seed purpose was less (16.7%).

Table 8.12: Tur production and retention pattern on sample households

(in qtls)

Farm Size	Production	Self-consumption		Seed (2)	Feed (3)	Others (4)	Total Retention (1+2+3+4)
		Retention (1)	Purchased				
Marginal	2.5	0.3	0.0	0.1	0.0	0.0	0.4
Small	6.0	0.6	0.0	0.3	0.0	0.1	0.9
Semi-medium	9.9	0.9	0.0	0.5	0.0	0.3	1.4
Medium	25.7	1.2	0.0	1.0	0.0	0.7	2.4
Large	79.0	1.5	0.0	1.8	0.0	1.1	4.0
All farms	14.8	0.8	0.0	0.6	0.0	0.3	1.4
States							
Karnataka	24.7	0.8	0.0	0.7	0.0	0.3	1.8
M.P.	24.4	1.4	0.0	0.8	0.0	0.7	2.9
Maharashtra	3.6	0.4	0.1	0.1	0.0	0.0	0.6
U. P.	2.5	0.5	0.0	0.1	0.0	0.0	0.6

Source: Field Survey, 2011-12

Average marketable and marketed surplus of tur on different categories of farms are presented in Table 8.13. It is evident from the Table that average household is a net seller of tur in all states. The survey findings show that more than 90 per cent of the total output produced is offered as marketable surplus. The share of small, marginal and semi-medium farmers was below average, while share of medium (90.7%) and large (94.9%) households was higher than this average.

The entire amount of marketable surplus, which is available for sales, may or may not be actually sold in the market. Therefore, there can be a gap between marketable and marketed surplus due to various reasons. Since marketed surplus represents actual quantity sold by farmers, the difference between marketable and marketed surplus can reveal different patterns of sale, purchase and stockholding by various categories of farmers. The gross marketed surplus (sales as a proportion of production) for small, marginal, semi-medium and medium farmers was higher than marketable surplus, indicating forced/distress sale by tur growers. The percentage of marketed surplus was highest (99.5%) on the medium households, followed by small (90.5%) and the lowest on semi-medium farms (86.5%). The net marketed surplus was equal to the gross marketed surplus, indicating that farmers did not buy tur from the market for home consumption. The marketable surplus was highest (92.7%) in Karnataka and the lowest (76.0%) in Uttar Pradesh, while marketed surplus was the highest (96.8%) in Madhya Pradesh and the lowest (85.7%) in Maharashtra. These trends clearly indicate that in Madhya Pradesh farmers grow tur primarily for the market.

A comparison of the share of respective groups in the total output and marketed surplus showed that marginal farmers contributed the lowest quantity (10.4%), whereas large households offered the highest share of marketable surplus accounting for over 36 per cent of the total marketed surplus. It is interesting to note that small and marginal farmers accounted for about 17 per cent of the total operated area but contributed only 14-15 per cent to total output and marketed surplus. On the other hand, share of large famers in total output as well as marketed surplus was higher than their share in total cropped area. All categories of tur growers sold output in the market and the proportion of farmers who sold in the market was the highest in case of large farms (100%) and the lowest (96.5%) on

marginal farms. These trends indicate that tur farmers are commercial farmers and produce for the market in addition to meeting their own requirements.

Table 8.13: Average marketable surplus and gross and net marketed surplus of tur on different categories of households

Farm Size	*Marketable Surplus*		*Gross Marketed Surplus*		*Net Marketed Surplus*	
	Quantity (qtl)	*% of Total Production*	*Quantity (qtl)*	*% of Total Production*	*Quantity (qtl)*	*% of Total Production*
Marginal	2.1	84.0	2.2	89.5	2.2	89.5
Small	5.1	85.0	5.4	90.5	5.4	90.5
Semi-medium	8.5	85.9	8.6	86.5	8.6	86.5
Medium	23.3	90.7	25.6	99.5	25.6	99.5
Large	75	94.9	67.2	85.0	67.2	85.0
All farms	13.4	90.5	13.7	92.5	13.7	92.5
State						
Karnataka	22.9	92.7	22.4	90.8	22.4	90.8
M.P.	21.5	88.1	23.6	96.8	23.6	96.8
Maharashtra	3	83.3	3.1	85.7	3.0	82.9
U. P.	1.9	76.0	2.1	85.8	2.1	85.8

Source: Field Survey, 2011-12

Table 8.14: Market participation by tur producers by size of farm

Farm Size	**Share (%) of Output**	**Share (%) of Marketed Surplus**	**Share (%) of Area Operated**	**Proportion of Farmers who Sold**
Marginal	4.3	3.9	5.2	96.5
Small	10.8	10.3	11.8	98.3
Semi-Medium	17.0	16.6	17.0	97.8
Medium	33.1	33.0	34.9	97.7
Large	34.8	36.1	31.1	100.0
All Farm	100.0	100.0	100.0	97.7

Source: Field Survey, 2011-12

The distribution of farmers presented in Table 8.15 shows that about 45 per cent of households sold more than 90 per cent of the output in the market, while 12.7 per cent sold less than 60 per cent. The share of farmers who sold more than 90 per cent of the output was the highest in Uttar Pradesh (59%) and the lowest in Madhya Pradesh (33%). In Karnataka, more than 87 per cent of tur growers sold more than 80 per cent of the total produce, while in Madhya Pradesh and Uttar Pradesh the share was about two-third.

In Uttar Pradesh, 25 per cent of the farmers sold less than 60 per cent of the produce in the market while this share was extremely low in Karnataka (1.4%) and Maharashtra (7%). These results clearly show that the level of market participation is quite high in all states.

Table 8.15: Distribution of gross marketed surplus of tur in selected states

Marketed Surplus	Karnataka	M.P.	Maharashtra	U.P.	All
<60%	1.4	23.0	7.0	25.0	12.7
60-70%	2.8	5.0	10.0	3.0	5.0
70-80%	8.5	16.0	17.0	6.0	11.6
80-90%	44.7	23.0	22.0	7.0	25.9
90-100%	42.6	33.0	44.0	59.0	44.9

Source: Field Survey, 2011-12

Sale Pattern of Tur

Table 8.16 shows the characteristics of the tur sale pattern by the type of agency. The data indicates that more than two-thirds of tur output was sold to government agencies, while 31.4 per cent was sold to private traders. It is interesting to note that with increase in farm size, share of marketed surplus sold to government agencies also increased. This indicates that large farmers had better access to public procurement system while small and marginal farmers were more dependent on private traders. However there were regional variations. For example, more than 93 per cent of produce in Karnataka was sold to government agencies while in Maharashtra, 95.5 per cent of the total marketed surplus was sold to private traders. In case of Madhya Pradesh, 52 per cent was sold to government agencies while 40.7 per cent was sold to private traders.

