# AGRICULTURAL SITUATION IN INDIA

# JUNE, 2013


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# *Agricultural Situation in India*

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**CONTENTS**

**PART I**

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The Journal is brought out by the Directorate of Economics and Statistics, Ministry of Agriculture. It aims at presenting a factual and integrated picture of the food and agricultural situation in India on month to month basis. The views expressed, if any, are not necessarily those of the Government of India.

## NOTE TO CONTRIBUTORS

Articles on the State of Indian Agriculture and allied sectors are accepted for publication in the Directorate of Economics & Statistics, Department of Agriculture & Cooperation 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 in Hard Copy as well as Soft Copy in MS Word, not exceeding five thousand words, may be sent in duplicate, typed in double space on one side of fullscape 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.

Although authors are solely responsible for the factual accuracy and the opinion expressed in their articles, the Editorial Board of the Journal, reserves the right to edit, amend and delete any portion of the article with a view to making it more presentable or to reject any article, if not found suitable. Articles which are not found suitable will not be returned unless accompanied by a self-addressed and stamped envelope. No correspondence will be entertained on the articles rejected by the Editorial Board.

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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.

## A. General Survey

**(i) Trends in Foodgrain Prices:**

During the month of May, 2013 the All India Index Number of Wholesale Price (2004-05=100) of Foodgrains increased by 0.18 per cent from 216.5 in April, 2013 to 216.9 in May, 2013.

The Wholesale Price Index (WPI) Number of Cereals increased by 0.33 per cent from 213.1 to 213.8 whereas the WPI of Pulses declined by 0.47 per cent from 232.7 to 231.6 during the same period.

The Wholesale Price Index Number of Wheat declined by 1.42 percent from 204.2 to 201.3 while that of Rice increased by 1.59 percent from 207.6 to 210.9 during the same period.

**(ii) Weather. Rainfall and Reservoir situation during June, 2013.**

As per IMD's updated Long Range Forecast for monsoon-2013, . season rainfall for the country as a whole is likely to be 98% of the long period average (LP A) with a model error of ±4%.

Rainfall over the country as a whole for the month of July 2013 is likely to be 101% of its LP A and that for the month of August is likely to be 96% of LP A both with a model error of ±9%.

Over the four broad geographical regions of the country, Season rainfall for the 2013 is likely to be 94% of its LP A over North- West India, 98% of its LP A over Central India, 103% of its LP A over South Peninsula, and 98% of its LP A over North-East India all with a model' error of ±8%.

Cumulative Monsoon (June to September) Rainfall for the country as a whole during the period 01st June to 30th June, 2013 is 32% more than LPA. Rainfall in the four broad geographical divisions of the country during the above period was 120% in North West India, 67% in Central India, 31% in South Peninsula and (-) 35% in East and North East India.

Out of a total of 36 meteorological sub-divisions, 33 sub-divisions received excess/normal rainfall and 03 sub-divisions received deficient/scanty rainfall.

Central Water Commission monitors 84 major reservoirs in the country which have a total live capacity of 154.42 BCM at Full Reservoir Level (FRL). Current live storage in these reservoirs as on 27th June, 2013 was 38.53 BCM as against 26.39 BCM on 27.06.2012(1ast year) and 26.45 BCM of normal storage (average storage of the last 10 years). Current year's storage is 146% of the last year's and the same for the normal storage also.

As per latest information available on sowing of crops, around 24% of the normal area under kharif crops have been sown upto 28.06.2013. Area sown under all kharif crops taken together has been reported to be 251.00 lakh hectares at All India level as compared to 135.87 lakh hectares in the corresponding period of 2012.

**Procurement :** Procurement of rice as on 1st May, 2013 was 31.06 million tonnes in Kharif Marketing Season as against 30.20 million tonnes procured last year in the corresponding period respectively. This represents an increase of 2.8 per cent. Wheat procurement during Rabi Marketing Season 2013-14 is 20.76 million tonnes as compared to 20.83 million tonnes during the corresponding period last year.

TABLE 1— Procurement in Million Tonnes

| | 2010-11 | 2011-12 | 2012-13 | 2013-14 |
|---|---|---|---|---|
| Rice | 34.20 | 35.04 | 32.98* | — |
| Wheat | 22.51 | 28.34 | 38.15 | 25.08* |
| **Total** | **56.71** | **63.38** | **71.13** | **25.08** |

* Position as on 8-6-2013

**Off-take:** Off-take of rice during the month of April, 2013 was 22.42 lakh tonnes. This comprises 21.061akh tonnes under TPDS and 1.36 lakh tonnes under other schemes. In respect of wheat, the total off take was 19.211akh tonnes comprising of 14.01lakh tonnes under TPDS and 5.20 lakh tonnes under other schemes.

**Stocks :** Stocks of food-grains (rice and wheat) held by FCI as on June 1, 2013 were 77.70 million tonnes, which is lower by 5.6 per cent compared to the level of 82.31 million tonnes as on June 1, 2012.

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

| | Off-take | | | Stocks | |
|---|---|---|---|---|---|
| | 2011-12 | 2012-13 | 2013-14(P) | June 1, 2012 | June 1, 2013 |
| Rice | 32.12 | 32.64 | 2.24 | 32.15 | 33.31 |
| Wheat | 24.26 | 33.21 | 1.92 | 50.17 | 44.39 |
| **Total** | **56.38** | **65.85** | **4.16** | **82.32** | **77.7** |

P=Provisional.

**Growth of Economy :—**

As per the Provisional Estimates of the Central Statistics Office (CSO), growth in Gross Domestic Product (GDP) at factor cost at constant (2004-05 prices) is estimated at 5.0 per cent in 2012-13 with agriculture, industry and services registering growth rates of 1.9 per cent, 2.1 per cent and 7.1 per cent respectively. As per the First Revised Estimates, the growth in GDP at factor cost at constant (2004-05) prices is estimated at 6.2 per cent in 2011-12. At disaggregated level, this (First Revised 2011-12) comprises growth of 3.6 per cent in agriculture and allied activities, 3.5 per cent in industry and 8.2 per cent in services. The growth in GDP is placed at 4.8 per cent in the fourth quarter of 2012-13.

TABLE 3— GROWTH OF GDP AT FACTOR COST BY ECONOMIC ACTIVITY

(at 2004-05 Prices)

| Sector | Growth | | | Percentage Share in GDP | | |
|---|---|---|---|---|---|---|
| | 2010-11 | 2011-12 1R | 2012-13 PE | 2010-11 (2R) | 2011-12 (1R) | 2012-13 (PE) |
| 1. Agriculture, forestry and fishing | 7.9 | 3.6 | 1.9 | 14.5 | 14.1 | 13.7 |
| **2. Industry** | **9.2** | **3.5** | **2.1** | **28.2** | **27.5** | **26.7** |
| a. Mining and quarrying | 4.9 | -0.6 | – 0.6 | 2.2 | 2.1 | 2.0 |
| b. Manufacturing | 9.7 | 2.7 | 1.0 | 16.2 | 15.7 | 15.1 |
| c. Electricity, gas and water supply | 5.2 | 6.5 | 4.2 | 1.9 | 1.9 | 1.9 |
| d. Construction | 10.2 | 5.6 | 4.3 | 7.9 | 7.9 | 7.8 |
| **3. Services** | **9.8** | **8.2** | **7.1** | **57.3** | **58.4** | **59.6** |
| a. Trade, hotels, transport and communication | 12.3 | 7.0 | 6.4 | 27.3 | 27.5 | 27.8 |
| b. Financing, insurance, real estate and business services | 10.1 | 11.7 | 8.6 | 17.2 | 18.1 | 18.7 |
| c. Community, social and personal services | 4.3 | 6.0 | 6.6 | 12.8 | 12.8 | 13.0 |
| **4. GDP at factor cost** | **9.3** | **6.2** | **5.0** | **100.0** | **100.0** | **100.0** |

(1R): 1st Revised Estimates; PE: Provisional Estimates CSO Source :

TABLE 4—QUARTERLY ESTIMATE OF GDP

(Year-on-year in per cent)

| | | 2011-12 | | | | 2012-13 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sector | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| 1 | Agriculture, forestry & fishing | 5.4 | 3.2 | 4.1 | 2.0 | 2.9 | 1.7 | 1.8 | 1.4 |
| 2 | Industry | 5.7 | 3.8 | 2.6 | 2.1 | 1.8 | 1.3 | 2.5 | 2.7 |
| a | Mining & quarrying | -0.4 | -5.3 | -2.6 | 5.2 | 0.4 | 1.7 | -0.7 | -3.1 |
| b | Manufacturing | 7.4 | 3.1 | 0.7 | 0.1 | -1.0 | 0.1 | 2.5 | 2.6 |
| c | Electricity, gas & water supply | 6.6 | 8.4 | 7.7 | 3.5 | 6.2 | 3.2 | 4.5 | 2.8 |
| d | Construction | 3.8 | 6.5 | 6.9 | 5.1 | 7.0 | 3.1 | 2.9 | 4.4 |
| 3 | Services | 8.9 | 8.5 | 8.3 | 7.3 | 7.7 | 7.6 | 6.7 | 6.6 |
| a | Trade, hotels, transport & communication | 9.5 | 7.0 | 6.9 | 5.1 | 6.1 | 6.8 | 6.4 | 6.2 |
| b | Financing, insurance, real estate & business services | 11.6 | 12.3 | 11.4 | 11.3 | 9.3 | 8.3 | 7.8 | 9.1 |
| c | Community, social & personal services | 3.5 | 6.5 | 6.8 | 6.8 | 8.9 | 8.4 | 5.6 | 4.0 |
| **4** | **GDP at factor cost** | **7.5** | **6.5** | **6.0** | **5.1** | **5.4** | **5.2** | **4.7** | **4.8** |

*Source*: CSO.

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## *B. Articles*

# Regional Processes and Patterns of Agricultural Growth in India after Economic Liberalization

SURENDRA SINGH* AND PREM CHHETRI**

**Abstract:** This paper investigates the impact of new economic policies on regional processes and agricultural growth patterns in India implemented during the 1990s. The analysis was conducted using a total of forty six crops including the crops occupying the area extent upto 0.023% to total Grossed Cropped Area. The spatial growth patterns of agricultural outputs for a period of post-liberalisation phase of economic development (2000-01 to 2006-07) were examined. Results show that expansion of horticultural crops and the diversification of cropping patterns were the main reasons behind high agricultural growth with the emergence of its uniform pattern in the hill areas of the country. The emergence of 'new market towns' that regulate the scale, types and location of agricultural products at local and regional levels explains the reasons for high growth in these areas. Contrary to this change, a rapid growth in metropolitan economies resulted in a greater diversification of the agricultural growth patterns by strengthening the processing-segment of food supply chains to benefit producers particularly in the central part of the Deccan. Parts of South and Western plateau Regions have lower or even negative agricultural growth due to overwhelming growth experienced in metropolitan economies in India.

**Introduction:**

After the introduction of new economic liberalisation policies during the 1990's, India became a member of the World Trade Organisation and started to adopt economic reforms to create market opportunities for high economic growth. The agricultural reforms and economic restructuring implemented during this phase might have a significant impact on agricultural sector of the country. Nonetheless, the impacts on agricultural production systems were neither adequately measured nor modelled. Further relaxation in trade rules and the development of new transport routes with a greater capacity to regulate the flow of agricultural commodities and allied services within and between countries brought agriculture to more open and free market systems. The economic restructuring and a rapid transformation of economic systems have impacted on the agricultural growth patterns and the levels of agricultural productivity. Notwithstanding, the spatiality of agricultural growth has attracted little interest despite the argument for policy interventions to mitigate regional disparities and stimulate equitable economic growth opportunities. No doubt, the share of agricultural sector to GDP has declined quite rapidly (1.0% annually) from 34 per cent to 24 per cent during the liberalization phase of the economy (1992-93 to 2003-04), which can be attributed to a slower rate of growth in comparison to the non-agricultural sectors of the economy. However, a record increase in agricultural productivity, a moderate change in cropping patterns, an increase in acreage of high-priced value-added crops like vegetables, fruits and horticultural crops, and inter-crop imbalances suggest remarkable achievements exhibited by the agricultural sector, despite attracting little government investment (Radhakrishnan 2009).

There has been noticeable increase in the trade of agricultural commodities in international market as export of agricultural commodities increased three-fold from Rs. 30 thousand crores to Rs. 90 thousand crores, but the share of export and import of agricultural commodities to total value of trade declined from 14.0% to 10.0% and from 5.0% to 4.0% respectively during the period of post-liberalization (2000-01 to 2009-10). It was due to fast increase in the trade of non-agricultural commodities. Vegetable oils and pulses were the major food items that were imported to fulfil the increasing demand; whilst rice and fresh fruits and vegetables were major export commodities during 2009-10 (Table-I). A significant annual increase in the export of rice and cashew-nuts were recorded during the post-liberalization period, which increased the ratio of Terms of Trade as it became 1.5 and India got foreign exchange of Rs. 30,155 crores from traded agricultural commodities in 2009-10.

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**Key words:** crop-diversification, processing-segment of food chain, commercial crops, new economic policies, agricultural growth.

TABLE1—TRADED MAJOR AGRICULTURAL COMMODITIES (2009-10) AND ITS GROWTH RATES (2001-2010)

| SI No. | Commodities | Impprt | | | Export | | |
|---|---|---|---|---|---|---|---|
| | | Total value (Rs. Crores) | % | Average Annual growth (Rs. Crores) | Total value Rs. Crores) | % | Average Annual growth (Rs. Crores) |
| 1. | Pulses | 9773.00 | 16.30 | 193.5 | 407.36 | 0.45 | 42.20 |
| 2. | Rice (Basmati) | - | - | - | 10838.86 | 12.11 | 145.46 |
| 3. | Vegetable oils | 26483.52 | 44.61 | 700.22 | - | - | - |
| 4. | Sugar | 5961.25 | 10.04 | 3.16 | 110.22 | 0.12 | 129.07 |
| 5. | Fruits and Vegetables | 2870.86 | 4.83 | 1.05 | 6855.30 | 7.66 | 96.30 |
| 6. | Cashew nuts | 3050.09 | 5.14 | 79.14 | 2828.60 | 3.16 | 182.97 |
| | **Total agriculture** | **59367.62** | **100.00** | - | **89522.59** | **100.00** | - |

*Source*: Director General of Commercial Intelligence and Statistics, Ministry of Commerce, Kolkata.

The analysis of agricultural statistics on consumption expenditure (NSSO 2010), in domestic market shows a significant increase in per capita consumption expenditure from Rs. 12,570 (of which 45.33% was spent on food, i.e., Rs. 5,698/- in its absolute amount in 1999-2000) to Rs. 16,372 (of which 35.79% on food as Rs. 5,859/- in 2006-07). Increased expenditure on food and the diversification of food consumption pattern substantiate the Angle's law, which states that the change in the composition of food-basket in which consumption of cereals has remained constant at 465 gm/day/ person during the period of economic liberalization. However, there has been a continuous decline in the consumption of pulses (dietary protein) to 29.1 gm/day/person in 2005, which is only half of the quantity recommended by Indian Council of Medical Research, Hyderabad. The prices of commodities required at a domestic level increased fast that may have affected on the cropping pattern and agricultural growth and on the levels of agricultural (and labour) productivity in India. In spite of significant change in agriculture and non-agricultural sectors, the inter-regional income inequalities have widened after the adoption of liberalization policies such as per capita income gap ratio between the states of highest and lowest income increased from 4.75 (recorded between Punjab and Bihar) in the 1996-97 to 5.50 (between Haryana and Bihar) in 2003-04 (Suryakant 2010). In addition, a greater gap in rural-urban divide in consumption expenditure as well as in per capita income has also been evidenced (NSSO 2010). Furthermore, statistical analysis of agricultural land use shows a significant increase in average annual Net Sown Area, NSA, (271.3 million ha) and in Gross Cropped Area, GCA (1612.0 million ha). Higher increases in non-food crops (895.7 million ha) and oil-seeds (793.9 million ha) were recorded during the post-liberalization phase in comparison to growth in NSA and GCA for cereals (Table -2).

TABLE 2—STATISTICAL ANALYSIS OF AGRICULTURAL ATTRIBUTES DURING DIFFERENT PHASES OF DEVELOPMENT

| Agricultural attributes | Annual Rate of Linear Increase during | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Green Revolution | | Post Green revolution | | Liberalisation | | Post-Liberalisation | |
| | 1970-1 | 1979-80 | 1980-1 | 1989-90 | 1990-1 | 1999-2000 | 2000-1 | 2008-9 |
| | b | $R^2$ | b | $R^2$ | b | $R^2$ | b | $R^2$ |
| **A General Landuse** | | | | | | | | |
| NSA (million ha) | 147.0 | .0490 | 167.7 | .0401 | -74.6 | .1122 | 271.3 | .0672 |

TABLE 2—STATISTICAL ANALYSIS OF AGRICULTURAL ATTRIBUTES DURING DIFFERENT PHASES OF DEVELOPMENT—*Contd.*

| Agricultural attributes | Annual Rate of Linear Increase during | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Green Revolution | | Post Green revolution | | Liberalisation | | Post-Liberalisation | |
| | 1970-1 | 1979-80 | 1980-1 | 1989-90 | 1990-1 | 1999-2000 | 2000-1 | 2008-9 |
| | b | $R^2$ | b | $R^2$ | b | $R^2$ | b | $R^2$ |
| GCA (million ha) | 917.5* | .4871 | 654.9 | .2533 | 725.6* | .6829 | 1612.0** | .5132 |
| Crop Intensity (%) | .527* | .9261 | .615* | .8783 | .579* | .9012 | .888* | .9132 |
| **B Crop Area Under** | | | | | | | | |
| Cereals & Pulses (million ha) | 502.2** | .2950 | -343.1 | .1372 | 13.9 | .0000 | 438.4 | .1522 |
| Other food crops (million ha) | 764.3* | .4500 | -66.7 | .0061 | 314.0* | .2762 | 716.4 | .3300 |
| Totaloilseeds (million ha) | 11.9 | .0005 | 788.4* | .9241 | 138.5 | .1631 | 793.9* | .6944 |
| Non food crops | 154.8** | .3940 | 731.0* | .7362 | 411.7* | .6480 | 895.7* | .6143 |

**Abbreviations:** NSA= Net Sown Area, GCA= Gross Cultivated Area

N.R.:*= at .01 significant level and and**at .10 level

1. Cereals and pulses include Paddy, Wheat, Jowar, Bajra, Maize, Gram and Tur (Arhar).

2. Other food crops include Potato, root-crops.

3. Oil seeds include Groundnut, Rapeseed &Mustard and other six Oilseeds.

4. Non-food crops include Sugarcane, Cotton, Jute and Mesta.

5. Linear increase is calculated by fitting straight line equation in given date of time series as Y=a+bt where Y=value of agriculture attributes, t=time period and b=annual rate of increase in attributes (million has except crop intensity, i.e., in %).

6. $R^2$ indicates the degree of determinant of temporal fluctuation.

*Source*: Agricultural Statistics at A Glance- 2007, Directorate of Economics and Statistics, Ministry of Agriculture, New Delhi

Despite the difference in the growth patterns, an average growth of agricultural production remained marginally lower (about 2.13%) during the post-liberalization phase (after 2000-01) compared to pre-liberalisation phase, which recorded a growth of 2.30% in the 1970's and 3.03% in the 1980's (Singh 1994: 46-47). However, wider regional disparities exist in the growth patterns in different parts of India. For example, regional variability in agricultural growth prior to green-revolution (1979-82 to 1988-90) was due to the dominance of agro-ecological factors on agricultural practices (Dogra 1981). The regional expansion of high growth areas during the Green Revolution was made due to intensification of seed-fertilizer technology and significant expansion of net irrigated area (Bhalla and Tyagi 1989). However, during the liberalization phase (1990's), the growth proceeded because of fast emergence of rural markets and implementation of rural road development programme (Singh 1994: 47-52). In this regard, one must question about the effect of the introduction of new economic policy that might have impacted on the regional growth processes during the post-liberalization phase of agricultural development in the country.

Given this context, the main objective of the present study is, thus, to examine the regional structure and embedded processes of agricultural growth that changed the performance of agricultural development in India. The study therefore will improve our understanding of the regional variability in agricultural growth and the factors that stimulate rapid growth or cause stagnant growth conditions.

**Concept and Measurement**

Growth and productivity are measured in an aggregated form of agricultural production. The proportional difference over time in total production is referred as growth and its quantity per unit of input represents productivity. Factors of production are considered to be the main determinants of growth and productivity. In that

sense, agricultural productivity is an inherent attribute of growth. The measurement of change in agricultural output is used to understand the production efficiency. Precise measure of growth is the differentiation of output over time made by changing efforts of input use in agricultural production processes. The computation of output of all farm activities that generates the problem of aggregating agricultural products, the measurement of such aggregate products over time and its comparison with input index are recognised as major methodological issues to measure the growth and to study growth acceleration.

A detail review on the measurement of aggregate agricultural production and productivity was done by Singh and Chauhan (1977) when Indian agricultural production processes were accelerated under agro-ecological conditions of growth throughout the country except few areas due to the impact of the Green Revolution. In addition to relative significance of crop area and yield as considered prior to this study by Ganguli (1938), Bhatia (1967) and Sen Gupta (1968), the grain equivalents of considered crops in the form of composite index of the relative prices, caloric significance and crop requirement at national level were considered to calculate aggregate output index (Singh and Chauhan 1977). Later on when the effects of production prices and input costs were seen in agricultural production processes during and after the Green Revolution, the harvesting prices of crop production was given greater importance to measure the aggregate production (Dayal 1984, Bhalla and Tyagi 1989, Singh and Sharma 2007). Relative crop price component is more significant now for calculation of agricultural output during the period of economic liberalization when Indian economy has been restructured keeping in mind the global market system and a farmer wishes to diversify the production process in the environment of economic competition and food supply chain.

**Methods and Data Base**

Measurement of agricultural growth is largely dependent on the foIlowing methods that are based on:

(i) the additive decomposition scheme of the analysis of agricultural growth components used by Minhas and Vaidyanathan (1965),

(ii) the multiplicative decomposition scheme of growth components which predict annual exponential growth of aggregated agricultural output used by Bhalla and Alagh (1979: 40-6 I), and

(iii) the compound rate of agricultural output growth used by many scientists (Mohapatra 1982, Ministry of Agriculture 1991: Table 14.2).

