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PART I

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Articles on the state of Indian Agriculture and allied Sectors are accepted for publication in the Directorate of Economics & Statistics, Department of Agriculture & Cooperation's monthly Journal "Agricultural Situation in India". The Journal intends to provide a forum for scholarly work and also to promote technical competence for research in agricultural and allied subjects. The articles, not exceeding five thousand words, may be sent in duplicate, typed in double space on one side of fullscap paper in Times New Roman font size 12, addressed to the Economic & Statistical Adviser, Room No.145, Krishi Bhawan, New Delhi-11 0001, alongwith a declaration by the author(s) that the article has neither been published nor submitted for publication elsewhere. The author(s) should furnish their e-mail address, Phone No. and their permanent address only on the forwarding letter so as to maintain anonymity of the author while seeking comments of the referees on the suitability of the article for publication.

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PART II

STATISTICAL TABLES

Abbreviations used

N.A. —Not Available.
N.Q. —Not Quoted.
N.T. —No Transactions.
N.S. —No Supply/No Stock.
R. —Revised.
M.C. —Market Closed.
N.R. —Not Reported.
Neg. —Negligible.
Kg. —Kilogram.
Q. —Quintal.
(P) —Provisional.
Plus (+) indicates surplus or increase.
Minus (–) indicates deficit or decrease.

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A. General Survey

(i) Trends in Foodgrain Prices :

During the month of February, 2012 the All India Index Number of Wholesale Price (2004-05=100) of Foodgrains decreased by 0.11 per cent from 183.6 in January, 2012 to 183.4 in February, 2012.

Similarly, the Wholesale Price Index Number of Cereals showed an increase of 0.17 per cent from 177.7 to 178.0 whereas Pulses showed a decline of 1.32 per cent from 211.5 to 208.7

The Wholesale Price Index Number of Wheat and Rice increased by 0.35 per cent from 0.06 per cent respectively during the same period.

(ii) Wheather, Rainfall and Reservoir Situation during February, 2012

1. Rainfall (Pre-Monsoon Season) reported for the country as a whole during 1st March to 28th March, 2012 is around 10.1 mm which is 64% less than Long Period Average (LPA). Rainfall (as % departure from normal) reported in the broad geographical divisions of the country during the above period was North West India (-63%), Central India (-98%), South Peninsula (-77%) and East and North East India (-51 %).

2. The total live storage in 82 important reservoirs in different parts of the country as on 28th March, 2012 was 50.79 BCM against 61.02 BCM in the corresponding period of last year.

   Current live storage is 33% of live capacity at Full Reservoir Level (FRL) as against 40% in the corresponding period of last year.

As per the second Advance Estimates of 2011-12 released on 3rd February, 2012, around 101 % of the normal area under Rabi crops have been sown. Area sown under all crops taken together is around 610.36 lakh ha. as compared to 632.62 lakh ha. during 2010-11(Final Estimate). Area coverage was lower by 9.3 lakh ha. under Rice, 6.2 lakh ha. under Jowar, 2.3 lakh ha. under Gram and 2.0 lakh ha. under Rapeseed & Mustard.

4. A statement indicating comparative position of area coverage under major Rabi crops during 2011-12 (second Advance Estimate 2011-12) and the last year is given in the following table.

ALL INDIA CROP SITUATION—RABI (2011-12)

Crop Name	Normal Area	Area sown reported (in lakh hectares)			Absolute Change over Last Year
		2nd Adv. Estimates of 2011-12	% of Normal	Final Estimates of 2010-11	
Wheat	277.45	288.93	104.1	290.69	–1.8
Rice	44.11	38.99	88.4	48.30	–9.3
Jowar	46.18	36.89	79.9	43.10	–6.2
Maize	10.48	12.61	120.3	12.71	–0.1
Barley	6.42	6.89	107.4	7.05	–0.2
Total Coarse Cereals	63.08	56.40	89.41	62.86	–6.5
Total Cereals	384.64	384.32	99.9	401.84	–17.5
Gram	76.05	89.59	117.8	91.86	–2.3
Urad	7.28	8.11	111.4	7.41	0.7
Moong	6.29	6.09	96.7	6.61	–0.5
Others	33.09	36.02	108.9	34.95	1.1
Total Pulses	122.71	139.80	113.9	140.82	–1.0
Total Foodgrains	507.35	524.12	103.3	542.66	–18.5

Crop Name	Normal Area	Area sown reported (in lakh hectares)			Absolute Change over Last Year
		2nd Adv. Estimates of 2011-12	% of Normal	Final Estimates of 2010-11	
Rapeseed & Mustard	63.56	66.98	105.4	69.01	–2.0
Groundnut	9.10	9.13	100.3	8.79	0.3
Safflower	3.29	1.78	54.2	2.44	–0.7
Sunflower	11.87	4.76	40.1	6.14	–1.4
Linseed	4.18	3.59	85.9	3.59	0.0
Total Oilseed (Nine)	94.52	86.24	91.2	89.96	–3.7
All. Crops	601.87	610.36	101.4	632.62	–22.3

'2nd Advance Estimate of 2011-12 as on 03rd February

All India production of foodgrains : As per the second advance estimates released by Ministry of Agriculture on 03-02-2012, production of foodgrains during 2011-12 is estimated at 250.42 million tonnes compared to 244.78 million tonnes in 2010-11(final estimates).

Procurement : Procurement of rice as on 1st February, 2012 (Kharif Marketing Season 2011-12) at 21.64 million tonnes represents an increase of 14.9 per cent compared to the corresponding date last year. Wheat procurement during Rabi Marketing Season 2011-12 is 28.34 million tonnes as compared to 22.51 million tonnes during the corresponding period last year.

TABLE 1— PROCUREMENT IN MILLION TONNES

	2009-10	2010-11	2011-12
Rice(Oct-Sept)	32.0	34.2	26.8*
Wheat(Apr-Mar)	25.4	22.5	28.3**
Total	**57.4**	**56.7**	**55.1**

* Position as on 1.3.2012. ** Position as on 12.12.2011

Off-take : Off-take of rice during the month of January, 2012 was 26.06 lakh tonnes. This comprises 20.60 lakh tonnes under TPDS and 5.46 lakh tonnes under other schemes. In respect of wheat, the total off take was 21.66 lakh tonnes comprising of 16.211akh tonnes under TPDS and 5.45 lakh tonnes under other schemes.

Stocks : Stocks of food-grains (rice and wheat) held by FCI as on February 1, 2012 were 55.25 million tonnes, which is higher by 17.2 per cent over the level of 47.17 million tonnes as on February 1, 2011.

TABLE 2—OFF-TAKE AND STOCKS OF FOODGRAINS (MILLION TONNES)

	Off-take			Stocks	
	2009-10	2010-11	2011-12 (Up to Jan. 2012)	1-Feb., 2011	1-Feb.-12
Rice	27.37	29.93	26.79	27.80	31.83
Wheat	22.34	23.07	19.97	19.37	23.43
Total	**49.71**	**53.0**	**46.76**	**47.17**	**55.26**

Growth of Economy

As per the latest Advanced Estimates (AE) of Central Statistics Office (CSO), the growth in GDP at factor cost at constant (2004-05) prices was estimated at 6.9 per cent in 2011-12 as compared to 8.4 per cent in 2010-11 (Quick Estimate). At disaggregated level, this (AE 2011-12) comprises growth of 2.5 per cent in agriculture and allied activities, 3.9 per cent in industry and 9.4 per cent in services as compared to a growth of 7.0 per cent, 7.2 per cent and 9.3 per cent respectively during 2010-11.The growth in real Gross Domestic Product (GDP) is placed at 6.1 per cent in the third quarter of 2011-12; agriculture grew by 2.7 per cent; industry by 2.6 per cent and services by 8.9 per cent.

TABLE 3— GROWTH OF GDP AT FACTOR COST BY ECONOMIC ACTIVITY (AT 2004-05 PRICES)

Industry	Growth			Percentage Share in GDP		
	2009-10PE	2010-11-(QE)	2011-12-(AE)	2009-10-PE	2010-11 (QE)	2011-12 (AE)
1. Agriculture, forestry and fishing	0.1	7.0	2.5	14.7	14.5	13.9
2. Industry	**8.4**	**7.2**	**3.9**	**28.1**	**27.8**	**27.0**
a. Mining and quarrying	6.3	5.0	–2.2	2.3	2.2	2.0
b. Manufacturing	9.7	7.6	3.9	16.0	15.8	15.4
c. Electricity, gas and water supply	6.3	3.0	8.3	2.0	1.9	1.9
d. Construction	7.0	8.0	4.8	7.9	7.9	7.7
3. Services	**10.5**	**9.3**	**9.4**	**57.2**	**57.7**	**59.0**
a. Trade, hotels, transport and communication	10.3	11.1	11.2	26.6	27.2	28.3
b. Financing, insurance, real estate and business services	9.4	10.4	9.1	17.1	17.4	17.8
c. Community, social and personal services	12.0	4.5	5.9	13.5	13.1	12.9
4. GDP at factor cost	**8.4**	**8.4**	**6.9**	**100.0**	**100.0**	**100.00**

PE: Provisional Estimates; (QE): Quick Estimates; (AE): Advanced Estimates

TABLE 4—QUARTERLY ESTIMATE OF GDP (YEAR-ON-YEAR IN PER CENT)

	2009-10				2010-11				2011-12		
Items	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1. Agriculture, forestry & fishing	**1.6**	**2.5**	**–1.4**	**1.1**	**3.1**	**4.9**	**11.0**	**7.5**	**3.9**	**3.2**	**2.7**
Industry	5.3	7.7	9.7	12.4	8.3	5.7	7.6	6.1	5.0	3.2	2.6
2. Mining & quarrying	7.5	7.0	5.4	8.9	6.9	7.3	6.1	1.7	1.8	-2.9	-3.1
3. Manufacturing	5.4	8.9	11.3	15.2	9.1	6.1	7.8	5.5	7.2	2.7	0.4
4. Electricity, gas & water supply	5.9	7.0	4.0	7.3	2.9	0.3	3.8	7.8	7.2	9.8	9.0
5. Construction	4.4	5.8	9.2	9.2	8.4	6.0	8.7	8.2	1.2	4.3	7.2
Services	**10.2**	**12.5**	**9.3**	**10.2**	**10.0**	**9.1**	**7.7**	**8.7**	**10.0**	**9.3**	**8.9**
6. Trade, hotels, transport and communication	8.4	10.3	10.6	13.7	12.7	10.8	9.8	9.3	12.7	9.8	9.2
7. Financing, insurance, real estate and bus.	11.2	10.6	8.3	6.3	10.0	10.4	11.2	9.0	9.0	10.5	9.0
8. Community, social & personal services	13.0	19.3	8.0	8.3	4.4	4.5	-0.8	7.0	5.6	6.6	7.9
9. GDP at factor cost (total I to 8)	**7.5**	**9.8**	**7.4**	**9.4**	**8.5**	**7.6**	**8.3**	**7.8**	**7.7**	**6.9**	**6.1**

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Demand and Supply for Pearl Millet Grain and Fodder by 2020 in Western India

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Parthasarathy Rao P., S. K. Gupta, Rajan Sharma, Gajanan†††

Abstract

The paper given an estimate of the demand and supply of pearl millet grain and fodder for the year 2011 and 2020 in western India. The paper estimated the projected pearl millet grain and stover production for 2020 based on historical growth rates from 1996-2009. On the demand side, food demand is projected based on population projections for 2020 by maintaining 2004/05 per capita consumption based on NSSO 61st round. The demand for alternative uses of grain (alcohol industry) is projected based on a field survey conducted during 2011. The demand for feed and stover is based on the livestock census 2007 and feed ration based on Dikshit and Birthal (2010) and projected growth rates of livestock population. Overall in 2011, 46 per cent of production of pearl millet grain goes for food use, 37.5 per cent goes for cattle feed, 7.7 per cent goes for poultry feed, 8.8 per cent goes for alcohol industry production and only a small fraction 0.4 per cent goes for seed purpose. The relative share of different uses of grain by 2020 shows that, the share of cattle feed will increase to 38.6 per cent, share of poultry feed will increase to 9.4 per cent, share of alcohol industry and other non-food uses will be increased to 11.7 per cent, while food uses will decrease to 40 per cent. Even though currently there is shortage in pearl millet grain production in western India which is indicated by higher prices, by 2020 it will become surplus to the extent of 5 per cent if it maintains the recent past production growth trend which is very high (4.22 per cent per annum). However, Gujarat state is deficit in grain even by 2020. While in case of dry-fodder, the projected deficit will be 10 per cent by 2020.

Introduction

Coarse cereals, viz., sorghum, pearl millet and finger millet assume significance in the cropping pattern of dry-land regions as they require little inputs and are more drought resistant compared to other competing crops (Breese *et al*., 2002). Coarse cereals are mostly grown as dual purpose crops to meet both food, feed and fodder requirements. However, the last few decades saw these crops lose area on account of declining demand due to change in food habits, drop in real prices *vis-a-vis* other competing crops leading to erosion in relative profitability of these crops. However, the lower prices of coarse cereals grains compared to other cereal crops increased their demand in alternative uses like feed and fodder from livestock sector. A significant share of coarse cereal grain is also used for various industrial uses (e.g. as starch in alcohol industry etc). Further, the nutritional value of these crops offers much scope to development of value added products in new health conscious consumer segments (Yadav *et al*., 2011). The fodder from coarse cereals particularly sorghum and pearl millet are very much preferred as livestock feed due to its superior quality.

Pearl millet *Pennisetum giaucum* is the world's hardiest warm season cereal crop. It can survive even on the poorest soils in the driest regions, on highly saline soils and in the hottest climates. India is the largest single producer of pearl millet, both in terms of area (9.3 million hectares) and production (8.3 million tons). Pearl millet is an important coarse cereal crop in Western India, which occupy about 38% total cereal cropped area in the region. About 6.5 million ha of cropped area is under pearl millet in western India with 5.5 million t production with an average yield of 852 kg/ha of grain and 25 quintal/ha of stover yield (Pray Carl and Nagarajan 2009). Given substantial economic importance of pearl millet as a mainstay for small and marginal farmers in this region the paper tries to examine demand and supply balance of pearl millet grain and fodder by 2020 in western India comprising Rajasthan, Gujarat and Haryana as shown in the below map. The information of different used of pearl millet grain and demand and supply of grain and fodder would be useful to crop scientists in targeting their research effort for the region.

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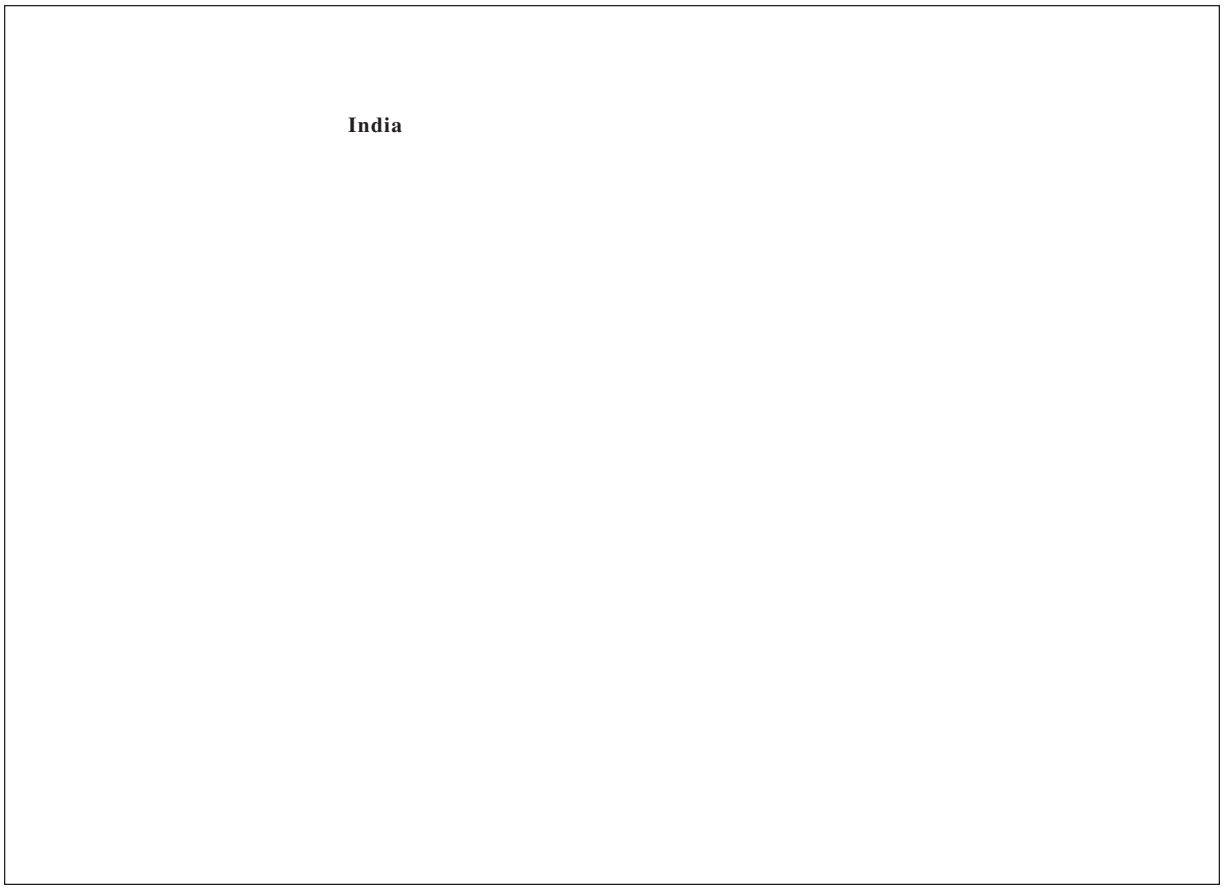

Changing pattern of food consumption

The decline in consumption of coarse cereals is due to changing food habits and tastes as income increases, and increased availability of rice and wheat at cheaper prices due to technological advances and also policy push through Public Distribution System (PDS). The PDS is an integral part of India's food safety net system, and handles about 40 per cent of the total quantities of rice and wheat transacted on the market. On the other hand, coarse cereals comprising sorghum, pearl millet and maize are known to receive higher shares in the household budgets of the poor especially in dry regions. The PDS in India is based on the wheat and rice model, which is less relevant in states like Gujarat, where pearl millet is traditionally the staple grains for household consumption (Dayakar Rao, Reddy, and Seetharama 2007). Despite the PDS at all India level consumption of coarse cereals is significant in rural area among poor (**Figure 1**).

Figure 1

Figure 2 presents' consumption concentration curves for pearl millet and wheat for rural and urban areas in western India, showing the cumulative % of pearl millet and wheat consumption against the cumulative % of number of households, ranked by MPCE (monthly per capita expenditure class) beginning with the poorest households. If the curve coincides with the diagonal, all households, irrespective of their economic status, enjoy the same consumption. If, curve lies below the diagonal, inequalities in consumption favour the better-off households; we shall call such inequalities pro-rich (as in wheat in urban areas, wheat and pearl millet in rural areas). If the curve lies above the diagonal, we have pro-poor inequalities (as in case of pearl millet in urban areas). The consumption concentration curve for pearl millet is above the diagonal in urban areas, which indicates pearl millet consumption is higher among urban poor. Hence, urban poor will benefit more from increased supply of pearl millet in urban markets either through free market or Public Distribution System.

Figure 2

Figure 3 depicts the changes in pearl millet and total cereal consumption between 1973 and 2004 in the three states of Gujarat, Haryana and Rajasthan in western India. The figure shows significant decrease in consumption of pearl millet in Haryana as, the state became richer and due to green revolution and availability of wheat. The figure also shows significant differences in consumption among states and within state between rural and urban areas. In 2004/05 per capita consumption in rural Gujarat (28 kg/ annum) and rural Rajasthan (33 kg) is much higher than per capita consumption in rural Haryana (5 kg), urban Gujarat (7 kg) and urban Rajasthan (7 kg) compared to just 0.4 kg/ annum/capita consumption in urban Haryana. One of the reasons for decrease in relative consumption of pearl millet is decrease in prices of wheat and paddy, which makes them more affordable to large population.

Figure 3. Consumption of pearl millet and other cereals

Table 1 depicts the changes in real prices, production between TE 1969 and TE 2009 for pearl millet, and its competing crops. Historical price trends shows that, pearl millet prices are moving in line with maize, sorghum, and wheat, but its prices are lower than all the competing crops. Real prices of pearl millet in TE 2009 are lower compared to maize and wheat due to decline in demand for food consumption since 1960s. Keeping the lower prices compared to competing grains like broken rice, maize and sorghum, there is a possibility of increasing demand from non-food uses (like feed, alcohol industry) in future. Since 2001, the prices of pearl millet are moving up steeply along with other foodgrains due to general rise in price trend of foodgrains and expansion of demand from poultry and cattle feed industry and also alcohol/starch industry (Ronald Trostle, 2008).

TABLE 1—TRENDS IN REAL PRICES (RS./QUINTAL)

Crop	% change in price between 1969-2009 (in 1986-87 constant prices)	% change in production between 1969 and 2009	Yield TE 2009 (kg/ha)	MSP (Rs/q) in 2011	Wholesale price in 2011 (Rs/ q)
Maize	–18.9	214	2251	980	1100
Pearl Millet	–17.4	29	957	980	871
Sorghum	–6.3	91	981	980	1225
Wheat	–10.2	405	2806	1285	1450
pigeonpea	42.0	63	715	3200	2200

Over all in western India about 38 per cent of total cereal area is under pearl millet in TE 2009, which is equivalent to 16 per cent of GCA. Area under pearl millet is about 7.3 per cent of GCA (25 per cent of total cereal area) in Gujarat, 9.6 per cent of GCA (14 per cent of cereal area) in Haryana and 22.9 per cent of GCA (53 per cent of cereal) in Rajasthan. Keeping the importance of pearl millet in total cereal area and GCA and its importance as dual purpose crop to meet the food, feed and fodder demand in the western India, this paper tries to examine (i) changing pattern of pearl millet demand in western India (ii) what are the past trends in supply of pearl millet grain and fodder and projected supply to 2020. (iii) What is the expected demand for the year 2020 and (iv) estimate demand and supply gap by 2020 for grain and fodder.