Table 8.16: Sale pattern of tur by type of buyer on selected households

Farm Size	To whom and quantity sold in percent and Price in Rs.					
	Organized Sector		Unorganized Sector		Others	
	% Sold	Price	% Sold	Price	% Sold	Price
Marginal	40.0	3138	58.8	3162	1.2	3000
Small	51.8	3236	47.7	3158	0.5	2600
Semi Medium	57.2	3247	42.8	3143	-	-
Medium	67.4	3207	32.2	3246	0.4	2800
Large	82.0	3356	18.0	3100	-	-
All Farm	68.4	3223	31.4	3165	0.2	2764
State						
Karnataka	93.4	3351	6.6	3238	-	-
M.P.	52.0	3089	40.7	2892	7.3	2785
Maharashtra	-	-	95.5	3088	4.5	2850
U.P.	87.0	2978	13.0	2965	-	-

Source: Field Survey, 2011-12\

The price paid to farmers by government agencies was higher (Rs. 3223/q) than private traders (Rs. 3165/q). Small and marginal farmers received marginally lower prices compared with large farmers. Karnataka farmers received higher price compared with other states under both public and private trade. Farmers in Uttar Pradesh received the lowest price (Rs.2978/q) from government agencies while in case of private traders; Madhya Pradesh farmers received the lowest price (Rs.2892/q).

It is evident from the earlier discussion that average marketed surplus of tur was much higher than other crops and was highest (99.5%) for the medium households, followed by small (90.5%) and the lowest on semi-medium farms (86.5%). The gross marketed surplus on small, marginal, semi-medium and medium farms was higher than marketable surplus, which indicated distress sale by tur growers. The marketable surplus was highest (92.7%) in Karnataka and the lowest (76.0%) in Uttar Pradesh while marketed surplus was the highest

(96.8%) in Madhya Pradesh and the lowest (85.7%) in Maharashtra. The results of market access indicated that large farmers had better access to organized sector, while small and marginal farmers were more dependent on private trade.

Chapter 9

Summary, Concluding Observations and Policy Implications

Agriculture constitutes only about 12 per cent of India's GDP, even though it is the largest employer and majority of the rural population depend on agriculture for their livelihood. Improving the performance of agriculture is, therefore, crucial for achieving food security, rural development and poverty reduction. The contribution of the agricultural sector to national gross domestic product (GDP) has witnessed a secular decline with the consequent increase in shares of other sectors, particularly services. However, agriculture's output share is declining faster than that of employment. Indian agriculture, which witnessed a visible deceleration during the 9th and 10th Five-Year Plans, recorded a robust growth during the 11th Plan. The foodgrains production touched a new peak of about 265 million tonnes in 2013-14, an addition of about 55 million tonnes between TE2005-06 and TE2013-14.

Indian agriculture has also witnessed structural changes with the composition of agricultural output shifting from traditional foodgrains to high-value products. Agriculture is increasingly being driven by expanding demands for livestock products and other high-value crops like fruits and vegetables, processed foods and beverages. Since 1980s, the composition of agricultural output has shifted dramatically. At the all-India level, the share of high-value commodities/products (fruits and vegetables, livestock products, fisheries) has increased from about one-third in TE1983-84 to over 50 per cent in TE2011-12. The composition of export trade has also changed, away from traditional products towards products such as horticulture, livestock, as well as processed products. The Indian food consumption basket has become increasingly diversified and expenditure on fruits, vegetables, milk, eggs, meat and fish, and beverages and processed food is rising, leading to changes in cropping pattern in the country.

Indian agriculture has become increasingly market-oriented and monetized. The proportion of agricultural production that is marketed by the farmers has increased significantly over

the last few decades. In the early 1950s, about 30-35 per cent of foodgrains output was marketed, which now has increased to more than 70 per cent. The marketed surplus is relatively higher in case of commercial crops than subsistence crops.

Understanding marketing behaviour of producers and reliable estimates of marketed surplus as well as factors affecting it can be of significant help in designing appropriate production, procurement, storage, distribution and pricing policies. Recognizing its importance, Government of India initiated an all India survey for estimation of marketable surplus and post-harvest losses in early-1970s which continued up to late-1990s. As Indian agriculture has undergone significant transformation, and no reliable estimates of marketed and marketable surplus are available, the present study was undertaken to estimate marketed and marketable surplus of major food crops in leading producing states and examine important factors which determine the level of marketed surplus for various categories of farms. It is expected that the results of this study would be useful in designing effective food procurement, distribution and price policy.

Objectives of Study

The main objectives of the study are:

1. To estimate marketable and marketed surplus of selected cereals (rice, wheat, maize, and bajra) and pulses (gram and tur) in selected states,
2. To estimate farm retention pattern of households for self-consumption, seed, feed, wages and other payments in kind, and
3. To examine the impact of various socio-economic, technological institutional, infrastructure, and price factors on marketed surplus of major crops

Methodology and Coverage

As the major focus of the study was on the estimation of the marketed and marketable surplus of foodgrains and response of marketed surplus to price and other exogenous variables, the study uses both primary and secondary data pertaining to selected foodgrains. In order to understand the emerging trends in production and yield performance, secondary data on area, production and productivity were collected from different published sources.

The primary data was collected from 918 households selected from nine districts in four major rice producing states, Haryana, Punjab, Uttar Pradesh and West Bengal; 1193 wheat farmers from 15 districts of Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana and Punjab, 358 maize growers from Rajasthan, Maharashtra and Karnataka, 500 bajra farmers from seven districts of Haryana, Rajasthan and Uttar Pradesh, 553 farmers from major gram growing states, namely, Rajasthan, Maharashtra, Karnataka and Madhya Pradesh and 441 households cultivating tur from seven districts of Uttar Pradesh, Madhya Pradesh, Maharashtra and Karnataka. The household survey was conducted by the participating Agro-Economic Research Centres/Units. The reference period for the study is 2011-12.