On account of following the law of diminishing return to agricultural production as widely accepted by agricultural scientists due to the limitations of production operations like land resources capability. and farmer socio-economic constraints (Miller 1966), the increase in agricultural production follows arithmetic progression (first case) rather than 'geometric ones' as Malthus viewed. In fact, arithmetic growth rate is also applicable for the growth calculations for shorter period of time as considered for the present study.

As the aggregated agricultural output $P_i$ is the product of three production elements: area, yield and prices of various crops in which crop pattern and crop-yield pattern are main elements (called determinants as the multiplier of area, $a_i$, and yield, $Y_i$, of a particular crop, i, is the production of that crop) and crop-price as 'convertor' of crop production into its money term, the given linear equation of agricultural growth rate, R, which is $R = (P_i - P_o)/P_o$, may be expressed for a particular crop, i, as

$$r_i = [(a_i1*Y_i1*p_io)–(a_io*Y_io*p_io)]/(a_io*Y_io*p_io), \text{or}$$

$$r_i = [\{(a_i1/a_io)\ Y_i1/Y_io)\}– 1];\ i = 1, 2, 3. . .n \text{ crops} \quad (1)$$

where $a_i1$ and $a_io$ are areas under $i^{th}$ crop for the current and base years respectively and $P_iO$ represents the base year's crop price. So the crop growth is the multiplier factor of the growth ratio of crop area $(a_i1/a_io))$ and crop yield $(Y_i1/Y_io)$ and the average of $r_i$ for various crops is the production growth of all agricultural crops R as,

$$R = \frac{1}{n}[\{\sum_{i=1}^{n} r\,i = (r_1+r_2+r_3+...+r_n)\}] \quad \ldots(2)$$

Crop-price is used here to show this production ratio in its money term to present results of change occurring in agricultural output over time.

The areal frame for mapping Indian agricultural growth consists of the 387 districts out of a total of 593 districts counted as administrative areal units in 2001. On account of problems of data availability, the smaller states, namely, Goa, Daman and Diu, Union territories of Chandigarh, Dadra and Nagar Haveli, Pondicherry, Lakshadweep, Andaman and Nicobar Islands have been excluded. The states of Arunachal Pradesh and the districts of Jammu and Kashmir State under occupation of Pakistan (PoK) could not be included in the present study due to non- availability of agricultural statistics. The districts which have urban characteristics (as follow urban population more than 90.0 per cent to total population of the district) and no longer have the agricultural activities have also been excluded for regional analysis of agricultural growth. The names of these districts are Greater Bombay (Maharashtra), Madras (Tamil Nadu), all districts of Calcutta Urban Agglomeration (West Bengal), Hyderabad (Andhra Pradesh), all districts of Delhi State, the Dangs and Rann of Kutch (Gujarat), Lahau and Spiti (Himachal Pradesh) and the Nilgiris (Tamil Nadu).

The statistics for the year 2000-01 and the year 2006-07 were collected district-wise and considered for agricultural growth calculation. This period of six years of post-liberalization was selected for three reasons:

(a) As per the statistics of macro-economic performance of India compiled by the Central Statistical Organization (CSO; see http://mospi.nic.in/mospi press release.htm) and Reserve Bank of lndia (RBI; see http://rbi.org.in), the seven years after implementation of new economic policy (2000-01 to 2007-08) has been exceptionally dynamic for Indian economy when it gained average annual growth of GDP of about 8.9% and Gross Domestic Investment to GDP reached up to 38.0% in 2007-08. The effect of such investment was realized on agriculture sector of the economy. The global crisis of Spring 2009 checked the speed of Indian economy expended with a great deal of momentum (Acharya 2012). It was the time of diversification of agricultural activities and significant increase in agricultural growth.

(b) District-wise crop statistics required for calculation of agricultural growth were easily available online at the website of the Ministry of Agriculture till 2007-08. Compilation of growth parameters were done by downloading the statistics of the area, yield, production and crop harvesting price data of various crops at district level from Ministry website (htpp://eands.dacnet.nic.in).

(c) Weather conditions were recorded normal in these two years 2000-01 and 2006-07 to provide correct results of agricultural growth.

The value of agricultural output is based on 46 crops which account for more than 99.5% of the crop area including horticulture crops in the process of output calculation (see Table- 3 for name of crops). However, detail analysis of agriculture growth was pursued to group the crops into two broad categories: food grains that include cereals and pulses as main crops dominate in the cropping pattern and, secondly, the commercial crops including fruits and vegetables as classified by the Ministry of Agriculture, New Delhi. Commercial crops are considered as high value crops that may have great impact on the processes of agricultural growth.

The greater areal extent of the country (about 3,287,263 sq. km. area lying the Northern Hemisphere at Inter Tropical Convergence Zone, ITCZ, between $8^0$04' to $37^0$ 18' N latitudes and $68^0$08' to $97^0$25' E longitudes), the spatially varied physiographic and agro-ecological conditions (greater North Plains to high Himalayan Mountains), the varied climatic conditions and soil formation (moist humid with lateritic soils of Meghalaya Plateau to hot and dry conditions of Thar with sandy soils) and the diverse socio-cultural milieu and increasing urbanization influence regional pattern of crop productivity and agricultural growth. In this context, it is most obvious and simple explanation of regional variation in agricultural growth to say that the most identified processes of growth may be provided to choose an appropriate regional frame of physical environment. It (physical environment) modifies the agricultural growth elements, namely, cultivation area, crop yield and production prices. Extent of cultivated area and length of crop seasons are largely dependent on the extent of agro-ecological conditions of land for crop growth. The variable use of technology is also influenced by this factor of land (Singh and Sharma 2007). Binswanger (1978) concept of intensification and use of appropriate technology is based on the productivity of land this is implicitly controlled by agro-ecological conditions of land. Out of different available regional frames like the 'physiographic complexes' prepared by Indian Statistical Institute, New Delhi for agricultural land use studies (Bhat and Das 1988), the 'agricultural zones of India' produced by Sen Gupta (1968), the Agro-Climatic Regions' prepared by Planning Commission (1989) and the 'Agricultural Planning Regions' analysed based on homogeneous agricultural characteristics by Singh (1994: 142-188), it is a question of choice to use for gauging the regional extent of agricultural growth processes. Assuming agro-ecological conditions as homogeneous, the effect of technological and growing market economies on agricultural growth processes may be visualized by using the variable pattern of agricultural growth within the region. Agro-climatic regions have been, therefore, used to analyze regional pattern of agricultural growth as this regional frame is most appropriate and applicable to view the regional personality of agricultural development (Basu and Guha 1996).

**Pattern of Agricultural Output Growth**

Agricultural growth in India remains low relative to the other developed countries like China even after the implementation of new economic policies for several reasons. Average yield of cereals was 5,095 kg/ha in China and was 2,417 kg./ha in India in 2003-05, the average annual growth of fruits and vegetables (1990-2005) and the contribution of the share of agricultural value added crops to total GDP (2003-05) were higher in China as 9.3% and 3.7% respectively than in India as 3.8% and 2.5% (World Developed Report 2008). As a result, cropping intensity was far higher in China. Despite of shift from traditional operations of agriculture to modern ones during the green revolution period and later, the agricultural growth in India could not be achieved the goal set for. Crop yield increased for fruits and vegetables but the yield of gram and other kharif pulses decreased remarkably. Unimpressive change was observed in crop area especially in food grains.

On the whole, GCA under the crops considered for present analysis was increased only 3.54% from 155,899 thousand ha (2000-01) to 161429 thousand ha (2006-07) (Table-3). The area under commercial crops was much lesser sharing only 22.0% to total GCA in 2000-01 and increased 1.85% during the period of six years of post-liberalization period. The increase in the yield of commercial crops was recorded however much higher than the increase in the yields of food grains. As a result, the productivity of commercial crops increased faster and changed the structure of agricultural growth. The annual growth of agricultural output was calculated 4.33% while the growth of food grain production was only 2.13% during post liberalization period. Inclusion of commercial crops in agriculture system influences the anatomy of agricultural growth (Halder and Das 2010). Area and yield ratio of commercial crops (Rapiseed and Soyabean, Banana and Dry ginger) are much higher than the cereals (Jowar, Bajra, Ragi and Barley). As a result, commercial crops contribute significantly to the growth. However, these crops concentrate regionally in their crop pattern. For example, Rapeseed and Mustered dominate in cropping pattern in Rajasthan and Madhya Pradesh, Groundnut in Gujarat, Cotton in the interior part of Maharastra, coconut in coastal areas in south India, and Bananas, dry ginger in the hill areas of the North-East and Uttrakhand.

TABLE-3—Growth Ratio of Area and Yield of Various Crops in India

| Crops | Area 2000-01 000 ha | % | Area 2006-07 000 ha | % | Area Ratio 2000-01 | Yield 2006-07 | (Kg/ha) | Absolute Change in Yield Kg/ha | Yield Ratio | Crop Growth Ratio* | Production Growth (2000-01 to 2006-07 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Foodgrains** | | | | | | | | | | | |
| Rice | 42047 | 26.970 | 42619 | 26.40 | 1.01360 | 596 | 646 | 50.55 | 1.08485 | 1. 09961 | 9.96 |
| Wheat | 25111 | 16.107 | 27080 | 16.77 | 1.07839 | 598 | 638 | 40.90 | I. 06844 | 1.15220 | 15.22 |
| Jowar | 10050 | 6.446 | 8676 | 5.37 | 0.86331 | 187 | 218 | 30.56 | 1.16340 | 1.00438 | 0.44 |
| Bajra | 10049 | 6.446 | 9529 | 5.90 | 0.94823 | 211 | 225 | 14.28 | 1.06778 | 1.01250 | 1.25 |
| Maize | 6372 | 4.087 | 7395 | 4.58 | 1.16048 | 561 | 593 | 31.48 | 1.05608 | 1.22556 | 22.56 |
| Ragi | 1413 | 0.906 | 1050 | 0.65 | 0.74349 | 134 | 134 | 0.16 | 1.00118 | 0.74437 | -25.56 |
| Barley | 726 | 0.466 | 658 | 0.41 | 0.90634 | 283 | 315 | 32.38 | 1.11460 | 1.01021 | 1.02 |
| **Pulses** | | | | | | | | | | | |
| Gram | 5213 | 3.344 | 7693 | 4.77 | 1.47556 | 235 | 238 | 3.67 | 1.01564 | 1.49864 | 49.86 |
| Arhar | 3772 | 2.419 | 3256 | 2.02 | 0.86311 | 223 | 217 | -5.67 | 0.97454 | 0.84114 | -15.89 |
| Urad | 2410 | 1.546 | 2576 | 1.60 | 1.06889 | 102 | 120 | 17.66 | 1.17300 | 1.25382 | 25.38 |
| Moong | 2817 | 1.807 | 3031 | 1.88 | 1.07617 | 108 | 110 | 2.13 | 1.01969 | 1.09736 | 9.74 |
| Masoor | 943 | 0.605 | 862 | 0.53 | 0.91441 | 103 | 110 | 7.63 | 1.07427 | 0.98232 | -1.77 |
| Horse Gram | 677 | 0.434 | 592 | 0.37 | 0.87425 | 43 | 31 | -11.82 | 0.72689 | 0.63548 | -36.45 |
| Other Kharif Pulse | 1317 | 0.845 | 364 | 0.23 | 0.27638 | 80 | 55 | -25.12 | 0.68641 | 0.18971 | -81. 03 |
| Other Rabi Pulse | 993 | 0.637 | 135 | 0.08 | 0.13625 | 90 | 99 | 9.25 | 1.10325 | 0.15032 | -84.97 |
| Groundnut | 6551 | 4.202 | 5938 | 3.68 | 0.90641 | 271 | 277 | 6.17 | 1.02275 | 0.92704 | -7.30 |
| Sesamum | 1598 | 1. 025 | 1476 | 0.91 | 0.92358 | 111 | 118 | 7.10 | 1.06391 | 0.98261 | -1.74 |
| **Total** | **122058** | **78** | **122929** | **76.15** | - | - | - | - | - | - | - |

TABLE-3—GROWTH RATIO OF AREA AND YIELD OF VARIOUS CROPS IN INDIA—*Contd.*

| Crops | Area 2000-01 000 ha | % | Area 2006-07 000 ha | % | Area Ratio 2000-01 | Yield 2006-07 | (Kg/ha) Absolute Change in Yield Kg/ha | Yield Ratio | Crop Growth Ratio* | Production Growth (2000-01 to 2006-07 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Commercial Fruits and Vegetables** | | | | | | | | | | |
| Potato | 1017 | 0.652 | 1202 | 0.74 | 1.18173 | 2664 | 2770 | 106.01 | 1.03979 | 1.22875 | 22.88 |
| Tapioca | 250 | 0.160 | 226 | 0.14 | 0.90669 | 980 | 1138 | 157.84 | 1.16112 | 1.05277 | 5.28 |
| Onion | 282 | 0.181 | 395 | 0.24 | 1.40109 | 2177 | 2734 | 556.66 | 1.25568 | 1.75932 | 75.93 |
| Sweet Potato | 60 | 0.038 | 75 | 0.05 | 1.25618 | 909 | 1144 | 234.65 | 1.25818 | 1.58050 | 58.05 |
| Peas & Beans | 405 | 0.259 | 485 | 0.30 | 1.19895 | 154 | 166 | 12.65 | 1.08228 | 1.29760 | 29.76 |
| Banana | 294 | 0.189 | 372 | 0.23 | 1.26556 | 2163 | 2678 | 514.12 | 1.23765 | 1.56631 | 56.63 |
| **Oil Seeds, Spices and Others** | | | | | | | | | | |
| Repseed & Mustard | 3969 | 2.546 | 6485 | 4.02 | 1.63370 | 187 | 370 | 182.52 | 1.97570 | 3.22772 | 222.77 |
| Linseed | 481 | 0.309 | 385 | 0.24 | 0.80054 | 93 | 102 | 8.96 | 1.09615 | 0.87751 | -12.25 |
| Castor Seed | 1090 | 0.699 | 686 | 0.43 | 0.62949 | 102 | 105 | 2.46 | 1.02399 | 0.64459 | -35.54 |
| Safflower | 451 | 0.289 | 378 | 0.23 | 0.83911 | 37 | 33 | -4.04 | 0.89040 | 0.74715 | -25.29 |
| Coconut | 1403 | 0.900 | 1809 | 1.12 | 1.28951 | 572 | 852 | 280.16 | 1.48980 | 1.92111 | 92.11 |
| Sunfllower | 1004 | 0.644 | 2117 | 1.31 | 2.10788 | 114 | 205 | 90.46 | 1. 79289 | 3.77920 | 277.92 |
| Cotton | 8062 | 5.171 | 7554 | 4.68 | 0.93705 | 261 | 243 | -17.49 | 0.93291 | 0.87419 | -12.58 |
| Mesta | 149 | 0.096 | 125 | 0.08 | 0.84144 | 421 | 499 | 78.66 | 1.18704 | 0.99882 | -0.12 |
| Chilly | 716 | 0.459 | 595 | 0.37 | 0.83100 | 207 | 256 | 48.65 | 1.23503 | 1.02631 | 2.63 |
| Turmeric | 172 | 0.110 | 150 | 0.09 | 0.87049 | 431 | 521 | 89.74 | 1.20813 | 1.05166 | 5.17 |
| Aracanut | 277 | 0.178 | 381 | 0.24 | 1.37623 | 69 | 77 | 8.63 | 1.12567 | 1.54917 | 54.92 |
| Coriander | 346 | 0.222 | 316 | 0.20 | 0.91225 | 60 | 72 | 11.36 | 1.18837 | 1.08409 | 8.41 |
| Sugar Cane (Gurh) | 4206 | 2.698 | 3404 | 2.11 | 0.80942 | 16766 | 14153 | -2612.84 | 0.84416 | 0.68328 | -31.67 |
| Tobacco | 219 | 0.141 | 345 | 0.21 | 1.57032 | 121 | 158 | 37.77 | 1.31299 | 2.06182 | 106.18 |
| Niger Seed | 462 | 0.297 | 405 | 0.25 | 0.87688 | 31 | 27 | -3.12 | 0.89784 | 0.78730 | -21.27 |
| Jute | 812 | 0.521 | 762 | 0.47 | 0.93923 | 422 | 579 | 157.13 | 1.37244 | 1.28903 | 28.90 |
| Dry Ginger | 52 | 0.033 | 75 | 0.05 | 1.44549 | 485 | 576 | 91.25 | 1.18829 | 1.71767 | 71.77 |
| Garlic | 52 | 0.033 | 88 | 0.05 | 1.69978 | 392 | 305 | -87.16 | 0.77763 | 1.32180 | 32.18 |
| Soyabin | 6295 | 4.038 | 8019 | 4.97 | 1.27380 | 116 | 130 | 14.08 | 1.12164 | 1.42875 | 42.87 |
| Sanhamp | 36 | 0.023 | 136 | 0.08 | 3.80138 | 159 | 135 | -24.69 | 0.84495 | 3.21197 | 221.20 |
| Moth | 1006 | 0.645 | 1204 | 0.75 | 1.19691 | 11 | 18 | 7.70 | 1.71372 | 2.05117 | 105.12 |
| Black Pepper | 211 | 0.135 | 252 | 0.16 | 1.19637 | 20 | 27 | 6.56 | 1.32434 | 1.58441 | 58.44 |
| Cardamom | 63 | 0.040 | 73 | 0.05 | 1.16026 | 1 | 2 | 0.64 | 1.49674 | 1.73660 | 73.66 |
| **Total Commercial** | **33840** | **22** | **38500** | **23.85** | - | - | - | - | - | - | - |
| Average | - | - | - | - | 1.11908 | - | - | 3.49283 | 1.14114 | 1.30321 | 30.321 |
| **Total All Crops** | **155899** | **100** | **161429** | **100** | - | - | - | - | - | - | - |

NB : * Crop growth ratios are calculated by using Eqn -1.

1. Fruits (except Banana),Tea and Coffee crops are not included under the category of commercial crops due to non-availability of area and production statistics district-wise.

2. The classification of foodgrains (cereal and pulses) and commercial crops (vegetables and fruits, oilseeds, spices and other industrial crops) is based on Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi (see Commodity Review, published in Agriculture Situation in India, Vol. LXVIII (5), 2011: 257-259).

There are four areas of high to very high growth (above 8%), which account for more than one-fourth (26.7%) share of total gross cultivated land of the country (Fig.-l). These are:

(i) The most parts of Rajasthan including Arravali hills, and Malwa plateau of Madhya Pradesh of arid climate and Saurastra region of Gujarat where agricultural growth sustained due to change in the cereal dominating cropping in 2000-01 to pulse and oil seed domination in. 2006-07. Gram and Rapeseed and Mustard are now major crops in Rajasthan and Malwa plateau, Groundnut in Saurastra-Gujarat. There has been significant increase in the yield of Gram, Groundnut and fast increase in oil seeds that boosted growth of agriculture in these areas. Castes and communities as social factors of agriculture do not affect cropping pattern and crop intensity, but the commercialization of crops has shown a large impact on agricultural growth (Vishwakarma 2010).

(ii) The most part of Jharkhand and Chhattisgarh plateau of moderately humid climate with forest dominated ecology where the share of NSA in general land use is lesser. However, in the moderate degree of cropping intensity (115-125%) the area has changed cropping pattern from rice dominated to new combination of Maize- Gram- Oilseed crops (Nag 2010).

(iii) In the hills and mountain valleys of Uttarakhand, Himachal Pradesh, Shiwaliks and foot-hills of Jammu and Kashmir state and also the hill areas of the North-Eastern Region, the increasing areas under fruits, spices in Himachal and Jammu-Kashmir and expanding areas under horticultural crops like Aricanut, Ginger, Turmeric, and Banana in the areas of '*jhoom*' cultivations especially in the Khasi-Jaintia hills of Meghalaya, Lusai hills of Mizoram and Patkai hills of Nagaland of the North-Eastern hill region are major causes of high agricultural growth.

(iv) A small pocket of five districts located in Upper Krishna basin of semi-humid conditions of cereal dominated cropping pattern is also included in this category of high to very high agricultural growth. Jowar, Bajra and Barley are main crops of the areas. Being higher production increase of Maize (as more than 22.56%) than the other cereals, there has been boost in agricultural output that increases growth rate fast.

Further, the main areas of green revolution technology-the Punjab and western parts of Uttar Pradesh plains including lower Ganga Valley have low to moderate agricultural growth (2-8%) despite of high cropping intensity (more than 165% recorded in 2006-07). The Punjab and Uttar Pradesh plains gained importance of Sugarcane in its cropping pattern as there has been remarkable price-hike in Sugarcane products (like gurh and sugar). The relative price of Sugarcane was also quite high during post liberalization period.

Surprisingly, negative growth of agricultural output was also observed in the central part of Deccan including interior Tamil Nadu and Karnataka. No doubt, Cotton is a commercial crop of the Daccan trap including the production of Mango, Grapes, Oranges, Citrus fruits grown in new pattern. The major share of Foreign Direct Investment (FDI) was made in the metropolitan areas of this region. The industries related to food processing chain are located in the urban centres like Mumbai, Chennai, Hyderabad and Bangaluru with their fast urbanization. Either non-inclusion of these crops in the calculation of agricultural growth or the fast urbanization with increasing urban infrastructure and industries, Multi-National Corporations, trade of agricultural and non-agricultural commodities, flow of rural capital and migration of labour to urban centres may be the main causes of negative agricultural growth. This area had been experienced low agricultural growth from very beginning of agricultural development phase as Tamil Nadu state was not meets the growth target prior to the implementation of new economic policies in the country (Agrawal and Gisselquist 1999).