Methodology for estimating demand and supply

We have estimated the projected pearl millet grain and stover production based on historical growth rates of production between 1997 to 2009 and extended the same until 2020, while food demand is projected based on population projections for 2020 by maintaining 2004/05 per capita consumption. The demand for alternative uses is estimated based on growth in poultry and alcohol sectors and competitiveness of pearl millet with alternative grains. The demand for feed and stover is based on the livestock census 2007 and feed ration based on Dikshit and Birthal (2010) and historical growth rates of livestock.

Supply

On the assumption of business as usual (forecasting supply of pearl millet grain and stover based on historical growth rates from 1997-2009) the annual compound growth rates of production of kharif (-0.61 %) and summer pearl millet (-0.34%) in Gujarat are used for forecasting production for 2011 and 2020 with TE 2009 as base year. While in case of Haryana (3.23%) and Rajasthan (5.29%) only yield growth rate was considered to forecast production, as we assume that the area contribution to production growth is negligible (assumed zero) in future, as the sustained growth in area under pearl millet is difficult to achieve. The stover production is forecasted based expected area growth rates. We assume the stover productivity is at 2.5 times that of grain yield, it is the same across all states and seasons, which was the average of last five years stover to grain yield ratio calculated from cost of cultivation data for all three states (Directorate of Economics and Statistics 2011).

TABLE 2—Growth Rates of Pearl Millet Area, Production and Yield (1997-2009)

	Gujarat (Kharif)	Gujarat (summer)	Gujarat (Total)	Western Haryana	Rajasthan	India
TE 2008						
Area (1000 ha)	762	163	925	614	4973	6512
Production (1000 t)	790	343	1133	955	3468	5555
Yield (kg/ha)	1040	2073	1225	1546	696	852
ACGR 1995-2009						
Area (%)	–1.52	–0.21	–1.30	0.45	1.16	0.71
Production (%)	–0.61	–0.34	–0.64	3.67	6.45	4.22
Yield (%)	0.92	–0.12	0.66	3.23	5.29	3.51

Source: Directorate of Economics and Statistics 2011.

Food demand

Food demand estimates for the year 2011 and 2020 are projected based on the per capita consumption in the year 2004/05 based on NSSO 61st round and the census population for the year 2011 and projected population for the year 2020 (National Commission on Population, 2006). We assume that the per capita consumption of 2004/05 levels will be maintained by both urban and rural population in the year 2011 and 2020. This assumption is based on the recent policy development that with the introduction of pearl millet in the PDS through Food Security Bill (2011) arrests the decline in the per capita consumption over the period. The projected population and per capita consumption in each state is given in **Table 3.**

TABLE 3—Population Projections and per Capita Consumption of Pearl Millet

State	Urban/rural	Population (million)		Consumption in TE 2004/05 (kg/capita/annum)
		2011	2020	
Gujarat	Urban	25.7	28.2	7.3
	Rural	34.7	37.3	28.1
	Total	60.4	65.5	19.2
Haryana	Urban	8.8	11.1	0.4
	Rural	16.5	17.9	5.0
	Total	25.4	29.0	3.4
Rajasthan	Urban	17.1	18.7	6.9
	Rural	51.5	58.0	33.0
	Total	68.6	76.8	26.5
Western India	Urban	51.6	58.0	6.0
	Rural	102.7	113.3	26.8
	Total	154.4	171.3	19.9

Source : Census 2011, population projections are based on Report of the technical group on population projections.

Demand for feed (cattle and poultry) and dry fodder (stover)

Potential demand for feed and fodder uses of pearl millet (Gujarat, Haryana and Rajasthan) estimated based on consumption requirements of livestock population in the year 2007 and projected for 2011 and 2020. We assume that the consumption per capita will be same for all the years. Conventionally, livestock feed is classified into roughages (green and dry fodders) and concentrates. We have estimated only demand for dry fodder and concentrates as pearl millet is not used for green fodder. Dry fodder includes crop residues, most of which are cereal straws. Pulses and other legume crops like groundnut also contribute to dry fodder. Sources of dry fodder may include (i) cultivated crop residues, and (ii) roughages gathered from different sources. Concentrate feed includes (i) food-grains and their preparations, such as flour; and byproducts of milling and household processing, like husk, bran, khuddi/chunni (minutiae of broken grains not fit for human consumption), (ii) oilseeds, oil cakes and meals, and (iii) manufactured feeds. Table 4 presents all-India feed consumption rates of different types of feed fed to different categories of livestock at the household premises. Per day mean consumption of green fodder was 5.96 kg for a buffalo in-milk, 5.44 kg for a dry buffalo, 4.06 kg for an adult male buffalo and 2.29 kg for a young one, average for heifers and calves. Corresponding consumption rate of dry fodder was 6.34 kg for a buffalo in-milk, 4.95 kg for a dry buffalo, 7.47 kg for an adult male buffalo and 2.22 kg for young stock. Consumption rate of concentrate feed, which is essential for animal's growth and production, was estimated as 1.05 kg for a buffalo in-milk, 0.52 kg for a dry buffalo, 0.36 kg for an adult male buffalo and 0.19 kg for a young one. These consumption rates, for any kind of feed, were lower for their counterparts of different categories of cattle, and the difference is larger in the case of in-milk and dry animals, especially for concentrate feed. There was hardly any difference in the feeding rates of young stock of buffalo and cattle. Feed consumption rates of different feeds were slightly higher for goats than for sheep (for details Dikshit and Birthal, 2010). The state wise and animal category wise consumption demand based on above statistics for western India is given in Table 4. Demand for feed and stover is estimated based on consumption estimates of animals taking base year as 2007(livestock census, 2007) and projected to increase by 3 per cent per annum, feed demand from poultry industry is estimated by assuming 5 per cent annual compound growth rate with base year 2007. After getting over all demand for feed concentrate from all sources, the demand for pearl millet cattle feed is estimated by assuming pearl millet constitute 20% of concentrate in Gujarat and Haryana and 30 per cent in Rajasthan. While estimating the pearl millet demand for poultry concentrate we assume 60 per cent of total poultry concentrate in Gujarat, 70 per cent in Haryana and Rajasthan is contributed by pearl millet grain. While estimating demand for dry fodder of pearl millet, we assume that 10 per cent of total dry fodder demand will be met by pearl millet in Gujarat and 25 per cent Haryana and 30 per cent in Rajasthan. The above share is estimated based on field survey conducted in three states under the HOPE project.

TABLE 4—Feed Demand Estimates of Feed, Green Fodder and Stover in Western India in 2007

	Cattle				Buffalo							
	in-milk	dry adult male		young	in-milk	dry adult male		young	Goats	sheep	others	Poultry
Livestock Population (million)												
Gujarat	1.73	1.09	2.62	2.53	3.04	1.79	0.17	3.77	4.64	2	0.1	13.4
Haryana	0.42	0.24	0.31	0.58	1.99	0.91	0.14	2.91	0.54	0.6	0.08	28.8
Rajasthan	3.22	2.3	2.08	4.53	3.93	1.89	0.1	5.17	21.5	11.19	0.55	14.4
Western India	5.37	3.63	5	7.64	8.96	4.6	0.4	11.86	26.68	13.79	0.73	56.5
feed consumption rates including intake throuh grazing (kg/animal/day)												
Green fodder	5.9	4.7	7.1	4	8.9	9.7	7.1	6.1	1.5	1.7	1.5	
Dry fodder	5.5	4	6	2.1	6.3	5	7.5	2.2	0.2	0.2	0.2	
Concentrates	0.6	0.4	0.3	0.2	1.1	0.5	0.4	0.2	0.1	0	0.1	
Total consumption of green fodder in 1000 t/annum)												
Gujarat	3742	1861	6817	3643	9877	6347	439	8405	2540	1205	56	
Haryana	914	407	795	842	6456	3244	361	6484	295	362	41	
Rajasthan	6954	3904	5394	6532	12764	6722	250	11515	11773	6739	301	
Western India	11610	6172	13006	11017	29097	16313	1051	26404	14608	8307	398	

TABLE 4—Feed Demand Estimates of Feed, Green Fodder and Stover in Western India in 2007—*Contd.*

	Cattle				Buffalo							
	in-milk	dry adult male		young	in-milk	dry adult male		young	Goats	sheep	others	Poultry
Total consumption of stover (in 1000 t/annum)												
Gujarat	3476	1605	5773	1965	7036	3232	462	3059	339	139	7	
Haryana	850	351	673	454	4599	1652	380	2360	39	42	5	
Rajasthan	6460	3368	4569	3522	9093	3423	263	4191	1570	776	40	
Western India	10786	5324	11015	5941	20727	8307	1104	9609	1948	957	53	
Total consumption of concentrates (in 1000 t/annum)												
Gujarat	404	160	316	166	1165	340	22	262	102	29	2	148
Haryana	99	35	37	38	762	174	18	202	12	9	2	319
Rajasthan	752	335	250	298	1506	360	13	359	471	163	12	159
Western India	1255	530	603	502	3433	873	53	822	584	201	16	626

Demand for alcohol industry and non-food industry

Among alternative uses (besides food and feed), pearl millet grain is mostly used in alcohol industry as a source of starch. Demand from alcohol industry is assumed to grow by 6 per cent per annum, with base year consumption as 5 per cent of production Gujarat, 12 per cent of production in Haryana and 10 per cent of production in Rajasthan based on the discussions with industry users, traders and farmers through participatory rural appraisal.

Demand for seed

Seed demand is estimated by multiplying the current seed rate of 4kg/ha with the projected area under pearl millet for all the years.

Results

Supply projections of grain and stover

Area under pearl millet increased in Rajasthan (1.16% per annum) and Haryana (0.45%), while decreased in Gujarat (1.3%) (Table 1). Growth in yields are also quite high (5.29%) in Rajasthan, even though yield levels are quite low (only 696 kg/ha). Even though, yield is much higher for summer pearl millet (2073 kg/ha) compared to kharif (1040 kg/ha), expansion of area is not catching up due to competition from other irrigated crops. It is important to increase production where yields are higher and cost of production is lower to position pearl millet with other competing cereal crops like maize and even broken rice to compete as raw material for alcohol industry. Keeping the less scope for expansion of pearl millet area, most of the future production growth comes from yield increase especially from Rajasthan.

The projected supply for the year 2011 and 2020 for grain and stover is presented in Table 5. The base year (TE 2008) production of pearl millet grain is 1101 thousand tons in Gujarat, 970 thousand tons in Haryana and 3823 thousand tons in Rajasthan. The projected production of grains is 8896 thousand tons, which is an increase of 43% by 2020 in western India. The projected supply of pearl millet stover is 15.53 mt in 2011 and it will be increased to 22.24 million ton by 2020.

TABLE 5—Supply Projections of Pearl Millet Grain and Dry-fodder

Year	Gujarat (Kharif)	Gujarat (Summer)	Gujarat (Total)	Haryana	Rajasthan	western India
Grain supply (1000 t)						
2011	776	339	1115	1050	4047	6212
2020	734	329	1064	1398	6435	8896
Dry-Fodder supply (mt)						
2011	1.94	0.85	2.79	2.63	10.12	15.53
2020	1.84	0.82	2.66	3.49	16.09	22.24

Demand Projections

Food demand

Food demand is estimated to be stagnant at 3393 thousand tons even by 2020, of which 60.3% is from Rajasthan, followed by 37 per cent in Gujarat and only 2.8 per cent from Haryana. 90 per cent is contributed by rural areas and only 10% is contributed by urban areas in Western India **(Table 6.)**

TABLE 6—FOOD DEMAND PROJECTIONS

State/area	Consumption (1000 t) 2011	2020	% share in total demand
Gujarat			
Urban	187.7	206.0	6.1
Rural	974.2	1048.3	30.9
Total	1162.0	1254.4	37.0
Haryana			0.0
Urban	3.5	4.4	0.1
Rural	82.7	89.7	2.6
Total	86.2	94.1	2.8
Rajasthan			0.0
Urban	117.9	129.1	3.8
Rural	1700.8	1915.5	56.5
Total	1818.7	2044.6	60.3
Western India			0.0
Urban	309.1	339.6	10.0
Rural	2757.7	3053.5	90.0
Total	3066.8	3393.1	100.0

Demand for cattle and poultry feed and dry fodder from all sources

Table 7 depicts state wise aggregate feed and dry-fodder demand. Demand for cattle feed is increasing significantly and very high Rajasthan (6634 thousand t), followed by Gujarat (4358 thousand t) and Haryana (2036 thousand t) by 2020. While demand from poultry feed industry is small, with higher share of Haryana (601 thousand t), followed by Rajasthan (301 thousand t) and Gujarat (279 thousand t). While, the demand for dry-fodder is much higher in Rajasthan (55 mt), followed by Gujarat (40 mt) and Haryana (17 mt). As the demand for cattle feed is met by different sources (sorghum, maize, wheat and rice bran etc.,) we assume that the pearl millet share is 20 per cent for both Gujarat and Haryana and 30 per cent in Rajasthan which are derived from a survey from all stakeholders. While major sources of ingredients of poultry feed are sorghum, pearl millet, maize, soybean, etc., after discussion with poultry farmers we assumed the pearl millet constitute 60 per cent of poultry concentrate in Gujarat, 70 per cent both in Haryana and Rajasthan. While major sources of dry fodder are wheat and paddy straw in addition to pearl millet stover. After consulting with local farmers, we assumed 10 per cent dry-fodder demand will be met by pearl millet in Gujarat, 25 per cent in Haryana and 30 per cent in Rajasthan.

TABLE 7—DEMAND PROJECTIONS FOR FEED AND FODDER FROM ALL SOURCES

Source	Year	Gujarat	Haryana	Rajasthan	Western India
Demand for grain from cattle feed	2011	3341	1561	5085	9986
concentrate (1000 tons)	2020	4359	2036	6634	13029
Demand for concentrate from poultry	2011	180	388	194	762
industry (1000 tons)	2020	279	601	301	1181
Demand for dry fodder	2011	30	13	42	85
million tons)	2020	40	17	55	111

NOTE: Demand for grain from cattle feed concentrate (based on 3 per cent CAGR of cattle population), demand for concentrate from poultry industry (based on 5 per cent ACGR of poultry population), demand for dry fodder (based on 3 per cent CAGR of cattle population)

Demand for pearl millet grain and fodder

After taking into account of the other sources of supply of feed (sorghum, maize, rice bran etc) and fodder (paddy and wheat straw, which are locally produced), demand estimates of pearl millet grain and fodder from feed (cattle and poultry feed), alcohol industry and seed purpose is given in Table 8. In western India, food needs are major source of demand for pearl millet grain followed by cattle feed, alcohol industry, poultry industry and the last comes the seed requirements in 2011, however by 2020 cattle feed industry is the major user of grain followed by food uses, alcohol industry, poultry industry. The total grain demand increased from 1997 thousand ton to 2391 thousand ton in Gujarat, from 798 thousand ton to 1138 thousand t in Haryana and 3904 thousand ton to 4949 thousand ton in Rajasthan from 2011 to 2020. Taken together, in Western India grain demand projected to increase from 6700 thousand ton in 2011 to 8478 thousand ton by 2020. The demand for pearl millet dry-fodder is higher in Rajasthan (12.59 mt) followed by Gujarat (3.05 mt) and Haryana (3.21 mt) in 2011. Overall, in Western India the demand for pearl millet dry-fodder is projected to increase from 18.84 mt in 2011 to 24.59 mt in 2020. Further, decline in area under permanent pastures and grazing land and also stagnant in area under cereals, which are major source of fodder, there will be growing demand for pearl millet fodder in the future.

TABLE 8—DEMAND FOR PEARL MILLET GRAIN AND DRY FODDER

Grain/fodder	Year	Gujarat	Haryana	Rajasthan	Western India
	2011	668	312	1525	2506
Cattle feed (1000 t)	2020	872	407	1990	3269
	2011	108	271	136	515
Poultry feed (1000 t)	2020	168	421	211	799
Alcohol and starch industry	2011	56	126	405	587
(1000 t)	2020	94	213	684	991
Demand for seed requirement	2011	3.6	2.5	19.9	25.9
(1000 t)	2020	3.2	2.5	19.9	25.5
Total grain demand	2011	1997	798	3904	6700
(food, feed, alcohol, seed					
purposes) (1000 t)	2020	2391	1138	4949	8478
dry fodder demand	2011	3.05	3.21	12.59	18.84
(million tons)	2020	3.98	4.19	16.42	24.59

NOTE: Cattle feed (assuming 20 per cent of concentrate in Gujarat, 20 per cent in Haryana, 30 per cent in Rajasthan is pearl millet), Poultry feed (assuming 60 per cent of concentrate in Gujarat, 70 per cent in Haryana, 70 per cent in Rajasthan is pearl millet), Alcohol and starch industry (alcohol industry demand growth @ 6 per cent per annum(started from 5 per cent, 12 per cent and 10 per cent of production in Gujarat, Haryana and Rajasthan), Demand for seed requirement (assuming 4kg/ha seed rate), Total grain demand (food, feed, alcohol, seed purposes), dry fodder demand (assuming 10 per cent of in Gujarat, 25 per cent in Haryana, 30 per cent in Rajasthan is pearl millet).

Supply and demand gap

Demand and supply projections shows that there is a deficit of about 7 per cent in pearl millet grain production in Western India to maintain the consumption levels of 2004/05 levels in food consumption and to meet the growing livestock demand. However, by 2020 it is projected that there will be surplus grain production to the extent of 5% of the demand due to productivity increase. Most of the grain deficit is in Gujarat state. While in case of dry-fodder, deficit is higher at 18 per cent in 2011, but will be reduced to 10 per cent by 2020. Based on these estimates, there is about 20 per cent deficit of dry-fodder in Rajasthan, 18% deficit in Haryana and 9 per cent deficit in Gujarat in 2011 **(Table 9)**. Given the growing demand for livestock products (milk, meat and their products), there is likely that the demand for fodder will increase exponentially in the region. Fodder availability in Gujarat and Rajasthan is 32 kg/animal/day and 26 kg/animal/day respectively compared to All-India average of 44 kg/animal/day. There will be huge gap between supply and demand (shortage) for fodder in three states by 2020. Local prices of dry fodder is varies between Rs 200 to 500/quintal based on source, generally wheat straw fetches higher prices than pearl millet Stover. Local informal commission agents facilitate fodder trading with 0.5 to 1 per cent commission on trade value of fodder. Colour, size, moisture, softness, purity, cleanliness and variety are some of the parameters which are taken into account during negotiation and price determination of fodder. Fodder having uniform colour, thin stalk and bright lustre is preferred. More fodder quantity with leaves, storability of fodder and palatability (quality and taste) are important factors in determining the price of fodder.

TABLE 9—DEMAND SUPPLY GAP (DEFICIT) IN PEARL MILLET GRAIN AND FODDER

	Year	Gujarat	Haryana	Rajasthan	Western India
Demand supply gap in	2011	–882	252	243	–487
grain (1000 tons)	2020	–1327	260	1486	418
Demand supply gap in dry	2011	–0.26	–0.58	–2.47	–3.31
fodder (million ton)	2020	–1.32	–0.69	–0.33	–2.35
Grain deficit as % of	2011	–44	32	4	–7
demand	2020	–56	23	30	5
Dry fodder deficit as % of	2011	–9	–18	–20	–18
demand	2020	–33	–17	–2	–10

NOTE : Positive figures indicates surplus, negative figures indicates deficit

Overall, 46 per cent of production of pearl millet grain goes to food, 37.5 per cent goes to cattle feed, 7.7 per cent goes to poultry feed, 8.8 per cent goes to alcohol industry and only 0.4 per cent goes to seed purpose in 2011 **(Table 10)**. And the relative share of different uses by 2020 shows that, the share of cattle feed will be increased to 38.6 per cent, share of poultry feed will be increased to 9.4 per cent, share of alcohol industry and other non-food uses will be increased to 11.7 per cent, while food uses will be decreased to 40 per cent. The food share is high in Gujarat and Rajasthan, while share of cattle feed and poultry feed is much higher in Haryana. Even though there is no much use of pearl millet grain in alcohol industry at present, there is good potential in future, given the rising prices of alternative stalks like sugarcane, broken rice and maize. State wise demand projections shows that even by 2020 in Gujarat, food and feed (cattle) are major contributors to demand. Cattle feed, poultry feed and alcohol industry are major drivers of demand growth in Haryana, while in Rajasthan cattle feed and food consumption together contributes to larger share of demand.