Major factors influencing marketed surplus, primary data from the households growing selected crops were collected. The data on the socio-economic profile, operational holding, cropping pattern, crop production, farm retention, access to inputs and services, etc. were also collected from farmers in selected states.

Summary of Findings

Rice

Rice is the most important crop in India occupying about 43.2 million ha of the total cultivated area and having a total production of over 102 million tonnes (TE2012-13). Rice had the highest contribution (14.5%) to the total value of output from agriculture and allied activities in TE2012-13 and also emerged as India's top agricultural export commodity with about 15.2 per cent of the total agricultural export value in TE2013-14.

Rice production in the country increased at an annual compound growth rate of 2.35 per cent during the period 1971-2012, of which yield accounted for nearly 84 per cent and area, 16 per cent of the production growth rate. Rice production has continued to increase during the last four decades; however, rice production (4.2%) and yield (3.58%) recorded the highest growth rate during the 1980s and the lowest (1.86% in production and 1.07% in yield) during the 1990s. However, growth rate picked up during the last decade.

Uttar Pradesh has the largest share (13.3%) in rice acreage, followed by West Bengal (12.4%), Odisha (9.8%), Andhra Pradesh (9.5%), Chhattisgarh (8.7%), Bihar (8%) and Punjab (6.6%). Punjab, Haryana and Karnataka have consistently increased their shares in rice

acreage during the last three decades while Odisha, Tamil Nadu and West Bengal have marginally lost their share. In terms of production, top five states accounted for 55 percent of the total rice production in the country. Currently, West Bengal is the largest producer, accounting for 14.5 per cent of the total rice production in the country. Other major producers include Andhra Pradesh (13%), Uttar Pradesh (13%), Punjab (11.2%) and Odisha (6.7%).

Rice yields, which were low (about 1393 kg/ha on the average) during the early-1980s, witnessed a steady increase during the last three decades and reached a level of 2175 kg/ha in the recent period (2006-11). However, rice yield in the country is lower compared to other major rice producing countries such as China (6.74 t/ha), Indonesia (5.14 t/ha), and Vietnam (5.63 t/ha) as well as the world average (4.39 t/ha). At the state level, Punjab has the highest yield (3949 kg/ha), followed by Andhra Pradesh (3134 kg/ha) and Haryana (3024 kg/ha), while Madhya Pradesh (933 kg/ha), has the lowest yield. Rice yields are relatively lower in eastern states of Assam, Jharkhand, Chhattisgarh and Odisha.

Due to effective government procurement policy, rice procurement has increased significantly from about 21 million tonnes in 2000-01 to 35 million tonnes in 2011-12 with a slight decline to 34 million tonnes in 2012-13 and 31.3 million tonnes in 2013-14. Procurement as percentage of production has also increased during these years from about 24 percent in 2000-01 to about 33.7 per cent in 2011-12 and declined in the next three years and reached 29.4 per cent in 2013-14. It is estimated that government procures about 40 per cent of marketed surplus at national level and it varies from less than 5 per cent in Karnataka and Assam to over 90 per cent in Chhattisgarh, Punjab (76%), Andhra Pradesh (68%) and Odisha (66%). Large scale procurement by government drives out the private sector from the market and thus restricts competition.

The procurement of rice, which was highly concentrated in few states like Punjab, Haryana and Andhra Pradesh up to the late-1990s, has become more diversified. Punjab is still the largest contributor (24.1%) to national procurement and Andhra Pradesh ranks number two (22.9%), but both states have lost their shares between TE2002-03 and TE2012-13. While states like Chhattisgarh, Odisha, West Bengal, and Bihar have increased their share in rice procurement. The share of decentralized procurement states, namely, Andhra Pradesh,

Chhattisgarh, Karnataka, Kerala, Madhya Pradesh, Odisha, Tamil Nadu, Uttarakhand, West Bengal, and Bihar, has increased significantly and crossed 50 percent share in TE2013-14.

The pattern of marketed surplus of rice, based on the household data collected from over 1000 farmers from 9 districts of four major rice producing states, namely, West Bengal, Punjab, Uttar Pradesh and Haryana showed that gross marketed surplus (sales as a proportion of production) was marginally lower than marketable surplus. Medium farms had the highest rate of marketed surplus (83.2% of total production), followed by semi-medium (80.9%) and marginal farms (62.8%). In the case of selected states, Punjab and Haryana farmers sold more than 95 per cent of their rice output in the market. West Bengal farmers, on the other hand, sold about 61 per cent of the total output. Since rice is a staple crop in eastern and southern regions, a significant proportion of crop output was for self-consumption. The average farm retention (self-consumption, seed, and other purposes) on sample households was 14.5 per cent but varied from less than one percent on large farms to 35.3 per cent on marginal farms. In the case of states, average retention was lowest (less than one percent) in Punjab and the highest (37.4%) in West Bengal. More than 90 per cent of the total retention was for self-consumption. It is interesting to note that farmers purchased for self-consumption, even after they have sold their produce in the market. Since farmers need cash for the next crop and for other requirements, they (particularly small and marginal farmers) are forced to sell part of the grains after harvest and buy at a later date at a higher price. Farmers' market participation was quite high in all the states and varied from 94.7% in West Bengal to 100 per cent in Punjab and Haryana.

Over 60 per cent of the sample farmers had access to regulated markets while around 39 per cent sold their produce in unregulated markets. The pattern of market access gives a somewhat different picture when analysis is carried out by size of farm. In the case of medium (76.2%) and large farms (100%), access to regulated markets was very high while small and marginal farmers had poor access to regulated markets. About one-third of the total marketed surplus was procured by government agencies, followed by private traders (30.2%) and processors (27.5%). Large farmers sold about 71.4 per cent of the marketed surplus to government agencies while small farmers sold about 30.2 per cent to government agencies. The price paid by private traders and processors was significantly lower than the

price paid by public agencies. However, large farmers received almost the same price from all agencies, showing their better bargaining power compared with small and marginal farmers, who received lower prices than large farmers. However, there were large inter-state variations in market access. For example, due to effective government procurement policy in Punjab and Haryana, more than 96 per cent of the total marketed surplus of sample farmers was purchased by the government agencies. In contrast, in West Bengal more than 68% of the total paddy output marketed was sold to village-level traders, and less than 1 percent of the marketed surplus was procured by government agencies. The rice millers purchased about 30 per cent of the paddy output from farmers in 2011-12 because mills were forced to purchase specified quantities directly from the farmers at MSP under the new government regulations. It is also worth noting that the prices received by farmers in Punjab were much higher than West Bengal under all channels.