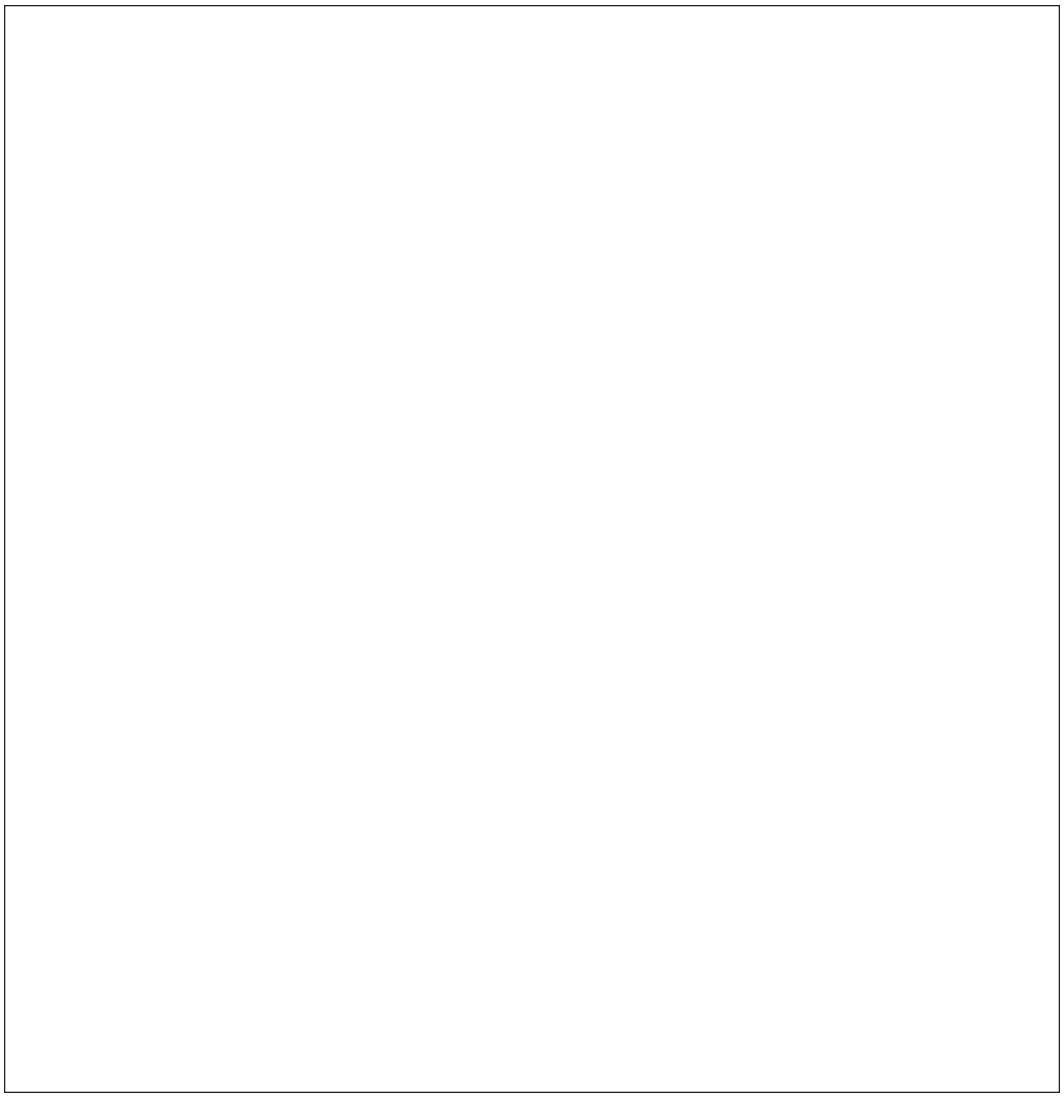

**Fig. 1: Agricultural output growth (2000-01 to 2006-07)**

On the whole, it has realized that there has been a significant alteration in crop-combination due to either to the economic liberalisation in trade policies or to the increasing demand of agricultural products in the domestic market since consumption pattern changed fast especially in the urban areas of the country. Shrinking proportional share of area and output of food grain crops and increasing fast the output share of commercial crops as agricultural growth proceeds is the evidence of crop-diversification and increasing importance of commercial crops in cropping pattern (Table-4).

TABLE 4—PROPORTIONATE SHARE OF AREA AND OUTPUT OF FOOD GRAINS AND COMMERCIAL CROPS (2006-07) BY AGRICULTURAL GROWTH CATEGORIES

| Annual Growth Rate | | No of Districts | Foodgrains | | | | Commercial | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Area | | Output | | Area | | Output | |
| | % | | ha (000) | % | Rs (in million) | % | ha (000) | % | Rs (in million) | % |
| Very High | >10 | 50 | 14951 | 72.30 | 7,974 | 30.79 | 5727 | 27.70 | 17,924 | 69.21 |
| | 10 - 8 | 53 | 16783 | 74.83 | 12,630 | 41.58 | 5645 | 25.17 | 17,743 | 58.42 |

TABLE 4—PROPORTIONATE SHARE OF AREA AND OUTPUT OF FOOD GRAINS AND COMMERCIAL CROPS (2006-07) BY AGRICULTURAL GROWTH CATEGORIES—*Contd.*

| Annual Growth Rate | % | No. of Districts | Foodgains Area ha (000) | Foodgains Area % | Foodgains Output Rs (in mil1ion) | Foodgains Output % | Commercial Area ha (000) | Commercial Area % | Commercial Output Rs (in mil1ion) | Commercial Output % |
|---|---|---|---|---|---|---|---|---|---|---|
| High | 8-6 | 42 | 10266 | 74.52 | 14,234 | 42.23 | 3511 | 25.48 | 19,473 | 57.77 |
| | 6-4 | 67 | 22483 | 77.07 | 36,148 | 46.48 | 6691 | 22.93 | 41,623 | 53.52 |
| Low | 4-2 | 64 | 21013 | 77.78 | 33,276 | 24.58 | 6004 | 22.22 | 1,02,103 | 75.42 |
| | 2-0 | 53 | 17856 | 79.99 | 33,434 | 35.02 | 4466 | 20.01 | 62,041 | 64.98 |
| Negative | -(0-2) | 20 | 5930 | 79.09 | 16,368 | 50.42 | 1567 | 20.91 | 16,097 | 49.58 |
| | -(2 >) | 37 | 15038 | 79.78 | 18,302 | 53.49 | 3812 | 20.22 | 15,913 | 46.51 |

The areas of high to very high growth that had Jowar-Bajara dominating pattern prior to 2000s diversified significantly their cropping pattern. For example, Oil seeds and Mustard are major crops rather than Millets in the high growth areas of Rajasthan and Malwa plateau. Green vegetables, Ginger, Aricanut, local fruits were commonly contributing to agricultural products in hill areas of North-Eastern region after liberalisation. The result of a survey on cropping pattern in Tinsukia district (located in the upper part of Brahmaputra Valley) conducted in 2010 for study of commercialization and farm income concluded that market-oriented economy is growing fast in this under-developed region of slow urbanization. As a result, commercial crops gain much importance in cropping pattern (Singh and Talukdar, 2012).

There have been three main reasons behind diversification of cropping pattern and changes in crop-combination.

(a) The commercial crops have much higher relative prices and shorter duration of crop-growth. Green vegetables, Sunflower, Soyabean, Garlic, Ginger take 60-90 days to grow and harvest, while cereals like Rice, Wheat and Millets take180-200 days (more than two times duration) with their low relative prices (Table-5).

(b) Horticulture and fruit crops grown in hill areas are less labour intensive and suite to these areas of low population density as less availability of agricultural labour to work at farm. The growth of new market towns with expansion of road network has provided common infrastructure to change cropping pattern from 'Jhoom' to 'broom' cultivation as broom is commercial high value bush-crop of hill areas of the North Eastern region.

(c) The emergence of strong spatial organization of agricultural commodities with their trading at national and global market. It provides competitive advantage of crop-products grown at farm and locational advantage of new emerging market centres.

TABLE 5—RELATIVE PRICES AND CROP-CALENDAR OF VARIOUS CROPS IN INDIA

| Crops (Seasons) | Price2000-01 Rs/Qu | Price2000-01 Relative Price | Price 2006-07 Rs | Price 2006-07 Relative Price | Increase in Prices Rs/Qu | Crop Calendar Duration | Crop Calendar Length (Months) |
|---|---|---|---|---|---|---|---|
| **Foodgrains (Cereals)** | | | | | | | |
| Rice (kharif)** | 612 | 100.00 | 825 | 100.00 | 212.88 | June-Nov | 6 |
| Wheat (Rabi) | 621 | 101.396 | 814 | 98.609 | 192.85 | Oct-April | 7 |
| Jowar (Kharif) | 376 | 61.436 | 368 | 44.569 | -8.4 | May-Sept | 5 |
| Baira (Kharif) | 368 | 60.125 | 492 | 59.566 | 123.37 | May-Sept | 5 |
| Maize (Kharif) | 446 | 72.911 | 614 | 74.347 | 167.06 | May-Aug | 4 |

TABLE 5—RELATIVE PRICES AND CROP-CALENDAR OF VARIOUS CROPS IN INDIA—*Contd.*

| Crops (Seasons) | Price 2000-01 | | Price 2006-07 | | Increase in Prices | Crop Calendar | |
|---|---|---|---|---|---|---|---|
| | Rs/Qu | Relative Price | Rs | Relative Price | Rs/Qu | Duration | Length (Months) |
| Ragi | 251 | 40.998 | 308 | 37.349 | 57.17 | July- October | 4 |
| Barley (Rabi) | 302 | 49.29 | 295 | 35.762 | -6.71 | Oct-April | 7 |
| **Pulses** | | | | | | | |
| Gram (Rabi) | 1489 | 243.245 | 1544 | 187.102 | 54.5 | Oct-April | 7 |
| Arhar (Kharif) | 1441 | 235.296 | 1408 | 170.567 | -33.27 | Aug-May | 10 |
| Urad (Kharif) | 2387 | 389.735 | 1074 | 130.126 | -13l2.7 | July-Oct | 4 |
| Moong (Kharif) | 2042 | 333.507 | 1I00 | 133.315 | -942.06 | July-Nov | 5 |
| Masoor (Rabi) | 1314 | 214.54 | 3742 | 453.44 | 2428.16 | Oct-April | 7 |
| Horse Gram (Kharif) | 1539 | 251.315 | 1517 | 183.836 | -21.86 | Aug-Dec | 5 |
| Other Kharif Pulse | 1453 | 237.365 | 2455 | 297.47 | 1001.29 | July-Oct | 4 |
| Other Rabi Pulse | 1263 | 206.265 | 2300 | 278.714 | 1036.95 | Oct-April | 7 |
| Groundnut (Rabi) | 1238 | 202.247 | 1493 | 180.876 | 254.18 | Mar-April | 5 |
| Sesamum (Kharif) | 1744 | 284.86 | 1259 | 152.555 | -485.41 | Sept-Dee | 5 |
| **Vegetables** | | | | | | | |
| Potato (Rabi) | 308 | 50.353 | 465 | 56.354 | 156.71 | Nov-Feb | 4 |
| Tapioca | 46 | 7.53 | 529 | 64.066 | 482.57 | | |
| Onion | 200 | 32.661 | 533 | 64.61 | 333.17 | | |
| Sweet Potato (Kharif) | 380 | 62.116 | 577 | 69.921 | 196.64 | Aug Nov | 4 |
| Peas & Beans | 1409 | 230.136 | 1670 | 202.37 | 260.78 | | |
| **Other Commercial Crops** | | | | | | | |
| Repseed & Mustard (Rabi) | 1062 | 173.479 | 1544 | 187.095 | 481.65 | Nov-Feb | 4 |
| Linseed | 1082 | 176.748 | 886 | 107.325 | -196.64 | | |
| Castor Seed | 759 | 123.883 | 582 | 70.559 | -176.32 | | |
| Safflower (Kharif) | 4965 | 810.848 | 5983 | 725.05 | 1018.08 | Aug-Oct | 3 |
| Sunfllower (Kharif) | 562 | 91.818 | 630 | 76.323 | 67.59 | Aug-Oct | 3 |
| Cotton (Lint) (Kharif) | 1530 | 249.864 | 915 | 110.836 | -615.39 | July-Nov | 5 |
| Mesta | 261 | 42.643 | 261 | 31.639 | -0.03 | | |
| Chilly (Kharif) | 2302 | 375.965 | 2096 | 253.976 | -206.35 | Aug-Oct | 3 |
| Turmeric | 1211 | 197.822 | 1226 | 148.529 | 14.34 | | |
| Aracanut (Kharif) | 841 | 137.337 | 11535 | 1397.796 | 10693.91 | | |
| Coriander | 2814 | 459.538 | 3845 | 465.932 | 1031.0 1 | | |
| Sugar Cane(Gurh) (Rabi) | 1871 | 305.53 | 2864 | 347.1I5 | 993.57 | Dec-Oct | 10 |

TABLE 5—RELATIVE PRICES AND CROP-CALENDAR OF VARIOUS CROPS IN INDIA—*Contd.*

| Crops (Seasons) | Price 2000-01 | | Price 2006-07 | | Increase in Prices | Crop Calendar | |
|---|---|---|---|---|---|---|---|
| | Rs/Qu | Relative Price | Rs | Relative Price | Rs/Qu | Duration | Length (Months) |
| Banana (Kharif) | 903 | 147.525 | 2115 | 256.263 | 1211.37 | July-Nov | 4 |
| Tobacco | 1378 | 224.97 | 2233 | 270.654 | 855.91 | | |
| Niger Seed | 420 | 68.586 | 426 | 51.676 | 6.46 | | |
| Jute (Kharif) | 259 | 42.243 | 179 | 21.715 | -79.48 | Aug-Dec | 5 |
| Dry Ginger (Kharif) | 708 | 115.688 | 3000 | 363.54 | 2291.59 | Sept-Nov | 3 |
| Garlic (Kharif) | 9587 | 1565.552 | 12765 | 1546.844 | 3178.29 | Sept-Nov | 3 |
| Soyabin (Kharif) | 3391 | 553.741 | 4461 | 540.54 | 1069.85 | July-Oct | 4 |
| Sanhamp (Kharif) | 482 | 78.669 | 565 | 68.472 | 83.32 | July-Oct | 4 |
| Moth (Kharif) | 1582 | 258.316 | 1817 | 220.128 | 234.75 | | |
| Black Pepper | 23450 | 3829.484 | 31721 | 3843.938 | 8271.32 | | |
| Cardamom | 112558 | 18381.524 | 176279 | 21361.473 | 63720.93 | | |

NB: Rice price is considered equal to 100 for calculation of Relative prices of other crops. ** Rice is also grown in Rabi season (November-May) in many parts of the country especially in coastal areas. It is called 'boro-rice" in the lower parts of Brahamaputra Valley.

**Regional Analysis:**

The spatial analysis shows that most heterogeneous regions in terms of physiography, such as Gujarat (humid), the central plateau of the Jharkhand- Chhattisgarh- interior Orissa (humid), and the Thar (most arid) have undergone a rapid growth of agricultural output with the emergence of greater uniformity in growth pattern (CV=50.47%, 54.30% and 71.18% respectively) and growth distribution. North Eastern hill and mountain region (lIa) of most humid agro climatic conditions were also included in this category of high growth. Contrary to it, the most physiographicaIly similar regions of Ganga Valley including Punjab-Haryana plains have a lower average annual growth of output with moderate to high degree of its intra-regional variability (Table-6). In fact, the regions of high output growth with its uniform pattern are the evidence of the alteration of crop pattern and agricultural production processes due to newly growing market centres that regulates the type, scale and production of crops that are consumed locally or regionaIly within the regions.

There are numerous studies on visualising the effects of seed- fertiliser- irrigation technolog'y on diversification of agricultural activities and increasing disparities in agricultural development pattern (Bhalla and Tyagi 1989, Singh 1994). A recent analysis conducted by Arora and Singh (2012) to show the impact of economic reforms on the regional structure of industrial development in India using regression and factor analysis for state wise data of the country at two points of time: pre and post reform periods, concludes that increasing regional disparities may be reduced providing basic public service facilities in more equitable distribution of power, road network, education and health facilities in the areas of poor infrastructure that increases regional diversity. In the same context, the policy interventions on low growth areas that have weak infrastructure are to be taken care.

Access to road infrastructure often has a strong bearing on spatial organisation of agricultural activities (Visser 1999). Such infrastructure increases crop diversification, changes cropping pattern, reduces costs of cultivation and transportation and increases production prices at farm gate due to timely marketing of high value agricultural products (NBARD 2004). In the moderate growth areas of Upper Gangetic plains, the share of surfaced roads grew faster during the economic liberalisation. It increased from 81.5 to 85.7 percent in Punjab and 90.9 to 93.2 percent in Haryana. It boosted the total production of agriculture in these areas with marginal growth. Having been the fast increase of growth centres along the road side, the agricultural areas became accessible to road and have shown much more progress than the interior areas of stagnant growth. Increasing road network increased the growth centres for collection and processing the agricultural surplus.

Consequently, the degree of intra-regional growth variability increased in its spatial context. Relevant in this context is Minten's et al. (2009) study of the relationship between access to rural road infrastructure and rural agricultural prices established using survey in the Uttrakhand agriculture region of high growth located in the Middle Himalayas.

The study concludes that rural road infrastructure reduces the regional agricultural prices variability and increases farmers' income elasticity. Farm size is an important determinant to diversify the cropping pattern and to generate surplus production (Singh and Daimari 2005). Farmers who have larger size of land holdings in the higher agricultural growth areas of Rajasthan and Jharkhand-Chhattisgarh regions tend to have high income elasticity. They also are more likely to generate production surplus and spend the saving on farm assets. Medium size tractor of 20 HP has been used as multipurpose tool for tillage, irrigation and transportation of production surplus to market centres. It increased surplus of high value crops and reduced the transport costs of agricultural products as well as of inputs supplied by the market centres (Binswanger 1978).

Furthermore, it is revealed from the Table-6 that the regional diversity in agricultural growth process evolves generally in the low or negative growth regions of the West and South plateaux including West Coast region (regions IX, X, and XII where average annual growth of 3.58%, 1.94% and - 0.12% with high coefficient of spatial variability as CV=242.76%, 336.80% and 5294.59% respectively) where up gradation of factors of production, efficient use of technology through use of investment in agricultural products, improved quality of seeds, relatively price-sensitive market for food demand, increasing capital requirement for strengthening the food supply-chain, growing metropolitan economies are prevalent (Sivakumar et at. 1999). Due to fast growth of 'agglomeration' and 'corridor' economies at regional level, the agricultural growth processes remain stabilized changing cropping pattern associated with process-dominated segment of food supply chain rather than its product- dominated segment.

Readon and Minten (2011) reported that the fast growing modem food retail shopping and food service industries in India as restaurants, fast food, cafes/bars and food stalls grew 49 percent and food processing industries grew 9.0 percent annually during the post liberalisation period (2000-01 to 2006-7). This could be attributed to rapid urbanisation and lifestyle change, substantial increase in income in certain demographic segment, greater ownership of vehicles and household appliances especially in urban areas of the country. Such factors have changed the consumption pattern that in turn led to increased food processing and consumption of take-away food from restaurants. In the process of the development offood supply chain, the emerging and most potential factor is the processing of agricultural products (related to rural producers) to modern food retail services (urban consumers). The producer segment of food supply chain seems much weaker in these areas of metropolitan economies in India. We argue that cold storage and efficient logistics in rural areas could potentially enable stabilising the agricultural prices, reducing regional variability of prices and food wastage (Viswanadham 2010). A big retail revolution, a strong producer- consumer ties and effective rural- urban linkages may be established through better collaboration among suppliers (producer, processor, distributor and retailer) in the food supply chain. It would also increase agricultural productivity and benefit farming community (Van-der-Vorst 2006). The current food supply chain is currently is not robust enough to permit growth in areas of lower agricultural productivity.

TABLE 6—STATISTICAL ANALYSIS OF AVERAGE ANNUAL AGRICULTURAL GROWTH (%)

**Annual Output Growth (2000-01 to 2006-07)**

| Agro-Climatic Regions | | No of Dist | Mean | Median | Maxi-mum | Mini-mum | SD | CV% | $Q_1$ | Q3 | Skewness |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I | Western Himalaya | 34 | 5.66 | 6.87 | 14.92 | -14.29 | 5.3744 | 94.89 | 4.13 | 8.77 | -1.7472 |
| IIa | North East- Assam Plains | 11 | 2.38 | 2.66 | 14.39 | -6.68 | 5.8184 | 244.87 | -1.18 | 4.65 | 0.4817 |
| IIb | North East- Hills and Mts | 30 | 5.75 | 7.84 | 15.32 | -10.88 | 5.5039 | 95.76 | 1.30 | 9.28 | -0.8216 |
| III | Lower Ganga Plains | 12 | 3.71 | 3.88 | 6.65 | 0.07 | 2.0487 | 55.16 | 2.22 | 5.47 | -0.2434 |
| IV | Middle Ganga Plains | 30 | 3.28 | 4.59 | 11.38 | -13.84 | 5.7870 | 176.56 | 1.09 | 6.97 | -1.2436 |

TABLE 6—STATISTICAL ANALYSIS OF AVERAGE ANNUAL AGRICULTURAL GROWTH (%)—*Contd.*

**Annual Output Growth (2000-01 to 2006-07)**

| Agro-Climatic Regions | | No. of Dist. | Mean | Mediun | Maxi-mum | Mini-mum | SD | CV% | $Q_1$ | Q3 | Skewness |
|---|---|---|---|---|---|---|---|---|---|---|---|
| V | Upper Ganga plains | 39 | 3.25 | 2.55 | 11.42 | -1.64 | 3.0863 | 94.92 | 1.50 | 4.78 | 1.1574 |
| VI | Punjab plains | 25 | 4.41 | 3.59 | 14.44 | 0.17 | 4.0976 | 92.99 | 1.25 | 5.51 | 1.4798 |
| VII | Eastern Plateau | 25 | 5.91 | 6.81 | 14.77 | -13. 95 | 6.4869 | 109.77 | 2.19 | '10.06 | -1.1718 |
| VIII | Central Plateau | 48 | 6.66 | 6.36 | 15.69 | -4.05 | 3.6158 | 54.30 | 4.77 | 8.90 | 0.0104 |
| IX | Western Plateau | 33 | 3.58 | 5.02 | 14.71 | -11.77 | 8.6845 | 242.76 | -4.60 | 10.13 | -0.5203 |
| X | Southern Plateau | 39 | 1.94 | 2.66 | 14.80 | -12.42 | 6.5396 | 336.80 | -2.48 | 6.43 | -0.1164 |
| XI | East Coast | 20 | 3.31 | 3.99 | 14.69 | -6.45 | 4.9190 | 148.49 | 0.39 | 6.23 | 0.1372 |
| XII | West Coast | 17 | -0.12 | 0.50 | 7.24 | -14.65 | 6.2254 | 5294.59 | -0.17 | 4.06 | -1.3124 |
| XIII | The Gujarat | 20 | 7.36 | 9.00 | 13.48 | 0.96 | 3.7165 | 50.47 | 3.66 | 9.67 | -0.2445 |
| XIV | The Thar | 4 | 7.44 | 8.34 | 12.90 | 0.18 | 5.2956 | 71.18 | 6.30 | 9.49 | -0.9831 |
| XV | The Islands | - | - | - | - | - | - | - | - | - | - |

**Abbrevaitions:** SD = Standard Deviation, CV= Coefficient of Spatial variation as 100. (SD/Mean).

The fast growing regions, where agricultural growth is dependent on 'Iocational advantage' have experienced rapid changes in the spatial organisation of agricultural activities. Access to knowledge and skills, capabilities and incentives to develop business network to increase agricultural production and food processing might have increased trade of agricultural commodities through economies of scale and output growth that in turn led to productivity growth (Mahadevan 2003). However, there are stringent inter-state restrictions on the trade flow of agricultural products and commodities that further accentuates inter-regional differences in the agricultural growth and help achieving the economies of scale rising from a competitive advantage. Nonetheless, further research is required to investigate other research questions that establish the effect of agricultural growth potential on economic growth and on the process of regional convergence/divergence to attain the optimality of a balanced economic growth across India (Singh 2007). This could form the basis of further research through which such questions can be explored.