TABLE 10—SHARE (%) OF DIFFERENT USES OF PEARL MILLET GRAIN IN 2011 AND 2020

Year	Utilization	Gujarat	Haryana	Rajasthan	Western India
2011	Foodgrain	58.3	10.8	46.8	46.0
	Cattle Feed	33.5	39.2	39.3	37.5
	Poultry feed	5.4	34.1	3.5	7.7
	Brewery and other non-food uses	2.8	15.8	10.4	8.8
	Seed	0.2	0.3	0.5	0.4
	Total	100.0	100.0	100.0	100.0
2020	Foodgrain	52.5	8.3	41.3	40.0
	Cattle Feed	36.5	35.8	40.2	38.6
	Poultry feed	7.0	37.0	4.3	9.4
	Brewery and other non-food uses	3.9	18.7	13.8	11.7
	Seed	0.1	0.2	0.4	0.3
	Total	100	100	100	100

Some micro issues

Cattle feed industry

The pearl millet is high protein and low calorie grain compared to maize for preparation of cattle and poultry feed. Its protein has more lysine, methionine and tryptophan than other foodgrains. Pearl millet contains more thiamin (Vitamin B I) and iron compared to other cereals. Cattle feed industry is composed of both small and large plants, some large feed manufacturers have capacity of 600 tons/day with annual capacity of 120000t/annum; however, they mostly use maize, sorghum as feed ingredients. Because of small size of the pearl millet grain, grinding is difficult and it adversely affects the palatability

and digestibility of feed. In addition pearl millet grain is palatable to cattle only if it is pre-boiled, which is not a general practice and not inbuilt in the feed manufacturing plants. However, the demand for feed is growing from dairy farms due to increased demand for milk animals. For example, Banas dairy maintained by Banaskantha district cooperative in Gujarat increased its size from l00t/day in 1980 to 600t/day in 2009. Similarly many factories reported increase in production capacity. Most of the small/medium scale plants are engaged by the Banas dairy for manufacture of feed on contract basis with specific quality parameters which specify the proportion of different ingredients. Banas dairy produces many different branded feed products with different composition of ingredients. The share of raw material (rice bran, maize, rice polish, pearl millet etc) cost is about 90% of production cost of feed manufacturers. The proportion of feed ingredients and substitution among them depends on their relative prices. Feed manufacturers use about 5-10% pearl millet as ingredient in feed concentrate; there is a possibility that the share of pearl millet can be increased to 15 per cent, if prices of pearl millet are sufficiently lower than its competing grains substitutes like maize, sorghum. According to feed millers, pearl millet is included in feed rations mainly due to its low cost compared to maize and sorghum. Among many reasons, low storability and small grain size of pearl millet grain are the reasons for non-inclusion of pearl millet grain by large millers. The adjustment of machinery which suits to different grain size will improve pearl millet grain as feed ingredient many times.

Poultry industry

There are many poultry feed manufacturers in western India especially in Haryana. There are many small scale poultry feed manufacturers with a capacity of 5 to l0t/day. The price of maize (Rs. 11 /kg) is more than that of price of pearl millet (Rs.8/kg). The ingredients of feed concentrate for broilers contain maize (55%), soya (25%), pearl millet (10%) and rice bran (10%), while ingredients of feed concentrate for layers includes pearl millet (30 %), maize (30%), soya (25%) and rice bran (15%). The sale price of feed concentrate is Rs. l6 to 17/kg. At poultry farms, farmers mix pearl millet with feed concentrate in 2:1 ratio for preparation of feed ration just before feeding.

Alcohol Distilleries

A significant portion of pearl millet, especially lower quality, severely blackened grain is used in Haryana and Rajasthan for manufacture of alcohol. The distilleries prefer varieties with a higher starch and less protein content. Distilleries purchase kharif season pearl millet from traders and brokers in the main producing centres and also from the secondary market, as the prices are low. In Haryana there are 8 distilleries, which are mostly started in early 1990s, out of 8 distilleries, 6 are using broken rice or pearl millet. From each distillery 48000 t/annum demand exist for grain. Currently, mostly barely and potato is used in alcohol making. Some prefer broken rice over pearl millet as former contain more starch (66-70%) than later (55-60%). However, whenever the prices are lower for pearl millet to compensate for lower starch levels, i.e., below Rs. 8000/t compared to Rs.I0000/t for broken rice they used pearl millet (Table 11). Jowar, barley and potato is used in beer making, while pearl millet and broken rice is used in whisky preparation. Distilleries prefer any material which contains high starch for making alcohol. Now increasingly many distilleries are shifting from sugarcane molasses to pearl millet as ingredients. Distilleries are willing to pay premium (or willing to undertake contract farming with farmers) for varieties with high starch (>65%) content. Keeping the demand, summer pearl millet is more suitable for contract farming, as with assured irrigation less supply uncertainty to both farmers and distilleries. Distilleries buy through brokers after examining the quality for starch content and moisture content (12% for pearl millet, <10% for rice).

TABLE 11—Cost Benefit Analysis of Alcohol Production with Pearl Millet

Item	Pearl millet	Broken rice
Price (Rs./t)	8000	10000
Rs/kg starch	13.7	14.7
Concentrate (96% alcohol) (lit/t)	380	433
Concentrate production value (@32/lit)price varies between Rs.30-Rs.35/lit	12160	13856
Profit (Rs/t)	4160	3856
Solid content (used as cattle feed)	Rs.l.5/kg	Rs.2/kg
Processing cost (Rs/lit)	5	5

Starch Industries

Some of starch manufacturers have used pearl millet whenever there is a shortage of maize and sorghum in the markets. Mostly starch manufacturers are not in favour of pearl millet as raw material, as starch content is low and crude protein content is high. The pearl millet grain contain 11.5 per cent crude protein and 2900 kcal metabolizable energy as against 9 per cent crude protein and 3330 kcal M.E. in maize (Prasad and Panwar, 1997). Hence the quality of the end product will be affected. Mostly surplus summer pearl millet production in Gujarat will move to Rajasthan although in small quantities, while the kharif harvest moves from Rajasthan to Gujarat for cattle feed. If prices of sorghum and maize go substantially above pearl millet, most of the pearl millet market arrivals will be purchased by feed manufacturers or large dairy farm holders.

Policy options and limitations

Government has announced an allocation of Rs. 300 crores under Rashtriya Krishi Vikas Yojana for promotion of millets as Nutri-cereals. Scheme on Initiative for Nutrition Security through Intensive Millets Promotion (INSIMP) has been formulated since 2011(AICPMIP, 2011). The scheme aims to demonstrate the improved production and post-harvest technologies in an integrated manner with visible impact to catalyze increased production of millets in the country. Besides increasing production of millets, the Scheme through processing and value addition techniques is expected to generate consumer demand for millet based food products.

The shortage of dry and green fodder requirements can be met by cultivating pure fodder pearl millet crop. Pearl millet sole crop grown for grain on average yield 25 t/ha green fodder (which is equivalent to 2.5 to 3t dry fodder), 2-2.5 t/ha grain. While, the crop grown purely for fodder yield about 40t/ha of green fodder (equivalent to 4 t of dry fodder), however, pure fodder purpose crop is very rare in Western India, which needs to be promoted.

Both grain and stover of pearl millet have a better mineral profile than many other cereals. However, the bioavailability of these minerals is low because of presence of some inherent anti-nutritional factors e.g. phytate, and polyphenols in grain; and oxalic acid in fodder and forage. Its flour acquires a rancid odour within a few days of milling because of high concentration of lipids that contribute to the development of fat acidity, lipolytic activity and accumulation of peroxides of lipids in the meal during storage. The typical grey colour of pearl millet grain and its products due to polyphenolic pigments present in peripheral area of the endosperm further restricts efficient utilization of pearl millet. However, several processing techniques have been developed to enhance food value and shelf-life of pearl millet products and to improve the availability of starch, protein and minerals.

Malting reduces anti-nutritional factors and imparts desirable flavour and taste. Shelf life of pearl millet flour is also increased by malting as this lowers the levels of lipids that are responsible for off-flavors. Blanching and heat treatment improve the storability and stability of flour. Acid treatment of grain may bleach grey colour, remove anti-nutritional factors and improve digestibility and shelf life of pearl millet flour. A wide range of value-added products may be prepared from pearl millet processed flour.

Formulation of poultry feed using pearl millet may help to reduce costs. Pearl millet-supplemented poultry feeds are generally superior to sorghum and equivalent to maize in broiler diets. In general, pearl millet is at least equivalent to maize and often superior to sorghum in cattle, pig and sheep rations because of its high energy and grain protein levels. Its grain, as a high-energy alternative source of inexpensive feed, could be exploited and utilized in production of high quality fish

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Do Market Facilities Influence Market Arrivals? Evidence From Karnataka

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Introduction

A dynamic agricultural sector is crucial for overall economic development. There are various factors affect the performance of agricultural sector in the state of Karnataka. Among others, agricultural marketing plays a crucial role in stimulating production and consumption of agricultural produce as it acts as a critical link between farm production sector and the non-farm sector. A lack of an efficient marketing system can affect the welfare of both producers and consumers. The distance to the market, manipulation of weighing machines, lack of proper grading, and proliferation of middlemen who charge enormous commissions can be listed as some of the problems that farmers who choose to sell the produce at the unregulated markets (Acharya, 2004). Higher agricultural production does not necessarily mean high returns to the farmer unless there is an orderly marketing system that ensures fair prices. The absence of such a fair system could also deprive the consumer of the benefits of a good cropping season. Recognizing the importance of marketing for development of agriculture, the Government of India emphasized the need for taking steps to make the marketing system more efficient. The government intervention was initially thought to be necessary to protect the interests of farmers from the vagaries of market regime, trade malpractices and high marketing cost. But, in view of the emergence of global markets, development of a competitive marketing system with adequate infrastructure facilities and professional management of existing market yards has become imperative in the country.

Building up of new market complexes with modern amenities would influence the market structure and pricing mechanism by increasing efficiency of the market (Kerur et aI, 2008). Further, provision of market amenities would assist in better handling of the produce and reduce storage losses, thereby offering higher prices to growers. An efficient regulated marketing system would, therefore, attract greater market arrivals due to effectiveness in pricing and efficiency in the movement of agricultural commodities (Shilpi and Umali-Deininger, 2007). On the other hand, in the absence of a fair marketing system, farmers would sell agricultural produce either at the farmgate or at the private markets risking a plethora of problems. Nevertheless, Agricultural Produce Market Committees (APMC) have greater role in motivating the farmers to sell their produce at the regulated market yard. This could be achieved by offering better accessibility, remunerative prices, and infrastructure for trading. The success of the APMC markets, therefore, needs to be measured in terms of quantity of market arrival, which is basically the marketed surplus of various agricultural produce. It is important note here that the marketed surplus and market arrivals do not always match. This is because the farmer may choose to store part of the produce for sale at a later date. An efficient APMC marketing system could help in reducing this gap between marketed surplus and market arrivals for a given period.

Farmers' desire to sell any agricultural produce at regulated markets depends on the facilities/amenities available rather than just the presence of regulated markets per se in the area. But, empirical evidences available in this regard are not comprehensive and are mixed in nature. Khunt and Gajipara (2008) reported that Rajkot market in Rajasthan could attract consistently high quantity of arrivals due to both the high rate of investment in providing superior infrastructural facilities and transport-connectivity of the market (Khunt and Gajipara, 2008). An analysis of four regulated markets in northern Karnataka revealed that producer-sellers experienced problems due to improper weighing of products and inadequate grading facilities (Vaikunthe, 2000).

A World Bank study in Tamil Nadu concluded that the likelihood of sales at the market increased significantly with an improvement in market facilities and with decrease in travel time from the village to the market (Shilpi and Umali-Deininger, 2007). Studies have also emphasized the positive relationship between market arrivals and price (Gote et al, 2010; Atteri and Bisaria, 2003). Better market infrastructure helps in curbing marketing losses (Rangi et aI, 2002; Atteri and Bisaria, 2003). However, few empirical studies have analysed the influence of market facilities in attracting market arrivals of agricultural commodities in India. In this context, the present study makes an attempt to understand the role of market facilities in attracting arrivals of agricultural commodities in the state of Karnataka.

Data and Methodology

The present study is based on the secondary data compiled from various published sources. Data on area, production and yield of major agricultural crops were collected from Statistical Abstract of Karnataka. The

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marketed surplus ratios (MSR) of major agricultural commodities were collected from the Agricultural Statistics at a Glance for various years. Since data on marketed surplus ratios were not available at the district level in Karnataka, three years average (2006-07, 2007-08 and 2008-09) of state marketed surplus ratios were used to estimate the district marketed surpluses of major crops viz., paddy, jowar, maize and ragi. The district level quantity of marketed surplus, thus estimated was used to work out the per cent market arrival of respective commodities in various markets falling in a particular district. Data on monthly quantity of arrivals and wholesale prices of these crops were collected for 144 APMCs from AGMARKNET portal (www.agmarknet.nic.in) for the year 2009-10. The details of market physical infrastructures and facilities across APMCs were also compiled from the same source. To examine the relationship between market facilities and market arrival, a multiple regression analysis was carried out with market arrival as percentage of marketed surplus as the dependent variable and number of market facilities, price, district road length and area of the principal market yard (ha) as the explanatory variables.

TABLE 1—Compound Annual Growth Rates of Area, Production and Yield of Major Crops in Karnataka

(Percent)

Period	1980–81 to 1989–90			1990–91 to 2007–08			1980–81 to 2007–08		
Crop	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Rice	0.25	0.01	–0.24	0.31	1.11	0.7	0.79***	2.05***	1.20***
Bajra	–2.89**	0.37	3.17*	0.09	1.86	1.42	–1.98***	–0.14	1.73***
Jowar	1.43	–0.05	–1.47	–2.49	–1.45	0.71	–1.60***	–0.76*	0.69
Maize	6.14***	7.02***	0.82	8.60***	7.82***	–0.97	7.75***	8.06***	0.16
Ragi	0.90*	0.64	–1.72	–1.87***	–0.72	1.08	–1.26***	0.41	1.32***
Small Millets	–6.86***	–5.76**	1.17	–6.81 ***	–6.14***	0.79	–8.20***	–6.78***	1.58***
Wheat	–3.77***	–6.44**	–5.51 ***	1.31***	1.94	0.63	–0.66**	0.78	1.65***
Cereals	0.19	0.42	0.24	–0.28	1.59*	1.50**	–0.43 ***	1.85***	2.11 ***
Arhar	4.22***	2.03	–2.09	2.66***	6.17***	3.42**	1.69***	2.51 ***	0.84
Gram	6.13***	3.04	–3.93***	5.74***	8.11 ***	3.29***	5.28***	6.8***	1.84***
Pulses	1.71**	0.07	–1.05	2.16**	3.09***	1.22	1.42***	2.16***	1.01 ***
Foodgrains	0.36	0.41	0.05	0.345*	1.712**	1.19	–0.003	1.87***	1.78***
Groundnut	5.04***	7.10***	1.97	–2.69***	–4.32***	–2.15**	–0.12	–0.35	–0.5
Sunflower	32.07***	26.77***	–4.001 *	0.18	1.29	1.36	7.05***	6.83***	–0.1
TotalOilseeds	7.73***	9.17***	0.83	–1.75**	–1.89**	–0.43	1.25**	1.23*	–0.2
Cotton	–7.31	1.72	9.74***	–3.06***	–3.07**	3.05	–2.79***	–0.49	3.68***
Sugarcane	4.72***	5.36***	0.59	–0.33	–1.41	–0.57	2.46***	2.48***	0.22
Tobacco	–0.62	1.42	1.93	4.61 ***	1.57**	2.95***	3.25***	2.52***	–0.75*
Fruits and nuts	—	—	—	10.83*	15.96	18.16**	—	—	—
Vegetables	—	—	—	1.24	15.9	16.27*	—	—	—

Note: (*=p<0.1, **=p<0.05, ***=p<0.01)

Source: Statistical Abstract of Karnataka (Various issues), Government of Karnataka

Growth Performance of Major Crops in Karnataka

The compound annual growth rates of area, production and yield of major agricultural commodities worked out for the period of 1980-81 to 2007-08 are shown in Table 1. The entire period has been divided into two sub-periods viz., 1980-81 to 1989-90 and 1990-91 to 2007-08 to examine the differential performance of various crops in different periods in Karnataka. Among crops, rice, jowar, ragi, wheat, gram, and sunflower registered negative growth in yield during 1980-81 to 1989-90. Growth in area for bajra, small millets, wheat and cotton was negative and statistically significant during the same period. It is important to note that maize recorded growth rate of about 7 per cent in production and this was contributed by growth in area (6.1 per cent). The compound annual growth in area under food-

grains was 0.3 per cent during 1980-81 to 1989-90 and its growth in production was low and not significant at 0.4 per cent. A cursory look at the performance of other crops indicates that the period 1980-81 to 1989-90 witnessed stagnation in production as has been discussed in the Report of the Expert Committee (1993). The production of cereals grew from 0.4 per cent per annum during 1980-81 to 1989-90 to 1.59 per cent per annum during 1990-91 to 2007-08. This growth has been contributed by increases in yield as the expansion in area for cereals was almost stagnant.

Notwithstanding, growth in area and yield was positive and significant for most other crops during 1990-91 to 2007-08. The compound annual growth rate in area under foodgrains remained at around 0.3 per cent during 1990-91 to 2007-08. However, growth in foodgrains production was high at 1.7 per cent compared to the earlier period. This comparatively high growth rate was due to growth in area under foodgrains (0.35 per cent). Despite a fall in area, cereals registered a significant growth in production at 1.6 per cent mainly contributed by growth in yield at 1.5 per cent. Maize continued to perform well in this period as well with growth in production at around 7.8 per cent contributed by growth in area (8.6 per cent) despite negative yield growth.

During the overall period from 1980-81 to 2007-08, the performance of agriculture in Karnataka was relatively good. Notable achievements were made on the fronts of production and yield growth. Overall growth in production of cereals, pulses, foodgrains, and total oilseeds was commendable. Rice registered approximately 2 per cent growth in production during this period contributed both by growth in area (0.8 per cent) and yield (1.2 per cent). Unfortunately, growth in area was negative for bajra, jowar, ragi, wheat, small millets, groundnut, and cotton. Though area under foodgrains recorded a negative growth, its production registered annual growth rate of 1.8 per cent which was mainly contributed by growth in yield. Thus, it can be understood from the analysis of growth performance that increased production leads to increased marketed surplus. However, actual arrivals at the market yards depend on the willingness of the producer to sell it at the regulated markets which, of course, depend on a variety of factors such as price, infrastructures, accessibility and finance.

Marketed Surplus Ratios (MSR) of Major Agricultural Commodities

Table 2 depicts the comparison of marketed surplus ratios of major agricultural products in Karnataka and India. The marketed surplus ratios of paddy, jowar, maize, ragi, arhar, and groundnut have been fluctuating over the years in Karnataka. Nevertheless, the marketed surplus ratios of these major grains were higher than all India weighted average. Any increase in marketed surplus always places demands for better transport, storage and grading facilities.

TABLE 2—MARKETED SURPLUS RATIOS OF MAJOR AGRICULTURAL COMMODITIES IN KARNATAKA

(Percent)

	Karnataka					All India				
Crops	2000-01	2004-05	2005-06	2006-07	2007-08	2000-01	2004-05	2005-06	2006-07	2007-08
Paddy	92.9	84.41	94.35	94.59	85.47	73.8	71.37	71.25	79.17	72.64
Jowar	71.5	51.01	96.85	55.33	98.79	62.7	53.44	80.01	61.02	82.87
Maize	96.4	93.47	41.19	96.54	58.84	69.1	76.22	46.25	78.56	61.46
Ragi	33.6	57.54	66.33	27.58	22.17	35.1	57.74	80.9	30.02	22.17
Arhar	72.7	73.7	90.93	98.13	93.98	—	85.26	77.78	83.61	79.16
Groundnut	93.8	97.5	65.77	85.35	82.56	—	88.75	80.2	91.6	88.61
Sugarcane	—	97.17	100	100	100	—	98.23	76.8	100	100
Cotton	98.8	82.91	100	100	100	—	94.94	94.1	96.23	96.15
Onion	96.9	82.91	99.46	99.62	99.46	—	82.91	—	99.62	42.13

Source: Agricultural Statistics at a Glance (various issues), Government of India

Distribution of Regulated Markets by Districts in Karnataka

Table 3 presents the distribution of regulated markets by districts during 2007-08. The density of regulated market, which is measured in terms of the number of regulated markets per lakh hectare of geographical area, is also presented. There are a total of 498 regulated markets in Karnataka which are well distributed between Northern and Southern districts. The districts Tumkur, Belgaum, Gulbarga and Uttara Kannada have greater number of regulated markets than others. It can be noticed that

Northern Karnataka has around 53 per cent of the total regulated markets in the state. However, the main markets in the state do not seem to be distributed uniformly across the districts.

TABLE 3—DISTRIBUTION OF AGRICULTURAL REGULATED MARKETS BY DISTRICTS IN KARNATAKA : 2007-08

Districts	Main Market	Sub-Market	Total Markets	Distribution of Markets (%)	Market density
Southern Karnataka					
Bangalore (U)	2	7	9	1.81	4.14
Bangalore(R)	1	5	6	1.2	2.39
Chitradurga	4	10	14	2.81	1.82
Davanagere	6	8	14	2.81	2.34
Kolar	5	7	12	2.41	3.08
Shimoga	4	18	22	4.42	2.6
Tumkur	9	25	34	6.83	3.19
Chikmagalur	6	9	15	3.01	2.08
D. Kannada	5	9	14	2.81	2.93
Udupi	3	3	6	1.2	1.68
Hassan	6	17	23	4.62	3.47
Kodagu	3	4	7	1.41	1.7
Mandya	6	10	16	3.21	3.21
Mysore	7	8	15	3.01	2.22
Chamarajanagar	3	4	7	1.41	1.23
Total	70	144	214	42.97	2.53
Northern Karnataka					
Belgaum	10	37	47	9.44	3.5
Bijapur	3	14	17	3.41	1.61
Bagalkot	5	15	20	4.02	3.04
Dharwad	5	11	16	3.21	3.74
Gadag	5	17	.22	4.42	4.72
Haveri	7	12	19	3.82	3.92
U. Kannada	8	20	28	5.62	2.73
Bellary	6	14	20	4.02	2.46
Bidar	5	9	14	.2.81	2.58
Gulbarga	7	22	29	5.82	1.8
Raichur	4	11	15	3.01	1.79
Koppal	4	13	17	3.41	3.08
Total	69	195	264	53.01	2.69
State	146	352	498	100	2.61

Source: Director of Agriculture Marketing, Government of Karnataka and Authors' calculation.

Distribution of Physical Market Infrastructures and Facilities

Table 4 reveals the distribution of regulated markets with respect to the percentage of markets having physical infrastructure and facilities. The study has classified the facilities provided in the APMC markets into two groups on the basis of the type of facilities, namely 'physical infrastructure' and 'market facilities'. Physical infrastructure

refers to those facilities that are required during the actual process of sale of produce at the regulated market. They include items such as input/sundry shops, auction platforms, grading and analysing laboratory, mechanical graders, sieves, market office building and warehouse. Physical infrastructure must be present in any market for smooth conduct of transactions. Market facilities refer to those amenities/conveniences that are provided in the APMC market including information notice board/ electric display board, canteen, toilets, internal roads, parking, fencing, post office, bank, fire extinguishers, rest houses for farmers, drinking water, electricity, garbage disposal system, sweeping facilities and extension unit.