The results of regression analysis to examine the factors affecting marketed surplus revealed that output price, farm size, and market access have positive impact on marketed surplus of rice. Family size matters too on marginal and small farms and has a negative impact on marketed surplus. Household's awareness about minimum support price (MSP) has positive and significant impact on marketed surplus and so has access to regulated markets. The relative importance of factors in influencing marketed surplus as measured by standardized regression coefficients indicated that the price received by farmers was the most important factor, followed by access to regulated markets, farm size and awareness of MSP. Family size turned out to be the least important variable in influencing marketed surplus of rice.

Wheat

Wheat is an important food staple crop in India and occupies about 15 per cent of the total cultivated area with a total production of nearly 92 million tonnes (TE2012-13). The share of wheat in the total value of output from agriculture and allied activities was about 10.4 per cent in TE2011-12 but varied from more than one-fourth to crop output in states like Punjab (34.4%), Haryana (34%) and Uttar Pradesh (25.2%) to less than one percent in many southern and eastern states.

Wheat acreage in the country increased from 19.1 million ha in TE1973-74 to 29.6 million ha in TE2012-13 and production increased from 24.3 million tonnes to 91.8 million tonnes in TE2012-13. During the same period, wheat productivity more than doubled from 1274 kg/ha to 3094 kg/ha. As a percent of total cropped area, wheat acreage share increased from 11.5 percent in TE1973-74 to 15.3 percent in TE2012-13. Wheat production increased at an annual compound growth rate of 3.25 per cent during 1971-72 and 2012-13 and this was due to a modest area expansion of 0.99 percent per year but a significant yield increase of 2.24 percent per year. Growth in wheat production was the highest (4.91%) during seventies which decelerated to 3.39 percent per year during 1980s, 3.11 per cent during the 1990s but improved marginally (3.13%) during the last decade. Among the major producers, Madhya Pradesh showed the highest growth rate (6.27%) during the last decade, followed by Rajasthan (4.79%) as against the national average of 3.13 per cent. Haryana, Punjab and Uttar Pradesh, the other three major producers, recorded lower than all-India growth rate.

Wheat yield growth rates were particularly rapid during the 1970s and 1980s. Growth in wheat yield, 2.51 percent per year in the 1970s and 3.02 percent per year in the 1980s, slowed down to 1.69 percent in the 1990s and 1.58 per cent in the first decade of the 2000s. During the last two decades, acreage expansion and yield improvement contributed almost equally to growth in wheat output while yield was the major source of growth in output during the 1980s.

Uttar Pradesh had the largest share with one-third of the total production, followed by Punjab with 18.6 per cent and Haryana with 13.3 per cent during TE2011-12. These three states together contribute around two-thirds of the total wheat production in the country. Madhya Pradesh is the fourth largest producer with 10.5 per cent share, followed by Rajasthan (9.2%) and Bihar (5.1%). Punjab and Bihar have marginally lost their share in national production while Haryana, Madhya Pradesh and Rajasthan have increased their shares. Wheat is an important foodgrains crop in many states such as Haryana (69.7%), Uttar Pradesh (64%), Madhya Pradesh (61.4%) and Punjab (58.8%).

Wheat yields vary substantially across states and Punjab and Haryana have higher yields of 4513 kg/ha and 4441 kg/ha, respectively. These are followed, after a significant gap, by Rajasthan, U.P., Uttarakhand and Bihar with 2982, 2935, 2156 and 2041 kg/ha respectively.

Madhya Pradesh, one of the major producers, has much lower yield of 1876 kg/ha, even lower than the national average (2904 kg/ha). However, wheat yields have shown consistent improvement in almost all states during the last three decades. The average yield of wheat in India during 2011-13 was 3.1 tonnes/ha as against the global average of about 3.2 tonnes/ha, which is comparable to the global benchmark but much lower than countries like China, Egypt and Uzbekistan.

Government plays an important role in procurement. Wheat procurement which reached a peak of about 21 million tonnes in 2001-02, witnessed a steady decline and touched the lowest level of 9.23 million tonnes in 2006-07. India imported about 5.4 million tonnes of wheat in 2006-07 and about 1.9 million tonnes in 2007-08 which concerned the policy makers, and concerted efforts were made to increase wheat production and procurement. This led to a significant increase in wheat production as well as procurement. Wheat production increased from 75.8 million tonnes to 93.5 million tonnes between 2006-07 and 2012-13, while procurement increased from 9.2 million tonnes to 37.9 million tonnes during the same period. Wheat procurement as percentage of total production increased from about 12 per cent in 2006-07 to 40.6 per cent in 2012-13 but fell during 2013-14.

In the late-1990s, wheat procurement was mainly concentrated in Punjab and Haryana and share of government procurement as a percentage of production was 59.2 per cent in Punjab and 51.4 per cent in Haryana.

The share of Punjab, Haryana and Uttar Pradesh in total procurement was more than 90 per cent in TE2003-04, making them almost a monopoly vis-à-vis other states. However, during the last decade, the share of traditional states like Punjab, Haryana and Uttar Pradesh has declined and the decline in share of these states has been compensated by an increase in share of Madhya Pradesh and Rajasthan. The share of Madhya Pradesh has increased from less than 2 percent to over 24 per cent during the last decade. This has happened primarily due to the state policy of additional bonus over the MSP. The procurement trends show that wheat procurement has diversified in terms of coverage of states but at an additional cost. The share of government procurement has been rising over the years in all wheat producing states. Madhya Pradesh has recorded the highest increase of over 30 per cent, from six per cent in TE2001-02 to 37.5 per cent in TE2011-12. These results indicate that the government

has almost a monopsony in wheat procurement and restricted participation of private sector.