**Conclusion:**

This paper has investigated the effect of new economic liberalisation policies implemented during the 1990s on the regional processes and agricultural growth patterns in India. Of course, the differences in the average annual growth of agricultural output between the Green and Post-Green revolution has been the result of implementing new economic policies to liberalise trade in India. High growth of agricultural output has been recorded in areas where a change in cropping pattern occurred through commercialisation of crops. These crops require a shorter period to grow and produce greater return for farmers. Fruits, Spices and Oilseed are gaining importance in the hill areas of Siwalik Himalayas, North-East regions and central plateau of Madhya Pradesh-Chattisgarh regions of high growth. More specific findings that are drawn from the present analysis are summarised below :

(i) Agricultural growth processes are greatly dependent on crop diversification and the inclusion of high value crops in farming system irrespective of the terrain conditions of land. Interestingly, the Hill regions of the country have exhibited greater higher rate of growth than the counterpart more fertile plains.

(ii) More heterogeneous regions, in terms of physiography, have recorded a relatively higher growth of agricultural outputs. However, these regions have experienced greater uniformity in growth processes within the region, which can perhaps be linked with the emergence and strengthening of local market centres to distribute agricultural surplus.

(iii) The proximity to metropolitan economies tends to create greater diversification the agricultural

growth pattern and even alter cropping pattern, so that the production of required crops. fulfilling local food-demand, becomes less important. It could be because processing-segment seems to exert greater impact on food supply chains than production-driven-segment, which in turn restricts agricultural growth. It has occurred even in the most fertile tracts of the Punjab plains that has been the home of green-revolution in the country.

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# Economics of Production and marketing of Rabi Sorghum in Western Maharashtra

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## INTRODUCTION

Sorghum is commonly known as great millet due to its size of grain amongst the millets. It is the fourth most important cereal following wheat, rice and maize in the world as far as area under sorghum and its production is concerned. Sorghum is an important crop providing food, feed and fodder in the arid and semi arid tropics of the world. It is a staple food for the rural poor in the country and African countries. Sorghum is often referred to as "coarse grain". Though it is a traditional subsistence crop but now changes its role to commercial or semi-commercial crop. It has also been used in the production of alcohol. The whole plant is used for forage, hay or silage. The sweet stalked sorghum is emerging as a potential raw material to the industries producing ethanol, jaggery and paper making. It is grown as kharif, rabi and also as summer sorghum.

The production of sorghum in India has decreased by 25.48 per cent over a period of time from 1960-61 to 2009-10. Maharashtra ranks first in the sorghum production. In case of productivity, it shows an increasing trend over a period of time from 1960-61 to 2009-10. India's sorghum productivity has increased by 78.61 per cent as compared to productivity in the year 1960-61. The major reasons for productivity improvement were use of high yielding varieties and increased utilization of input for sorghum cultivation. In India, Andhra Pradesh, ranks first while Maharashtra ranks third in the productivity of sorghum.

The area, production and productivity of *rabi* sorghum in Maharashtra was 31,120 thousand hectares, 24,138 thousand tons and 776 kg/ha, respectively in the year 2009-10. The area under *rabi* sorghum in Maharashtra has shown decreasing trend. As compared to area under *rabi* sorghum in the year 1960-1961 it showed -13. 20 per cent decline in area in 2009-10. In India, 55 per cent of the grain produce concurrently is used for food purposes and about 14 per cent for livestock feed. 18 per cent for poultry feed, 12 per cent for starch and 1 per cent for seed. By the end of this century, the expected demand will be around 46 per cent for food, 14 per cent for livestock feed, 19 per cent for poultry feed, 19 per cent for starch industry and 15 per cent for seed.

In Solapur district the area under *rabi* sorghum in the year 2009-10 was 6.576 lakh hectares with the production of 4.01 lakh tones and having productivity of 609 kg/ha. In Satara district, the area under rabi sorghum in the year 2009-10 was 1.344 lakh hectares with the production of 1.205 lakh tones and productivity of 897 kglha. Out of total *rabi* sorghum area in Western Maharashtra, the contribution of Satara district was 6.59 per cent in the year 2009-10 and it contributed 8.3 per cent in the total production of western Maharashtra. While Solapur district has contributed 32.24 per cent in area and 27.62 per cent in the total production of Western Maharashtra.

The present investigation was attempted to study the resource use structure, resource use productivities, cost of cultivation, marketing of *rabi* sorghum and constraints in production and marketing of *rabi* sorghum.

## METHODOLOGY

Solapur and Satara districts are important districts producing cereals. Rabi sorghum is an important crop grown in Solapur and Satara districts. Therefore, these two districts were purposively selected for the study. Three stage random sampling design with tahsil as first unit, village as the second unit and the rabi sorghum cultivator as an ultimate unit of sampling was used for the selection of sample.

Khandala, Phaltan and Man tahsils from Satara district and Madha, Mangalvedha and Mohol tahsils from Solapur district were selected for study because these three tahsil of each district are having maximum area under rabi-sorghum as compared to other tahsils of these districts. The villages from each tahsil were selected randomly from the list of villages having substantial acreage under *rabi* sorghum.

Thus, in all 6 villages, one from each 6 tahsils were selected randomly. A list of *rabi*-sorghum cultivators with the operational holding was obtained from each village. A sample of 15 *rabi* sorghum cultivators were randomly selected from each village i.e. 5 each from small (below 2 ha), medium (2.01 to 4 ha) and large (above 4 ha) size groups of holdings. Thus, the total 90 *rabi* sorghum cultivators were selected for the study. Survey method of data collection was used

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for collection of primary data from the selected respondents for the year 2010-11.

In order to estimate the resource use efficiency in cultivation of *rabi* sorghum, the Cobb-Douglas type of production function was used.

$$Y = a.\ X_1^{b1}\ X_2^{b2}\ X_3^{b3}\ X_4^{b4}\ X_5^{b5}\ X_6^{b6}\ X_7^{b7}\ X_8^{b8}\ e^u$$

Where,

Y is dependent variable, X i$^s$ are explanatory/ independent variables, $b_1$, $b_2$, $b_3$, $b_4$ . . .$b_n$ are regression coefficients, 'a' is constant and eu is error term.

This function being non-linear was converted in to logarithmic form and written as,

Log Y = Log a + $b_1$ Log $X_1$ + $b_2$ Log $X_2$ + $b_3$ Log $X_3$ + $b_4$ Log $X_4$ +. . . .bn Log Xn+ u.

This is now linear function

Where,

Y = Yield of rabi sorghum (qtl.)

$X_1$ = Human labour (man days)

$X_2$ = Bullock labour (pair days)

$X_3$ = Manures (qtl.)

$X_4$ = Nitrogen (kg/ha)

$X_5$ = Phosphorous (Kg/ha)

$X_6$ = Potash (Kg/ha)

$X_7$ = Cost of irrigation (₹) / Number of irrigation

$X_8$ = Other working capital (₹/ha)

a = Constant/Intercept

bi's = Regression coefficient, or production elasticities

$e^u$ = Error term

**RESULTS AND DISCUSSION**

**1. Resource use structure**

The quantities of various inputs directly affect the cost of cultivation and therefore, the use of different inputs like human labour, bullock labour, seeds, manures, fertilizers etc. in quantitative and monetary terms have been studied in detail. The information on utilization of different resources for *rabi* sorghum is presented in the Table 1.

TABLE 1—PER HECTARE RESOURCE USE LEVEL OF RABI SORGHUM

| Sr. No. | Particulars | Small | Medium | Large | Overall |
|---|---|---|---|---|---|
| 1. | Total Human labour (Days) | 61.88 | 53.90 | 62.01 | 59.25 |
| | a. Male | 26.80 | 23.10 | 26.71 | 25.50 |
| | b. Female | 35.08 | 30.80 | 35.30 | 33.75 |
| 2. | Bullock power ( pair days) | 7.00 | 6.13 | 8.16 | 7.31 |
| 3. | Machine power in hrs. | 8.69 | 7.29 | 8.16 | 7.94 |
| 4. | Seed ( Kgs) | 13.09 | 13.80 | 13.10 | 13.34 |
| 5. | Manures (Qtls.) | 7.00 | 6.19 | 4.20 | 5.27 |
| 6. | Fertilizers ( Kgs) | | | | |
| | N | 17.12 | 19.26 | 20.15 | 19.42 |
| | P | 9.15 | 11.20 | 12.30 | 11.48 |
| | K | 5.60 | 6.40 | 6.90 | 6.55 |

It is seen from the Table 1 that, the total labour utilization per hectare was highest in large small size group followed by small medium and large size groups of rabi sorghum growers. The male human labour utilization were 26.80, 26.71 and 23.10 man days per hectare in case of small, medium and large size groups of rabi sorghum growers, respectively. While, at overall level, the male human labour utilization level was 25.50 man days per hectare.

The female human labour utilization in small, medium and large size groups of maize growers were 35.08,30.80 and 35.30 man days per hectare, respectively and at overall level, it was 33.75 man days per hectare.

The bullock labour utilization in case of small, medium and large size groups of rabi sorghum growers were 7.00, 6.13 and 8.16 pair days, respectively whereas, at overall level, it was 7.31 pair days. The per hectare use of nitrogen was 17.12,19.26 and 20.15 kg per hectare in small, medium and large size groups, respectively. At overall level the use of nitrogen was 19.42 kg per hectare.

At overall level, per hectare use of P and K was 11.48 and 6.55 kg per hectare respectively. Farmers have used the fertilizers doses as per the recommendations.

**2. Per hectare cost of cultivation of rabi sorghum**

The per hectare cost of cultivation of *rabi* sorghum on the sample farms during 2010-11 has been estimated and the same is represented in Table 2.

It can be seen from the table that at the overall level, per hectare cost of cultivation of *rabi* sorghum i.e. Cost 'C' was ₹ 22036.33. Amongst the different items of cost, rental value of land was the major item of cost which accounted ₹ 4278.54 (19.42 per cent) followed family human labour ₹ 3924.41 (17.81 per cent), bullock labour ₹ 3655.01 (16.59 per cent), hired human labour charges ₹ 3275.64 (14.87 per cent), machine power ₹ 873.46 (3.96 per cent), interest on working capital ₹ 646.52 (2.93 per cent) manures ₹ 526.77 (2.39 per cent), nitrogenous fertilizers ₹ 314.44 (1.43 per cent), and plant protection charges ₹ 57.76 (0.26 per cent). The total cost of cultivation of *rabi* sorghum, Cost A was ₹ 12058.17 (54.72 per cent) and cost B was ₹ 18111.92 (82.19 per cent).

Over the size groups, the total cost of cultivation for one hectare of rabi sorghum was ₹ 22,222.61, ₹ 20,485.57 and ₹ 22,992.61 for small, medium and large size group of holdings, respectively. It has been observed that the variation in use of different inputs was less on all types of sample farms which has resulted into small difference in cost of cultivation of *rabi* sorghum in all types of farms under study. It was higher for large size group of holding.

TABLE 2—ITEMWISE PER HECTARE COST OF CULTIVATION OF RABI SORGHUM

| Sr. No. | Cost items | Small | Per cent | Medium | Per cent | Large | Per cent | Overall | Per cent |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Total Human labour | | | | | | | | |
| | a. Male | 1260.00 | 5.67 | 945.00 | 4.61 | 1366.50 | 5.94 | 1208.96 | 5.49 |
| | b. Female | 2018.00 | 9.08 | 1820.00 | 8.88 | 2240.00 | 9.74 | 2066.68 | 9.38 |
| 2. | Bullock power ( pair days) | 3500.00 | 15.75 | 3065.00 | 14.96 | 4080.00 | 17.74 | 3655.01 | 16.59 |
| 3. | Machine power in hrs. | 955.90 | 4.30 | 801.90 | 3.91 | 897.60 | 0.00 | 873.46 | 3.96 |
| 4. | Seed ( Kgs) | 287.98 | 1.30 | 303.60 | 1.48 | 288.20 | 1.25 | 293.38 | 1.33 |
| 5. | Manures ( Qtls.) | 700.00 | 3.15 | 619.00 | 3.02 | 420.00 | 1.83 | 526.77 | 2.39 |
| 6. | Fertilizers ( Kgs) | | | | | | | | |
| | N | 277.17 | 1.25 | 311.82 | 1.52 | 326.23 | 1.42 | 314.44 | 1.43 |
| | P | 166.53 | 0.75 | 203.84 | 1.00 | 223.86 | 0.97 | 209.01 | 0.95 |
| | K | 54.88 | 0.25 | 62.72 | 0.31 | 67.62 | 0.29 | 64.17 | 0.29 |
| 7. | Irrigation Charges (₹) | 630.18 | 2.84 | 598.12 | 2.92 | 712.60 | 3.10 | 662.27 | 3.01 |
| 8. | Plant protection charges (₹) | 55.11 | 0.25 | 70.19 | 0.34 | 50.40 | 0.22 | 57.76 | 0.26 |
| 9. | Incidental charges (₹) | 312.50 | 1.41 | 299.80 | 1.46 | 390.14 | 1.70 | 348.65 | 1.58 |
| 10. | Repairs | 160.18 | 0.72 | 170.95 | 0.83 | 360.18 | 1.57 | 267.99 | 1.22 |
| 11. | Working capital | **10378.43** | **46.70** | **9271.94** | **45.26** | **11423.33** | **49.68** | **10548.54** | **47.87** |
| 12. | Int. on working capital | 622.71 | 2.80 | 650.43 | 3.18 | 650.43 | 2.83 | 646.52 | 2.93 |
| 13. | Depre.on farm imliments | 820.50 | 3.69 | 850.40 | 4.15 | 810.56 | 3.53 | 825.43 | 3.75 |

TABLE 2—ITEMWISE PER HECTARE COST OF CULTIVATION OF RABI SORGHUM—*Contd.*

| Sr. No. | Cost items | Small | Per cent | Medium | Per cent | Large | Per cent | Overall | Per cent |
|---|---|---|---|---|---|---|---|---|---|
| 14. | Land revenue and other taxes | 40.50 | 0.18 | 35.38 | 0.17 | 38.40 | 0.17 | 37.67 | 0.1 7 |
| 15. | Cost-A | **11862.14** | **53.38** | **10808.15** | **52.76** | **12922.72** | **56.20** | **12058.17** | **54.72** |
| 16. | Rental value of land | 4460.17 | 20.07 | 4247.12 | 20.73 | 4249.77 | 18.48 | 4278.54 | 19.42 |
| 17. | Int. on fixed capital | 1650.30 | 7.43 | 1650.30 | 8.06 | 1890.12 | 8.22 | 1775.21 | 8.06 |
| 18. | Cost-B | **17972.61** | **80.88** | **16705.57** | **81.55** | **19062.61** | **82.91** | **18111.92** | **82.19** |
| 19. | Family labour | | | | | | | | |
| | a. Male | 2760.00 | 12.42 | 2520.00 | 12.30 | 2640.00 | 11.48 | 2616.35 | 11.87 |
| | b. Female | 1490.00 | 6.70 | 1260.00 | 6.15 | 1290.00 | 5.61 | 1308.06 | 5.94 |
| 20. | Cost-C | **22222.61** | **100** | **20485.57** | **100** | **22992.61** | **100** | **22036.33** | **100** |
| 21. | Output | | | | | | | | |
| | a. Main produce (qtls.) | 17950.00 | | 17250.00 | | 17875.00 | | 17674.24 | |
| | b. Bye-produce ( qtls.) | 9054.00 | | 8445.00 | | 7854.00 | | 8223.04 | |
| 22. | Cost-C net bye produce | 13168.61 | | 12040.57 | | 15138.61 | | 13813.28 | |
| 23. | per quintal cost | **1834.07** | | **1745.01** | | **2117.29** | | **1951.47** | |

It is revealed from the table that the Cost 'A' for different size group of holdings was  11862.14,  10808.15 and  12,922 for small, medium and large size group of holdings, respectively. The Cost 'B' was  17972.61,  16705.57 and  19062.61 for the size groups, in order. The per cent shares of different items of costs in the total cost varied considerably between the size group of holdings.

**3. Profitability of Rabi Sorghum**

An attempt has been made to compare the per hectare gross income, different costs and the profit at different costs with net returns and the benefit cost ratio in *rabi* sorghum cultivation in different size groups of *rabi* sorghum growers. The details are given in Table 3.

TABLE 3—PER HECTARE COSTS, RETURN, GROSS INCOME AND B: C RATIO FOR RABI SORGHUM

| Sr. No. | Particulars | Size groups | | | | |
|---|---|---|---|---|---|---|
| | | Unit | Small | Medium | Large | Overall |
| 1. | Total cost | | | | | |
| | (i) Cost 'A' |  | 11862.14 | 10808.15 | 12922.72 | 12058.17 |
| | (ii) Cost 'B' |  | 17972.61 | 16705.57 | 19062.61 | 18111.92 |
| | (iii) Cost 'C' |  | 22222.61 | 20485.57 | 22992.61 | 22036.33 |
| 2. | Profit at | | | | | |
| | (i) Cost 'A' |  | 15141.86 | 14886.85 | 12806.28 | 13839.12 |
| | (ii) Cost 'B' |  | 9031.39 | 8989.43 | 6666.39 | 7785.36 |
| | (iii) Cost 'C' |  | 4781.39 | 5209.43 | 2736.39 | 3860.96 |

TABLE 3—PER HECTARE COSTS, RETURN, GROSS INCOME AND B: C RATIO FOR RABI SORGHUM—*Contd.*

| Sr. No. | Particulars | Unit | Size groups Small | Medium | Large | Overall |
|---|---|---|---|---|---|---|
| 3. | Production | Qtls | 7.18 | 6.90 | 7.15 | 7.07 |
| 4. | Gross income | ₹ | 27004.00 | 25695.00 | 25729.00 | 25897.29 |
| 5. | B:C ratio | | | | | |
| | (i) Cost 'A' | ₹ | 2.28 | 2.38 | 1.99 | 2.15 |
| | (ii) Cost 'B' | ₹ | 1.50 | 1.54 | 1.35 | 1.43 |
| | (iii) Cost 'C' | ₹ | 1.22 | 1.25 | 1.12 | 1.18 |

It is noted from the table that the per hectare gross income received was ₹ 27004.00, ₹ 25695.00 and ₹ 25729.00 for small, medium and large size group of holding, respectively. At the overall level, it was ₹ 25897 with per hectare production of 7.07 quintals. The per hectare profit at Cost 'A' was highest in case of small size group holding (₹ 15141.86) followed by medium size group (₹14886.85) and large size group of farms ₹12806.28). The benefit cost ratio at Cost C was highest in case of medium size group (1.25), followed by small size group (1.22) and large size group (1.12). At the overall level, benefit cost ratio was 1.18.

The benefit cost ratio at all the levels of cost and groups were observed more than unity, therefore the cultivation of rabi sorghum is viable economic. proposition in the area under study. The net profit from all the size groups was in the range .from 2700 to 5200 per hectare. The per hectare total cost, i.e. Cost 'C' was ₹ 22222.61, ₹ 20485.57 and ₹ 22036.33 in small, medium and large size groups, respectively. The profit at Cost 'C' was ₹ 4781.39, ₹ 5209.43 and ₹ 2736.39 in small, medium and large size groups, respectively.

From the above foregoing discussion, it is clear that the cultivation of rabi sorghum is profitable at every stage of production. It is seen that medium size group of rabi sorghum growers got more profit followed by small size group and large size group of *rabi* sorghum growers.

**4. Marketing channel**

In case of rabi sorghum following marketing channels were observed in the study area.

**Channel-I**→Producer→commission agent→ wholesaler →retailer →consumer

**Channel-II** →Producer →commission agent cum →wholesaler →retailer →consumers

Out of these two marketing channels, channel-I is most prominent marketing channel.

**5. Marketing cost**

Marketing cost is the cost required for performing different marketing functions. Cost of marketing affects the producer's net share in the consumer rupee. An attempt has been made here to work out the item wise per quintal cost of marketing for rabi sorghum. The per quintal cost incurred on the various items of marketing has been worked out and is presented in Table 4.

It can be seen from Table 4 that at the overall level, the average per quintal cost of marketing for rabi sorghum was worked out to ₹ 223.56 in channel-I .The items of marketing cost such as commission, transport and packing charges were the most important items which accounted for 59.35 per cent 29.39 per cent 5.88 per cent, respectively.