TABLE 5—PERCENTAGE OF APMC MARKETS HAVING PHYSICAL INFRASTRUCTURE AND FACILITIES

Physical Infrastructure	Northern Karnataka	Southern Karnataka
Input/Sundry Shops	86.9	71.1
Auction Platform	78.7	83.1
Grading and Analysing Laboratory	21.3	9.6
Mechanical Graders	4.9	6.0
Sieves	21.3	15.7
Market office building	98.4	91.6
Storage facilities (Warehouse)	60.7	57.8
MARKET FACILITIES		
Information Notice Board/Electric Display Board	100	96.4
Canteen	68.9	68.7
Toilets	86.9	90.4
Internal Roads	98.4	91.6
Parking	86.9	81.9
Fencing	85.2	77.1
Post office	47.5	16.9
Bank	47.5	25.3
Fire extinguishers	47.5	21.7
Rest houses for farmers	82.0	74.7
Drinking water	98.4	92.8
Electricity	100	95.2
Garbage Disposal System	31.1	38.6
Sweeping facilities	57.4	69.9
Extension unit	21.3	19.3

Source: agmarknet.nic.in

The number of market facilities was higher than physical infrastructures in both Northern and Southern Karnataka. Physical infrastructure such as mechanical graders, grading and analysing laboratory and sieves are very poorly developed in both the regions though these are very basic to the proper functioning of the market. Among market facilities, extension unit and garbage disposal system are poorly developed in the regulated markets. It is commendable to note that in both the regions, internal roads that are crucial for market access are well developed. Market amenities such as parking, fencing, rest houses for farmers, and toilets are fairly well developed in both the regions. Banks, post offices and fire extinguishers are better developed in Northern Karnataka when compared to South. Further, it is important to note that by and large markets in Northern Karnataka are better equipped with market facilities than the markets in Southern region.

Analysis of Relation between Facilities and Market Arrival

Table 6 presents the results of the regression analysis. The market-level regression analysis was carried out to examine the relationship between the arrivals and market facilities. For this purpose, the study has estimated two models. In Model 1, market arrivals as percentage of

marketed surplus was regressed on market facilities. In model 2 we regress on market facilities by inclusion of other variables such as price, district road length, area of the principal market yard. Price has been one of the most important determinants of the market arrivals in the regulated markets. An efficient marketing system can help in stabilizing the price level.

In the case of paddy in model 1, the coefficient of market facility was positive and significant. It implies that better market facilities enable greater arrival of paddy in APMC yards. However, when other explanatory variables included as shown in model 2, the coefficient of market facilities was positive, but turned insignificant. Area of principal yard and price showed expected positive relation and were significant, indicating that they played an important role in determining the quantity of market arrivals. Similar results were obtained in the case of jowar too. In model 1, market facilities were positive and significant. In model 2, all the explanatory variables were statistically not significant. It would be interesting to note that the coefficient of district road length showed a negative sign indicating that better transport might not necessarily lead to greater market arrivals. However, in both the models, no explanatory variable turned out significant in case of maize. In fact, as observed in jowar, district road length recorded a negative sign. Price, market facilities, and area of principal yard showed positive relation but were found to be statistically not significant. In the case of ragi, model 1 showed market facilities as significant and positive thereby stressing that facilities at the market yard attracted greater market arrivals. In Model 2, the regression results showed that all the explanatory variables were significant. However, coefficients of district road length and area of the principal yard turned out negative.

TABLE 6—Regression Analysis of Market Facilities and Market Arrival

Variables	Paddy		Jowar		Maize		Ragi	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Market	1.017*	0.632	2.324*	2.009	1.953	1.376	0.999**	0.738**
facility	(1.77)	(1.11)	(1.97)	(1.61)	(1.19)	(0.81)	(2.64)	(2.1)
Price		0.014*		0.167		0.051		0.011**
		(1.92)		(1.14)		(1.6)		(2.53)
District road length		0.001 (0.21)		–0.007 (–1.45)		–0.013 (–1.45)		–0.008*** (–3.36)
Area of principal yard		0.156** (2.41)		0.012 (0.09)		0.044 (.29)		–0.048* (–1.68)
Constant	–3.864	–14.854	–27.876	–15.616	–3.297	–7.099	–7.912	7.610
	(–0.49)	(–1.25)	(–1.58)	(–0.75)	(–0.14)	(–0.18)	(–1.45)	(1.08)
No of observations	81	81	49	49	86	86	39	39
R^2	0.0381	0.1549	0.0766	0.1360	0.0165	0.0754	0.1582	0.4157

Note: Figures in parenthesis are't' values; *** significant at 1 % level, ** significant at 5% level and * significant at 10% level.

Overall, regression results indicated a positive relationship between market facilities and market arrivals. The differentials in the influence could be due to absence of produce-specific facilities, geographic location of the markets, and the cropping pattern of areas served by different markets. Further, coefficient of district road length, a proxy for market access, was expected to be positive and significant. However, unfortunately it turned out to be negative in most cases, which might be due to data problems as consistent data on road length at district level are not available. Further, the present study considered only the district road length, which did not include national and state highways, and village roads.

Conclusions

The study indicates that the regulated foodgrain markets within the state are beset with a number of imperfections and are found wanting in amenities and infrastructural facilities for promoting orderly and efficient marketing. Consequently, the regulated markets have been attracting low arrivals despite substantial increase in marketed surpluses over time. The present

study has attempted to examine the relationship between market facilities and arrival in the APMC markets of Karnataka by using regression analysis at market level. The analysis of the distribution of market infrastructure reveals that the main markets are fairly distributed equally between Northern and Southern Karnataka. However, markets in Northern Karnataka are better equipped with market facilities than the markets in Southern region.

Regression analysis has showed that the coefficient of market facilities was positive but its statistical significance varied across crops. Market facilities differed in their effectiveness in inducing market arrivals of different crops. The differentials in the influence could be due to absence of produce-specific market facilities, geographic location of the markets, and the cropping pattern of areas served by different markets. Nevertheless, it is important to note that higher production need not lead to higher market arrivals in a district. Despite relatively lower production in a given year, market arrivals could still remain high due to delayed sale of crops made possible by better storage facilities.

Thus, the study shows that the regulated markets have greater capacity to attract market arrivals and therefore, there is scope for large scale increase in agricultural production. It needs to be stated here that only a few major crops have been considered in this analysis. Also, inclusion of more explanatory variables could have strengthened the analysis. Further analysis could cover more periods of time to examine the possibility of a trend in the market arrivals since any improvement in market facilities could have long-term impacts on the market arrivals. The data available on the public domain with regard to the market infrastructure is provided on 'as-on-date' basis which restricts the possibility of a time-series analysis of the advancement of market facilities. Nevertheless, there is a need to strengthen the functioning of these regulated markets by the state government and market committees in a way that the knowledge is disseminated on profitable marketing to the farmers and at the same time facilitate availability of produce to the non-farming population at affordable prices.

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AGRICULTURAL PRICES IN INDIA

It is an old adage that Agricultural prices mirror the economy of a country. It is more true in the case of an agricultural country like India. Viewed from this angle, it is quite an important publication. It gives information on index numbers, farm (Harvest) prices, wholesale and retail prices of various agricultural commodities, etc.

Crop Diversification in Tamil Nadu-A Temporal Analysis

C. VELAVAN AND P. BALAJI*

Introduction

Agriculture is an important sector in Tamil Nadu state economy. It contributed 13 per cent to the state income. Nearly 56 per cent of population in the state is depending on agriculture. It has the net cropped area of 5.12 million hectares and nearly 56 per cent of the area is irrigated by various irrigation sources. It has seven agro climatic zones which are suitable for various crops. Tamil Nadu stands first in productivity of sugarcane and third in groundnut in the country.

Crop diversification is helpful for sustainability of agriculture. Mono cropping affects soil health and creates biotic and abiotic stress to the soil. Introduction of green revolution in late 60's and early 70's to meet the food shortage in the country had adversely affected the cropping pattern in the country. Introduction of fertiliser responsive and high yielding varieties in rice and wheat had converted many states as a mono crop state. After attaining self sufficiency in foodgrain production central and State Government introduced many schemes to diversify cropping pattern to maintain food security. The crop composition further changed by the changes in prices, rainfall and labour availability. In this context, it is necessary to study the status crop diversification after forty years of green revolution. Hence, the objective of the study is to measure the crop diversification over the years in the State.

Methodology

a. Growth Rate Analysis

For the present study, area under major crops in the State for the last 48 years i.e. from 1960-61 to 2007-2008 has been collected from Government of Tamil Nadu publications (Government of Tamil Nadu, 1960-2000). Average area under each crop and share to the total cropped area for each crop were worked out for this study. Compound growth rates of area of these crops were estimated to assertion change in cropping pattern in the state. Exponential function of the following form was used to estimate the growth rate (Gujarati, 1992). It is defined as

$$Y_{it}=A_i (1+r_i)^t \quad \text{(1)}$$

Where,

Yit- Area of i th crop at time t (ha)

r - Compound growth rate of Y_i

A_i - Initial year Area of i th crop t - time in years

By taking natural logarithm of (1),

$$In\ Y_{it} = In\ A_i + t\ In\ (1+r_i) \quad \text{(2)}$$

Now letting

$$a_i = In\ A_i$$

$$\beta_i = In(1+r_i)$$

Equation (2) can be written as

$$In\ Y_{it} = a_i + \beta_i t \quad \text{(3)}$$

Adding the disturbance term to (3), it can be written as

$$In\ Y_{it} = a_i + \beta_i t + U_t$$

Y_{it} = Area of i th crop at time t (ha)

t = time in years

α. = constant term

β = regression co-efficient

This log linear function was fitted by using ordinary least square (OLS) method. The compound growth rate (r) was obtained using the formula.

$$r_i = (Antilog\ \beta_i - 1) \times 100$$

b. Herfindahl Index

Herfindahl index was used to study the extent of diversification in the state. Herfindahl index is defined as:

$$HI=\sum_{i=1}^{n} Pi^2$$

Pi = Proportion of area under i th crop

$Pi = Ai / \sum A_i$

In which Ai=Area under ith crop and $\sum_{i=1}^{n} Ai$ = Total cropped area

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The value of HI index varies between zero to one. It is one in case of perfect specialization and zero in case of perfect diversification.

Result and Discussion

Changes in share important crops

The changes in share of important crops in gross cropped area are presented in Table 1. Paddy has the highest share of nearly 32 per cent in gross cropped area followed by groundnut, sorghum and fruits and vegetable. Share of the major cereals has decreased over the years except maize in the state. The share of paddy has decreased from 32.5 per cent in 1980's to 31.5 in 2000-07. However, the share of maize has increased from 0.34 per cent in 1980's to 2.68 per cent in 2000's. The main reason could be the increase in demand of maize for animal feed in the state. Among the pulses, area under all crops has decreased except black gram and green gram. Share of black gram has increased from 2.64 per cent in 1980's to 4.13 per cent in 2000-07. Similarly, share of green gram has also increased from 1.21 per cent in 1980's to 2.31 per cent in 2000-07. Share of other major pulses like horse gram and Bengal gram has decreased nearly 50 per cent over the years. Share of chillies and onion has slightly improved over the years. Share of sugarcane has increased from 2.88 per cent to 5.13 per cent. The main reason could be the increase in the number of sugar mills and procurement price of sugarcane over the years. Share of fruits and vegetable has doubled in the study period. However, share of groundnut, gingelly and caster has decrease in the same period. In contrast, share of coconut has tripled in the study period. Share of cotton has decreased from 3.42 per cent in 1980-89 to 2.03 per cent in 2000-07.

It is clear from the above discussion that the share of major crops like paddy, groundnut and jowar has decreased over the years in the state. However, share of minor crops like maize, black gram, green gram, coconut and fruits and vegetable has increased over the years in the state. This shows that state is moving towards crop diversification rather than specialisation.

Area Growth of Important Crops

Compound growth rate of important crops is presented in Table 2. It is observed from the table that annual area growth rate of all cereals except maize has grown negatively in the state. Maize has grown 5.88, 10.35 and 17.81 per cent in 1980's, 1990's and 2000's respectively. Growth rate of maize is 10.71 per cent over the study period. Area under bajra, ragi and jowar has grown negatively in the study period. Among the pulses, Black gram and green gram have grown positively and the growth rate is constantly increasing over the decades. Growth of area under Bengal gram has turned positive in the recent years. Growth rate of sugarcane has increased 1.92 per cent in 80's to 3.25 per cent in 2000-07. Similarly, Area under fruits and vegetable has grown 2.4 percent, 3.87 per cent and 3.02 percent in 80's, 90's and 2000-07 respectively. In contrast, Area under gingelly has reduced 5.54 per cent in 2000-07. Similarly, Area under groundnut has decreased nearly 3 per cent in recent years. Area under coconut has increased positively over the years and it has grown 4.91 per cent over the years. But, the area under cotton has decreased in past two decades and area has reduced 5.58 percent in recent years.

Based on the area growth rates of crops in the state, it is evident that the crops are having the major shares like paddy, groundnut and jowar have grown negatively in the state. The crops are having the least share like maize, sugarcane, coconut and green gram have grown positively over the years. This gives further clear picture of crop diversification in the State.

Crop diversification in Tamil Nadu

Results of Crop diversification is presented in Table 3. The index value was 0.17 in 1960-69 and it was reduced to 0.13 in 2000-07. It is clear from the results that the crop diversification is taking place over the years in the State.

Conclusion

It is concluded from the study that the share of major crops like paddy, groundnut and jowar has decreased over the years in the state. However, share of minor crops like maize, black gram, green gram, coconut and fruits and vegetable increased over the years. This shows that state is moving towards crop diversification rather than specialisation. Based on the compound annual growth rate of area of crops, it is evident that major crops like paddy, groundnut and jowar have grown negatively and least share crops like maize, sugarcane, coconut and green gram have grown positively over the years. The crop diversification index value has reduced over the years. Hence, it is concluded from the study that crop diversification has been taking place in the state over the years.

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TABLE 1—SHARE OF IMPORTANT CROPS IN TAMIL NADU

(per cent)

S. No	Crops	1980-89	1990-99	2000-07	Over all 1980-07
1.	Paddy	32.54	31.98	31.50	32.06
2.	Jowar	10.08	6.47	5.66	7.59
3.	Bajra	4.58	2.92	1.76	3.23
4.	Ragi	2.79	2.03	1.87	2.27
5.	Maize	0.34	0.72	2.68	1.08
6.	Black Gram	2.64	3.29	4.13	3.27
7.	Green Gram	1.21	1.58	2.31	1.63
8.	Red Gram	1.31	1.34	0.76	1.18
9.	Horse Gram	2.15	1.47	1.25	1.67
10.	Bengal gram	0.12	0.12	0.11	0.12
11.	Chillies	1.00	1.06	1.15	1.06
12.	Turmeric	0.24	0.27	0.42	0.30
13.	Sugarcane	2.88	4.09	5.13	3.91
14.	Onion	0.31	0.38	0.47	0.38
15.	Fruits and Vegetables	4.56	6.47	9.57	6.57
16.	Gingelly	1.64	1.76	1.29	1.59
17.	Groundnut	13.64	14.58	10.15	13.09
18.	Coconut	2.16	3.48	6.09	3.66
19.	Cotton	3.42	3.55	2.03	3.11

TABLE 2—COMPOUND GROWTH RATE OF IMPORTANT CROPS IN TAMIL NADU

(per cent)

S.No	Crops	1980-89	1990-99	2000-07	Over all 1980-07
1.	Paddy	–2.53	1.06	–0.21	–0.82
2.	Jowar	–0.99	–4.92	–1.84	–3.83
3.	Bajra	–2.45	–6.13	–10.99	–5.92
4.	Ragi	–2.21	–4.61	–4.30	–2.97
5.	Maize	5.88	10.35	17.81	10.71
6.	Black Gram	0.92	2.10	1.13	1.81
7.	Green Gram	1.22	3.07	3.04	2.97
8.	Red Gram	5.43	–6.13	–10.82	–3.78
9.	Horse Gram	–4.80	–5.41	–10.22	–4.00
10.	Bengal Gram	–4.21	1.27	0.26	–1.03
11.	Chillies	–3.37	3.54	–3.31	0.08
12.	Turmeric	3.20	11.34	1.75	2.94
13.	Sugarcane	1.92	3.70	3.25	2.42
14.	Onion	1.12	3.02	0.82	1.67
15.	Fruits and Vegetables	2.40	3.87	3.02	3.33
16.	Gingelly	5.00	–4.76	–5.54	–1.91
17.	Groundnut	2.33	–3.77	–2.97	–2.19
18.	Coconut	5.19	6.12	2.36	4.91
19.	Cotton	2.99	–2.57	–5.58	–3.25

TABLE 3—CROP DIVERSIFICATION INDEX

S. No	Period	Herfindahl Index
1.	1960-69	0.1729
2.	1970-79	0.1646
3.	1980-89	0.1472
4.	1990-99	0.1414
5.	2000-07	0.1305

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Labour Use, Farm Size and Productivity Relationship: An Empirical Evidence from Low Hill Zone of Himachal Pradesh

SANDEEP KUMAR* AND L. R. VERMA**

Abstract

Human labour is an important input and most dynamic agent of production around which the entire production process moves, It dominates our agriculture as most activities are done by hand using traditional tools and implements, Its utilization varies with the size of farms, from crop to crop and place to place depending on the adopted cultural practices, Focusing, specifically, on some selected foodgrain crops which are extensively cultivated in the study area, in particular, the present paper examines the relationship between labour absorption on the one hand and grosses returns, farm size, crop operations on the other; and also the question of the labour productivity in agriculture. The major finding of this study is that at the existing level of technology, labour was employed beyond a point of maximum productivity and there diminishing returns are in operation; suggest that agriculture is not in a position to absorb more labour at the cost of labour productivity. Similarly, the relationship between size of holding and productivity has been the subject of study since the results of farm management investigation. The results obtained from the study pointed out that there exists an inverse relationship between the operational holding and productivity on maize crop, whereas, constant productivity relationship was observed on paddy and wheat crops. When all these, crops were taken together, inverse relationship between the two holds true, In respect of profitability, only small farmers are able to convert their output advantage into net profitability by taking all these crops together. The important policy implication of the analysis is that the consolidation of land holdings formulation and effective implementation of a developmant strategy and management of basic and economic holding in the study area will undoubtedly of primary importance to boost agricultural production, productivity and profitability thereby enhancing the productive employment and well-being of the farm families.

I

Introduction

The population of our country is increasing at a rapid rate leading to decline in land-man ratio and expansionary demand for foodgrain production. In order to fulfill the growing demand, it has been argued that small farms are more efficient in producing most of the agricultural commodities, therefore, land distribution in favour of marginal and small farms is an attractive policy instrument for raising production, improving rural employment and quality of income distribution. No doubt, over the past few years in our country, substantial progress has been made in respect of the performance of agricultural system which relies more on abolition of intermediaries, ownership right, security of tenants and ceiling of land holdings. But in order to formulate the proper policy regarding land reforms, it is equally important to know the exact relationship between farm size and productivity in Indian farming. The debate on the possible relationship between farm size and productivity was stated by A.K. Sen (1962) in India and later on joined by Khusro, A.P. Rao, Rudra, Hanumanta Rao, O.R. Saini and others. Majority of the studies pointed out that there exists an inverse relationship between the farm size and productivity. The findings of Directorate of Economics and Statistics (1955), Khusro (1964), Krishna (1964), Sharma (1971), Bardhan (1973), Bhardwaj (1974), Sankhayan (1978), Saini (1979), Sekar (1994), Chattopadhyay and Sengupta (1997), and Sharma & Sharma (2000) are pioneering in this regard, though they offered different explanations in favour of inverse relationship. On the other hand, a few studies conducted by Singh & Patel (1973), Ghose (1979), Nagraja (1985) and Reddy (1993), showed that inverse relationship between the two has disappeared with the advent of new agricultural strategy which involved HYV seeds, chemical fertilizers, labour saving machinery, modern irrigation equipment etc. However, the studies made by Rao (1967), Rudra (1968), Rani (1971), Vaidya (1993) in case of wheat crop and Singh Bal (1994) indicated that productivity remains constant irrespective of the difference in holding size. In sum, the debate on this controversial issue continues to be a moot point in Indian agriculture.

The new agricultural strategy called the High Yielding Variety Programme (HYVP) introduced in the mid-sixties in our country has caused considerable changes in the trend of area, production and productivity. Though this strategy is confined to a few crops and not with the same vigour in all parts of the country, it favour large farm bias, however upto a limited extent. It is argued that new agricultural strategy has displaced the importance of family

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labour which was considered to be the main determinant of inverse relationship between farm size and productivity. The use of chemical fertilizers, HYV seeds, irrigation facilities along with other infrastructural facilities, process of liberalization, change in tenancy relations, replacement of share tenancy with fixed rent tenancy etc., have profound implication in favour of large farm bias.