The findings of the study conducted in five major wheat producing states, namely, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Rajasthan covering 1193 wheat producers spread over 15 districts showed that marketed surplus of wheat was about 82 per cent and ranged from about 61 per cent on marginal farms to 86 percent on large farms. The gross marketed surplus was the highest (90.1%) in Punjab, followed by Haryana (82.9%), Madhya Pradesh (82.6%) and the lowest (54.3%) in Rajasthan.

The share of various farm size groups in total output, marketed surplus, and area operated as well as farmers' participation in wheat marketing showed that more than two-thirds of the total output of sample households was contributed by medium and large farms while marginal farmers contributed about 5 per cent. A comparison of the shares of respective farm size groups in the total marketed surplus shows that marginal farmers contribute the lowest quantity (4.1%), whereas medium farms offered the highest share of marketable surplus (35%) of the total marketed surplus. The share of small and marginal farmers in total output as well as marketed surplus was higher than their share in total area under wheat. More than 96 per cent of the sample households participated in the marketing of wheat, and there was no significant difference among various farm categories. The results also show that all farmers including small and marginal farmers have access to markets and the main reason for market access is effective government procurement system in all selected states.

The average farm retention (self-consumption, seed, and other purposes) was 15.3 per cent of the total production but varied from 11.6 percent on large farms to 33.3 per cent on marginal farms and from about 10 percent in Punjab to 38.7 per cent in Rajasthan, as wheat is an essential part of the daily diet in the northern part of India. About 60 per cent of the total retention was for self-consumption, followed by for seed (21.4%) and feed purpose (12.9%).

More than 63 per cent of the total marketed surplus was procured by government agencies, followed by private traders (20.4%) and less than 5 per cent by millers/processors. Large farmers sold about 91 per cent of the marketed surplus to government agencies while small

farmers sold about 25.3 per cent to government agencies. The price paid by private traders and processors was lower than the price paid by public agencies. However, large farmers received marginally higher price from private traders and the price received was also higher compared to small and marginal farmers, thereby indicating that large farmers had better bargaining power compared with small and marginal farmers. About 73 per cent of the sample farmers in the study areas were aware of MSP, but the awareness was comparatively low in case of marginal farmers. Traders were the main source of price information (30.2%), followed by print media (24.2%), and APMC mandi (10.5%). Large farmers had better access to print and electronic media while small and marginal farmers mainly depended on traders and other informal channels like visit to mandis.

Farm size, wheat price, awareness about MSP and access to regulated market have positive influence on marketed surplus while family size and distance to markets have negative influence and most variables are statistically significant, indicating that they significantly influence marketed surplus. The relationship between farm size and marketed surplus is positive and statistically significant, indicating that with an increase in farm size, marketed surplus ratio also increases. This result holds for all farm-size categories except for large farms where it is positive but non-significant. The relative importance of factors in influencing marketed surplus indicated that the price received by farmers was the most important factor, followed by awareness of MSP, farm size and access to regulated markets. Distance to market was the least important variable in influencing marketed surplus of wheat.

Maize

Maize is the third important cereal in the country with 22.8 million tonnes production contributing about 9.5 percent to the country's total cereals production. The area under maize has increased from 5.8 million ha in TE1973-74 to about 8.7 million ha in TE2012-13 while production increased by more than 280 per cent from 5.7 million tonnes to about 21.9 million tonnes during the same period, primarily due to a significant increase in yield. The average yield of maize also increased from about 990 kg per ha in early-70s to 2528 kg per ha during TE2012-13 but is still much lower compared to the world average and major producers like the United States and China (4.93 t/ha).

Maize production in the country increased at an annual growth rate of 3.28 per cent during 1971-2012 while area and yield increased at 0.96 per cent and 2.34 per cent, respectively during the same period. During the nineties, production of almost all cereals, including rice and wheat witnessed deceleration in growth rates but maize production exhibited an impressive positive and accelerated growth rate (3.74%). During the last two decades, in new non-traditional maize growing areas, more acreage has been brought under maize cultivation and the contribution of area was very close to the contribution of yield in increased production.

Maize has experienced a marked regional shift in the production as well as acreage. Traditionally, maize was grown in Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan with nearly two-thirds of the total area and over half of the total production in early-80s. However, in the recent period, peninsular India has emerged as a dominant maize-growing region and accounts for more than 40 per cent of the total production. Three states, namely, Andhra Pradesh, Karnataka and Tamil Nadu increased their share in total acreage from less than 10 per cent in TE1983-84 to 27.4 per cent in TE2011-12, while production share increased from 15.4 per cent to 42.8 per cent during the same period. Traditional maize-growing states have lost their share in total acreage as well as production during the last three decades. For example, Uttar Pradesh, the largest producer of maize in the eighties lost its share from 13.8 per cent in TE1983-84 to about 6 per cent in TE2011-12. Similarly, Madhya Pradesh, the second largest producer during the eighties, lost its share from 12.8 per cent in TE1983-84 to about 6.5 per cent during the TE2011-12.

The results of household data collected from 358 maize producers from three states, Karnataka, Maharashtra and Rajasthan, shows that relatively younger households were engaged in maize cultivation. The average productivity of maize on the surveyed households was 2969 kg per ha, higher than the national average. The highest yield of kharif maize was observed in Karnataka (3692 kg/ha), followed by Maharashtra (2888 kg) and the lowest in Rajasthan (2179 kg). The main reason for this low productivity in Rajasthan was the lack of irrigation facilities as less than one percent of the maize area was under irrigation, while in Karnataka about 40 per cent of the maize area was irrigated. The average

productivity of maize under irrigated conditions was significantly higher (3468 kg/ha) than unirrigated areas (2913 kg/ha) on sample households.

The average farm retention (self-consumption, seed, and other purposes) was 9.1 per cent but varied from 6.7 per cent on medium farms to 18.8 per cent on large farms. The average retention was the lowest (1.7 per cent) in Maharashtra while in Rajasthan farmers retained about 19 per cent of maize for household use because maize was an important part of their diet. More than half of the total retention was for self-consumption, while 29 per cent was kept for animal feed. However, there were regional differences. On an average, gross marketed surplus accounted for 88.3 per cent of total maize production in the study area. In the case of different farm sizes, marketed surplus was the highest (93.35) on medium households and the lowest on marginal farms (79.9%). Among states, Maharashtra had the highest (98.1%) marketed surplus. The marketed surplus was lower than marketable surplus in case of small and marginal farmers, thereby indicating distress sale.