TABLE 4—MARKETING COST FOR RABI SORGHUM IN DIFFERENT MARKETS

(₹)

| Particulars | Channel-I Koregaon | Mohol | Overall | Channel-II Local |
|---|---|---|---|---|
| Packing charges | 12.50 | 13.80 | 13.15 | 6.62 |
| | (5.55) | (6.22) | (5.88) | (11.10) |
| Transport | 70.60 | 60.80 | 65.70 | 50.21 |
| | (31.36) | (27.39) | (29.39) | (84.21) |

TABLE 4—MARKETING COST FOR RABI SORGHUM IN DIFFERENT MARKETS—*Contd.*

(₹)

| Particulars | Channel-I | | | Channel-II |
|---|---|---|---|---|
| | Koregaon | Mohol | Overall | Local |
| Hamali | 7.18 | 7.26 | 7.22 | 2.80 |
| | (3.19) | (3.27) | (3.23) | (4.70) |
| Tolai | 4.70 | 4.90 | 4.80 | 0.00 |
| | (2.09) | (2.21) | (2.15) | (0.00) |
| Commission | 130.18 | 135.20 | 132.69 | 0.00 |
| | (57.82) | (60.91) | (59.35) | (0.00) |
| Total marketing cost | 225.16 (100) | 221.96 (l00) | 223.56 (100) | 59.63 (l00) |

(Figures in parentheses are percentages to the total marketing cost)

These items together contributed 94.62 per cent, of the total marketing cost. The remaining cost was 5.38 per cent contributed by items like hamali (3.23 per cent) and tolai charges (2.15 per cent).

While in channel-II ( local market) average per quintal cost of marketing for rabi sorghum was ₹ 9.63 out of that transport, packing and hamali charges were 84.21, 11.10 and 4.70 per cent, respectively.

**6. Price spread**

Price spread is the good indicator for determining the producers share in consumer rupee. Price spread refers to the difference between the price paid by the consumer and price received by the producer for an unit quantity of farm produce. Intermediaries which ultimately determines the overall efficiency of marketing system. The price spread in marketing of rabi sorghum is given in Table 5

The price spread is made up of various cost incurred and margins of intermediaries in the various marketing process such as assembling, transport, wholesaling, retailing etc. The price spread per quintal of rabi sorghum in the channel-I at the overall level i.e. per quintal price paid by the consumer was ₹ 2750. The per quintal net price received by the producer was ₹ 2226.44. Thus producers share in consumer rupee was 80.94 per cent. The expenses incurred by producer was ₹ 223.56 which accounted 8.13 per cent of total price paid by consumer.

TABLE 5—PRICE SPREAD IN MARKETING OF RABI SORGHUM

| Sr. No. | Particulars | Channel-I | | | Channel-II |
|---|---|---|---|---|---|
| | | Koregaon | Mohol | Overall | Local |
| | | ₹/qtl | ₹/qtl | | ₹/qtl |
| 1. | Gross price received by the producers | 2500 (89.06) | 2400 (89.07) | 2450 (89.06) | 1800 (96.79) |
| 2. | Market expenses incurred by the producers | 225.16 (8.02) | 221.96 (8.24) | 223.56 (8.13) | 59.63 (3.21 ) |
| 3. | Net price received by the producers | 2274.84 (81.04) | 2178.04 80.83 | 2226.44 (80.94) | 1740.37 (93.59) |
| 4. | Commission received by the wholesalers | 15.40 (0.55) | 12.1 (0.45) | 13.75 (0.50) | 0.00 (0.00) |
| 5. | Expenses incurred by the wholesalers | 10.12 (0.36) | 7.2 (0.27) | 8.66 (0.31) | 0.00 (0.00) |

TABLE 5—PRICE SPREAD IN MARKETING OF RABI SORGHUM—*Contd.*

| Sr. No. | Particulars | Channel-I | | | Channel-II |
|---|---|---|---|---|---|
| | | Koregaon | Mohol | Overall | Local |
| | | /qtl | /qtl | | /qtl |
| 6. | Margin of the wholesalers | 5.28 (0.19) | 4.90 (0.18) | 5.09 (0.19) | 0.00 (0.00) |
| 7. | Commission received by the retailers | 38.20 (1.36) | 35.18 ( 1.31) | 36.69 (1.33) | 0.00 (0.00) |
| 8. | Expenses incurred by the retailers | 18.23 (0.65) | 18.2 (0.68) | 18.22 (0.66) | 0.00 (0.00) |
| 9. | Margin of the retailers | 19.97 (0.71) | 16.98 (0.63) | 18.48 (0.67) | 0.00 (0.00) |
| 10. | Price paid by consumers in the market | 2807.11 (100) | 2694.64 (100) | 2750.88 (100) | 1859.63 (100) |

(Figures in parentheses are percentage to final price paid by the consumers)

The share of wholesaler and retailer in a consumer rupee was 0.19 and 0.67 per cent, respectively. Total share of wholesaler and retailer was 0.86 per cent. The expenses incurred by wholesaler and retailer were 0.31 and 0.66 per cent, respectively. Total expenses incurred by the producer, wholesaler and retailer were  250.44 which accounted 9.10 per cent of the price paid by the consumer.

While in channel-II, the per quintal price paid by the consumer was  1859.63. The per quintal net price received by the producer was  1740.37. Thus producers share in consumer rupee was  93.59 per cent. The expenses incurred by the producer was  59.63 which accounted 3.21 per cent of the total price paid by the consumer.

It is thus clear that in the process of marketing of a rabi sorghum producers are getting only 80.94 and 93.59 per cent of the consumer rupee in I and II channel. Though, channel-II getting more per quintal price than channel-II. The actual marketing process from channel-I is prominent.

**Problems faced by sample cultivators in production of rabi sorghum**

From the table 6 it is observed that high wage rates was major problem which was reported by 72.22 per cent of the farmers .The problems of high fertilizer cost was reported by 58.89 per cent farmers. Nearly 55.50 per cent farmers complained about the non availability of labour. The information on problems faced by rabi sorghum growers in production are presented in table 6.

TABLE 6—PROBLEMS FACED BY SAMPLE CULTIVATORS IN PRODUCTION OF RABI SORGHUM

(NO.)

| Sr. No. | Particulars | Size of group | | | |
|---|---|---|---|---|---|
| | | Small N=30 | Medium N=30 | Large N=30 | Overall |
| 1. | High wage rate | 24 (80.00) | 22 (73.33) | 19 (63.33) | 65 (72.22) |
| 2. | High fertilizer cost | 21 (70.00) | 17 (56.66) | 15 (50.00) | 53 (58.89) |
| 3. | Non availability of labour | 23 (76.67) | 21 (70.00) | 16 (53.33) | 50 (55.50) |
| 4. | Quality of produce | 20 (66.67) | 15 (50.00) | 13 (43.33) | 48 (53.33) |

TABLE 6—PROBLEMS FACED BY SAMPLE CULTIVATORS IN PRODUCTION OF RABI SORGHUM—*Contd.*

(NO.)

| Sr. No. | Particulars | Size of group | | | |
|---|---|---|---|---|---|
| | | Small N=30 | Medium N=30 | Large N=30 | Overall |
| 5. | Non availability of bank credit | 17 (56.66) | 14 (46.67) | 09 (30.00) | 46 (44.44) |
| 6. | Technical knowledge about rabi sorghum cultivation | 16 (53.33) | 11 (36.67) | 13 (43.33) | 40 (44.44) |
| 7. | Non availability of input in time | 18 (60.00) | 12 (40.00) | 07 (23.33) | 37 (41.11) |
| 8. | Difficulty in transportation | 15 (50.00) | 13 (43.33) | 08 (26.67) | 36 (40.00) |

( Figures in parentheses are percentages to the total marketing cost)

The 53.33 per cent farmers had complained regarding the quality of produce, 44.44 per cent farmers complained about the non availability of bank credit on time. Technical knowledge about rabi sorghum about cultivation was lacking in 44.44 per cent farmers. About 41.11 per cent of farmers faced problem of the non availability of input in a time while 40.00 per cent farmers had complained about difficulty in transportation of rabi sorghum.

**Conclusions**

The present investigation was intended to depict the picture of rabi sorghum growing enterprise in Solapur and Satara districts. The enterprise assumed an important place in economy of the tract under study. The foregoing discussion on various aspects of study led to draw the following conclusions. The per hectare human labour and bullock labour requirement for rabi sorghum cultivation increased with the increase in size of holdings. Female human labour requirement is more than the male human labour requirement. There was a low and imbalance use of all the inputs in all the size groups. The low and imbalanced use of inputs leads to the low productivity of rabi sorghum than that of recommended level. At the overall level, the gap between actual and recommended yield was 76.43 per cent. The gap was maximum in medium size group of holdings followed by large and small size group of holding. The major items of cost of cultivation in rabi sorghum were rental value of land, hired human labour charges, manures, bullock labour charges, family human labour, manures cost, machine power charges. The cost of cultivation decreased with increase size group of holdings. Benefit: cost ratio at the overall level, was greater than unity therefore, rabi sorghum is profitable enterprise.

As such, 43.64 per cent farmer used the channel-II and sold 47.09 per cent quantity through this channel. The proportion of the sale at village level is high due to which they receive less price to the fodder due to lack of competitive buyers. It is observed that the per quintal cost of marketing was  225.16 in Koregaon market. This cost appears to be moderate and high commission cost is the major contributor in marketing cost. Price spread in marketing of rabi sorghum was maximum in Channel-I. The functional analysis has indicated that 5 variables viz., human labour ($X_1$), manures ($X_3$), nitrogen ($X_4$), potash ($X_6$) and irrigation($X_7$) are significant to affect the productivity by the producer for rabi sorghum. The major problems faced by rabi sorghum growers in production and marketing of rabi sorghum were high wage rates, non-availability of labour, high fertilizer cost, price variation, lack of market intelligence low prices etc.

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# Performance of Major Oilseeds Production in Maharashtra

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Oilseeds are the second largest agricultural commodity in India after cereals occupying 13-14 per cent of gross cropped area and accounting for nearly 1.4 per cent of the GDP and 8 per cent of the value of all agricultural products. (Hegde, Agricultural Yearbook, 2010). Indian vegetable oil economy is the fourth largest in the world accounting for about 14.5 per cent of the world's oilseed area and 6.65 per cent of the production next to USA, China and Brazil.

India followed the policy of import substitution in the oilseeds and edible oil sector till 1994-95. This policy of doubling the output in order to stabilize the oilseeds production in the country, led to diversification into new crops such as soybean and sunflower in the place of rapeseed -mustard and groundnut. India became self-reliant in edible oils almost up to 98 per cent and oilseeds meal occupied major share in exports from India. Imports of oilseeds and edible oils were canalized through the State Trading Corporation (STC) while exports of oil cakes were restricted. Similarly, exports of oilseeds and oils were restricted (banned) whereas the exports of oil cakes were allowed. The imported oils were passed on to State Governments for sale through Public Distribution System (PDS) at administered prices. These prices included custom duty and service charges to STC, since 1989. A part of imported oil was also allotted to vanaspati industry at concessional rates. To ease the supply position and to support rapid Technological change in the oilseeds sector, certain development programmes were pursed. They were: (i) Oilseed Growers Cooperative Project, (ii) National Oilseed Development Project, (iii) Technology Mission on Oilseeds and Development Project and (iv) Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize.

In 1960s, India was an exporter of edible oilseeds and oils, while it depends upon imports to the extent of nearly 50 percent of its edible oil requirements as on date. Hence, a study to analyze the growth of oilseed crops in India during pre and post- TMO periods was felt necessary so as to suggest suitable strategies to increase the production of oilseeds in the country and simultaneously working out measures for taking advantage of trade openness in a dynamic setting without affecting the base objective of domestic food and nutritional security. With the above background and with broad objective of analyzing the growth rates of domestic oilseeds production, the present study was taken up with the specific objective to analyze the temporal growth in area, production and productivity of major oilseed crops in Maharashtra.

The oilseed scenario in the country has undergone a sea change in the last 25 years with the setting up of Technology Mission on oilseeds (TMO) in May, 1986. In a span of decade from 1985-86, oilseeds production more than doubled achieving self sufficiency. However, in the last few years oilseeds production has virtually declined. The growth rates in area, production and productivity of oilseeds which were much higher than other crops in 1980's were drastically reduced during the 1990's.

The present study was undertaken to analyze the past performance, present scenario and future prospects for oilseeds production in Maharashtra. The investigation was based on the districtwise time-series data on area, production, productivity of oilseeds and other competing crops and farm harvest prices and rainfall. The data were obtained for the period of 50 years beginning with 1960-61 to 2009-10.

**Methodology**

The data obtained from secondary sources were analyzed obtain estimates of annual compound growth rates of area, production and productivity of oilseeds viz; groundnut, sunflower, safflower and soyabean for the time periods viz; Period- I (1960-61 to 1985-86), Period- II (1986-87 to 2009-10) and Period- III (1960-61 to 2009-10, i.e. the entire period). The acreage response of these oilseeds for state as a whole was analysed for three different time periods by using linear multiple regression based on Nerlovian partial adjustment model. The short-run and long- run price elasticities of acreages were estimated. The gaps in availability and requirements of oilseeds in Maharashtra at different time periods were also worked out. The analysis was further extended to work out the supply estimates and the future projections for oilseeds.

The following functions and models were employed for the analysis of the data of groundnut and sunflower.

**(i) Compound growth rates**: The compound growth rates in area, production and productivity of different oilseeds were estimated by using the following type of exponential model.

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$$Y = a\, b^t$$

Where,

Y = Area/Production/Productivity
a = Constant

b = Trend value

t = Time period in years

**(ii) Acreage Response:** Nerlove developed two distributed lag models. The choice between different lag models depends upon whether postulated lags are formulations of technological, institutional setting or expectational behaviour of the sector concerned. In the distributed lag model; based on price expectations, he assumed that past experience influence formation of expected price which in turn influences the acreage allocation decision. The adjustment lag model in its simplest form can be explained as below,

$$At^* = b_o + b_1 p_{t-1} + U_t \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, long-run equilibrium acreage for a crop at is a function of its price during preceding year and

$$A_t - A_{t-1} = \beta (A_t^* - A_{t-1}): o < \beta \ldots\ldots\ldots\ldots (2)$$

Where, $\beta$ is the coefficient of adjustment which means that in each period actual acreages were adjusted in proportion to the difference between the equilibrium acreage desired in the long-run and observed acreage under the crop concerned in the previous years. Equation (2) may be written as,

$$A_t - A_{t-1} - \beta A_{t-1} = \beta A_{t^*} \text{ or}$$

$$A_t - (1- \beta)\, A_{\tau} - 1 = \beta A_{\tau^*} \ldots\ldots\ldots\ldots (3)$$

Multiplying equation (1) by $\beta$ we get

$$\beta A_{t^*} = \beta b_o + \beta b_1 P_{t-1} + \beta U_t \ldots\ldots\ldots\ldots (4)$$

Substituting values of $\beta$At from equation (3) in equation (4) we get,

$$A_t - (1-\beta) A_{t-1} = \beta b_o + \beta b_1 P_{t-1} + \beta Ut \text{ or}$$

$$A\,t = \beta b_o + \beta b_1 P_{t-1} + (1\,\beta) A_{t-1} + \beta Ut \text{ or } \ldots (5)$$

By using appropriate notations, the above equation can be written as,

$$A_t = a_o + a_1 p_{t-1} + a_2 A_{t-1} + V_t \ldots\ldots\ldots\ldots\ldots (6)$$

Where,

$$a_0 = \beta b_o$$

$$a_1 = \beta b_1$$

$$a_2 = (1-\beta)$$

$$V_t = \beta U_t$$

However, in real world situation, the acreage allocation of the crop is being influenced by a large number of variables. Therefore, efforts were made to develop different types of theoretical models for empirical tests envisaging lagged prices, area under competing crops, lagged yields and rainfall during pre-sowing period for different oilseed crops.

The competing crops were defined to be those crops which directly or indirectly affect the area allocation of selected crop or the crops for which farmers had a choice to use land in place of selected oilseed crops.

**Estimation of Nerlovian Adjustment Model**

The following modified version of Nerlovian adjustment model was used in its simplest form for the purpose of this study.

$$At = a + b_1 P_{t-1} + b_2 A_{t-1} + b_3 Y_{t-1} + b_4 R_t + b_5 A_{c1t} + b_6 A_{c2t} + b_7 A_{c3t} + b_8 P_{c1t}\text{-}) + b_9 P_{c2t-1} + b_{10} P_{c3t-1} + b_{11} Y_{clt-1} + b_{12} Y_{c2t-1} + b_{13} Y_{c3t-1} + Ut$$

Where, =

$A_t$ = Acreage of oilseed crop in '00' hectares during the .current year

$P_{t-1}$ = Price (Rs. / qtl.) of oilseed crop during the preceding year

$A_{t-1}$ = Acreage of oilseed crop in hectares during the preceding year

$Y_{t-1}$ = Productivity (Kg/ha) of oilseed crop during the preceding year

$R_t$ = Rainfall during pre-sowing period (mm)

$A_{clt}$ = Area under first competing crop during the current year

$A_{c2t}$ = Area under second competing crop during the current year

$A_{c3t}$ = Area under third competing crop during the current year

$P_{clt-l}$ = Price of first competing crop during the preceding year

$P_{c2t-l}$ = Price of second competing crop during the preceding year

$P_{c3t-l}$ = Price of third competing crop during the preceding year

$Y_{clt-l}$ = Productivity of first competing crop during the preceding year

$Y_{c2t-1}$ = Productivity of second competing crop during the preceding year

$Y_{c3t-l}$ = Productivity of third competing crop during the preceding year

$Y_{c3t-l}$ = Productivity of third competing crop during the preceding year

$U_t$ = Error term

a = Intercept term

$b_{i's}$ = Regression co-efficient

The rule applied to visualize the magnitude of multicollinearity was the correlation coefficient between a pair of independent variables. The multicollinearity was considered 'high' if it is greater than 0.80 (Heady and Dillon, 1961).

The short-run and long-run price elasticities of acreage for oilseeds were estimated from the estimated equations. The coefficient of adjustment i.e. $\beta$ was obtained by subtracting coefficient of lagged acreage from unity. In the linear function, long run price elasticity of acreage was obtained by multiplying the estimate of the slope of long-run supply function by the ratio of price to acreage at a particular point. Usually, this point is taken to be the average price and average acreage for the period of analysis. Sort-run price elasticity of acreage was obtained by multiplying long-run price elasticity by , $\beta$, the coefficient of adjustment. The levels of significance of short-run and long-run elasticities thus calculated for oilseeds were tested. Based on the formulation, both short-run and long-run elasticities can be calculated. The short-run elasticity was worked out by using the conventional model,

E (S.R.) = bl (Pt-l/ At) and

Long- run elasticity by-

E (L.R.) = (bl/I-b2) (Pt-l /At)

Since the coefficient of adjustment $\beta$ = (l-b2) is never greater than unity, it follows that, short-run elasticity can never be greater than long-run elasticity.

**Specification of retained variables in the final regression**

To examine the influence of different factors on acreage allocation decision of different oilseeds amongst those were selected previously, only the following variables were retained.

**(i) Current acreage (At)**

The dependent variable included in the analysis was the acreage under selected crop in “00” hectares during current year. The area consists of all types of strains, irrigated as well as unirrigated and also grown during agricultural year.

**(ii) Lagged acreage (At-1)**

The area under the crop in the current year was mainly affected by the area of selected crop in “00” hectares during preceding year when the conditions are not abnormally changed. This variable was included in the model as proxy for traditional cropping pattern is also expected to affect the decision of the area allocation.

**(iii) Lagged price of selected crop (Pt-1)**

The previous year’s price of the selected crop was also expected to influence farmer's acreage allocation decision. The lagged price per quintal in rupees from 1959 - 60 to 2008-09 was, therefore, tried separately as an independent variable in the analysis.

**(iv) Lagged per hectare productivity (Yt-1)**

The per hectare productivity of selected crop was measured in kilograms. The variable was included in the model since the acreage allocation during the current year is also likely to be affected by the productivity of the crop during the preceding year.

**(v) Pre-sowing rainfall (Rt)**

The amount of rainfall received during the pre-sowing months for the crop in "mm « was tried as a separate variable because the decision of area allocation depends on the rainfall which results into potential irrigation during the season.

**(vi) Acreage under competing crops (Act)**

The area under competing crops in ‘00’ hectares were also considered as independent variables in different models developed for the selected crops, because, there is inverse relationship between area under competing crops and selected oilseed crop.

**(vii) Lagged prices (Pct-1)**

The harvest price of competing crops of the preceding year was also expected to influence farmer's acreage allocation decision. Therefore, it was considered as independent variable.

**(viii) Lagged productivity (Y ct-l)**

The lagged productivity of competing crops was considered another independent variable in the estimation of acreage response model.

**Demand for and Supply of Oilseeds in Maharashtra**

The projections of demand for and supply of oilseeds for 2019 A.D. and 2029 A.D. were estimated on the basis of the past performance of production and consumption of oilseeds in the State.

**(a) Supply of Oilseeds in Maharashtra**

The supply of most of the agricultural commodities primarily depends on the acreage under these crops. The projection of supply of the oilseeds for 2019 A.D. and 2029 A.D. were then worked out on the basis of the results of

the acreage response model under constant productivity and variable productivity conditions. The future production projections of the oilseeds were made by making use of the projected hectareage and average productivity (983 kg/ ha) and assumed productivity growth rate of 2.07 per cent per annum (1960-61 to 2009-10).

**(b) Demand for Oilseeds in Maharashtra**

A demand projection is generally based on a set of assumptions regarding the factors that influence the demand including growth of population, changes in per capita income, relative prices, consumer's taste and preferences, etc. The two key factors viz., growth in population and per capita income were considered as varying ones while, other factors such as consumer's taste and preferences, prices and income elasticities for the oilseeds under study were assumed to remain constant during the entire period of projections for the purpose of projections. Urbanization is another factor influencing the demand for oilseeds and there are inherent differences in the demand for oilseeds in rural and urban areas. Hence, it was meaningful to estimate the demand for oilseeds for rural and urban areas separately.