Agriculture is the backbone of Indian economy as it provides direct employment to more than 60 per cent of the working population and contributes about one fourth of the Gross Domestic Product of our country. Agriculture is also the largest single industry and main occupation of the people of Himachal Pradesh as 70 per cent of the working population is directly or indirectly depends upon it and about 17 per cent of the gross state domestic product comes from this sector, yet the agriculture sector continues to occupy a significant place in the State economy and any fluctuation in the production of foodgrains/Fruits affect the economy. Such type of dominance of agricultural sector in the employment structure prompts ones' thoughts on the possibilities of absorption of additional labour force in this sector. Several studies [Rao (1976), Ishikawa (1978), Vaidyanathan (1978), Bardhan(1978), Alagh *et al.* (1978), Vyas and Mathai (1978), Pandey *et al.* (1981), Gupta (1981), Gowda *et al.* (1989), Lakshamananet *et al.* (1988)] have made it clear that agriculture sector has a latent capacity to absorb more labour. on the other hand the studies conducted by Singh *et al.* (1981) and Ninan (1984) have put forward the view that possibilities of more absorption of labour force in Indian agriculture is fully exhausted at the present level of technology. The studies conducted by Rathore *et al.* (1981), Verma (1981), Oberai and ahmed (1981), Lakshmanan et al. (1998), Singh (2000) etc., have suggested that labour use decline with the increase in farm size. On the other hand, Naidu *et al.* (1981) revealed that the inverse relation between the two not only disappeared but turned positive. Similarly, Singh *et al* (1981) noted that per acre labour input increase with an increase in the size of holding up to three hectares and after that it decline for all crops technologies. The same findings have been reported by Gupta (1981) and Ninan (1984) too. Therefore, it necessitates for the detailed study on the pattern and magnitude of labour use across farm sizes, crops and region to guide the planners about more absorption of labour force in agriculture. It is in this background, the present paper seeks to analyze the pattern and magnitude of human labour employment potential in selected foodgrain crops and the relationship between farm size and productivity with the following specific objectives :

(1) To study the impact of an increase in agricultural output on labour employment.

(2) To examine the relationship between farm size and labour use per unit of area and to know the pattern and magnitude of labour absorption across different crop operations.

(3) To find out the relationship between labour productivity and employment generation.

(4) To examine whether farm size is an important factor to determine farm productivity and profitability.

(5) To examine the relationship between farm size and productivity.

(6) To suggest remedies to increase foodgrains production, productivity and input utilization in the study area.

II

Data Source and Methodology

For the purpose of present study, the entire state was divided into three agro-climatic zones viz., low-hill, mid-hill and high-hill zones based on the height above the mean sea level. Out of which low-hill zone was purposively selected on account of similar agro-climatic conditions, having good production potential, fertile soil, good roads and communicational network and above all, major foodgrain crops are grown here. Besides, the agro-climatic conditions of the low-hill zone are congenial for the production of foodgrains crops, viz., Maize, Paddy and Wheat, whereas the mid-hill and high-hill zones, the agro-climatic conditions are congenial mostly for the production of horticultural and cash crops like, off-season vegetable, such as potato, cabbage, peas, cauliflower etc. With the help of random mechanism, two districts, Una and Bilaspur, have been selected out of which one block from each district, namely, Una and Ghumarwin respectively were drawn for the present empirical investigation. After that, three panchayats from each block and three villages from each panchayat, thus a total of 18 villages have been selected with the help of multi-stage random sampling. Farms from each selected village were arranged in the ascending order on account of their farm size namely, marginal, small and medium measuring less than 1.0, 1.0-2.0 and 2.0 and above hectares respectively. The data were collected by survey method with the help of pre-tested and well-structured schedule from 200 farms consisting of 98 marginal, 62 small and 40 medium selected randomly on the basis of probability proportional to the number of farms in each size class pertaining to the year 2004-05. Due to the non-availability of data on some minor crops such as pulses, mustard, gram etc. we have concentrated in our analysis only in major foodgrain crops viz., maize, paddy and wheat which are extensively grown in the study area and when all these crops were taken together. In order to meet out the objectives of present work, both linear and log-linear equations were fitted to the data. In addition to this, correlation coefficients have also been used to examine the relationship between labour productivity and

employment intensity. More specifically, the following types of regression equations were fitted to the data :

In order to achieve the objectives of present study we have fitted the following regression equations :

$H = a+b_1 Y$ .. ..(i)

$\text{Log } H = \log a + b_1 Y + U$ .....(ii)

$\text{Log } Y = \text{Log } a + b_1 \log X_1 + u$ .....(iii)

$\text{Log } H = \log a + b_1 \log X_1 + U$ .....(iv)

$\text{Log } M = \log a + b_1 \log X_1 + u$ .....(v)

$\text{Log BTC} = \log a + b_1 \log X_1 + U$ ..... (vi)

Where

H = Per hectare labour input in maize/paddy/wheat/all crops cultivation in standard mandays.

Y = Per hectare output of maize/paddy/wheat/all crops in '.

X_1 = Size of operational holding under respective crop (hectare)

M = Value of manure & fertilizer per hectare (')

BTC = Bullock labour & tractor charges per hectare (')

b_1 = Elasticity coefficient

u = error term

a = intercept term

In addition to this, the differences in the means of gross value productivity of different crops and mean inputs use between different categories of farm were tested with the help of appropriate statistical tools.

III

Rcsults and Discussion

In this section, we shall make an attempt to achieve the objectives of present study. But before going into the analysis of labour absorption, farm size and productivity relationships and its connection with pattern of resource use on farms, it would be appropriate to have an idea of the basic characteristics of the study area across different farm size groups. These characteristics are presented in Table 1 in terms of family size, standard mandays, literacy percentage, sex ratio, farm size, cropping intensity, average yield, per capita income, average propensity to consume etc. indicated that there are large variations across farm size groups.

TABLE 1—BASIC CHARACTERISTICS - SOME SELECTED INDICATORS

S. No.	Indicators	Size class			
		Marginal holding	Small holding	Medium holding	Overall holdings
1.	Family size	5.76	6.09	7.05	6.12
2.	Family work force (per cent)	67.07	69.57	64.18	67.18
3.	Total available mandays (per annum)	1146	1218	1365	1212
4.	Literacy percentage	68.31	69.57	81.20	70.12
	A. Male	79.13	74.16	86.09	77.58
	B. Female	57.83	63.90	75.57	62.01
5.	Sex ratio (at 100 males)	103	80	86	92
6.	Per capita income (')	14902.31	20174.49	22443.31	18266.76
7.	Average propensity to consume	0.77	0.61	0.63	0.68
8.	Farm size (ha.)	0.46	1.26	2.32	1.08
9.	Cropping intensity (per cent)	185.97	179.51	178.9	180.56
10.	Raio of hired labour to family labour	0.03	0.07	0.13	0.08
11.	Irrigation (per cent)	0.14	0.26	0.22	0.22
12.	Tractor (No./farm)	0.07	0.11	0.20	0.10
13.	Thresher (No./Farm)	0.07	0.22	0.30	0.16
	Average Yield (qtls/ha)				
	Maize	23.80	19.88	15.79	19.15
	Paddy	32.87	26.22	21.86	25.91
	Wheat	18.00	15.54	14.53	15.66
	All crops (Maize+Paddy+Wheat)	23.02	19.34	16.56	19.04

Source: Field Survey 2004-05

1. Labour Absorption and Output

To find out the quantum of labour required for a given increase in output, we have treated labour as a function of output here and the results of regression analysis are presented in Table 2. The results indicate that all the regression coefficient (linear as well as log-linear) in each crop and farm size are significant at 1 per cent level. The linear function indicates the requirement of additional mandays of labour for a given increase in output whereas log-linear function measures the employment elasticity with respect to output. The deviation from unity of all these elasticity coefficients with the help of 't' test shows that these coefficients are statistically less than unity indicates that a one per cent increase in output in each crop and holding size, leads to a less than proportionate increase in Labour input per hectare.

TABLE 2—Relationship between Labour Input in Mandays (H) and Gross Value of Output (Y) in Result of Regression Analysis

Sl. No.	Size Class	N	Linear			Log-linear		
			Constant (a)	Coefficient (b_1)	R^2	Constant (log a)	Coefficient (b_1)	R^2
(1)	Maize crop							
	Marginal	89	25.65*	0.0035*	0.64	0.219*	0.389*	0.72
	Small	60	27.04*	0.0056*	0.56	–0.314NS	0.553*	0.65
	Medium	40	32.89*	0.0075*	0.74	–0.305NS	0.584*	0.78
(2)	Paddy crop							
	Marginal	63	25.35*	0.0030*	0.72	–0.073NS	0.459*	0.81
	Small	54	33.35*	0.0034*	0.86	–0.1 47NS	0.498*	0.88
	Medium	40	41.08*	0.0037*	0.86	–0.296*	0.552*	0.91
(3)	Wheat crop							
	Marginal	95	30.72*	0.0034*	0.75	0.262*	0.389*	0.77
	Small	61	56.17*	0.0020*	0.48	0.401*	0.370*	0.63
	Medium	40	95.47*	0.0011*	0.28	1.354*	0.167*	0.35
(4)	All crops (Maize + Paddy + Wheat)							
	Marginal	247	27.38*	0.0033*	0.72	0.415***	0.278*	0.09
	Small	175	44.33*	0.0027*	0.63	0.094NS	0.444*	0.74
	Medium	120	67.73*	0.0025*	0.49	0.278*	0.421*	0:67

*and***significant at 1 and 10 per cent level respectively, NS = Not Significant

However, a given increase in output leads to more employment potential with the increase in farm size in case of maize and paddy crop whereas, trend is reverse in case of wheat crop. When all these crops were taken together, the employment elasticity was found higher on small sized farms. The results of pooled analysis are presented separately to get an overall view of the annual labour absorption. The results are presented in table 3.

The table explores that every hundred rupees increase in output will require 0.76, 0.40, 0.31 and 0.36 additional mandays of labour for maize, paddy, wheat, and all crops respectively. The employment elasticity with respect to output is 0.60, 0.55, 0.45, and 0.50 for maize, paddy, wheat and all crops reveals that a one per cent increase in respective output of these crops would result in 0.60, 0.55, 0.45, and 0.50 per cent increase in mandays of labour for these crops respectively. The employment elasticities with respect to output were not only less than proportionate but also the deviation from unity was statistically significant at one per cent level in all the cases.

TABLE 3—Relationship between Labour Input in Mandays (H) and Gross Value of Output (Y) in : Result of Regression Analysis (Pooled)

S. No.	Crops	N	Linear			Log-linear		
			Constant (a)	Coefficient (b_1)	R^2	Constant (log a)	Coefficient (b1)	R^2
	Maize	189	17.65*	0.0076*	0.76	–0.468*	0.60 1*	0.80
	Paddy	157	26.61 *	0.0040*	0.83	–0.371 *	0.553*	0.86
	Wheat	16	40.04*	0.0031 *	0.67	0.0051NS	0.457*	0.80
	All crops	542	34.42*	0.0036*	0.67	–0.154*	0.508*	0.80

*significant at1per cent level, NS not significant.

It can also be observed from the table that the magnitude of labour absorption in wheat cultivation is lower than that in case of maize and paddy.

2. Input use and farm size

In the present work, Table 4 presents data pertaining to input use in selected crops cultivation among the different strata of farms. The table indicates that marginal farms used significantly higher amount of humun labour as compared to their large counterparts in each crop as well as when all the crops were taken together. The difference in the labour use between small and medium farms, however significant only in case of wheat crop cultivation. The inverse relationship between labour use and farm size can also be supported by the results of regression analysis. Table 5 revealed that all the coefficients are dominated by significantly negative signs in all the cases. It is indicative of the fact that inverse relationship between the labour use and farm size appeared to hold true not in the case of individual crop but also when all these crops were taken together. The higher labour intensity on lower size category may be due to availability of cheap family labour per unit of land, the situation arising from low opportunity cost of labour the fact is that they use less of hired-in labour as compared to their counterparts.

However, in respect bullock labour tractorization and manure and fertilizers, marginal farms used significantly higher amount of respective input factors as compared to their counterparts in each crop as well as when all the crops were taken together.

TABLE 4—INPUTS USE ON DIFFERENT CATEGORIES OF FARMS

S. No.	Crops	Marginal holding		Small holding		Medium holding		't'value for difference		
		Mean	Standard deviation	Medan	Standard deviation	Mean	Standard deviation	Marginal and small	Marginal and medium	Small and medium
	Inputs use in maize crop									
1.	Human labour (days/ha)	202.93	90.12	147.65	62.57	141.19	29.96	4.12*	4.20*	0.60
2.	Bullock labour and tractorization ('/hd)	3465.64	1306.02	2725.81	1060.92	2508.12	373.92	364*	4.87*	1.23
3.	Manure and fertilizer (/ha)	2728.41	1225.49	2001.86	936.50	1666.52	735.06	3.88*	5.07*	1.90****
	Inputs use in Paddy crop									
4.	Human labour (days/ha)	220.67	72.98	163.78	43.54	155.68	28.0	5.01*	5.37*	1.01
5.	Bullock labour and tractorization ('/ha)	3813.78	1281.96	3119.61	805.11	2595.21	861.42	3.43*	5.28*	3.02*
6.	Manure and fertilizer ('/ha)	2711.37	1351.95	1989.32	742.91	1924.65	802.54	3.54*	3.31*	0.40
	Inputs use in Wheat Crop									
7.	Human labour (days/ha)	139.89	73.17	108,77	18.88	97.06	17.15	3.24*	3.64*	3.15*
8.	Bullock lahour and tractorization ('/ha)	3106.78	1319.24	2648.15	569,12	2738.41	170.21	2.55*	188***	-0.96
9.	Manure and fertilizer (/ha)	2792.71	1061.56	1811.39	1012.04	1517.94	659.36	5.73*	7.02*	1.61
	Inputs use in All crop									
10.	Human labour (days/ha)	183.20	81.57	139.07	53.15	131.31	38.34	6.27*	6.61*	1.37
11.	Bullock labour and tractorization ('/ha)	3416.41	1367.75	2820.53	875,03	2613.91	572.49	5.07*	6.16*	2.27**
12.	Manure and fertilizer ('/ha)	2748.80	1195.72	1931.32	909.94	1703.03	747.74	7.61*	8.77*	2.29**

Source: Field Survey, 2004-05*, and ***significant 1, 5 and 10 per cent level respectively

The difference in the inputs use between small and medium farmers, however not significant in most of the cases in these crops but when all the crops were taken together, it was found significant (except human labour). The inverse relationship between farm size and inputs use can also be supported by the results of regression analysis.

TABLE 5—INPUT USE AND FARM SIZE: RESULTS OF REGRESSION ANALYSIS

Sl. No	Inputs /Crops	Maize			paddy			Wheat			All Crops		
		Log A	b_i (coefficient)	R^2	Log A	b_i (coefficient)	R^2	Log A	b_i (coefficient)	R^2	Log A	b_i (coefficient)	R^2
1.	Human labour (Man days)	2.042* (0,009)	–0.398* (0.013)	0.83	2,104* (0.01)	–0,344* (0,017)	0.73	1.997* (0.006)	–0.452* (0.013)	0.86	2,032* (0.005)	–0.421* (0.008)	0,82
2.	Bullock labour and tractorization	3,321* (0,016)	–0.294* (0.025)	0.42	3.406* (0,014)	–0.247* (0,024)	0.42	3.407* (0,012)	–0.0099 (0.024)	0.08	3.386* (0.008)	–0.209* (0.014)	0.28
3.	Manure and fertilizer	3.18* (0.034)	–0.202* (0.052)	0.07	3.186* (0.031)	–0.226* (0.052)	0.11	3.176* (0.021)	–0.332* (0.043)	0.24	3.180* (0.016)	–0.244* (0.027)	0.13

NOTE: Figures in the parentheses to standard error *Significant at 1 per cent level

Table 5 revealed that coefficient are dominated by significantly negative signs for all the respective factor inputs in each crop as well as when all the crops were taken together. It is indicative of the fact that farm size has negative impact on the use of inputs.

3. Labour use and crop operations

Labour is an important input entering the production process and hence the pattern and intensity of its use is of vital importance in agriculture activities from beginning to the end. The requirement of labour is also vary from crop depending on the specific cultivation. activities that needs to be done. Some crop operations are more labour intensive than others and hence influences the quantum of labour needed to cultivate various crops. Table 6 presents a comparative picture of human labour input in the cultivation of selected crops with respect to various crop operations.

It is evident from the table that per hectare utilization of human labour is maximum in paddy cultivation followed by maize and wheat. The higher labour requirement in paddy and maize crops is mainly due to that these are season-bound crop and hence during peak season farmers are obliged to use more of their family as well as hired labour to complete the various operations well in time without caring much of marginal contribution. When all these crops were taken together about 420 days are utilized in the cultivation of these crops out of which maximum share is appropriated by inter-culture (quite understandably) followed by land preparation and transporting. Transporting operations absorbs more employment due to the fragmented and scattered holdings thereby increase the distance between farmers' house and from plot to plot, thus putting more pressure on manual transport due to hilly area.

TABLE 6—PATTERN OF HUMAN LABOUR DAYS UTILIZATION

(Standard mandays per hectare) .

S. No.	Items	Crops			
		Maize	Paddy	Wheat	All crops
					(maize+paddy+wheat)
1.	Land preparation	16.13 (10.55)	17.35 (10.71)	19.47 (18.40)	52.95 (12.59)
2.	Sowing	12.44 (8.14)	14.16 (8.74)	12.10 (1.45)	38.71 (9.21)
3.	Hoeing/weeding/interculture	24.87 (16.27)	25.74 (15.89)	16.00 (15.12)	66.58 (15.84)
4.	Manuring/Fertilizers	11.73 (7.68)	10.53 (6.50)	7.97 (7.53)	30.23 (7.19)

TABLE 6—PATTERN OF HUMAN LABOUR DAYS UTILIZATION—*Contd.*

(Standard mandays per hectare) .

Sl. No.	Items	Crops			
		Maize	Paddy	Wheat	All crops
					(maize+paddy+wheat)
5.	Looking after crops	9.69	4.46	1.07	15.22
		(6.34)	(2.75)	(1.01)	(3.62)
6.	Irrigation and spraying	1.09	3.65	1.00	5.74
		(0.71)	(2.25)	(0.94)	(1.36)
7.	Harvesting	13.32	19.60	17.00	49.92
		(8.71)	(12.10)	(16.07)	(11.87)
8.	Transporting	15.80	18.94	15.26	50.00
		(10.34)	(11.69)	(14.42)	(11.89)
9.	Threshing/Winnowing	24.84	22.39	3.71	50.97
		(16.25)	(13.82)	(3.50)	(12.12)
10.	Storing	14.08	15.05	5.95	35.08
		(9.21)	(9.29)	(5.62)	(8.34)
11.	Hired-in labour	13.78	13.22	8.63	35.63
		(9.02)	(8.16)	(8.15)	(8.47)
12.	Hired-out labour	5.02	3.24	2.47	10.73
		(3.28)	(2.00)	(2.33)	(2.55)
13.	Total mandays utilized	152.75	161.91	105.76	420.42
		(100.00)	(100.00)	(100.00)	(100.00)

NOTE : - Figures in parentheses are percentage to respective column total.

Harvesting, sowing and storing (in that order) are the other operations which are more labour intensive. As far as different crops are concerned, land preparation, inter-culture, harvesting and transporting are the more labour intensive operations in each crop whereas threshing and storing operations absorb less labour in wheat crop as compared to other crops.

4. Labour Productivity and Employment Generation

Labour productivity in agriculture is an important issue of labour use itself. Increasing labour productivity is of vital importance from the policy point of view to generate additional employment opportunities. Table 7 explores the data pertaining to average labour productivity in rupees per manday of labour employed. Average labour productivity increase with the increase in size of holding from marginal to small and then declines from small to medium not in the case of all crops but the individual crops also.

TABLE 7—AVERAGE LABOUR PRODUCTIVITY OF MAIZE, PADDY, WHEAT AND ALL CROPS VALUE OF OUTPUT IN RUPEES PER MANDAY

(Per manday)

S. No.	Crops	Marginal farmers	Small farmers	Medium farmers	Overall farmers
1.	Maize	85.21	99.93	88.70	89.92
2.	Paddy	137.58	155.87	141.83	144.08
3.	Wheat	141.76	159.07	156.06	149.75
4.	All Crops	119.75	137.76	126.29	127.01

Labour productivity is higher for wheat crop than that of maize and paddy in all size classes. But it does not mean that labour use efficiency in wheat crop is more than that of its counterparts. The fact is that the cultivation of wheat crop requires less quantum of labour unlike paddy and maize cultivation, however land productivity is much higher in case of paddy and maize crop than wheat crop and both these crops are labour intensive crops thereby pushing down the average labour productivity.

The correlation coefficients between labour input in mandays per hectare and average labour productivity per mandays were -0.62 (taking into account all the 189 observations), -0.52 (157 observations), -0.56 (196 observations) -0.51 (542 observations) in case of maize, paddy, wheat and all crops respectively. All these correlation coefficients are statistically significant at I per cent level, thus suggest that average labour productivity would increase significantly only if per hectare labour input were to decline. In other way, it can be concluded that at the present level of technology, labour is employed in agriculture beyond a point of maximum productivity and thereby diminishing returns are in operation.

5. Farm size and Productivity

The gross return of maize, paddy, wheat and all crops are given in Table 8. The data indicated that the gross returns from maize, paddy, wheat as well as all crops are significantly higher on marginal farms as compared to the small and medium farmers. Similarly, the gross returns were also higher on small farms as compared to medium farmers except in wheat crop.

TABLE 8—FARM SIZE AND GROSS OUTPUT OF DIFFERENT CROPS

Sl. No.	Crops	Marginal holding		Small holding		Medium holding		't' value for difference		
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Marginal and small	Marginal and medium	Small and medium
1.	Maize	16857.22	3697.54	15187.96	3373.98	12819.20	2407.74	2.34*	6.32*	4.84*
2.	Paddy	29107.25	10894.35	24381.53	5831.49	20623.25	5371.91	3.30*	4.57*	3.19*
3.	Wheat	18384.24	7323.27	16207.55	6531.38	14765.72	5488.88	1.89***	2.75*.	1.15
4.	All crops	20569.04	8988.57	18380.23	6728.62	16069.39	5685.41	2.72*.	5.00*.	5.99*

*and ***significant at 1 and 10 per cent level respectively

TABLE 9—FARM SIZE AND PRODUCTIVITY RELATIONSHIP: RESULTS OF REGRESSION ANALYSIS

S. No.	Crops	N	Loga (constant)	b_1	't' value of deviation from unity	R^2
1.	Maize	189	4.116	0.892* (0.021)	–5.14.	0.90
2.	Paddy	157	4.401	1.047 (0.039)	1.20	0.82
3.	Wheat	196	4.195	1.009 (0.036)	0.25	0.79
4	All crops	542	4.223	0.962*** (0.021)	–1.80	0.79

NOTE: Figures in parentheses are standard error.
*and*** significantly different from unity at 1 and 10 per cent level respectively.