Only 10 per cent of the sample farmers had access to regulated markets while around 90 per cent sold their produce in unregulated markets. However, large farmers (about one-third) had better access to regulated markets compared with small (9.1%) and marginal farmers (6.1%). Among states, Karnataka farmers had better access to regulated markets compared with Maharashtra and Rajasthan because Karnataka Food and Civil Supplies Corporation Limited and Karnataka State Cooperative Marketing Federation Limited procure maize from farmers directly, while in other states, government procurement is either absent or negligible. Less than half of the sample farmers in the study area were aware of MSP, but the awareness was quite high (83.3%) for large households. The traders and commission agents were a major source of price information (60.7%) to the farmers, while about 21 per cent households were dependent on APMC mandies. Small and marginal farmers were mainly dependent on traders for market information while medium and large farmers had better access to print and electronic media.

The size of farm and maize price had a positive and statistically significant impact on marketed surplus, indicating that with an increase in farm size and higher prices, marketed surplus increases. Family size and number of livestock had a negative impact on marketed

surplus, which shows that larger the household family size and livestock herd size, the lower is the marketed surplus of maize.

Bajra

India is one of the world's leading producers of bajra, both in terms of area (8.54 million ha) and production (9.8 million tonnes) with average productivity of about 1152 kg per ha during TE2012-13. The area under bajra declined by about 26 per cent between early-80s and TE2012-13, but production increased by nearly 60 per cent, mainly due to a significant increase (118%) in productivity. Bajra which was the second largest millet in the country after sorghum in terms of area and production till early-2000s has thereafter surpassed sorghum and occupied the first position. The share of bajra in total cereals acreage, as well as production has declined during the last four decades from 12.2 per cent and 6.7 per cent during the TE1971-72 to 8.6 per cent and 4.2 per cent in the TE2012-13, respectively. However, the performance of bajra has slightly improved during the last decade mainly due to improvement in yield, from 736 kg per ha to 1149 kg per ha.

Bajra recorded a negative (-0.08%) growth in production during the 1970s before increasing to 1.35 per cent in 1980s and reaching a level of 2.16 per cent during the last decade. The productivity witnessed an accelerated growth rate during the last four decades. The production (2.16%) and productivity (3.22 %) recorded the highest growth rate during the last decade while the growth rates were the lowest during the 1970s. The variability in both production and productivity has remained fairly high due to extremely low coverage of irrigation facilities (about 8-9%).

Rajasthan alone accounts for 57.4 per cent of the acreage and 41.2 per cent of bajra production in the country. The top five states, Rajasthan, Uttar Pradesh, Haryana, Gujarat and Maharashtra, account for over 93 per cent of acreage and about 92 per cent of bajra production in the country. Rajasthan has increased its share in national acreage as well as production during the last three decades while Maharashtra and Gujarat have lost their shares. Bajra is an important food crop and accounts for about 22 per cent and 14 per cent in total foodgrains in Rajasthan and Gujarat, respectively, whereas in Haryana and Maharashtra, it accounts for about 6 per cent. Bajra has lost its share in foodgrains production in all major producing states except Rajasthan.

It is evident from the results of primary data collected from about 500 farmers growing bajra in Rajasthan, Haryana and Uttar Pradesh, that the average productivity per hectare varied significantly among different farm size classes, from 1077 kg on large farmers to 1819 kg in case of marginal farmers with average yield of 1526 kg. There are also significant inter-state variations in yield. The highest yield (2221 kg/ha) was recorded in Uttar Pradesh, followed by Haryana (1448 kg/ha) and the lowest (956 kg/ha) in Rajasthan. An inverse relationship between farm size and crop productivity was observed for the entire sample and for the states of Haryana and Rajasthan.

A considerable quantity (about 25% of total production) was retained by sample households for various purposes. More than two-thirds of the total produce was retained for self-consumption while about 27 per cent was kept for feed purposes. Marginal farmers retained a larger proportion (32.7%) of the produce for household requirements compared with large farmers (19.8%). The share of produce retained for household requirements was higher in Rajasthan (30.3%) compared with Uttar Pradesh and Haryana because bajra is main staple food in Rajasthan.

The marketed surplus of bajra was estimated at 67.7 per cent on all farms and varied from about 60 per cent on small farms to 74 per cent on large farms. In Haryana, the marketed surplus was higher (83.5%) compared with Uttar Pradesh (61.4%) and Rajasthan (63.4%). The marketed surplus was lower than marketable surplus on all farm categories as well as in Rajasthan and Uttar Pradesh. Market participation of farmers was 100 per cent in Haryana and Uttar Pradesh while in Rajasthan about 87 per cent farmers sold their produce in the market. About 15.6 per cent of the total marketed surplus was procured by government agencies, while about 85 per cent was sold to private traders and other buyers. However, large farmers had better access to government agencies than small and marginal farmers. The government agencies paid higher price (Rs. 878/q) than private sector (Rs. 857/q). The large farmers received higher price than small and marginal farmers under both market channels, showing their better bargaining skills.

Family size and age of head of household had adverse impact on marketed surplus while impact of farm size on marketed surplus was positive and statistically significant indicating that with an increase in farm size, marketed surplus of bajra also increases. Other important

factors, which influenced marketed surplus positively, include farmers' awareness about MSP and access to regulated markets.

Gram

Gram is the most important pulses crop in India and accounts for approximately 35 percent of total pulses acreage and about 46 per cent of the total production in the country. The area witnessed a declining trend during the post-reforms period as crop acreage declined from 7.5 million ha in TE1981-82 to 6.1 million ha in TE1993-94 and reached 5.9 million ha in TE2001-02 but the trend reversed during the last decade. Although the area under gram cultivation declined during the nineties, production increased from 4.5 million tonnes to 4.8 million tonnes. Gram production reached a record level of 8.83 million tonnes in 2012-13 and is expected to touch 9.88 million tonnes as per fourth estimates for 2013-14. The gram yield increased from 607 kg/ha in 1971-73 to 913 kg/ha in 2010-12. The last decade witnessed the highest increase (12.7%), followed by the period between 1981-83 and 1991-93 (12%) and the lowest (8.1%) during the 1970s.