The per capita income projections were made based upon the growth in the State income. During the Eighth and Tenth plan periods, the estimates of average annual growth rate in state income was 7.80 and 8.30 per cent, respectively (Economic Survey of Maharashtra, 2008). Therefore, the average growth rate in state income during two plans was estimated to 8.05 per cent. Thus it is assumed that the State income is likely to grow at the rate of 7.50 per cent or 8.00 per cent during the next two decades. Separate demand estimates for oilseeds for the rural and urban population were obtained by using the following formula.

$$Yr = CYu \quad \text{and}$$

$$Y\,u = \frac{Y}{(CPr + Pu)}$$

Where,

Yr = Per capita income of rural areas

Yu = Per capita income of urban areas

Pr = Population in the rural areas

Pu = Population in the urban areas

C = Ratio of per capita expenditure between the rural and the urban sectors in the base period

Y = Estimates of state income

The population of the State grew at Decennial growth rate of 25.73 per cent during 1981-91 and 22.73 per cent during 1991 - 2001. Two alternative population growth estimates were considered in the present study. The first alternative assumes that the rural population will decline by 0.04 per cent per annum during the next two decades and urban population increase at the rate of 0.04 per cent per annum which is considered as Situation 1. The second alternative assumes that the rural population will decline by 0.05 per cent per annum and population in urban areas will increase at the rate 0. 05 per cent per annum which is considered as Situation II.

The income elasticity of demand for oilseeds depends on the level of consumption in the base period, changes in consumption habit, tastes and relative price of Rs./month

a = Constant

b = Quantity elasticity of demand for oilseeds

The per capita demand for oilseeds in the rural and the urban sectors have been estimated by using the formula-

$$dt = \frac{do}{Yo}[Y_0 + b\,(Y\,t - Yo)]$$

Where,

dt = Per capita consumption demand for oilseeds in the year 't'

do = Per capita consumption demand for oilseeds in the base period

Yo = Per capita income in the base period

Yt = Per capita income in the projected tth year

b = Quantity elasticity of demand for oilseeds

The projected per capita demand for oilseeds for the rural and the urban sectors was multiplied by the corresponding projected population for the concerned period in order to estimate the total human consumption demand for oilseeds.

**Results and Discussion**

**I. Changes in cropping pattern in Maharashtra**

The changes in cropping pattern of Maharashtra at different points of time is presented in Table 4.11. The gross cropped area of Maharashtra was to the tune of 187.41 lakh hectares which has increased continuously during the periods under study, except 1970-73 being the year drought and has reached to the 229.85 lakh hectares during 2007-10. The dominance of cereal crops remained over the period but the share of cereals in gross cropped area declined from 55.42 per cent during 1960-63 to 37.60 per cent during 2007-10

TABLE 1—Decadal Change in Cropping Pattern of Maharashtra State

(Triennium average, Area in lakh ha.)

| Sr. No. | Crops | Periods | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1960-63 | 1970-73 | 1980-83 | 1990-93 | 2000-03 | 2007-10 |
| 1. | Paddy | 13.02 (6.95) | 13.40 (7.47) | 14.69 (7.49) | 15.80 (7.50) | 14.97 (6.70) | 14.95 (6.50) |
| 2. | Wheat | 8.97 (4.79) | 8.33 (4.64) | 10.06 (5.13) | 7.32 (3.48) | 8.63 (3.86) | 11.19 (4.87) |
| 3. | Jowar (K) | 24.85 (13.26) | 24.38 (13.59) | 30.01 (15.30) | 27.68 (13.14) | 17.87 (8.00) | 10.61 (4.62) |
| 4. | Jowar (R) | 36.32 (19.38) | 33.00 (18.40) | 35.07 (17.88) | 31.28 (14.85) | 32.09 (14.36) | 30.71 (13.36) |
| 5. | Bajra | 16.48 (8.79) | 15.93 (8.88) | 15.86 (8.09) | 19.23 (9.13) | 15.82 (7.08) | 10.61 (4.62) |
| 6. | Other Cereals | 4.23 (2.26) | 3.77 (2.10) | 4.15 (2.12) | 4.26 (2.02) | 6.16 (2.76) | 8.35 (3.63) |
| 7. | Total Cereals | 103.87 (55.42) | 98.81 (55.09) | 109.84 (56.02) | 105.57 (50.13) | 95.54 (42.75) | 86.42 (37.60) |
| 8. | Gram | 3.70 (1.97) | 3.25 (1.81) | 3.81 (1.94) | 5.33 (2.53) | 7.43 (3.32) | 12.63 (5.50) |
| 9. | Mung (Green ram) | 4.23 (2.26) | 4.45 (2.48) | 5.58 (2.85) | 7.81 (3.71 ) | 7.24 (3.24) | 5.05 (2.20) |
| 10. | Tur (Pigeon pea) | 5.36 (2.86) | 5.42 (3.02) | 6.43 (3.28) | 10.15 (4.82) | 10.58 (4.73) | 10.87 (4.73) |
| 11. | Udid (Black Gram) | 4.30 (2.29) | 4.58 (2.55) | 4.34 (2.21) | 4.38 (2.08) | 5.68 (2.54) | 4.14 (1.80) |
| 12. | Other Pulses | 4.75 (2.53) | 4.40 (2.45) | 4.97 (2.53) | 3.80 (1.80) | 3.49 (1.56) | 2.59 (1.13) |
| 13. | Total pulses | 22.34 (11.92) | 22.10 (12.32) | 25.13 (12.82) | 31.47 (14.94) | 34.42 (15.40) | 35.29 (15.36) |
| 14. | Total oilseeds | 13.09 (6.98) | 15.60 (8.70) | 16.57 (8.45) | 25.58 (12.15) | 24.70 (11.05) | 39.05 (16.99) |
| 15. | Sugarcane | 1.47 (0.78) | 2.01 (1.12) | 3.59 (1.83) | 5.54 (2.63) | 5.86 (2.62) | 8.72 (3.79) |
| 16. | Cotton | 25.87 (13.80) | 26.08 (14.54) | 25.81 (3.16) | 26.85 (12.75) | 29.94 (13.40) | 32.44 (14.11) |
| 17. | Total Fruits | 0.87 (0.46) | 1.11 (0.62) | 1.64 (0.84) | 3.04 (1.44) | 8.68 (3.89) | 14.70 (6.40) |
| 18. | Total Vegetables | 0.79 (0.42) | 1.05 (0.59) | 1.45 (0.74) | 2.51 (1.19) | 4.57 (2.04) | 4.51 (1.96) |
| 19. | Other crops | 19.11 (10.20) | 12.61 (7.03) | 12.06 (6.15) | 10.03 (4.76) | 19.77 (8.85) | 8.72 (3.79) |
| 20. | GCA | 187.41 (100.00) | 179.37 (100.00) | 196.09 (100.00) | 210.59 (100.00) | 223.48 (100.00) | 229.85 (100.00) |

(Figures in the parentheses are percentage to gross cropped area)

It was observed from the table that not only shares in the gross cropped area but also the absolute area under cereal crops reduced, except paddy during 2007-10 over the year 1960-63. Pulses occupied second position in the cropping pattern of state and increased share in gross cropped area was noted during the periods under study. During 1960-63, the area under pulses was 22.34 lakh hectares which increased to 35.29 lakh hectares during 2007-10. This area expansion was mainly contributed by increase in area under gram (3.70 to 12.63 lakh hectares), tur (pigeon pea) (5.36 to 10.87 lakh hectares) and mung (green gram) (4.23 to 5.05 lakh hectares).

Oil seeds in the state occupied 6.98 per cent of gross cropped area during 1960-63 increased to 12.15 per cent during 1990-93 and reached to 39.05 lakh hectares which is the result of effective implementation of Technology Mission on Oilseeds Programme (TMO) and introduction of soybean crop in the state during late eighties.

**II. Area, production and productivity of major crops**

The information on area, production and yield of major crops in Maharashtra for the year 2009-10 alongwith its rank at the national level is presented in the Table 2.

Maharashtra ranked first in the area and production of crops viz., tur, jowar, onion and second in cotton, total pulses, soybean, sugarcane and gram while ranked third in coarse cereals in the country. The state was at second position in area of bajra Very dismal picture was noticed in the case of productivities of all crops in the State during the year 2009-10 in the country. As regard oilseeds, the State ranked fourth in area and production and tenth in productivity at national level.

TABLE 2—AREA, PRODUCTION AND PRODUCTIVITY OF MAJOR CROPS IN MAHARASHTRA (2009-10)

| Sr. No. | Crop | Area (Million ha.) | Rank | Production (MT) | Rank | Productivity (Kg/Ha.) | Rank |
|---|---|---|---|---|---|---|---|
| 1. | Jowar | 4.13 | I | 3.64 | I | 881 | VI |
| 2. | Bajra | 1.03 | II | 0.77 | V | 748 | VII |
| 3. | Coarse cereals | 8.48 | III | 10.35 | III | 1222 | III |
| 4. | Tur (Pigeon pea) | 1.93 | I | 0.92 | I | 841 | V |
| 5. | Cotton | 3.39 | II | 5.11 | II | 250.74 | VIII |
| 6. | Onion | 0.20 | I | 3.14 | I | 15700 | VI |
| 7. | Foodgrains | 12.11 | IV | 12.59 | VII | 1039 | XV |
| 8. | Total Pulses | 3.38 | II | 2.37 | II | 702 | VII |
| 9. | Soybean | 3.02 | II | 2.20 | II | 728 | IV |
| 10. | Sugarcane | 0.76 | II | 64.16 | II | 84421 | III |
| 11. | Oilseeds (Nine) | 3.90 | IV | 2.91 | IV | 746 | X |
| 12. | Chick pea | 1.29 | II | 1.11 | II | 863 | VII |
| 13. | Sunflower | 0.14 | III | 0.08 | III | 567 | VI |
| 14. | Groundnut | 0.32 | V | 0.36 | V | 1125 | IV |
| 15. | Wheat | 1.08 | VII | 1.74 | VIII | 1611 | XIII |
| 16. | Rice | 1.47 | XI | 2.18 | XII | 1483 | XIII |

*Source*: Agriculture Statistics at a Glance, 2011, Directorate of Economics and Statistics, Government of India, New Delhi.

## III. Trends in area, production and productivity of different oilseeds in Maharashtra state

Since the main objective of the present study was to evaluate the supply response of oilseeds in Maharashtra in general, and those in different divisions in particular, it was necessary to examine whether changes had occurred in oilseed acreage in absolute terms during the different time periods selected for the study in various regions and for the entire state. Similarly, whether changes had occurred in productivity and production of oilseeds in different districts of each of the region were also examined. What so ever changes had occurred in area, production and productivity of oilseeds in different regions and what its rate of change was also evaluated. The results of the same presented below.

The change in triennial averages of area, production and productivity of different oilseeds during different time periods in Maharashtra are presented in Tables 3, 4 and 5, respectively.

The table 3 revealed that the area under kharif groundnut, safflower and sunflower declined by 75, 40 and 29 per cent, respectively in TE 2007-2010 over the base period. While the area under soybean, other oilseeds and total oilseeds increased during the same period. As the soybean crop was introduced after 1980's, the base period considered for the crop was 1986-89. Soybean contributes about 56 per cent of the area under oilseed crops in Maharashtra in 2007-2010 which recorded a maximum rise of 5561 per cent over the base period of 1986-89. It is revealed from the table 4, that the production of all oilseeds showed a rising trend during the entire period of study except *kharif* groundnut which declined by 52 per cent.

TABLE 3—Changes in Oilseeds Acreage of Maharashtra State

(Triennium average, '00' ha.)

| Sr. No. | Oil seed | Time Period | | |
|---|---|---|---|---|
| | | 1960 -1963 (Base year) | 1986 - 1989 | 2007 - 2010 |
| 1. | Kharif Groundnut | 11147.00 | 6242.33 (-44.00) | 2810.67 (-74.78) |
| 2. | Soybean | 0.00 | 515.01 | 29153.00 (5560.78) |
| 3. | Safflower | 3343.13 | 5894.67 (76.32) | 2015.67 (-39.71) |
| 4. | Sunflower | 0.00 | 3652.00 | 2603.07 (-28.72) |
| 5. | Other oilseeds | 3067.74 | 4683.99 (52.83) | 3288.22 (7.19) |
| | Total oilseeds | 17557.87 | 20988.00 (19.54) | 39869.96 (127.08) |

(Figures in the parentheses indicate per cent change over the base year)

TABLE 4—Changes in Oilseeds Production of Maharashtra State

('00' tonnes)

| Sr. No. | Oil seed | Time Period | | |
|---|---|---|---|---|
| | | 1960 - 1963 (Base year) | 1986 - 1989 | 2007 - 2010 |
| 1. | KharifGroundnut | 7949.58 | 5009.34 (-36.99) | 3793.83 (-52.28 |
| 2. | Soybean | 0.00 | 258.01 | 26710.83 (99.03) |
| 3. | Safflower | 709.82 | 3150.00 (343.77) | 1225.37 (72.63 |
| 4. | Sunflower | 0.00 | 1440.67 | 1580.67 (9.72) |
| 5. | Other oilseeds | 277.57 | 1488.65 (436.32) | 2920.71 (952.24) |
| | Total oilseeds | 8136.97 | 11346.67 (26.97) | 38230.58 (305.40) |

(Figures in the parentheses indicate per cent change over the base year)

TABLE 5—CHANGES IN OILSEEDS PRODUCTIVITY OF MAHARASHTRA STATE

(Triennium average, kg/ha)

| Sr. No. | Oil seed | Time Period | | |
|---|---|---|---|---|
| | | 1960 -1963 (Base year) | 1986 - 1989 | 2007 - 2010 |
| 1. | Kharif Groundnut | 713.48 | 802.50 (12.48) | 1278.00 (79.12) |
| 2. | Soybean | 0.00 | 501.00 | 985.00 (87.62) |
| 3. | Safflower | 212.35 | 543.50 (151.89) | 608.00 (186.79) |
| 4. | Sunflower | 0.00 | 394.00 | 607.00 (54.06) |
| 5. | Other oil seeds | 90.50 | 540.60 (252.22) | 888.00 (881.20) |
| | Total oilseeds | 509.00 | 534.11 (6.10) | 962.24 (78.59) |

(Figures in the parentheses indicate per cent change over the base year).

The period wise change in productivity of oilseeds is presented in Table 5. The productivity of *kharif* groundnut, soybean, safflower and sunflower increased by 79, 88, 186 and 54 per cent, respectively from TE 1960-63 to TE 2007-2010. The productivity of total oilseeds also increased from 509 kg/ha. in TE 1960-63 to 962 kg/ha. In TE 2007-2010 with a rise of 79 per cent over the base year.

The period wise annual compound growth rates in area, production and productivity of different oilseeds in Maharashtra state is presented in Table 5.

The area under *kharif* groundnut was decreased significantly during all three periods with the growth rate of 2.80, 3.86 and 2.79, respectively. The production of groundnut also declined during all the three periods while the productivity was positive and non-significant. The area and production of soybean increased significantly while the productivity remained stagnant. The growth rates for area, production and productivity of safflower were positive and significant during pre-TMO period.

TABLE 5—PERIOD WISE ANNUAL COMPOUND GROWTH RATES IN AREA, PRODUCTION AND PRODUCTIVITY OF TOTAL OILSEEDS IN MAHARASHTRA

| Sr. No. | Oil seeds | Period I (Pre-TMO Period) | | | Period II (Post- TMO Period) | | | Entire period | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | P | Y | A | P | Y | A | P | Y |
| 1. | Kharif Groundnut | -2.80*** | -2.29*** | 0.53 | -3.86*** | -1.09*** | 0.31 | -2.79*** | -1.15 | 1.21 |
| 2. | Soybean | — | — | — | 31.08*** | 33.60*** | 1.73 | 31.08*** | 33.60.*** | 1.73 |
| 3. | Safflower | 2.67*** | 6.73*** | 3.96*** | -4.98*** | -4.01 *** | 1.01 | -0.68** | 1.63*** | 2.33*** |
| 4. | Sunflower | -- | -- | -- | -2.19*** | -1.08 | 1.12 | -2.19*** | -1.08 | 1.12 |
| 5. | Total oilseeds | 2.45 | 0.67 | 0.43 | 2.80*** | 5.22*** | 2.36*** | 1.75*** | 3.80*** | 2.017*** |

[ * = Significant at 10 per cent level, ** = Significant at 5 per cent level, and *** = Significant at 1 per cent level]

In case of total oilseeds, the area, production and productivity showed a positive but non-significant growth during the pre- TMO period, while during the post- TMO period, the area, production and productivity increased significantly at the rate of 2.80, 5.22 and 2.36 per cent, respectively. This may be due to the introduction of new oilseed crops like soybean and sunflower as a result of impact of technology mission on oilseeds. Thus, the

hypothesis stating that the growth rate of area, production and yield of oilseeds in Maharashtra remain low in first period (1960-61 to 1985-86) and these improved in second period (1986-87 to 2009-10) gets confirmed.

During the entire period, the area, production and productivity of total oilseeds showed significant increase. Thus, the hypothesis stating that the contribution of productivity improvement was relatively more important in increasing oilseed production as compared to area expansion gets confirmed.

**IV. Supply of oilseeds**

Supply of oilseeds has been assumed to be directly dependent upon the magnitude of the changes in area under oilseeds and the yield per hectare. For estimating the supply for oilseed, acreages under oilseed were estimated and the same were multiplied by their present and expected yields per hectare. The production being dependent on acreage, the projected production of oilseeds in 2019-20 and 2029-30 AD were estimated in Table 6.

TABLE 6—Estimation of Supply of Oilseeds in Maharashtra State

| Sr. No. | Year | Area ('00' ha.) | Productivity (Kg./ha.) | Production lakh tonnes |
|---|---|---|---|---|
| | **Situation I (Constant productivity 983 kg/ha.)** | | | |
| 1 | 2009-10 | 41412.89 | 983.00 | 40.69 |
| 2. | 2019-20 | 51106.49 | 983.00 | 50.24 |
| 3. | 2029-30 | 57765.48 | 983.00 | 56.78 |
| | **Situation II (Increased productivity @ 2.017 per annum)** | | | |
| 1. | 2009-10 | 41412.89 | 983.00 | 40.69 |
| 2. | 2019-20 | 51106.49 | 1200.27 | 61.34 |
| 3. | 2029-30 | 57765.48 | 1436.59 | 82.98 |

The acreage under oilseeds would be 51.11 and 57.77 lakh hectares during 2019-20 and 2029-30 AD, respectively. The present (2009-10) productivity of oilseeds is about 983 kg/ha. Taking into consideration that the productivity would remain constant during the next two decades, the estimated production of oilseeds in the state would be 50.24 and 56.78 lakh tones during 2019 and 2029 AD, respectively. The supply of oilseed was also estimated by considering productivity growth rate of 2.02 per cent per annum for next two decades (based on "r" actually observed during the period of 50 years). The productivity of oilseed would be 1200.00 and 1437 kg/ ha during 2019 and 2029 AD, respectively. The estimated production of oilseed in the state would be 61.34 and 82.98 1akh tonnes during 2019 and 2029 AD.

**V. Aggregate demand for oilseed**

The aggregate demand for human consumption was estimated by multiplying the per capita estimates of the quantity demanded and population estimates of the corresponding time period. The estimates of demand for oilseeds are presented in Table 7.

The demand for oilseeds had been projected under different situations for both the rural and urban sectors separately. The demand for oilseeds at the growth rate of 7.50 per cent per annum in the state income would be 28.77 and 49.75 lakh tonnes in the rural and urban areas,

TABLE 7—Estimation of Demand for Oilseeds in Maharashtra

(Lakh tonnes/year)

| Sr. No. | Year | Situation I | | | | | |
|---|---|---|---|---|---|---|---|
| | | 7.50 per cent | | | 8.00 per cent | | |
| | Rural | | Urban | Total | Rural | Urban | Total |
| 1. | 2009-2010 | 18.09 | 25.01 | 43.10 | 18.09 | 25.01 | 43.10 |
| 2. | 2019-2020 | 28.77 | 49.75 | 78.52 | 29.52 | 51.16 | 80.68 |
| 3. | 2029-2030 | 49.30 | 117.63 | 166.93 | 53.20 | 124.84 | 178.04 |
| | | **Situation II** | | | | | |
| 1. | 2009-2010 | 18.09 | 25.01 | 43.10 | 18.09 | 25.01 | 43.10 |
| 2. | 2019-2020 | 28.23 | 50.62 | 78.85 | 28.96 | 52.07 | 81.03 |
| 3. | 2029-2030 | 46.97 | 121.43 | 168.40 | 50.30 | 129.11 | 179.41 |

respectively, during 2019 AD under situation I. Also, the demand for oilseeds-would be 29.52 and 51.16 lakh tonnes in the rural and urban areas, respectively at the growth rate of 8.00 per cent per annum in the state income. The demand for oilseeds, at 7.50 per cent per annum growth rate in the state income, would be 49.30 and 117.63 lakh tonnes for rural and urban areas, respectively during 2029 A.D., while assuming 8.00 per cent annual growth rate in the state income the demand would be 53.20 and 124.84 lakh tonnes for rural and urban areas, respectively.

By considering the 7.50 per cent per annum growth rate of state income, the demand for oilseeds would be 28.23 and 50.62 lakh tonnes during 2019 A.D. in rural and urban areas, respectively under situation- II. Also the demand for oilseed in the rural and urban areas would be 28.96 and 52.07 lakh tonnes, respectively, at the growth rate of 8.00 per cent per annum in the state income.

Assuming 7.50 per cent per annum growth in the state income, the demand for oilseeds would be 46.97 and 121.43 lakh tonnes in the rural and urban areas, respectively during 2029 AD under situation II. By considering the 8.00 per cent per annum growth rate of state income, the demand for oilseeds would be 50.30 and 129.11 lakh tonnes in the rural and urban areas, respectively during 2029 AD.

**Conclusions**

In brief, the conclusions drawn on the basis of empirical evidences in the study are.

1. The area under total oil seeds in Maharashtra increased during the period under study. The area under total oilseeds had increased in all the regions of the state except, Western Maharashtra and Konkan region. The performance of total oilseeds was quite satisfactory as regards to productivity in all the regions of the state. The productivity of total oilseeds in the state was almost doubled over the base period. Highest productivity increased in Marathwada region of the state.

2. The area production and productivity of total oilseeds increased at the rate of 1.75, 3.8, and 2.02 per cent per annum in the state. The growth rates of area, production and productivity were positive and significant for Western Maharashtra region whereas the growth rates of area were negative for Marathwada and Vidarbha region.

3. The productivity of Kharif groundnut has increased by 79.12 per cent over the base year as a result of varietal and crop improvement.