To examine the effect of farm size on productivity of different crops, log-linea regression was done. The results of regression analysis (Table 9) showed the negative effect of farm size on productivity in case of maize and when all the crops were taken together, however the effect was positive in case of paddy and negative for wheat though insignificant.Thus, inverse relationship between farm size and productivity is a confirmed phenomenon the area under study.

6. Farm size and Profitability

In the present analysis, profitability is defined as the value of net returns which is obtained by deducting the total cost (all cash and kind expenses incurred on material inputs, rental value of owned land, rent on owned fixed capital, imputed value of owned family labour etc.) from the gross returns. Net returns are presented in Table 10.

TABLE 10—NET RETURNS

(per hectare)

Sl. No.	Crops	Farm Size			
		Marginal farmers	Small farmers	Medium farmers	Overall farmers
1.	Maize	(–)7382.61	(–) 2941. 98	(–)3534.17	(–) 4260.54
2.	Paddy	1884.93	5796.37	3375.69	4487.20
3.	Wheat	(–) 2144.84	780.05	44.93	(–) 115.02
4.	All Crops	(–) 7643.39	3634.44	(–) 114.24	111.64

It can be observed from the table that net returns in terms of R/ha are very low due to the poor resource base, inadequate knowledge and lack of motivation. Further, the cultivation of these crops gave a good amount of loss except paddy crop. As between the farms in different size classes, only small farmers are able to convert their output advantageously into net profit, however it is negative in respect of maize crop but the loss of amount is less than their countarparts. The negative returns on maize crop may be attributed to the low value of crop yield whereas, low yield rate was responsible for the same on wheat crop. The cultivation of paddy crop required good quality of muddy soil without any slope in the field. Therefore, farmers irrespective of any farm size category put better application of available resources for the cultivation of paddy crop, which is reflected in high yield rate as compared to maize and what crops. That is why, there are positive returns in paddy crop.

IV

Concluding Observations

To sum up, an increase in productivity will lead to a less than proportionate increase in the levels of labour use however the impact of increase of the productivity on labour absorption varies across crops and strata of holdings. Secondly, the inverse relationship between the per hectare labour use and size of holding was observed in each crop as well as when all these crop were treated together as confirmed from the results of regression analysis. However, the difference of labour use between the small and medium farms was significant only in case of wheat crop. The proportion of hired labour was founded to be directly related with the size of holding. Thirdly, crop operations like weeding/ inter-culture/holding, land preparation, transporting and harvesting were found to be more labour intensive operations in each crop. Similarly, in case of maize and paddy crops, labour absorption was much higher than wheat crop in each size class. Lastly, an increase in the labour absorption may be at the cost of labour productivity. As our result indicated that average labour productivity would rise only if per hectare labour input were to decline. The crux of the problem of increasing employment at the present level of technology without producing a decline in labour productivity is an important issue to be settled. The only way out for increasing both the productivity and employment is to upgrade the present level of technology.

Similarly, the inverse relationship between the farm size and productivity was observed in maize crop whereas, constant productivity relationship was observed in case of paddy and wheat crops. When all these crops were taken together, inverse relationship between the two holds true. The results further explored that marginal farms used higher amount of human labour, bullock labour and tractorization and manure & fertilizers as compared to higher farm size categories. The existing inverse relationship between farm size and productivity is mainly due to the higher input intensity on other farm size categories as compared to lower size category. The marginal farms use more amount of labour per unit of land because of availability of cheap family labour. The situation arising from low opportunity cost of labour, the fact is that they use less of hired in labour as compared to their large counterparts. Similarly, the intensity of bullock labour & tractorization was also found higher on smaller sized categories of farms due to willingness to get profit and higher availability of bullock labour per unit of land as compared to large farm size category. Further, land fertility was also higher on lower sized categories due to the higher availability of farmyard manure per unit of land for them. In other way, they have large number of cattle per hectare. The situation becomes worse for larger farm size category as there was no market for farmyard manure. However, the introduction of chemical fertilizers has eroded the importance of farmyard manure, yet it is equally required for retaining and enhancing the soil fertility along with balanced fertilizer (N+P+K). In broader terms, the results obtained from the study support the hypothesis of inverse relationship between farm size and productivity however, in respect of individua1 crops, the effect of farm size on productivity was size neutral in case of paddy and wheat crops. As far as the net return to farming is concerned, the marginal farmers are not able to convert their output advantages into higher net profits due to their higher total costs. In other way, the viability of marginal farmers in terms of net returns is not as strong as in the case of output. Similarly, medium farmers also not getting profits despite

their low cost, mainly due to the low yield rates. On the other hand, small farmers are not only getting positive returns but also minimizing the amount of loss on maize crop as compared to their counterparts. Therefore, in the light of declining net returns from farming, especially of marginal and medium farms, the viability of farming need to be improved It necessitates for the consolidation of land holding, management of basic and economic holding and introduction of an integrated development strategy encompassing both its production and marketing aspects to make the cultivation of these crops a competitive viz-a-viz profitable enterprise. For this, there is inevitable need to tone up, strengthen and modernize the extension network to transfer the production technology and technical know-how to the farmer in order to increase the risk bearing capacity. Besides, a multidimensional approach covering optimum farm plans, soil conservation, water harvesting animal raising, effective crop insurance scheme etc, was badly needed to increase productive employment in agriculture which is believe to be the key of accelerated development thereby the well-being of farm families. The emphasis should also be laid down on some areas such as efficient use of resources, delivery of critical inputs at the right time and place, flow of institutional credit, development of irrigation facilities, development of high yield variety seeds, programmes for stray-animals, effective policy related to women etc.

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"कृषि समस्याओं का विशेषज्ञों द्वारा समाधान"

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कृषि मंत्रालय, भारत सरकार, नई दिल्ली

Possibilities and Constraints in Increasing Pulses Production in Andhra Pradesh and the Impact of National Food Security Mission on Pulses*

Executive Summary

Pulses production has received the attention of government and public in recent years, in response to soaring consumer prices. Global shortages in pigeon pea (Tur dal production have occurred in recent years. Prices of Tur dal increased nearly four fold during the last five years (2005-09). Price of Tur dal, which used to be Rs. 24-32/kg during 2005, had increased to Rs.l00/kg in December 2009. Demand is rising with increase in population as well as rise in purchasing power of the rural people due to NREGS, ADWDR etc. The area under pulses started declining even in the pre High Yield Varieties (HYV) era. Pulses did not get its due share even in respect of increases in irrigation. The crop has failed to keep pace with the demand of population.

Need for the Study :

Nearly 23 million hectares of pulses crops have been raised in India producing 1.4 million tonnes of pulses grains. The pulses sector in India at present is characterized by short supply, high prices and high dependence on imports. India is the largest producer and consumer of pulses in the World accounting for about 25 per cent of their global production, 27 per cent of their global consumption and about 33 per cent of World's area under pulses. However, production performance of pulses in India has remained stagnant.

When prices are rising, it is logical that there is an incentive for farmers to produce more of these crops to earn higher incomes. Productivity of pulses in India has stagnated at 622kg/ha compared to yield of 1908kg/ha in Canada/USA due to the vagaries of monsoon, problem in the availability of good quality approved HYV seeds, low seed replacement rate etc.

National Food Security Mission (NFSM) :

The National Food Security Mission (NFSM) was launched in the state from Rabi 2007-08 after the state level Executive Committee decision, with the objective of increasing production and productivity of Rice and Pulses on a sustainable basis to ensure food crops security. The approach is to bridge the yield gap in respect of these crops through dissemination of improved technologies and farm management practices. It is envisaged to focus on districts which have high potential but relatively low level of productivity performance at present. Under the Mission there are series of program intervention efforts to reach resource poor farmers and continuous monitoring of various activities.

Objectives :

To

(1) Analyze returns from cultivation of pulses vis-a-vis competing crops

(2) Analyze the other major problems and prospects for pulse cultivation

(3) Assess the impact, if any, of NFSM pulses.

Methodology :

For the survey of primary data Prakasam district under NFSM and Ranga reddy district outside NFSM are selected. Ervaguda village from Sankarampally mandal is selected from Ranga reddy district and from Prakasam district Veerannapalem is selected from Parachur mandaI. From each village 50 farmers comprising small, marginal, SC/ST, Women farmers are selected using PPS sampling.

Using secondary data growth trends of pulses and major competing crops since 1990 are calculated on the aspects of area, production, yield, and irrigated area, area under improved varieties, prices and procurement. Time series data on pulses are collected from the "Season and Crop Reports" and "Statistical Abstracts of A.P. published by the Directorate of Economics and Statistics, Government of Andhra Pradesh. The reference period for the study is 2006-07 to 2008-09.

Growth Trends of Pulses in A. P. :

In A.P., there is a stable growth trend for Bengal gram and Red gram during the study period. It is unbalanced for Green gram and Black gram in Coastal Andhra and Rayalaseema, while Telangana shows strong growth trend during 1990-08. The Horse gram and 'Other Pulses' show declining trend across A.P. The Rabi fallows of irrigated districts viz East and West Godavari, Krishna and Guntur are the best for pulses growth as a third crop, though there is commercial crops are cultivated, provided suitable seed variety and manual labour saving devices (suitable mechanization in cultivation) to the farmers in this area. The whole picture of ''Total Pulses' appear bleak in Coastal

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Andhra compared to Rayalaseema and Telangana. It is much appropriate to implement the required policies across Coastal Andhra particularly, for Green gram and Black gram.

Profile of sample Area and Farmers :

Prakasam :

Prakasam district is one among the 14 districts selected under National Food Security Mission (NFSM) under Pulses Programme. Rice is the major crop in the district accounting for 19.78 per cent in gross cropped area followed by Bengal gram (14.10 per cent) Tobacco (12.31 per cent). Red gram (10.29 per cent) Cotton (6.14 per cent) and Sunflower (6.02 per cent). Bengal gram is cultivated in 94000 ha forming 15 per cent of state's area under the crop. Similarly 15 per cent of area i.e., 68000 ha. under, Red gram in the state is in Prakasam district. Notably, forty eight per cent of the area under Tobacco crop in the state is in Prakasam district. An area of 677 ha of pulses crop is under irrigation though there is no irrigation for Red gram and Bengal gram.

Ranga Reddy :

Ranga Reddy district is selected for the study as it is not covered under NFSM pulses but has a predominant pulses crop—Red gram. The Principal crops in the district are paddy, Jowar, Maize, Cotton, Castor, Pulses and Vegetables. Red gram with a cropped area of 33000 ha (14.82 per cent in GCA) is the leader in the un-irrigated land followed by Maize with 30000 ha (13.36 per cent) and Jowar with 24000 ha. (10.51 per cent). Rice is cultivated in 32000 ha (14.29 per cent) in the irrigated land. About 33000 tonnes of Red gram, nearly 7.45 per cent of the state's production, comes from Ranga Reddy district.

Cropping Pattern :

Bengal gram is the leading crop in Prakasam district with 77.38 ha. It is followed by Tobacco and Paddy with 23.31 ha. and 10.93 ha. respectively. Red gram is cultivated in 3.91 hectares. The others are Jowar and fodder crops. While Paddy is cultivated in exclusively irrigated area, Bengal gram is raised in unirrigated land, that too in the Rabi season. The major crops in Kharif season are Tobacco and Rice being cultivated in 23.91 (48.66 percent) 10.93 ha. (22.43 per cent) respectively. Other crops are Jowar, Red gram (20.89 per cent) and some vegetable crops. Rice is the most preferred crop among the marginal farmers with 89.01 per cent of their cropped area under its cultivation. Tobacco found favour in the other size groups. On the overall, I Tobacco leads by 48.66 percent followed by Rice with 22.43 percent and other crops like Jowar and Vegetables. Red gram is being cultivated by medium and small farmers with 22.15 percent and 6.31 percent of land allocated for the crop.

In Rabi season farmers in the sample grow only Bengal gram in Prakasam district. The area under this crop is generally left fallow in Kharif season so that the yield would be better. Maize is the leading crop being grown in 45.12 ha followed by Pulses crop Red gram with 28.28 hectares. These two crops account for 44.53 per cent and 27.88 per cent respectively in the net cropped area. Another food crop, Rice is grown in 10.93 hectares covering 10.79 per cent to total kharif crop being grown by the sample farmer. Cotton is grown in 14.20 hectares accounting for 14.01 per cent of the net cropped area. In all the size groups Maize was given priority as far as cropped area is concerned. Bengal gram is the only crop raised in Rabi season in Maize fallows. There is not much variation in area under the crop. Total area is 5.60 hectares.

Pulses Crops :

Out of the total cropped area under Pulses in district 95.19 per cent is occupied by Bengal gram while the rest is under Red gram. Marginal and Large farmers are exclusively cultivating Bengal gram among the sample households in this district. About 14.82 per cent of medium farmers and 3.11 per cent of small farmers are also growing Red gram.

Red gram, the major crop, is raised in 28.28 hectares accounting for 83.47 per cent of the cropped area under Pulses. Though this crop is normally raised as a mixed crop with Jowar and Maize. It is also raised as mono crop. Bengal gram, sown mainly in kharif fallows accounts for 16.53 per cent of the area under pulses. This practice is more popular among marginal farmers with 29.47 per cent followed by large farmer group (16.00 per cent) and small (14.58 per cent).

ECONOMICS OF PULSES CULTIVATION

NFSM District - Prakasam :

Bengal gram :

Bengal gram is exclusively cultivated in the rabi season and area under the crop is mostly left fallow in kharif. Large scale seed distribution was taken up in the district on 50 per cent subsidy. The crop seems to be not popular among marginal farmers as it was discontinued in 2007-08 and 2008-09. Its area is more or less stable in large farmer group while it shows oscillation in small and medium farmers' group. Gross returns per hectare have shown an increasing trend over farm size groups ranging from Rs. 40363 in marginal group to Rs. 54,006 in large farmer group. Overall per hectare gross return is Rs. 47178 among the sample farmers.

Tobacco :

Tobacco is the main commercial crop of the region and widely cultivated among the sample households. For the Triennium Ending (TE) 2006-09 about 23.71 hectares are under Tobacco cultivation. The cropped area is stable in large and medium farmers and oscillation is there among marginal and small farmers. While area under the crop remained the same for marginal farmers in the study period,

it increased in all the other three groups, i.e., for small, medium and large farmers in 2008-09. Gross returns per hectare ranges from Rs. 41184 for marginal farmer group to Rs. 78,107 hectare for farmers in the medium group. At the same time small size group farmers are realizing higher net income, i.e., 36.64 per cent of the gross income with a relatively low percentage of 63.36 of paid out costs. For marginal farmers the percentage of paid out costs in the gross income is 78 per cent resulting in low net income at 22 per cent. On the overall, farmers of Tobacco crop get Rs. 68281 gross income per hectare out of which 64.98 per cent goes as paid out costs.

Non-NFSM Ranga Reddy District :

Red gram :

Red gram is the major pulse crop in the District cultivated in kharif season. It is traditionally raised as mixed crop with food crops like Maize and Jowar. In the recent past it is also raised as mono crop. The cropped area under Red gram is stable in the study period 2006-09 for all groups. Gross return per hectare for the crop varied from Rs. 27,890 to Rs. 42,411. Though gross returns are high at Rs. 42,411 in medium size group it received lower percentage of net returns as their paid out costs are high at 41. 72 per cent in the gross. Large farmer size group incurred lowest paid out costs at 33.68 per cent and received highest net returns i.e., 66.83 per cent of gross income. On the whole the gross returns received on the crop are Rs. 31,165 out of which 62.57 per cent is the net income. The larger farmer group is able to sell more at the market and reported that 91.49 per cent of the gross value is for sale. The acceleration trend is there for gross returns per ha to all size groups and vice-versa for paid-out costs to all farmer groups during 2006-09. Therefore, the Red gram cultivation has led to increasing trend for Net returns per ha/per Qtl for whole study period. The paid-out costs are very less to large farmers followed by marginal farmers and consequently these groups have better edge in net returns.

Cotton :

Cotton is cultivated in 14.20 hectares accounting for 14 per cent of the total cropped area by sample farmers. Area under the crop did not undergo any change in the study period in all the size groups. Though the returns are not comparable with pulses where hike in prices is seen, farmers feel that the crop is dependable as its returns are not that susceptible to weather and pests. Gross returns per hectare varied from Rs. 9,320 in large size group to Rs. 10,827 in the small size group. Lowest of Rs. 8,135/ha is reported in medium group. Percentage of net returns in gross returns is the highest in marginal group at 32.56 and the lowest in medium group at 25.41. When the sample is considered as a whole gross returns per hectare is reported as Rs. 9,832 out of which 71.00 per cent has gone out as costs resulting in net return of 29.00 per cent (Table 4.6). Paid-out costs as a percentage in gross returns declined from year to year in the study period in all farm size groups. In the same manner, as a consequence as well, net returns have consistently increased in the same period over all size groups.

Bengal gram :

Bengal gram occupies second place in pulse crops in Rangareddy district. It is mostly raised in Maize fallows in Rabi season. Area under the crop is stable over the period across all farm size groups. Gross returns per hectare varied from Rs. 18,251 in small size group to Rs. 21,458 in marginal group. Overall TE average is Rs. 19,491. About 45.95 per cent of this is paid out costs leaving a margin of 54.05 per cent as net income on the whole. The percentage of paid out costs is high in large farmer group at 54.32. On the contrary marginal farmer size group is receiving a high income at 58.94 per cent. This could be attributed to higher participation of family labour in farming which would in turn out the paid out costs. Consistent increase in net income is observed only in medium farmer group in the study period. Marginal farmers are keeping more of the produce for seed and home consumption thereby having lower percentage of market surplus at 64.51. Medium farmers report the highest market surplus percentage of 89.46. The overall market surplus ratio is 79.92.

Profitability of Pulses vis-a-vis other crops :

In Prakasam (NFSM) district only paddy is raised in Irrigated lands. While Tobacco is raised in un-irrigated lands in kharif season, Bengal gram is raised in Rabi season. Bengal gram is the only crop raised in that land as it is left fallow in kharif season. Naturally yields in this district are high and net returns on the crop surpasses Tobacco and Paddy. But the investment on Tobacco is much higher about 154 per cent, than the Bengal gram. Even when compared with paddy the farmers are realizing 84 per cent higher net income on Bengal gram. In Ranga reddy district, which is selected as non-NFSM district in the reference year, Red gram is the principal pulse crop. Thanks for the spike in prices it outstripped the other crops like Rice, Cotton, Maize and even secondary pulse crop Bengal gram in net income. The profit on the Red gram is 294.70 per cent more than Maize, 239.86 per cent more than Cotton and 76.28 per cent more than Rice.

Technology adoption and marketing :

NFSM District - Prakasam :

Seed :

Improved varieties of seeds are widely popular among the sample households. Agriculture department is also supplying Bengal gram seed varieties like Annegiri and Laxmi on 50 per cent subsidy under NFSM—Pulses programme. All the sample farmers, irrespective of their land holding size, are cultivating improved varieties of Bengal gram. The awareness and acceptance is 100 per

cent. While the marginal farmers are cultivating improved varieties of Bengal gram in 13.76 hectares, the large farmers have 29.14 hectares under the same category. Overall 86.32 hectares of sample farmers are under improved varieties of Bengal gram, which means 100 per cent adoption of new technology.

To reap full benefits of the improved varieties, the recommended cultivation practices are to be followed by the farmers. When delved in to this aspect it was found that sowing practices were followed by 40 per cent of sample farmers, 28 per cent followed seed practices while other 16 per cent did not follow any. About 20 per cent of marginal farmers and an equal percentage of medium farmers did not follow any recommended practices. Though the penetration of improved varieties of seeds in pulses crops is 100 per cent problems that are still bothering the farmer community are enumerated. About 60 per cent of medium farmers and 50 per cent of large farmers feel that yield levels of the improved varieties are not up to the expectations. The same opinion is conveyed by 30 per cent of the overall groups.

Pest resistance :

When it comes to pest resistance 40 per cent in medium group and 25 per cent each in marginal and large group expressed that improved varieties did not perform well. 22 per cent of overall sample concurred with that opinion. Though 50 per cent subsidy is given on seed under NFSM 35 per cent of the reported households under marginal group felt the cost of the seed is still high and must be brought down. Another 20 per cent of overall sample, who reported problems, said the seed though available is not supplied on time. About 60 per cent in medium group and 50 per cent in large group felt that yield performance is lower than expected. As the time of sowing is very crucial, 71 per cent of the overall sample farmers have asked for timely availability of seed at low prices of genuine seed.

Marketing :

In Prakasam district, where NFSM programme is being implemented, farmers are not utilizing the regulated market for pulses. They are not convinced of fair price for their crop after incurring transport costs and an arduous wait at the yard. Once the produce is taken to the yard they feel that they are at the mercy of the unscrupulous traders as they can not wait there indefinitely for a good price. Instead they are selling the pulses at their own home to a Commission agent at their chosen time. If the market prices are low some of the farmers who can wait are choosing to stock their crop at a cold storage in near by mandal head quarters. This practice has become more common in recent years as it helps in retaining the colour of the produce. Another advantage they are citing is that the stock at the storage can be pledged to a bank for a loan to tide over any immediate financial needs. When the prices go up they can dispose off the stock from the cold storage to a commission agent and pay the bank loan if any. In Prakasam district all the marketable surplus is sold through commission agents only. Regulated markets. There is no market intervention by government agencies like NAFED in the region. Among the size groups large farmers, who can wait for a better price, received the higher price of Rs. 2,999 followed by medium farmers with Rs. 2,706. The marginal farmers who can not wait for long for better price got the lowest price of Rs. 2,357.