Gram production recorded a negative growth rate during the 1970s and 1980s (during green revolution period) but started showing some improvement during the last two decades. The annual growth rate of production became positive (1.19%) during the 1990s and reached 5.51 per cent during the last decade. Gram production (5.51%) and yield (2.10%) recorded the highest growth rate during the last decade.

Gram is the primary pulse crop in Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, and Uttar Pradesh and these states account for about 94 per cent of the total acreage and production. Madhya Pradesh had the largest share in crop acreage and production, followed by Rajasthan, Maharashtra and Karnataka. Madhya Pradesh, Maharashtra, Karnataka and Andhra Pradesh have increased their share in acreage as well as production while Rajasthan and Uttar Pradesh have lost their share during the last three decades. Andhra Pradesh, Madhya Pradesh and Uttar Pradesh had higher crop yield compared with the national average (873 kg/ha). The all India average yield has increased from 674 kg per ha in 1981-95 to 873 kg per ha in 2006-11, an increase of about 30 per cent.

Gram production increased at an annual compound growth rate of about 1.41 per cent during 1981-2011, while crop acreage and yield recorded 0.34 percent and 1.06 per cent growth rates, respectively. In the long term, of the 1.41 per cent annual growth in gram production, increase in yield accounted for about three-fourths of the growth in production while remaining one-fourth came from area expansion. All the major gram producing states except Rajasthan and Uttar Pradesh recorded a positive significant growth rate in production during 1981-2011. Andhra Pradesh had the highest growth rate, followed by Karnataka, Maharashtra and Madhya Pradesh. In most of the major producing states, growth rates were higher during the 1990s and 2000s compared to the 1980s.

The estimates of marketed surplus based on data collected from about 550 households from four major gram producing states, namely, Maharashtra, Madhya Pradesh, Uttar Pradesh and Karnataka showed that, on an average about 87 per cent of total gram production was sold in the market. The marketed surplus was highest (88.7%) on the large farms, followed by semi-medium (87.1%) and the lowest on marginal farms (85%). The average farm retention for self-consumption, seed, and other purposes was 12.2 per cent and varied from 11.7 per cent on medium farms to 13.8 per cent on marginal farms. In the case of states, average farm retention was the lowest (8.8%) in Rajasthan while in Madhya Pradesh, farmers retained about 19.3 per cent of gram for household use because seed replacement rate in Madhya Pradesh is one of the lowest.

Nearly 60 per cent of the total retention was for seed purpose while 32 per cent was kept for self-consumption. However, there were regional differences, Rajasthan and Maharashtra kept more than two-thirds of the total retention for food purpose while in Madhya Pradesh, and about 80 per cent was kept for seed purpose. In Karnataka about half of total output was retained for seed and 32 per cent for food purpose.

The average productivity of gram was 949 kg per ha and ranged from 847 kg per ha in case of large farms to 973 kg per on semi-medium farm. The highest yield was recorded in Madhya Pradesh (1124 kg/ha), followed by Maharashtra (971 kg/ha) and the lowest in Rajasthan (843 kg/ha).

Majority of gram growers sold their produce in unregulated markets and a small proportion of households (<20%) sold in the regulated markets. The average price received in

unregulated markets was higher than regulated markets on all categories of farms except for large farms. Less than 30 per cent of the sample farmers in the study areas were aware of MSP, but there was a positive association between farm size and MSP awareness. Traders were the main source of price information to the respondents, followed by visit to APMC mandies and electronic and print media being the least important.

Tur

India is the world's largest producer of tur and accounts for about 63 per cent of the total global production. Tur is cultivated on about 4.1 million ha, grown mainly under rainfed conditions (4% area under irrigation), with a production of about 2.8 million tonnes in the country. More than three-fourths of the total cropped area is concentrated in the semi-arid tropics and Maharashtra has the largest acreage (about 31%) under the crop, followed by Karnataka (19.2%), Andhra Pradesh (about 12%), Madhya Pradesh (13.2%) and Uttar Pradesh (about 8%). The top five states account for nearly 85 per cent of the total tur area and production. Among major tur producing states, Andhra Pradesh, Gujarat, Karnataka and Maharashtra have increased their share in total production during the last three decades while Uttar Pradesh and Madhya Pradesh have lost their share in national production. Gujarat has the highest yield (966 kg/ha), followed by Uttar Pradesh (860 kg/ha) and the lowest yield of 444 kg per ha in case of Andhra Pradesh.

Tur production in the country increased from about 1.7 million tonnes in TE1973-74 to 2.8 million tonnes in TE2012-13 amounting to about 70 per cent increase in about four decades. During the same period, acreage under the crop increased from about 2.5 million ha to just over 4 million ha, representing an increase of about 60 per cent. Yield, on the other hand, increased very marginally by about 2 per cent during the same period. The crop has experienced consistently high inter-annual acreage as well as yield variability over time. Most of the increases in production was due to an increased acreage as yield increased marginally from 682 kg per ha (1971-73 average) to 698 kg per ha (2010-12).

The compound annual growth rates of area, production and yield of tur revealed that growth performance of the crop was not impressive during the last four decades as the crop production registered an annual growth rate of less than one per cent (0.97%) while area grew by nearly one percent and growth rate in yield was negative. However, performance

was relatively better during the last decade when production recorded the highest growth rate (2.22%). Tur yield witnessed a negative growth rate during the 1970s and 1980s before improving marginally during the last two decades but with a less than one per cent growth. The growth trends showed that performance of tur has not been very encouraging in Gujarat, Madhya Pradesh and Uttar Pradesh during the last three decades.

The average productivity of tur based on household data from 441 tur producers spread over seven districts in four major producing states, namely, Maharashtra, Madhya Pradesh, Uttar Pradesh and Karnataka, revealed that average productivity was 895 kg per ha and varied from 838 kg per ha in case of small farmers to 928 kg per ha on semi-medium farms. The crop yield in Karnataka, Maharashtra and Madhya Pradesh was higher than the sample average while Uttar Pradesh had lower yield. The main reason for low productivity in tur was lack of irrigation facilities as less than five percent of tur area is under irrigation at national level.