4. The productivity of Soybean has increased by 87.62 per cent, over the base year mainly as a result of area expansion and increase in productivity at State level, while in Marathwada, the area decreased by 6.64 per cent.

5. The productivity of Safflower has increased by 186.79 per cent over the base year. It also showed an increasing trend in all the three regions.

6. The productivity of Sunflower has increased by 54.06 per cent over the base year. It also showed an increasing trend in all the three regions.

7. The phenomenal increase in the production of oilseeds during the post-TMO period in the State was contributed largely by productivity improvement and introduction of crops like Soybean and Sunflower.

8. For kharif groundnut and safflower the lagged yield and lagged area of respective crops significantly attributed to be the deciding factors for the acreages under kharif groundnut and safflower respectively for the state.

9. The lagged area of soybean and sunflower significantly attributed to be the deciding factors for the acreages under respective oilseed crops in Maharashtra.

10. Projection of supply of oilseeds in Maharashtra indicated that 50.24 lakh tonnes (at constant productivity) to 61.34 lakh tonnes (at increasing productivity) in 2019 A.D. as against the demand of 68.63 lakh tonnes (by assuming rural population decreased by 0.04 per cent per annum and urban population increased by 0.04 per cent per annum and State income increased by 7.50 per cent per annum) and 70.52 lakh tonnes (by assuming rural population decreased by 0.04 per cent per annum and urban population increased by 0.04 per cent per annum and State income increased by 8.00 per cent per annum). The gap between supply of and demand for oilseeds would be 20.28 and 31.93 lakh tones, respectively during 2019 A.D.

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# Problems and Prospects of Oilseeds Production in Rajasthan : Special Reference to Rapeseed and Mustard*

## 1.0 Introduction

Oilseeds sector has played a prominent role in agricultural development in India. The State of Rajasthan contributes significantly to oilseeds production in India. Among the oilseeds, rapeseed-mustard, sesamum, soybean and groundnut are the major oilseed crops produced in the state. Groundnut and soybean are the major Kharif crops largely dependent on rainfall conditions while rapeseed-mustard and taramira are important Rabi crops grown in the majority of districts of the state. Rajasthan claims first position in the production of rapeseed-mustard in India with a share of 48.6 per cent (in TE 2007-08). The state also ranks third position in production of sesamum (13.8%) and soybean (8.1 %).

The diverse agro-ecological conditions in the state are favourable for growing oilseeds. A wide range of oilseed crops is grown in different agro-climatic regions of the state. Among the oilseeds, rapeseed-mustard, sesamum, soybean and groundnut are the major oilseed crops of the State. Groundnut and soybean are the major Kharif crops largely dependent on rainfall conditions while rapeseed-mustard and taramira are important Rabi crops grown in the majority districts of Rajasthan. Rajasthan claims first position in the production of rapeseed-mustard in India with a share of about 48.6 per cent. The state also ranks third in production of sesamum (with 13.8% share) and soybean (8.1 % share) in the country.

Given the competing demands on agricultural land from various crops, the production of oilseeds can be increased only If productivity is improved significantly and farmers get remunerative and attractive prices. However, farmers face various constraints in oilseeds production in the state of Rajasthan. Since cultivation of these high value crops requires irrigation facilities, the irrigation expansion has been a major challenge in the state. Only about 33.6 per cent of gross cropped area was irrigated during 2009-10, Nearly 45.3 per cent of area under oilseed was found to be irrigated in Rajasthan during TE 1993-94 that has further increased to 59.2 per cent during TE 2009-10. The growth performance of these crops in the state has been prone to various kinds of risk over time and across the agro-climate regions because of the rainfall behavior, prolonged drought periods, limited water resources and facilities available in the state (Jain et al., 2005). Several biotic, abiotic, technological, institutional, and socio-economic constraints inhibit exploitation of the yield potential of crops, which need to be addressed. Rising input prices, timely availability of good quality inputs, insufficient extension services have potential negative effects on the farmers in the state. Taking into account the changing policy environment, increasing demand, concerns about slow growth in domestic production and rising imports, the present study attempts to analyze performance and potential of oilseeds sector in Rajasthan and identify major problems or constraints facing the sector in the State.

## 2.0 Major Objectives of the Study

The present study was a part of larger coordinated study on problems and prospects of oilseeds and oil palm production in India. The major objectives of the study for the State of Rajasthan were (i) to examine trends and pattern of growth of different edible oilseeds over time and across districts and identify the sources of growth in edible oilseeds output in Rajasthan; (ii) to determine the impact of price and non-price factors influencing the supply response behavior and demand for edible oilseeds and oil in the state; and (iii) to identify the major constraints in cultivation of edible oilseed and to suggest policy options for increasing oilseeds production and productivity in the state. As far as the first two objectives of the study are concerned, secondary data on district-wise area, production, yield of major crops/crop groups, major inputs used, irrigated area under oilseeds, farm-harvest prices of selected oilseeds and competing crops and annual rainfall (1971-72 to 2009-10) were used.

Apart from a detailed crop-wise analysis of growth patterns and sources of growth of edible oilseeds, the study has attempted to investigate the supply relations for major oilseeds in the state. In order to identify major constraints in edible oilseed production in the state, primary data from households growing oilseeds in the selected districts were collected and analyzed.

## 3.0 Data and Methodology

### 3.1 Sampling Design

The multistate, purposive sampling method was used to select the districts, blocks and farm households. At first

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stage, the states growing considerable quantities of oilseeds and having potential were selected. In total, seven major oilseeds producing states were selected for the study. Rajasthan along with Uttar Pradesh and Madhya Pradesh were chosen for the detailed study on rapeseed- mustard (R&M) since these states are found to be the major producers of this crop. The present study was undertaken to generate better understanding of the specific problems and prospects of oilseeds cultivation in the State of Rajasthan with a special focus on rapeseed-mustard.

In the second stage, all districts growing significant Quantities (area/production) of rapeseed- mustard were selected. The major districts in the state were categorized into four groups such as high area and high yield (HH), high area and low yield (HL), low area and high yield (LH), and low area and low yield (LL). Bharatpur, Tonk and Kota were selected from Rajasthan as HH, HL and LH category of districts respectively for a detailed study. At third stage, major rapeseed-mustard producing talukas/blocks were selected and an appropriate number of villages were selected for the household survey. From each selected village, an appropriate number of farmers (200) representing different farm categories (Marginal 0-1 ha, Small 1-2 ha, Medium 2-4 ha; Large >4 ha) were selected. About 19 villages from 6 blocks of three study districts were covered to get the desired sample households (200). The reference year of the study for the household survey was 2011-12.

**3.2 Data Analysis Methods and Tools**

As far as the data analysis methods are concerned, the study used the simple statistical methods like averages, percentage, coefficient of variation and compound annual growth rate (CAGR) for the analysis of secondary data. The CAGR was estimated by fitting a semi-log trend equation which was estimated by applying Ordinary Least Square (OLS) method and the t- test was performed to test the significance of '$\beta$'. To measure the relative contribution of area and yield towards the change in total output of individual crops, the decomposition analysis was performed for major oilseeds and competing crops. The analysis helped in identifying the sources of growth in output by breaking the change in production into three effects i.e., area effect, yield effect and interaction effect.

The decomposition analysis was carried out on the major oilseeds and competing crops mainly for three periods, i.e., Period I (TE 1983-84 to TE 1993-94), Period II (TE 1993-94 to TE 2009-10) and overall period of TE 1983-84 to TE 2009-10. During Period I, the expansion of area under oilseeds was encouraged by introduction of Technology Mission on Oilseeds (TMO) in 1986 by Government of India. During Period II, the effects of trade liberalization was examined since the change in trade policy had considerably affected the domestic production and consumption pattern of major oilseeds in the country.

For better understanding of the different sources of growth in output, analysis was also carried out on growth in input use during different time periods. The growth pattern of irrigation coverage, fertilizer consumption, annual rainfall, farm harvest prices and minimum support prices have also been analyzed. The behavior of monthly prices has also been examined so as to assess the variability in short-term prices of the major oilseeds and major competing crop.

The attempt has also been made to examine the effects of variation in major agricultural inputs on crop yield with the help of a log-linear regression model which was estimated for main oilseed crop (rapeseed-mustard) and main competing crop (wheat) separately. The relative contribution and significance of the major factors such as area under the crop, seed cost, fertilizer cost, pesticide/ insecticide cost, human labour cost, machine labour cost, irrigation charges and working capital to change in yield of major oilseed and competing crop for sample farmers have been examined.

As far as the acreage allocation between main oilseed crop and competing crop by the sample farmers is concerned, another similar log-linear regression model was fitted. Some major price and non-price factors that actually influenced the farmers' decision to allocate the available cultivable area for different crops were taken into account as explanatory variables and the area allocated for the main oilseed (rapeseed-mustard) was considered as the dependant variable. The explanatory variables for the fitted regression model were the size of land holdings ($LS_t$), one year lagged area of R&M ($A_{t-1}$), lagged yield of R&M ($Y_{t-1}$), lagged price of R&M ($P_{t-1}$) , lagged area of wheat ($AC_{t-1}$), lagged yield of wheat ($YC_{t-1}$) and the lagged price of wheat ($PC_{t-1}$).

The yield gap analysis was conducted for the main crop groundnut to ascertain the gap between the potential yield and actual yield and between the experimental yield and actual yield. An index called 'Technology Index' was used for measuring the feasibility of the evolved technology at the farmer's fields. Appropriate analytical techniques were used to identify and prioritize major constraints facing oilseeds production in the state. The responses of the sample farmers on the extent of severity of various constraints faced by them have been ranked by using ordinal scores from 4 to 1 (severe =4, Moderate = 3, minor = 2, not important =1). The results are displayed in the form of composite index called Oilseed Constraint Index (OCI) which has been constructed as a weighted average.

**4.0 Major Findings of the Study**

**4.1 Nature and Causes of Change in Cropping Pattern**

The share of oilseeds has increased significantly in the State, while the share of total cereals, total pulses and

total food grains has decreased over last four decades. There has been very high growth in area under rapeseed-mustard (R&M) and soybean while the growth in area under groundnut and cotton has been moderate in the state. The area under total oilseeds has increased from 7.4 per cent in TE 1973-74 to 18.3 per cent of gross cropped area (GCA) in TE 1993-94. Thereafter, there was negative growth in area under oilseeds in the state which slightly increased to 19.2 per cent in TE 2009-10. However, the area under the main oilseed crop rapeseed-mustard (R&M) has increased steadily from 3.5 lakh ha in TE 1973-74 to over 24.71akh ha during TE 2009-10.

The GCA and total area under oilseeds in the state in TE 2009-10 was 222.4 lakh ha and 42.8 lakh ha, respectively. The share of total oilseeds has increased from 7.4 per cent during TE 1973-74 to 19.2 per cent during TE 2009-10. On the other hand, the share of total cereals and total food-grains has declined from 55.5 per cent and 76.2 per cent during TE 1973-74 to 43.7 per cent and 60.1 per cent during TE 2009-10 respectively. Wide fluctuation in area under different crops has been observed during 1990s and early 2000s due to occurrence of frequent droughts in larger part of the State during this period. The overall area expansion effect was better for the irrigated area than the cultivated area for the all reference periods except TE 2003-04 to TE 2009-10.

The district level analysis of cropping pattern reveals that the GCA has declined in 16 districts out of 33 districts between TE 1993-94 and TE 2009-10. It was surprising to find that the selected district with high area and high yield (Bharatpur) and the selected district with low area with high yield (Kota) experienced a decline in area during the corresponding period. On the other hand, the selected district with high area with low yield (Tonk) experienced an increase in area by 70.13 per cent. during the corresponding period.

Among various factors responsible for changes in cropping pattern, profitability, change in taste and preferences, availability of irrigation provisions and climatic aberrations were the major ones in the state of Rajasthan. Since the majority of farmers adopted HYVs for better income, the crop on which value addition was relatively high claimed a larger share. The expansion of area under horticultural crops, pulses and oilseeds have been promoted through various programmes like National Horticulture Mission (NHM), National Food Security Mission (NFSM), Integrated Scheme on Oilseeds, Pulses, Oil Palm and Maize (ISOPOM), Agricultural Technology Management Agency (ATMA) etc. in the state. Since the required inputs in proper quality and quantity have been provided at subsidized prices and remunerative prices have offered to the farmers, the area under these crops have depicted significant increase in recent years compared to earlier periods in most of the districts in Rajasthan.

### 4.2 Growth Trends in Area, Production and Yield of Major Oilseeds

Though the growth in area, production and yield of major oilseeds has been steady since 1950s, significant increase with respect to these variables was observed since 1980s. The average annual area under oilseeds has increased from 1088.3 thousand ha in 1960s to 2082.2 thousand ha in 1980s, that has further increased to 4065.5 thousand ha in 2000s (Table 1). The average production and yield of oilseeds has increased from 395.1 thousand ha and 312.7 kg/ha during 1970s to 1274.9 thousand ha and 612.2 kg/ha during 1980s. Thereafter, the increased production and productivity of oilseeds have been sustained comfortably in the State.

TABLE 1—Trends in Average Area, Production and Yield of Total Oilseeds in the State

| | 1956-57 to 1960-61 | 1961-62 to 1970-71 | 1971-72 to 1980-81 | 1981-82 to 1990-91 | 1991-92 to 2000-01 | 2001-02 to 2009-10 |
|---|---|---|---|---|---|---|
| Area (000 hectares) | 921.4 (-4.3) | 1088.3 (0.6) | 1263.6 (0.7) | 2082.2 (4.6) | 3676.0 (-3.2) | 4065.5 (3.7) |
| Production ('000 tonnes) | 226.8 (-12.1) | 270.5 (8.3) | 395.1 (-0.3) | 1274.9 (15.5) | 2964.5 (-3.1) | 4378.9 (4.5) |
| Yield (kg/ha) . | 246.1(-8.2) | 248.6 (7.7) | 312.7 (-1.0) | 612.27 (10.4) | 806.4(0.1) | 1077.1 (0.7) |

Note: Figures in parentheses are the CAGR in per cent.

The district level analysis of area and production of oilseeds reveals that Sri Ganganagar (8.1%), Sawai Madhopur (7.9%) Bharatpur (6.8%), Alwar (7.3%) and Nagaur (7.26%) accounted for major share of area under oilseeds in Rajasthan during TE 1993-94. As far as the oilseeds production in the state is concerned, five out of seven districts having major share of oilseed acreage are among the seven major districts producing oilseeds during both the reference periods (TE 1993-94 and TE 2009-10). They were Sri Ganganagar, Bharatpur, Sawai Madhopur, Alwar and Nagaur during TE 1993-94 and Baran, Alwar, Jhalawar, Kota and Sri Ganganagar during TE 2009-10.

Among the Kharif oilseeds, soybean and sesamum were the major crops occupying about 30 per cent of total area under oilseeds during TE 2009-10 in the state. On the other hand, the rapeseed-mustard was the major Rabi

crop occupying about 58 per cent of total area under oilseeds. Thus these three crops along with groundnut occupied about 95 per cent of total area under oilseeds in the state. The total area and production of Kharif oilseeds was 40.1 per cent and 36.0 per cent of total oilseeds acreage and production respectively. Total oil extracted from Kharif oilseeds and Rabi oilseeds during TE 2009-10 was 60.2 per cent and 39.8 per cent, respectively.

If we analyze the nature of variability in ranks of various districts in cultivation of oilseeds between TE 1993-94 and TE 2009-10, variation in seasonal rainfall and availability of irrigation facilities played a vital role. Though rainfall variability remained at alarming level over the years, the development of irrigation facilities in the state has been quite satisfying. The irrigated area under Kharif oilseeds has increased from 1.3 lakh ha in TE 1993-94 to about 3.8 lakh ha in TE 2009-10, an increase by about three times. Similarly, the irrigated area under Rabi oilseeds has increased from 14.6 lakh ha in TE 1993-94 to about 21.4 lakh ha in TE 2009-10, an increase by about 1.5 times. The districts having major share in irrigated area under Rabi oilseeds were Alwar, Sri Ganganagar, Bharatpur, Sawai Madhpur and Tonk in TE 2009-10. On the other hand, Bikaner, Jalore, Jodhpur and Sikar were some of the states having major share of Kharif irrigated area under oilseeds during the corresponding period.

### 4.3 Growth and Variability in Area, Production and Yield of Major Oilseed (Rapeseed and Mustard) vis-a-vis Competing Crop (Wheat)

Rajasthan stands first in the cultivation of R&M. The share of R&M in total oilseeds in the state is about 58 per cent. Rapeseed and mustard (R&M) was found to be the major oilseed crop while the wheat was found to be its major competing crop in Rajasthan during TE 2009-10. The area under R&M has exhibited negative trend during 1950s, 1960s and 1970s (Table 2). However the growth in area, production and yield of R&M has been quite impressive during 1980s and 2000s, but not during 1990s. However, the extent of variability in its area, production and yield has also been quite large in terms of the level of fluctuations in annual growth rates and magnitude of coefficient of variation (CV). On the other hand, the growth in area, production and area under the main competing crop (wheat) has not been quite impressive throughout, but the extent of variability in its area, production and yield has been comparatively very less in terms of both the parameters.

TABLE 2—TRENDS IN AVERAGE AREA, PRODUCTION, AND YIELD OF MAJOR OILSEED (RAPESEED - MUSTARD) VIS-A-VIS MAJOR COMPETING CROP (WHEAT) IN THE STATE

| A/P/Y | 1956-57 to 1960-61 | | 1961-62 to 1970-71 | | 1971-72 to 1980-81 | | 1981-82 to 1990-91 | | 1991-92 to 2000-01 | | 2001-02 to 2009-10 | | 1956-57 to 2009-10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | CAGR | Mean | CAGR | Mean | CAGR | Mean | CAGR | Mean | CAGR | Mean | CAGR | Mean | CAGR |
| **Rapseed and mustard (main oilseed crop)** | | | | | | | | | | | | | | |
| Area (000 | 249.8 | -6.4 | 233.0 . | 0.6 | 333.8 | -0.6 | 1055.1 | 12.8 | 2329.0 | -5.0 | 2485.3 | 2.9 | 1169.0 | 4.1 |
| hectares) | (24.2) | | (25.5) | | (18.1) | | (39.9) | | (16.7) | | (30.8) | | (88.6) | |
| Production | 84.4 | -9.5 | 93.9 | 9.6 | 169.1 | 8.1 | 890.2 | 15.4 | 2054.5 | -5.3 | 2946.8 | 5.4 | 1093.0 | 6..3 |
| ('000 tonnes) | (34.4) | | (63.9) | | (33.4) | | (46.7) | | (19.6) | | (34.9) | | (109.4) | |
| Yield (kg/ha) | 337.9 | -3.3 | 403.0 | 10.2 | 506.6 | 8.8 | 843.7 | 2.4 | 882.1 | -0.4 | 1185.7 | 2.5 | 712.5 | 2.2 |
| | (19.5) | | (54.4) | | (28.9) | | (10.5) | | (11.7) | | (11.3) | | (44.5) | |
| **Wheat (main competing crop)** | | | | | | | | | | | | | | |
| Area (000 | 1180.2 | -5.8 | 1192.0 | 1.5 | 1710.0 | 0.9 | 1809.9 | 0.3 | 2344.2 | 2.9 | 2241.3 | 0.6 | 1789.5 | 1.1 |
| hectares) | (10.3) | | (12.9) | | (13.2) | | (10.2) | | (13.2) | | (11.6) | | (27.5) | |
| Production | 1056.8 | -6.8 | 1168.5 | 4.9 | 2238.2 | 2.7 | 3485.6 | 4.4 | 5683.4 | 2.4 | 6487.2 | 2.0 | 3507.9 | 3.3 |
| ('000 tonnes) | (16.9) | | (28.4) | | (18.1) | | (14.6) | | (19.9) | | (15.1) | | (62.2) | |
| Yield (kg/ha) | 895.4 | -1.0 | 980.3 | 3.3 | 1308.9 | 1.8 | 1925.8 | 4.1 | 2424.5 | -0.5 | 2894.4 | 1.4 | 1788.8 | 2.2 |
| | (8.7) | | (15.9) | | (8.7) | | (14.3) | | (11.2) | | (6.1) | | (42.1) | |

NOTE: Figures in parentheses are the CV in per cent. CAGR has also been expressed in per cent.
*Sources*: GoR (2008a; 2008c; 2009; 2010a)

The CV of area and production of R&M during the entire period of 1956-57 to 2009-10 was 88.6 per cent and 109.4 per cent, respectively while the same for what was 27.5 per cent and 62.2 per cent, respectively (Table 2). It is worth-mentioning that the higher compound annual growth rates in area, production and yield of R&M during 1980s and 2000s was accompanied by the greater degree of variability in the state. That kind of trend has not been observed in the case of major competing crop (wheat).

The variability in area and production of oilseeds is largely linked to availability of irrigation facilities. The share of irrigated area under R&M to total area under R&M in the state has declined from 65.0 per cent in TE 1993-94 to 50.3 per cent in TE 2003-04, which has sharply increased to 86.4 per cent in TE 2009-10. The number of districts with more than 90 per cent of irrigated area under R&M has tremendously increased from 6 in TE 1993-94 to 19 in TE 2009-10.

**4.4 Sources of Growth in Output of Oilseeds in the State**

With the help of decomposition analysis, the relative contribution of area and yield towards the total change in production of major oilseeds and competing crops was assessed. Among the three effects i.e., area effect, yield effect and interaction effect, the area effect was dominant during Period I (TE1983-84 to TE 1993-94) whereas the yield effect was dominant during Period II (TE1993-94 to TE 2009-10). The interaction effect was found to contribute more to the change in output during the overall period of TE 1983-84 to TE 2009-10. During Period I, the expansion of area under oilseeds was the major source of growth in oilseeds production, which was encouraged by introduction of Technology Mission on Oilseeds (TMO) in 1986 by Government of India. To meet with increased domestic demand, there was serious effort to increase oilseeds production through increase in yield levels during Period II. As far as the main oilseed (rapeseed-mustard) of the state is concerned, the yield effect accounted for 73.4 per cent of total output growth during the later period.