Non-NFSM - District—Ranga Reddy : Seed varieties :

Adoption of HYV seed is 100 per cent in the size groups of medium and large farmers. About 85 per cent of area under Red gram of small farmers and 91 per cent of land of marginal farmers are under HYV pulses. On the whole the adoption rate of HYV seed is 95 per cent among the sample farmers. But agricultural officials assert that there is no traditional variety being cultivated now. Farmers are well aware of seed varieties under HYV.

Recommended Practices :

Recommended sowing practices were followed by 70 per cent of medium farmers and 50 per cent of small and large farmers. Half of the large farmer group, 20 per cent each of medium farmers and marginal farmers are following good seed practices. Other recommended practices like proper doses of fertilizers, weeding and plant protection measures are being followed by 25 per cent of large farmers and 20 per cent of medium farmers. On the whole 42 per cent are adopting sowing practices, 22 per cent are following seed practices and another 14 per cent are implementing other practices like fertilizer and pesticide application. But at the end, quite a proportion of 44 per cent are not following any recommended practices.

Farmers are asked whether they had any problems or apprehensions with HYVs and to suggest some solutions. More prominent among the problems are lower yields as reported by 43 per cent of sample farmers. Small farmers (69 per cent) followed by marginal farmers .(60 per cent) are more vocal in expressing their opinion. Majority of marginal farmers, 75 per cent, followed by small farmers, 38 per cent, felt that the seeds are very expensive. Fifty per cent of marginal farmers, 25 per cent of small farmers and 20 per cent of medium farmers share the view that HYVs also need higher doses of fertilizers and pesticides. Availability of seed is not a big issue with the farmers. Only 10 per cent felt that the seeds are not available on time. When asked to suggest solutions for pulses crop improvement 80 per cent of marginal farmers said that they need cheaper seeds or subsidy on prices. This view was shared by'38 per cent of small farmers and 20 per cent of medium farmers. About 20 per cent of sample farmers felt that the quality of seed must be monitored by agricultural officials.

Marketing :

Large farmers seem to be more equipped in dealing with market forces as they realize higher prices, Rs. 4,369 per quintal, for their crop. Another reason for this is their ability to wait for better price. The marginal farmers, on the other hand could realize only Rs. 4,134 per quintal. The medium and small farmers could get only Rs. 4,266 and Rs. 4,254 respectively.

Farmer's Perceptions :

Pest problems :

Farmers reported considerable loss due to pod borer and wilt to Bengal gram and Red gram in NFSM and Non-NFSM districts Damage due to pod borer is reported by 46 per cent of Bengal gram cultivators in NFSM district and 60 per cent of Red gram cultivators of Non-NFSM district. Estimated crop loss is 18 per cent in Bengal gram and 22 per cent in Red gram. Wilt is also reported to be causing damage 32 per cent of Bengal gram farmers with a crop loss of 15 per cent. Red gram crop in Non-NFSM district also suffered a loss of 15 per cent affecting 42 per cent of farmers.

Reasons for growing pulses :

The reasons enlisted are—traditional habit, home consumption, the inferior quality of land and profitability. While all farmers across size groups expressed the need of pulses for consumption at home, 50 per cent in large farmer group, 31 per cent in small group 20 per cent each in medium and marginal farmers group felt that the unsuitability due to inferior quality of land to raise other crops made them take up pulses cultivation. In NFSM - Prakasam district, all the farmers in large, medium groups, 75 per cent in marginal and 63 per cent in small groups have said that they could get some cash for domestic expenditure by raising pulses. All the farmers in Ranga Reddy district (Non-NFSM), who raise Red gram, have responded that they need the crop for home consumption. Similarly all of them have said that the inferior quality of land also prompted them to go for the crop. Profitability was the motive for 90 per cent of marginal, small and 75 per cent of large farmers expressed the same.

Limitations in area expansion :

Few questions were directed at the sample farmers to find out the reasons for low area under pulses crops. In NFSM district problem of pests is the leading factor as expressed by 77 per cent of farmers followed by low profitability (56 per cent) and instability of prices or yield (47 per cent). About 29 per cent have also said that marketing problem is also a hurdle. In Non-NFSM district where Red gram is cultivated, majority of farmers (83 per cent) are bothered about low yields followed by pest problem (69 per cent), instability of prices and yield (68 per cent), low profitability (36 per cent) and marketing problems (18 per cent). In NFSM district 50 per cent of pulses farmers in large group, 21 per cent in medium group, 18 per cent in marginal group followed by 14 per cent of small farmers are willing to expand the area under pulses if assured market is provided and competitive prices offered. In similar pattern 75 per cent of large farmers, 15 per cent of medium farmers have shown interest in area expansion in the scenario of assured market. Similar views are shared by 12 per cent of small farmers and 5 per cent of marginal farmers in non-NFSM district.

Major problems that are plaguing the cultivators of pulses are low yields, lack of improved varieties and lack of irrigation in some areas. Low yield is the major problem according to 64 per cent of farmers in NFSM area. This is even a bit higher in Non-NFSM area (72 per cent). High Pest incidence is reported by 14 per cent in NFSM area and by 16 per cent in Non-NFSM area. Low market price is bothering 6 per cent of farmers in NFSM area and 8 per cent in Non-NFSM area. About 6 per cent of NFSM farmers and 4 per cent of Non-NFSM farmers feel that the seed they use is not of improved variety or of spurious quality. Suggestions are sought to increase area under pulses. Assured marketing through government procurement agencies with minimum support price seems to be the main concern of 90 per cent of Bengal gram farmers in NFSM district. Another 88 per cent of farmers have voiced that reasonable market price must be maintained to encourage pulses farmers. Same view is also shared by 72 per cent of Non-NFSM farmers of Red gram. Pest resistant varieties are the need of the hour according to 36 per cent of Non-NFSM farmers and 14 per cent of NFSM farmers. About 6 per cent in NFSM area and 4 per cent in Non-NFSM area have suggested that high yielding varieties of certified seed must be readily made available on time.

Implementation of NFSM—Pulses :

Distribution of Certified Seed :

Recognizing the use of certified seed as the basic step to realize higher yields, a major chunk of the funds are allocated and utilized under NFSM. During 2007-08 Rabi season, when the NFSM pulses was first launched there was 100 per cent achievement all across the pulses growing districts. A total of Rs. 1,060 lakhs was spent on certified seed distribution for the Rabi season. In the next year, 2008-09, though district-wise breakup was not available, 280 per cent achievement was shown over the target and an amount of Rs. 3,269 lakhs was expended. This amount was increased by 11 per cent and reached to Rs. 3,720 in the next year, i.e., 2009-10.

Integrated Nutrient Management :

Under this programme Lime/Gypsum is supplied to the farmers at 50 per cent subsidy with a limit of Rs. 750 per hectare. Zinc is also supplied similarly at 50 per cent cost with a limit of Rs. 500 per ha. In the first year, 2007-08 the programme was sluggish and implemented only in

Srikakulam, East Godavari, Nizamabad and Adilabad. Except in Nizamabad where the financial achievement was only 74 per cent, in all other districts it was a success with 100 per cent achievement In the next year, i.e., 2008-09 the achievements under this head are not so impressive. Except in Nizamabad, where it was 254 per cent, in the other eight districts the program was not satisfactory. In the remaining 5 districts the performance was less than 50 per cent. In many of the districts there is a mismatch between physical and financial achievements and the later being lower than the former. In 2009-10 the figures show a uniform 100 per cent achievement all across the districts.

Supply of SSP :

The supply of (SSP) is reported to have been done only in the first year. A complete performance was recorded in Srikakulam, Krishna and Ananthapur while it was only 50 per cent in Nizamabad. Prakasam has shown 14 per cent achievement. In all other districts there was no supply. The total amount spent was 33 lakhs.

Integrated Pest Management :

In 2007-08 Rs. 187.5 lakhs were spent under the programme and achieved a 100 per cent performance in all the districts. In the later years, i.e., 2008-09 though the expenditure increased to Rs. 401 lakhs its performance registered not so impressive pattern. In half of the districts the financial performance is more than 80 per cent The programme was not implemented in Srikakulam district. In 2009-10 Prakasam, Nizamabad and Mahaboobnagar districts recorded 100 per cent performance in Pest Management programme.

Sprayers :

Sprayers were supplied as part of the Pest Management Programme at Rs. 3,000 subsidy. In the first year Rs. 314 lakhs were spent on distribution of sprayers but district-wise breakup of expenditure was not available. In 2008-09 no funds were allocated for the scheme. However in the next year, i.e., in 2009-10 only 75 lakhs were spent for the scheme. Except Prakasam where the performance was 73 per cent, others have registered 9 to 34 per cent achievement only.

Sprinkler Sets :

For effective water management Sprinkler sets were supplied to the farmers at 50 per cent subsidy of the cost limited to Rs. 7,500 per. hectare. The scheme was a success in Nizamabad. Nalgonda and Adilabad in 2007-08. Khammam registered 59 per cent achievement. Seven districts Srikakulam, East Godavari, Krishna, Kurnool, Kadapa, Mahaboobnagar and Warangal did not receive any funds under this scheme in the same year. Guntur, Prakasam and Ananthapur performed poorly at 7 and 14 per cent achievement. Overall, only 11 lakhs were spent in 2007-08. Srikakulam, Nalgonda and Adilabad were the major beneficiaries in 2008-09 under the scheme. Eight districts did not receive any funds under this scheme. Total expenditure was 31 lakhs in the year. This has gone up to 104 lakhs in 2009-10. Guntur, Mahaboobnagar and Warangal which did not get enough allocation earlier got benefited in this year. Srikakulam, Guntur, Nizamabad have achieved 100 per cent of the targets while Khammam and Adilabad outperformed at 138 and 316 per cent respectively.

Diesel Pump sets :

Distribution of Diesel pump sets was taken up in 2009-10 to bring more area under irrigation and to boost the yields. An amount of Rs. 674 lakhs was spent in the state. Except Ananthapur and Kadapa all 12 remaining districts were brought under the programme. East Godavari and Prakasam were the major beneficiaries by receiving 214 and 143 lakhs respectively. About 6 districts performed extremely well by registering 300 to 800 per cent achievement in the financial target in the year. The others have also done well with 100 to 200 per cent.

Vermi-Compost Units :

To encourage organic farming vermi-compost units are encouraged in all the pulses growing districts by spending 200 lakhs. Each unit was given Rs. 20,000 for establishing and maintenance. All the districts were benefited under the scheme and recorded 100 per cent financial achievement in 2009-10. Vermi hatcheries were sanctioned at a cost of 30 lakhs by providing financial help of Rs. 75,000 per unit to enthusiastic farmers. Even this programme was extended to all districts and they in turn have fully utilized the funds.

Seed Drills :

In support of farm mechanization seed drills and Rotovators were also distributed under NFSM programme in 2009-10. Ananthapur, Mahaboobnagar, Kadapa, and Kurnool districts received these machinery at a total cost of 27 lakhs. Ananthapur has recorded 470 per cent financial achievement while Guntur failed at 2 per cent.

Rotavators :

Nizamabad, Mahaboobnagar, Kadapa and Ananthapur districts were given priority under the programme. It was also successfully implemented in Ananthapur district. An amount of Rs. 8 Lakhs was incurred under this head in 2009-10.

Impact of NFSM Pulses:

All the cultivators irrespective of their size group are aware of NFSM Pulses program as the program is noticed by 100 per cent awareness.

Seed Supply :

Seed is distributed to all farmers in the sample on 50 per cent subsidy. Everyone, irrespective of land holding is benefited under the scheme. Some demonstration farms

were also developed to showcase the effective crop management. Training was also imparted in seed treatment and crop husbandry to 58 per cent of marginal farmers in the sample NFSM—Pulses program found favour with all the small farmers as everyone was benefited by the seed distribution programme.

Benefits accrued :

Among the other benefits that the sample farmers of NFSM programme reported are higher yields, reduced pest problem and knowledge of crop husbandry. Majority, 70 per cent of marginal farmers and the same percentage of medium farmers have reported that they were benefited through higher yields. Even in small and large farmer group more than half of them expressed the same. Overall 66 per cent got higher yields. About 70 per cent of medium farmers, 56 per cent of small and 50 per cent of marginal farmers expressed that pest problem was considerably reduced. On the whole 54 per cent opined the same. Eighty per cent of medium farmers responded by saying that they are enriched by the crop management practices demonstrated by the NFSM programme. However, this feeling was shared by only 30 per cent of marginal farmers and 25 per cent of large farmers. Overall 36 per cent of farmers concurred with them.

Production also increased in Bengal gram due to NFSM Programme. Highest growth is observed in medium group farmers at 68.10 per cent followed by 35.04 per cent in large farmer group and 26.38 per cent in marginal group. The lowest per cent of 12.44 is recorded in small size group farmers. On the whole an increase of 34.33 per cent is observed in production post NFSM programme. There is positive attitude towards NFSM pulses programme. All of the sample farmers are enriched by the demonstration and training programmes. Distribution of certified seed at 50 per cent subsidy is very beneficial as higher yields are reported by majority of the farmers. Pest problem are also considerably reduced due to IPM and crop management practices. Farmers in all size groups have reported increase in pulses production after NFSM. This growth is even higher in medium and large size groups.

Constraints in Pulses Development :

Pulses crop is mostly given low priority and usually grown in rain fed, moisture stress areas and marginal and sub-marginal lands in terms of soil quality, lack of irrigation etc. Though it is a energy rich crop it is raised in conditions of energy starvation. Although Tur dal Board recommends seed replacement every 3 years, farmers continue to use seeds grown in the farm year after year. Seed management, a crucial element for growth in productivity had witnessed serious problems in the recent past as it is not improving seed production. The role of public sector in seed production is minimal. High fluctuations in prices of pulses indicating high risk seems to have turned the farmers away from its cultivation. Low harvest prices continuing up to market season is one of the reasons for the low expansion of acreage under pulses cultivation.

Policy Implications :

(1) Technology Access :

Every one concedes with the application of latest technical know-how across fields. In this study it is found that farmers received information regarding "Certified seed availability and the pest control practices" from neighbours (90 per cent). There is need that the department is to arrange the sources authentically regarding technology adoption practices and the reliable access to the farmer community. The farmer community lacks dynamism in practicing the recommended doses or methods, since they are not well-versed with the practices recommended. The supply of equipment in question (sprayers) is to be channelized at the required and reliable level to reach the farmer in-time and with out prejudice.

(2) Nutrient Management :

It is seen that the good level of yields are realized by the application of potassium, nitrogen and phosphorous as expressed by the farmers. This can be supplemented by Rhizobium culture. But these practices are to be across fields in sowing season by the extension staff followed by post-sowing advice and methods to be practiced by the cultivators.

(3) Marketing Intervention :

The government intervention in market is sought at certain level. During the harvest season, the low price existence is to be given redress through the cold-storage arrangement by the department or by permitting the private to start cold storage at large scale. Further, post-harvest prices should reach the farmers, since the middlemen are sharing the lot of price. The prevailing market price is to be well known to farmers with the initiation of marketing department, provided some stipulations are laid against middlemen to avoid low price fixation in their sales.

(4) Management of Cultivation :

As the farmers expressed, the mixed cropping for Red gram is to be followed in other areas. This reduces the costs of pest control to the farmers. Pest Management in pulses cultivation is very important and well accepted norm/ practice. The in-time completion of these practices are to be done and these should be guided by the extension staff.

(5) Distribution/Availability of Inputs :

It is observed the scarcity of certified seed across the study district. Therefore, the high amount of certified seed is to be distributed. Some information brochures/ pamphlets in Telugu regarding the latest input use is to be distributed to the farmers. The sources of durable and reliable pesticides are to be informed to the farmers. The good pesticide brands are to be made available to farmers. The bulletins or some brochures may be handy to the farmers regarding input prices or the prices of produce of the area in question.

D. Commodity Reviews

(i) Foodgrains

During the month of February 2012 the Wholesale Prices of foodgrains displayed a falling trend. Wholesale Price Index (Base 2004-05=100) of foodgrains and pulses fall by 0.11 per cent and 1.32 per cent but Cereals rose by 0.17 per cent over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base : 2004-2005=100)

Commodity	Weight (%)	WPI for the Month of February 2012	WPI for the Month of January 2012	WPI A year ago	Percentage change during	
					A month	A year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rice	1.793	173.0	172.9	170.4	0.06	1.53
Wheat	1.116	169.7	169.1	177.1	0.35	–4.18
Jowar	0.096	250.8	259.4	213.0	–3.32	17.75
Bajra	0.115	199.9	200.1	176.5	–0.10	13.26
Maize	0.217	213.8	210.1	183.1	1.76	16.77
Barley	0.017	188.8	182.7	187.5	3.34	0.69
Ragi	0.019	216.1	207.1	181.4	4.35	19.13
Cereals	3.373	178.0	177.7	175.0	0.17	1.71
Pulses	0.717	208.7	211.5	193.4	–1.32	7.91
Foodgrains	4.09	183.4	183.6	178.2	–0.11	2.92

Source : Office of the Economic Adviser, M/O Commerce and Industry.

Behaviour of Wholesale Prices

The following Table indicates the State wise trend of Wholesale Prices of Cereals during the month of February, 2012.

Commodity	Main Trend	Rising	Falling	Mixed	Steady
Rice	Mixed	Jharkhand	Delhi West Bengal	Kerala Haryana Karnataka Uttar Pradesh	Assam Tamil Nadu Gujarat
Wheat	Mixed	Karnataka	Maharashtra	Gujarat Haryana Uttar Pradesh Rajasthan	Jharkhand Delhi
Jowar	Mixed	Gujarat U.P.	Karnataka Tamil Nadu	Rajasthan A.P. Maharashtra	Delhi
Bajra	Mixed	A.P. Delhi	Karnataka Haryana Tamil Nadu	Maharashtra Rajasthan Gujarat	
Maize	Mixed	A.P. U.P. Jharkhand Gujarat	Gujarat	Haryana Uttar Pradesh Rajasthan	Karnataka M. pradesh

Procurement of Rice

4540 thousand tonnes of Rice (including paddy converted into rice) was procured during February 2012, as against 3974 thousand tonnes of Rice (including paddy converted into rice) procured during February 2011.The total procurement of Rice in the current marketing season i.e 2011-2012, upto 29.02.2012 stood at 25898 thousand tonnes, as against 22777 thousand tonnes of rice procured, during the corresponding period of last year. The details are given in the following table.

PROCUREMENT OF RICE

(in thousand tonnes)

State	Marketing Season 2011-12 (up to 29-02-12)		Corresponding Period of last Year (2010-11)		Marketing Year (October-September) 2010-11		2009-10	
	Procure-ment	Percentage to Total	Procure-ment	Percentage to Total	Procure-ment	Percentage to Total	Procure-ment	Percentage to Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	3872	14.95	3227	14.17	9610	28.10	7555	23.58
Chhatisgarh	4074	15.73	3479	15.27	3743	10.95	3357	10.48
Haryana	1974	7.62	1657	7.27	1687	4.93	1819	5.68
Maharashtra	129	0.50	154	0.68	308	0.90	229	0.71
Punjab	7731	29.85	8634	37.91	8635	25.25	9275	28.95
Tamil Nadu	986	3.81	757	3.32	1543	4.51	1241	3.87
Uttar Pradesh	2673	10.32	1884	8.27	2554	7.47	2901	9.06
Uttarakhand	258	1.00	271	1.19	422	1.23	375	1.17
Others	4201	16.22	2714	11.92	5695	16.65	5282	16.49
Total	**25898**	**100.00**	**22777**	**100.00**	**34197**	**100.00**	**32034**	**100.00**

Source: Department of Food and Public Distribution.

Procurement of Wheat

The total procurement of wheat in the current marketing season i.e 2011-2012 upto Aug, 2011 is 28144 thousand tonnes against a total of 22462 thousand tonnes of wheat procured during last year. The details are given in the following table.

PROCUREMENT OF WHEAT

(in thousand tonnes)

State	Marketing Season 2011-12 (up to 1-08-2011)		Corresponding Period of last Year (2010-11)		Marketing Year (April-March) 2010-11		2009-10	
	Procure-ment	Percentage to Total	Procure-ment	Percentage to Total	Procure-ment	Percentage to Total	Procure-ment	Percentage to Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Haryana	6891	24.48	6347	28.26	6347	28.19	5237	23.08
Madhya Pradesh	4894	17.39	3538	15.75	3539	15.72	2410	10.62
Punjab	10957	38.93	10166	45.26	10209	45.35	9941	43.81
Rajasthan	1302	4.63	476	2.12	476	2.11	935	4.12
Uttar Pradesh	3460	12.29	1645	7.32	1645	7.31	3137	13.83
Others	640	2.27	290	1.29	298	1.32	1029	4.54
Total	**28144**	**100.00**	**22462**	**100.00**	**22514**	**100.00**	**22689**	**100.00**

Source : Department of Food and Public Distribution.

(ii) Commercial Crops

Oil Seeds and Edible Oils

The Wholesale Price Index (WPI) of nine major oilseeds as a group stood at 164.3 in February, 2012 showing a rise of 0.7 per cent and 9.4 per cent over the previous month and over the previous year.

The Wholesale Price Index (WPI) of all individual oilseeds showed a mixed trend. The WPI of Rape and Mustard (1.2 per cent), Copra (7.6 per cent) and Niger Seed (5.3 per cent) decreased over the previous month. However, the WPI Groundnut seed (3.3 per cent), Cottonseed (1.4 per cent), Gingelly seed (4.6 per cent), Sunflower seed (0.2 per cent) and Soyabean (1.3 per cent) increased over the previous month. However, the WPI of Safflower seed remained unchanged over the previous month. The Wholesale Price Index (WPI) of Edible Oils as a group stood 139.2 in February, 2012 showing a decline of 0.1 per cent over the previous month. However, it increased by 7.6 per cent over the previous year. The WPI of Cottonseed Oil (1.0 per cent), Mustard Oil (0.5 per cent), Soyabean Oil (0.6 per cent), Sunflower Oil (1.3 per cent) and Gingelly Oil (0.4 per cent) decreased compared to the previous month, However, the WPI of Groundnut Oil (2.0 per cent) and Copra oil (0.6 per cent) increased over the previous month.