The average farm retention (self-consumption, seed, and other purposes) was about 9.5 per cent and ranged from 5.1 per cent on large farms to 15-16 per cent on small and marginal farms. In the case of states, average farm retention was lower (7.3%) in Karnataka while in Uttar Pradesh, farmers retained about 24 per cent of tur for household use because tur was the main pulse in their diet. More than 57 per cent of the total retention was for self-consumption, while nearly 43 per cent was kept for seed purpose.

The average marketed surplus in case of tur was quite high (92.5%) and was the highest (99.5%) on medium households and the lowest on semi-medium farms (86.5%). The marketed surplus was the highest (96.8%) in Madhya Pradesh and the lowest (85.7%) in Maharashtra. These trends clearly indicate that in Madhya Pradesh, farmers grow tur primarily for the market. All categories of tur growers sold output in the market and the proportion of farmers who sold in the market was very high (97.7%). About 45 per cent of sample households sold more than 90 per cent of the output in the market, while nearly 13 per cent sold less than 60 per cent.

More than two-thirds of the output was sold to government agencies, while 31.4 per cent was sold to private traders. With increase in farm size, share of marketed surplus sold to government agencies also increased, which shows that large farmers have better access to

public procurement system, while small and marginal farmers are more dependent on private traders. However, there are regional variations; for example, more than 93 per cent of the produce in Karnataka was sold to government agencies, while in Maharashtra, 95.5 per cent of the total marketed surplus was sold to private traders. In case of Madhya Pradesh, 52 per cent was sold to government agencies while 40.7 per cent was sold to private traders.

The price paid by government agencies was higher (Rs. 3223/q) than private traders (Rs. 3165). Small and marginal farmers received marginally lower prices compared with large farmers. Karnataka farmers received higher price compared with other states under both public and private trade.

Policy Implications

Development of efficient and competitive agricultural marketing system is essential for accelerating the growth of agricultural production and marketed surplus and also has the potential to benefit poor consumers. However, marketing structure and organization for agricultural commodities in India varies across different states and commodities, and consists of both public and private sectors. For few commodities like rice and wheat government has direct intervention, while in most other crops, marketing is dominated by the private sector. The organised marketing of agricultural commodities promoted through a network of regulated markets has helped in ameliorating the market constraints of producers at the wholesale assembling level and protect them from the exploitation of market intermediaries and traders as well as ensured better prices and timely payment for the produce. However, these markets have become restrictive and monopolistic, and restricted private investment in the sector, which has led to poor market infrastructure due to lack of investment. To improve the investment in market infrastructure, however, requires undertaking significant investments in technology, institutions, infrastructure and management. Understanding marketed surplus and marketing behaviour can help in designing appropriate policies, technology choices and institutions to facilitate the development of agriculture. Some important policy implications for improving the marketed surplus and infrastructure drawn from the analysis of the present study based on a cross-

section analysis of household data of about 5000 farmers growing major foodgrains in major producing regions are discussed below.

Strengthen Physical Infrastructure

Physical market infrastructure is critical in enhancing production and marketed surplus and ensuring higher returns to farmers. Due to the reliance of output market development on physical infrastructure such as markets/yards, collection centres, grading and packaging, rural roads, etc., it should be the top-most priority for investment and development. The development of quality physical infrastructure will reduce transactional costs and improve market efficiency. Improved roads and creation of market hubs that are closer to producers can reduce transportation costs and post-harvest losses, which in turn can lead to higher prices received for outputs, resulting in farmers receiving higher returns from agricultural production. Farmers growing coarse cereals and pulses have poor access to regulated markets and are forced to sell their produce in unregulated markets at lower prices. Since farmers can receive higher prices under competitive markets, there is a need to create more competitive market structure by liberalizing agricultural markets so that farmers could choose the agency to whom they wished to sell their produce. Small and marginal farmers are forced to sell their produce just after harvest at lower prices. Sometimes farmers may want to sell it later when prices are higher but feel constrained by, among other things, lack of storage facilities and access to credit. Therefore, a competitive market combined with storage facilities can ensure better prices to small farmers by allowing them to have greater flexibility in the timing and location of their sales.

Improve the Reach and Quality of Information Services

Market information and extension services play a significant role in increasing productivity and market participation of small farmers. However, availability of timely and reliable market information has been seen as a major constraint by farmers in marketing of their produce, leading to low price realization. A significant proportion of farmers especially the marginal are dependent on the traders/commission agents for price and market information, hence, there is a need to strengthen dissemination of market intelligence/information so that farmers can make appropriate marketing decision. Most of

the extension services being provided by government agencies are focused on crop cultivation despite a need for post-harvest management and marketing extension services.

Facilitate Access to Institutional Credit and Develop Storage Facilities

Marketed surplus ratios were lower for coarse cereals among cereals and generally lower for cereals than pulses. Among different farm size groups, the marketed surplus ratios were lower for small and marginal farmers compared with large farms. It was also found that marketed surplus increased with an increase in farm size and output. Further, marketed surplus was higher than marketable surplus for small and marginal farmers, indicating distress sale. There are also considerable differences in marketed surplus ratios across states and generally lower in states with less developed market infrastructure. Farmers sold almost entire marketed surplus immediately after the harvest as they need credit for the next crop and that leads to serious constraints in handling and storage of produce for procurement agencies, particularly in rice and wheat. Therefore, access to institutional credit and proper storage at farm household level will play an important role in increasing marketed surplus and reduce distress sale.

Improve Regulation of Markets

High proportion of farmers growing pulses and coarse cereals perceive lack of market regulation to be a major problem. They indicated that lack of access to organized/regulated markets leading to exploitation by middlemen and non-remunerative prices were among the major problems for the producers. Public procurement was an important factor in creating competitive market particularly in the case of rice and wheat in some states and helping farmers receive higher prices. Since the government has no effective procurement policy for coarse cereals and pulses in majority of the states, there is a need to improve regulation of markets to avoid exploitation of farmers by market intermediaries.

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