Fruits and Vegetable

The Wholesale Price Index (WPI) of Fruits and Vegetable as a group stood at 165.6 in February, 2012 showing a rise of 2.5 per cent and 4.6 per cent over the previous month and over the previous year.

Potato

The Wholesale Price Index (WPI) of Potato stood at 105.9 in February, 2012 showing an increase of 7.1 per cent over the previous month. However, it decreased by 2.2 per cent over the previous year

Onion

The Wholesale Price Index (WPI) of Onion stood 134.2 in February, 2012 showing a fall of 11.3 per cent and 48.5 per cent over the previous month and over the previous year.

Condiments and Spices

The Wholesale Price Index (WPI) of Condiments and Spices (Group) stood at 214.1 in February, 2012 showing a fall of 5.3 per cent and 20.1 per cent over the previous month and year respectively. The Wholesale Price Index of Black Pepper and Turmeric increased by 0.1 per cent and 1.9 per cent over the previous month. However, the WPI of Chillies (Dry) decreased by 5.6 per cent over the previous month.

Raw Cotton

The Wholesale Price Index (WPI) of Raw Cotton stood at 199.2 in February, 2012 showing a fall of 2.5 per cent and 32.3 per cent over the previous month and over the previous year respectively

Raw Jute

The Wholesale Price Index (WPI) of Raw Jute stood at 223.2 in February, 2012 showing an increase of 8.5 per cent over the previous month. However, it decreased by 3.6 per cent over the previous year.

WHOLESALE PRICE INDEX OF COMMERCIAL CROPS FOR THE MONTH OF FEBRUARY, 2012

(Base Year : 2004-05=100)

Commodity	Latest	Month	Year	Percentage Variation over the	
	Feb., 2012	Jan., 2012	Feb., 2011	Month	Year
Oil Seeds	164.3	163.2	150.2	0.7	9.4
Groundnut Seed	214.0	207.1	156.9	3.3	36.4
Rape and Mustard Seed	162.7	164.6	136.9	–1.2	18.8
Cotton Seed	142.1	140.2	134.9	1.4	5.3
Copra (Coconut)	97.1	105.1	121.9	–7.6	–20.3
Gingelly Seed (Sesamum)	230.3	220.2	247.4	4.6	–6.9
Niger Seed	167.7	177.1	142.2	–5.3	17.9
Safflower (Kardi Seed)	130.9	130.9	148.0	0.0	–11.6
Sunflower	160.7	160.4	173.9	0.2	–7.6
Soyabean	150.8	148.8	140.0	1.3	7.7
Edible Oils	139.2	139.4	129.4	–0.1	7.6
Groundnut Oil	172.6	169.2	144.7	2.0	19.3
Cotton Seed Oil	149.3	150.8	137.6	–1.0	8.5
Mustard and Rapeseed Oil	144.9	145.6	122.3	–0.5	18.5
Soyabean Oil	150.7	151.6	141.1	–0.6	6.8
Copra Oil	121.1	120.4	109.6	0.6	10.5
Sunflower Oil	133.6	135.3	128.3	–1.3	4.1
Gingelly Oil	151.4	152.0	141.0	–0.4	7.4
Fruits and Vegetables	165.6	161.5	158.3	2.5	4.6
Potato	105.9	98.9	108.3	7.1	–2.2
Onion	134.2	151.3	260.6	–11.3	–48.5
Condiments and Spices	214.1	226.0	267.8	–5.3	–20.1
Black Pepper	425.2	424.9	290.9	0.1	46.2
Chillies (Dry)	251.4	266.2	271.6	–5.6	–7.4
Turmeric	164.7	161.6	404.2	1.9	–59.3
Raw Cotton	199.2	204.4	294.4	–2.5	–32.3
Raw Jute	223.2	205.8	231.6	8.5	–3.6

1. Daily Agricultural Wages in Some States (Category-wise)

(in rupees)

State/Distt.	Village	Month and Year	Normal Daily Working Hours	Field Labour			Other Agri. Labour			Herdsman			Skilled Labour		
				Man	Woman	Child	Man	Woman	Child	Man	Woman	Child	Carpenter	Blacksmith	Cobbler
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Andhra Pradesh															
Krishna	Ghantasala	Dec., 2011	8	250.00	100.00	—	250.00	130.00	—	—	—	—	—	—	—
Guntur	Tadikonda	Dec., 2011	8	200.00	175.00	110.00	200.00	160.00	110.00	160.00	—	—	—	—	—
Rangareddy	Arutla	Dec., 2011	8	200.00	120.00	—	150.00	120.00	—	150.00	120.00	—	220.00	200.00	—
Karnataka															
Bangalore	Harisandra	July to Sep., 2011	8	200.00	150.00	—	200.00	150.00	—	250.00	180.00	—	300.00	300.00	—
Tumkur	Gedlahali	July to Sep., 2011	8	150.00	150.00	—	140.00	145.00	—	150.00	—	—	150.00	150.00	—
Maharashtra															
Nagpur	Mauda	Dec., 2009	8	100.00	80.00	—	—	—	—	—	—	—	—	—	—
Ahmednagar	Akole	June, 2009	8	80.00	70.00	—	—	—	—	—	—	—	83.5	85.00	85.00
Jharkhand															
Ranchi	Gaintalsood	May, 2011 & June, 2011	8	100.00	100.00	—	90.00	90.00	—	58.00	58.00	—	170.00	150.00	—

1.1 Daily Agricultural Wages in Some States (Operation-wise)

(in Rupees)

State/Distt.	Centre	Month and Year	Type of Labour	Normal Daily Working Hours	Plough-ing	Sow-ing	Weed-ing	Harvest-ing	Other Agri. Labour	Herds-man	Skilled Labour		
											Carpenter	Blacksmith	Cobbler
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Assam													
Barpeta	Loharapara	Feb.,11	M	8	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
			W	8	—	—	120.00	120.00	120.00	—	—	—	—
Bihar													
Muzaffarpur	Bhalui Rasul*	Feb. &, March, 2010	M	8	104.00	104.00	104.00	104.00	104.00	—	150.00	150.00	150.00
			W	8		104.00	104.00	104.00	104.00	—	—	—	—
Shekhpura	Kutaut	May & June, 2010	M	8	150.00	—	—	—	150.00	—	220.00	—	—
			W	8									
Chhattisgarh													
Dhamtari	Sihaba	Nov., 2011	M	8	—	—	—	100.00	80.00	80.00	150.00	100.00	70.00
			W	8	—	—	—	80.00	70.00	80.00	—	—	—
Gujarat													
Rajkot	Rajkot	April., 2011	M	8	187.00	195.00	130.00	155.00	140.00	133.00	308.00	273.00	200.00
			W	8	—	152.00	130.00	147.00	140.00	140.00	—	—	—
Dahod	Dahod	April, 2011	M	8	71.00	71.00	71.00	71.00	71.00	—	143.00	150.00	150.00
			W	8	—	71.00	71.00	71.00	71.00	—	—	—	—
Haryana													
Panipat	Ugarakheri	May to June, 2011	M	8	180.00	180.00	180.00	200.00	180.00	—	—	—	—
			W	8	—	150.00	150.00	180.00	150.00	—	—	—	—

1.1 Daily Agricultural Wages in Some States (Operation-wise)

(in rupees)

State/Distt.	Centre	Month and Year	Type of Labour	Normal Daily Working Hours	Ploughing	Sowing	Weeding	Harvesting	Other Agri. Labour	Herdsman	Skilled Labour: Carpenter	Skilled Labour: Blacksmith	Skilled Labour: Cobbler
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Himachal Pradesh													
Mandi	Mandi	July, 2010	M	8	300.00	110.00	110.00	110.00	110.00	110.00	200.00	200.00	—
			W	8	—	110.00	110.00	110.00	110.00	110.00	—	—	—
Kerala													
Kozhikode	Koduvally	Nov., 2011	M	4 to 8	670.00	450.00	—	450.00	560.00	—	500.00	—	—
			W	4 to 8	—	—	350.00	350.00	400.00	—	—	—	—
Palakkad	Elappally	Nov., 2011	M	4 to 8	400.00	300.00	—	275.00	356.3	—	400.00	—	—
			W	4 to 8	—	—	150.00	200.00	155.00	—	—	—	—
Madhya Pradesh													
Hoshangabad	Sangakherakalan	Aug., 2011	M	8	100.00	100.00	100.00	—	100.00	100.00	275.00	275.00	—
			W	8	—	100.00	100.00	—	100.00	100.00	—	—	—
Satna	Kotar	Aug., 2011	M	8	120.00	—	120.00	—	120.00	120.00	180.00	180.00	180.00
			W	8	—	—	120.00	—	120.00	120.00	—	—	—
Shyopur Kala	Vijaypur	Aug., 2011	M	8	N. R.								
			W	8	N. R.								
Orissa													
Bhadrak	Chandbali	June, 2011	M	8	150.00	130.00	—	—	145.00	120.00	200.00	—	—
			W	8	—	—	—	—	120.00	100.00	—	—	—
Ganjam	Aska	June, 2011	M	8	160.00	90.00	90.00	90.00	101.7	90.00	160.00	160.00	160.00
			W	8	—	60.00	60.00	60.00	60.00	60.00	—	—	—
Punjab													
Ludhiana	Pakhowal	June, 2008	M	8	—	—	90.00	95.00	—	99.44	—	—	—
Rajasthan													
Barmer	Vishala	Aug., 2011	M	8	N. A.								
			W	8	N. A.								
Jalore	Panwa	Aug., 2011	M	8	—	—	—	—	—	150.00	100.00	150.00	—
			W	8									
Tamil Nadu													
Thanjavur	Pulvarnatham	Jan., 2012	M	6	—	N. R.							
			W	5	—	N. R.							
Tirunelveli	Malayakulam (Kurvikulam)	Jan., 2012	M	8	—	N. A.							
			W	8	—	—	—	100.00	—	—	—	—	—
Tripura													
Agartala	Govt. Agri. Farm				N. R.								
*Uttar Pradesh**													
Meerut	Ganeshpur	April, 2011	M+W	8	159.00	175.00	156.00	156.00	157.00	—	250.00	—	—
Chandbali	Dhanpur	April, 2011			N. R.								
Chanduli	Chanduli	April, 2011	M+W	8	—	—	120.00	124.3	120.00	—	172.9	—	—

M-Man, W-Women, C-Child N. A. —Not Available N. R. —Not Reported

*District avarage data, there is no bifurcation between Man and Women.

B. PRICES

2. WHOLESALE PRICES OF CERTAIN IMPORTANT AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA

(Month-end Prices in Rupees)

Commodity	Variety	Unit	State	Centre	Feb.-12	Jan.-12	Feb.-11
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wheat	PBW 343	Quintal	Punjab	Amritsar	1300	1170	1205
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	1110	1060	NA
Wheat	—	Quintal	Madhya Pradesh	Sagar	1400	1500	NA
Jowar	—	Quintal	Maharashtra	Mumbai	2250	2200	1900
Gram	—	Quintal	Punjab	Abohar	NA	NA	NA
Maize	Yellow	Quintal	Uttar Pradesh	Bahraich	1045	1030	960
Gram Split	—	Quintal	Maharashtra	Mumbai	4400	4350	3300
Gram Split	—	Quintal	Bihar	Patna	4700	4750	3300
Arhar Split	—	Quintal	NCT of Delhi	Delhi	5700	5650	6000
Arhar Split	—	Quintal	Maharashtra	Mumbai	5200	5300	6250
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	5700	5300	5500
Arhar Split	—	Quintal	Bihar	Patna	6200	6100	6100
Gur	Balti	Quintal	Uttar Pradesh	Hapur	2225	2375	1850
Gur	Sort II	Quintal	Tamil Nadu	Chennai	2900	2900	2300
Gur	—	Quintal	Maharashtra	Mumbai	3100	2850	2730
Mustard seed	Rai UP	Quintal	West Bengal	Kolkata	3550	3700	2825
Mustard Seed	Raira	Quintal	West Bengal	Kolkata	NA	NA	NA
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	2860	3015	2410
Linseed	—	Quintal	Maharashtra	Nagpur	3650	3450	NA
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	3460	3475	2760
Cotton Seed	Superior	Quintal	Maharashtra	Jalgaon	NA	NA	NA
Castor Seed	—	Quintal	Andhra Pradesh	Badepalli	NA	NA	NA
Sesamum Seed	Black	Quintal	Tamil Nadu	Chennai	4500	4500	4570
Cotton Seed	—	Quintal	Maharashtra	Mumbai	NA	NA	NA
Copra	FAQ	Quintal	Kerala	Alleppey	4400	4900	6450
Groundnut	—	Quintal	Maharashtra	Mumbai	5900	5900	5290
Groundnut	TMV 7	Quintal	Tamil Nadu	Chennai	4280	4280	4060
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1350	1300	1035
Mustard Oil	—	15 Kg.	Uttar Pradesh	Kanpur	1118	1137	930
Groundnut Oil	—	15 Kg.	Maharashtra	Mumbai	1575	1500	1143
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	1575	1511	1103
Linseed Oil	—	15 Kg.	Uttar Pradesh	Kanpur	NA	NQ	863
Castor Oil	—	15 Kg.	Uttar Pradesh	Kanpur	NA	NA	NA
Sesamum Oil	Agmark	15 Kg.	Tamil Nadu	Chennai	2040	2070	1875
Sesamum Oil	—	15 Kg.	Maharashtra	Mumbai	NA	NA	1163
Coconut Oil	—	15 Kg.	Kerala	Cochin	975	1073	1500
Mustard Cake	—	Quintal	Uttar Pradesh	Kanpur	1150	1125	1250
Groundnut Cake	—	Quintal	Uttar Pradesh	Kanpur	NA	NA	NA
Cotton/Kapas	F414	Quintal	Punjab	Abohar	NA	NA	NA
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Thiruppur	NA	NA	NA
Wool	Fine	Quintal	Madhya Pradesh	Dabra	NA	NA	NA
Jute Raw	TD5	Quintal	West Bengal	Kolkata	2440	2270	NA

2. WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA —*Contd.*

(Month-end Prices in Rupees)

Commodity	Variety	Unit	State	Centre	Feb.-12	Jan.-12	Feb.-11
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Jute Raw	W 5	Quintal	West Bengal	Kolkata	2440	2270	NA
Oranges	—	100 No.	Maharashtra	Mumbai	NA	NA	1791
Oranges	Nagpuri	100 No.	West Bengal	Kolkata	NA	NA	NA
Oranges	Big	100 No.	Tamil Nadu	Chennai	540	530	500
Banana	Basarai	100 No.	Maharashtra	Jalgaon	400	375	350
Banana	Singapore	100 No.	West Bengal	Kolkata	NA	NA	NA
Cashewnuts	—	Quintal	Maharashtra	Mumbai	42500	52500	50000
Almonds	—	Quintal	Maharashtra	Mumbai	40000	40000	36000
Walnuts	—	Quintal	Maharashtra	Mumbai	52500	62500	57500
Kishmish	—	Quintal	Maharashtra	Mumbai	12000	13000	14500
Peas Green	—	Quintal	Tamil Nadu	Chennai	1800	1800	1000
Tomatoes	—	Quintal	Tamil Nadu	Chennai	1400	1000	1200
Ladyfinger	—	Quintal	Tamil Nadu	Chennai	3000	3500	2000
Cauliflower	—	100 No.	Tamil Nadu	Chennai	1200	1200	1000
Potatoes	Red	Quintal	Bihar	Patna	500	510	600
Potatoes	Desi	Quintal	West Bengal	Kolkata	480	460	470
Potatoes	Sort I	Quintal	Tamil Nadu	Mettuppalayam	1056	1373	1304
Onions	Bombay	Quintal	West Bengal	Kolkata	NA	NA	NA
Turmeric	Erode	Quintal	West Bengal	Kolkata	NA	NA	NA
Turmeric	Nadan	Quintal	Kerala	Cochin	6700	6300	15500
Chillies	—	Quintal	Bihar	Patna	8500	8300	7300
Black Pepper	Palai	Quintal	Kerala	Alleppey	NT	NT	23000
Ginger	Dry	Quintal	Kerala	Cochin	7600	7500	15000
Cardamom	Big	Quintal	West Bengal	Kolkata	95000	100000	120000
Cardamom	Small	Quintal	West Bengal	Kolkata	70000	75000	140000
Milk	Cow	100	NCT of Delhi	Delhi	3300	NA	3600
Milk	Buffalo	100	West Bengal	Kolkata	3200	3200	NA
Ghee Deshi	Agmark	Quintal	West Bengal	Kolkata	NA	NA	NA
Ghee Deshi	—	Quintal	Uttar Pradesh	Khurja	NA	NA	NA
Ghee Deshi	—	Quintal	Maharashtra	Mumbai	27000	26600	23500
Fish	Rohu	Quintal	West Bengal	Kolkata	NA	NA	NA
Fish	Sea Prawns	Quintal	Tamil Nadu	Chennai	20000	18000	20000
Eggs	Madras	1000 No.	West Bengal	Kolkata	3250	3250	2650
Tea	Medium	Quintal	Assam	Guwahati	NA	NA	NA
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	13000	13000	14000
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	30000	30000	25000
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	12400	12400	12000
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	2325	2300	2550
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	2215	2200	2500
Tobacco	Bidi	Quintal	West Bengal	Kolkata	3400	3500	NA
Rubber	—	Quintal	Kerala	Kottayam	18200	18100	21800
Arecanut	Rashi	Quintal	Tamil Nadu	Chennai	30000	30000	24000

NA :—Not Available

NT :—Not Transaction

3. SOWING AND HARVESTING OPERATIONS NORMALLY IN PROGRESS DURING APRIL, 2012

State	Sowing	Harvesting
(1)	(2)	(3)
Andhra Pradesh	Autumn Rice, Sugarcane.	Summer Rice, Jowar (R), Ragi (R), Small Millets (R), Other Rabi Pulses, Sugarcane, Cotton.
Assam	Autumn Rice, Maize, Small Millets (R), Tur (R), Sugarcane, Cotton, Mesta.	Wheat, Tur (R), Sown during previous year.
Bihar	Jowar (K), Bajra, Jute.	Wheat, Barley, Gram, Tur (K), Castorseed, Linseed.
Gujarat	Sugarcane.	Castorseed, Onion.
Himachal Pradesh	Maize, Summer Potato (Hills), Sugarcane, Ginger Chillies (Dry), Sesamum, Cotton, Turmeric.	Wheat, Barley, Gram, Other Rabi Pulses, Rapeseed and Mustard, Linseed.
Jammu & Kashmir	Autumn Rice, Jowar (R), Maize, Ragi, Small Millets (K), Summer Potato, Chillies (Dry), Tobacco, Sannhemp, Onion.	Wheat, Barley, Small Millets (R), Gram, Sesamum, Linseed, Onion.
Karnataka (Plains)	Maize, Urad (K) Mung (K), Summer Potato (Hills), Tobacco, Castorseed, Sesamum, Sweet Potato (Hills), Sannhemp, Onion (2nd Crop).	Summer Rice, Gram, Urad (R), Summer, Potato, Cotton, Turmeric, Onion (1st Crop). Tapioca.
Kerala	Autumn Rice, Ragi, Ginger, Turmeric, Tapioca.	Summer Rice, Tur (R), Other Rabi Pulses, Sesamum.
Madhya Pradesh	Sugarcane, Onion	Wheat, Barley, Tur (K), Winter Potato (Plains), Castorseed, Linseed, Onion.
Maharashtra	Sugarcane.	Maize (R), Wheat Gram, Other Rabi Pulses, Cotton, Onion.
Manipur	Maize, Turmeric.	Gram.
Orissa	Sugarcane, Chillies (Dry)	Wheat, Barley, Urad (R), Mung (R), Chillies (Dry).
Punjab and Haryana	Tur (K), Potato, Sugarcane, Ginger, Chillies (Dry), Sweet Potato, Turmeric.	Wheat, Barley, Small Millets (R), Gram, Tur (K), Other Rabi Pulses, Potato, Castorseed, Rapeseed and Mustard, Linseed, Onion.
Rajasthan	Sugarcane.	Wheat, Barley, Urad (R), Mung (R), Other Rabi Pulses, Tobacco, Castorseed, Rapeseed and Mustard, Linseed.
Tamil Nadu	Summer Rice, Jowar (R), Summer Potato, Sugarcane, Pepper (Black), Chillies (Dry), Groundnut (Late), Sesamum Cotton, Onion Sannhemp.	Winter Rice, Jowar (R), Tur (R), Mung (K), Winter Potato (Hills), Sugarcane, Chillies, (Dry), Tobacco, Groundnut (Early), Cotton, Onion.
Tripura	Autumn Rice, Maize, Sugarcane, Ginger, Chillies, (Dry), Sesamum, Cotton, Jute.	Summer Rice, Chillies (Dry), Tobacco.
Uttar Pradesh	Sugarcane, Chillies (Dry), Cotton, Jute, Mesta.	Summer Rice, Wheat, Barley, Gram, Tur (K), Tobacco, Castorseed, Rapeseed and Mustard, Linseed, Onion, Sugarcane.
West Bengal	Autumn Rice, Maize, Tur (K), Sugarcane, Ginger Chillies (Dry), Sesamum, Jute, Mesta.	Summer Rice, Wheat, Barley, Gram, Tur (K), Urad (R), Other Rabi Pulses, Winter Potato (Plains), Chillies (Dry).
Delhi	Jowar (K), Sugarcane, Tobacco, Onion.	Wheat, Gram, Tur (K), Rapeseed and Mustard, Linseed.

(K)-Kharif (R)-Rabi.

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