Among the study districts, Bharatpur was one of the major districts growing rapeseed-mustard. The yield effect was found to be the highest for both total oilseeds (145.6%) and rapeseed-mustard (130.9%) during Period II in the district. However, in other two study districts, i. e., Kota and Tonk, the area effect was still larger than the yield effect for growth in oilseeds output during the corresponding period. As far as the case of major competing crop (wheat) is concerned, the yield effect was found to play dominant role in Rajasthan state as a whole and in Tonk district as well. The yield effect as a source of growth in production of wheat in Rajasthan during Period I, Period II and overall period was 96.6 per cent, 57.8 per cent and 67.1 per cent, respectively. The yield effect as a source of growth of production of wheat during Period I, Period II and overall period in Tonk was 569.7 per cent, 1914.2 per cent and 1198.7 per cent, respectively.

Overall, the yield effect played significant role for both main oilseed crop and competing crop in the state, particularly during the Period II. The logical sequence of arguments brings us to know about the factors responsible for significant increase in yield-during this period. The increase in irrigation coverage, better nutrient supply through application of adequate fertilizers and pesticides, availability of quality seeds, increased input use efficiency and availability of better technological and institutional infrastructure have played a crucial role in enhancement of productivity of oilseeds and other cash crops during the corresponding period. The growth in irrigated area under oilseeds has been much better during 2000s than 1990s. Compared to over 7.5 per cent annual growth in irrigated oilseeds area in Rajasthan during a period of TE 1999-20 to TE 2009-10, the annual growth in irrigated oilseed area during previous decade (TE 1989-90 to TE 1999-2000) was only 2.5 per cent. However, the growth in fertilizer use was better during the period of TE 1989-90 to TE 1999-2000(8.5%) than that during later period of TE 1999-20 to TE 2009-10 (7.4 %).

**4.5 Variability in Monthly/Annual Prices of Major Oilseeds in the State**

The growth in annual prices of major oilseeds has been impressive in Rajasthan. The Farm Harvest Price (FHP) of sesamum and soybean, which are the major Kharif oil seeds in the state, has increased from Rs 1412 and Rs 742 in TE1993-94 to Rs 4367 and Rs 1793 in TE 2009-10, respectively. Similarly, the annual prices of major Rabi oilseeds (rapeseed.-mustard and tarameera) have increased from Rs 980 and Rs 827 in TE 1993-94 to Rs 2104 and Rs 2071 in TE 2009-10, respectively. It was good to find that the FHP of all major oilseeds was much more than their MSPs in the State.

As far the case of the major oilseed and the major competing crop is concerned, the growth in Minimum Support Price and Farm Harvest Price of both rapeseed-mustard (major oilseed) and wheat (major competing crop) has been very impressive too during 2000s over 1990s. However, the level of variability in prices of rapeseed-mustard was much higher than that of wheat during the corresponding period. The variability in price of rapeseed-mustard in terms of CV was found to be relatively more during January (9.4%) and July (9.1 %). On the other hand, the variability in price of wheat in terms of CV was found to be relatively more during December-January and August-September.

## 5.0 Household characteristics, Cropping Pattern and Production Structure

### 5.1 Socio-Economic Status of Sample Households

Among the sample farmers, 19 were marginal farmers, 38 were small farmers, 62 were medium farmers and 81 were large farmer. The average house hold (HH) size for entire sample was 7.8 persons. About 67 per cent sample households belonged to OBC category, 25.5 percent HHs belonged to SC/ST category and remaining 7.5 per cent HHs belonged to general caste category. The average off-farm income per sample household was Rs 22108. Near about 89.5 per cent members had crop farming as the main source of livelihood. The average number of years of schooling of the sample farmers was 8.1 years.

The net sown area (NSA) and gross cropped area (GCA) of a sample household was found to be 5.3 ha and 8.1 ha respectively, which implies that the cropping intensity in the study area was 152 per cent. The size of operational holding in the case of small, medium and large farmers was 1.6 ha, 3.1 ha, and 9.8 ha, respectively. It was good to see that the area under irrigation was 91.3 per cent of total operated area.

As regards the land tenancy, near about 36 per cent of HHs were having leased in land constituting about 30.2 per cent of total operated area. The term of lease for about 72.2 per cent of HHs with leased in lands was fixed rent in cash and for remaining 27.8 per cent HHs, it was share cropping.

As far as different sources of irrigation are concerned, about 41.5 per cent of total operated area of sample farmers was irrigated by tube wells followed by dug wells (41 %), usually run by electricity and/or diesel. Canal and tank and other source of irrigation had minor presence in the study area as their joint contribution was about 14 per cent in the case of our sample farmers.

### 5.2 Cropping Pattern and Yield of Major Crops

The GCA per HH was 8.1 ha for all farmers taken together whereas the large farmer had highest GCA of 14.5 ha and marginal farmers had minimum GCA of 1.47 ha. Medium and small farmer had 5.1 ha and 2.5 ha of GCA, respectively. The per-HH area under Kharif crops and Rabi crops cultivated by the sample farmers was 2.97 ha and 5.09 ha, respectively.

Among various Kharif crops, the share of cereals, pulses and oilseeds was 44.0 per cent, 5.5 per cent and 47.8 per cent, respectively. Among Kharif oilseeds, soybean was found to be the major crop cultivated by farmers of all categories except marginal farmers and the share of soybean in total Kharif crops was about 37.7 per cent. The area under Rabi oilseeds for all selected farmers of all categories ranged between 58.9 per cent (large farmers) and 65.9 per cent (marginal farmers) of total area under Rabi crops. The rapeseed-mustard was the only crop cultivated by the sample farmers during Rabi season mainly because of better profitability and better availability of marketing channels.

The average yield of Kharif crops and Rabi crops under rainfed conditions was 17.3 quintals per ha and 11.6 quintals per ha, respectively; whereas the average yield of Kharif crops and Rabi crops under irrigated conditions was 25.5 quintals per ha and 24.9 quintals per ha, respectively.

### 5.3 Production, Retention and Marketed Surplus Pattern of Oilseeds

As discussed earlier, the major oilseeds cultivated by our sample households were sesamum and soybean in Kharif and rapeseed-mustard in Rabi. The sample farmers growing soybean produced 76.9 quintals per household on an average, all of which was sold at the average price of Rs 2320.9 per quintal. In the case of sesamum, the sample farmers produced 15.7 quintals per household on an average, out of which, 15.2 quintals was sold at the average price of Rs 4135.3 per quintal. About 0.48 quintals of sesamum was retained per household for use as seed.

In the case of main oilseed crop(R&M), 59.7 quintals was produced per household, out of which, 59.3 quintals was sold at the average price of Rs 3021 per quintal. About 0.35 quintals of rapeseed-mustard was retained per household for use as seed. As far as the case of main competing crop (wheat) is concerned, 59.1 quintals was produced per household, out of which, 48.8 quintals was sold at the average price of Rs 1112 per quintal. About 10.3 quintals of wheat per HH was retained for household consumption or for use as seed.

### 5.4 Comparative Economics/Profitability of Oilseeds vis-a-vis Competing Crops

The cultivation of rapeseed-mustard was much profitable over the competing crops wheat and coriander in the study areas. The gross value of main product and value of by-product of rapeseed-mustard across all size groups of farmers was found to be Rs 57914 and Rs 3583 per ha, respectively (Table 3). The total variable cost of cultivation of the crop was Rs 22123 per ha. Thus the net income derived from cultivation of rapeseed-mustard was Rs. 39374 per ha. The maximum annual net return from cultivation of the crop was earned by large farmers which was Rs 43328 per ha whereas the marginal, small and medium farmers generated the net income of Rs. 30401, Rs. 37807 and Rs. 37925 per ha, respectively. On the other hand, the net income derived from the cultivation of wheat and coriander was Rs. 26943 and Rs. 26100 per ha, respectively which were much lower than that of rapeseed-mustard.

TABLE 3—Profitability of Major Oilseeds and Competing Crops

(Rs./Ha.)

| | Main Oilseed (Rapeseed-Mustard) | | | | |
|---|---|---|---|---|---|
| Cost items | Marginal | Small | Medium | Large | All Farms |
| 1. Total Operational Costs (TC) | 22046 | 24225 | 21632 | 21531 | 22123 |
| Yield (Quintals) | 17 | 20 | 19 | 20 | 19 |
| Price | 2808 | 2979 | 2996 | 3117 | 3024 |
| 2. Value of main-product | 48502 | 58391 | 55464 | 61774 | 57914 |
| 3. Value of by-product | 3945 | 3642 | 4093 | 3085 | 3583 |
| Net Income (2+3) - (1) | 30401 | 37807 | 37925 | 43328 | 39374 |
| Cost of production/q [TC/Q] | 1307 | 1237 | 1165 | 1082 | 1156 |
| *Total Cost of Cultivation (TC/Ha)* | 22046 | 24225 | 21632 | 21531 | 22123 |
| | Main Competing Crop (Wheat) | | | | |
| Cost items | Marginal | Small | Medium | Large | All Farms |
| 1. Total Operational Costs (TC) | 37 | 40 | 38 | 41 | 40 |
| Yield (Quintals) | 1075 | 1117 | 1079 | 1126 | 1106 |
| Price | 39541 | 44598 | 42091 | 46022 | 44024 |
| 2. Value of main-product | 3932 | 4224 | 3930 | 3479 | 3792 |
| 3. Value of by-product | 25402 | 25932 | 23747 | 29973 | 26943 |
| Net Income (2+3) - (1) | 489 | 572 | 579 | 478 | 526 |
| Cost of production/q [TC/Q] | 18071 | 22890 | 22274 | 19528 | 20873 |
| *Total Cost of Cultivation (TC/Ha)* | 37 | 40 | 38 | 41 | 40 |

Source: Field survey

Among the cost components, fertilizer and labour accounted for the largest share of the total operational costs for both main oilseed crop and major competing crops. For cultivation of rapeseed-mustard (R&M), human labour and machine labour accounted for 36.4 per cent and 20.9 per cent of total operational cost, respectively. Fertilizer consumption accounted for 18.7 per cent of total operational cost of cultivation of R&M. The overall pattern of cost of cultivation for the selected competing crops was similar. The cost on irrigation and harvesting and threshing was found to be less on competing crops than that on the main oilseed crop.

**5.5 Profitability vis-a-vis Risks in Oilseeds Production**

Profitability is the major driving force for farmers to decide about the crop they would cultivate. However, farmers often make trade-off between profitability and risk, while choosing a suitable cropping pattern. From the profitability point of view, rapeseed-mustard has proved to be much better option than the competing crops (wheat and coriander). On the production and price risk perspectives, the main crop (rapeseed-mustard) exhibited mixed results. The yield risk and price risk were marginally higher for the main crop. The coefficient of variation (CV) in yield and farm harvest price as the measure of yield risk and price risk for rapeseed-mustard was 28.4 per cent and 12.0 per cent, respectively; whereas the same for wheat was 25.4 per cent and 11.0 per cent, respectively (Table 4).

TABLE 4—PROFITABILITY VIS-A-VIS RISKS IN OILSEEDS PRODUCTION

(Coefficient of Variation in per cent)

| Indicators | Marginal | Small | Medium | Large | All Farms |
|---|---|---|---|---|---|
| **Main crop oilseed crop (rapeseed and mustard)** | | | | | |
| Acreage variability | 28.8 | 32.7 | 34.5 | 70.3 | 106.4 |
| Yield variability | 27.8 | 26.9 | 28.6 | 28.5 | 28.4 |
| Price variability | 18.9 | 11.0 | 11.0 | 10.7 | 12.0 |
| Net income variability | 56.5 | 42.3 | 35.1 | 36.8 | 39.8 |
| **Main competing crop (wheat)** | | | | | |
| Acreage variability | 66.9 | 49.6 | 53.6 | 82.4 | 115.2 |
| Yield variability | 26.9 | 22.6 | 28.0 | 23.8 | 25.4 |
| Price variability | 7.3 | 8.5 | 15.5 | 8.0 | 11.0 |
| Net income variability | 77.0 | 62.2 | 58.7 | 71.6 | 66.7 |

*Source:* Field survey

The income risk and acreage risk was found to be higher for the major competing crop (wheat) than the main oilseed crop (R&M). The coefficient of variation in acreage and net income from the crop as the measure of acreage risk and net income risk for rapeseed-mustard was 106.4 per cent and 39.8 per cent, respectively; whereas the same for wheat was 115.2 per cent and 66.7 per cent, respectively. For both the crops, the extent of acreage risk and income risk was found to be considerably larger than the extent of yield risk and price risk.

### 5.6 Yield and Technology Gap Analysis

The yield gap analysis was conducted for the main crop (rapeseed-mustard) to ascertain the gap between the potential yield and actual yield and between the experimental yield and actual yield. The average potential yield of rapeseed-mustard was 24.7 quintal per ha and the average experimental yield of the main crop was 20.4 quintal per ha. However, the average actual yield of the crop was found to be only 19.1 quintal per ha (q/ha). Thus, the yield gap-I, i.e., the gap between the. experimental yield and potential yield was (-) 4.3 q/ha, whereas the yield gap-II, i.e., the gap between the actual yield and potential yield was 5.6 q/ha (Table 5). The yield gap-III, i.e., the gap between the experimental yield and actual yield (often known as extension gap) was found to be 1.3 q/ha. Among the three types of yield gap, the yield gap-II was found to be largest. The feasibility of technology is found to be more in the case of large farmers as the Technology Index for the corresponding farmer category was the lowest (17.22).

TABLE 5—YIELD GAP ANALYSIS

(Quintal/Ha)

| Yield | Marginal | Small | Medium | Large | All Farms |
|---|---|---|---|---|---|
| 1. Experimental farm yield | 20.4 | 20.4 | 20.3 | 20.5 | 20.4 |
| 2. Potential farm yield | 24.7 | 24.7 | 24.6 | 24.7 | 24.7 |
| 3. Actual farm yield | 16.9 | 19.6 | 18.6 | 19.9 | 19.1 |
| Yield gap I (1-2) | -4.3 | -4.3 | -4.4 | -4.3 | -4.3 |
| Yield gap II (2-3) | 7.8 | 5.1 | 6.1 | 4.8 | 5.6 |
| Yield gap III (1-3) | 3.5 | 0.84 | 1.69 | 0.58 | 1.25 |
| Technology index | 17.46 | 17.36 | 17.74 | 17.22 | 17.45 |

NOTES: (1) Experimental and potential farm yields have been collected from ICAR/State Agri. University scientists

(2) Technology index= {(Potential yield – Experimental yield)/Potential yield} × 100

*Source*: Field Survey .

### 5.7 Access to Improved Technology and Markets for Oilseeds

About 96.5 per cent of the sample farmers were found to use HYVs for getting better yield of oilseeds. The major source of seeds was market. Only 13.5 per cent of seeds was farmers' own seed. Most of the sample farmers were aware about the minimum support price (MSP) of their crops that helped them in getting and bargaining for the right price of their produce. It is noteworthy that about 92 per cent of sample farmers have received the price of rapeseed-mustard which was higher than the prevailing MSP. It was found that the majority of farmers used more than recommended doses of fertilizers and pesticides. Only 16 per cent of sample farmers used recommended doses of fertilizers. The proportion of farmers using the recommended doses of fertilizers has declined with the increase in the farm sizes. About 26.3 per cent of marginal farmers have used recommended doses of fertilizers while only 12.3 per cent of large farmers have used recommended doses of fertilizers.

### 5.8 Marketing Pattern of Oilseeds

About 46.5 per cent of farmers expressed that there is marketing problems which can be improved further. About 54 per cent and 22 per cent of farmers cultivating repeseed-mustard (R&M) have sold their output to local commission agent and village traders, respectively, not directly at Agricultural Produce Marketing Committee (APMC) or market ward (Mandi). Surprisingly not a single sample farmer could sell R&M to government agency. About 47.4 per cent of farmers were found to sell R&M to local village traders while only16.0 per cent of large farmers sold the same to local village traders. Among different farmer categories, more number of large farmers (19.8%) could directly sell R&M to processing mill, whereas no marginal and small farmers could sell R&M to processing mill given the fact that the processing mill offered best prices since there were no middlemen involved.

The average distance travelled by the farmers to sell their produce was considerably high (16.7 km). The average distance travelled by the farmers was lowest for marginal farmers (10.4) since most of them sold their output to the local traders.

The sale of main competing crop (wheat) exhibited slightly different pattern. Here the local village traders purchased slightly more output from the sample farmers, particularly from marginal and small farmers. About 28.7 per cent of sample farmers sold the output to local village traders at the average price of Rs1116 per quintal. Other major purchasers were commission agents who purchased the largest share of about 47.2 per cent of the total wheat output of the sample farmers.

### 5.9 Sources of Technology and Market Information

The major sources of information on seeds, extension services and market were found to be local input market (72.5%), State Department of Agriculture (84.5%) and Television and fellow farmers (98.5%), respectively. It may be noted that the awareness level of marginal and small farmers was very less compared to that of medium and large farmers. Input dealers, agricultural supervisors on behalf of Department of Agriculture and specialized organizations like ICAR/SAU/KVK have played key role in dissemination of required information to the needy farmers. Besides, print media and commission agents also transmitted some relevant information to the sample farmers in an effective manner.

### 5.10 Determinants of Oilseed Production and Acreage Allocation

The relative contribution and significance of the major factors (such as area under the crop, seed cost, fertilizer cost, pesticide/insecticide cost, human labour cost, machine labour cost, irrigation charges and working capital) to change in yield of major oilseed and competing crop for sample farmers was analyzed with the help of a log-linear model. The coefficient values of some explanatory variables as the major determinants of rapeseed-mustard yield in the study area unexpectedly did not get positive sign. This was mainly because of the fact that the farmers applied overdoses of inputs to get higher yield. The negative sign of these variables indicate that the further increase in input doses will reduce the yield level. Only the area under the concerned crop, irrigation charges and interest on working capital got the positive sign as expected.

As far as the acreage allocation between main oilseed crop and competing crop by the sample farmers is concerned, another similar log-linear regression model was fitted. Some major price and non-price factors that actually influenced the farmers' decision to allocate the available cultivable area for different crops were taken into account as explanatory variables and the area allocated for main oilseed (rapeseed-mustard) was considered as the dependant variable. The size of land holding ($LS_t$). one year lagged area of R&M ($A_{t-1}$). lagged yield of R&M ($Y_{t-1}$). lagged price of R&M ($P_{t-1}$) , lagged area of wheat ($ACt_{-1}$) and the lagged price of wheat ($PC_{t-1}$) were found to have statistically significant influence on the area allocated for the main oilseed crop rapeseed-mustard. Among these variables, the size of land holdings, one year lagged area of R&M and lagged yield of R&M positively influenced the area allocation for R&M, whereas the lagged price of R&M, the lagged area and the lagged price of competing crop wheat have negatively influenced the area allocation for the main oilseed crop (rapeseed-mustard) in the study districts.

### 5.11 Perceived Constraints in Cultivation of Oilseeds

Among the major constraints faced by the sample farmers, lack of irrigation facilities, incidence of diseases and incidence of insect pests, extreme variations in temperature, erratic rainfall pattern and the risk of crop failure/yield variability due to biotic and abiotic stresses, poor pod/grain setting were found to be the major technological and agro-climatic constraints for the sample farmers. Among the economic and institutional constraints, high input costs, shortage of human labour, irregular supply of electricity and problem of timely availability of good quality certified seeds were found to be the major ones. As regards the issues of post harvest, marketing and value-addition, the sample farmers have faced problems due to inadequate storage facilities, exploitation by market intermediaries, high transportation costs and poor road infrastructure.

### 5.12 Farmers' Suggestions for Improving Production and Productivity of Oilseeds

The larger proportion of the sample farmers have suggested to alleviate the major constraints through necessary policy instruments so as to increase the production and productivity of oilseeds in the state. About 54 per cent of sample farmers suggested that electricity should be made available on regular basis for longer duration and low voltage problem should be resolved. About 31 per cent of respondents have suggested to expand the irrigation facilities in their region. Also sample farmers urged to take some meaningful measures to reduce or to stabilize the prices of chemical fertilizers, seeds and other inputs. Though the performance of agricultural supervisors is found to be satisfactory, the number of visits of the agricultural supervisors was inadequate. Near about 22.5 per cent sample farmers expressed that they needed better pesticides/plant protection chemicals for preventing or eradicating the crop diseases. A large number of sample farmers faced the problems of crop damage by blue bull (Nilgai) and pigs. So the sample farmers expressed that they need assistance for fencing in the form of subsidies that will encourage them to build boundary walls/fences so as to protect their cultivated lands from these crop damaging animals.

## 6.0 Conclusions and Policy Implications

The suggestions made by the sample oilseeds farmers have been highlighted in the preceding section that specifically, covered the issues related to the required provisions or facilities to be created by the government to lessen the difficulties of the oilseeds growers or to encourage the farmers to cultivate more areas under oilseeds. If some of the suggestions of the sample farmers could be considered and implemented by the policy makers that will surely help in further increase in area and production of oilseeds in the state. Besides the farmers' suggestions, few more issues have been discussed in the following sections that may help the policy makers to devise the policy for further expansion of area under oilseeds in the state and to increase the production and productivity of oilseeds in the State.

From the analysis of relative contribution of area, yield and their interaction to change in production of total oilseeds in the selected districts of Rajasthan, it was found that the area effect was dominant during Period I (TE 1983-84 to TE 1993-94) and yield effect was dominant during Period II (TE 1993-94 to TE 2009-10). During Period I, the expansion of area under oilseeds was the major source of growth in oilseeds production, which was encouraged by introduction of Technology Mission on Oilseeds (TMO) in 1986 and the policy of Import Substitution Industrialization (ISI) strategy until 1994-95. The ISI strategy pursued until 1994-95 was highly beneficial to oilseeds economy in the country as well as in the State of Rajasthan. Because of limited availability of cultivable lands, the focus was on increase in yield during Period II. It may be noted that the average productivity of oilseeds increased from 872 kg/ha in TE 2000-01 to 1042 kg/ha in TE 2010-11.

### 6.1 Scope for Expansion of Area under Oilseeds in the State

Though the scope of expansion of area under oilseeds in recent years looks gloomy in the state, it is possible to increase the area under the oilseeds by following the disaggregated approach. The district level analysis reveals that 7 out of 33 districts (Baran, Jhalawar, Tonk, Alwar, Sri Ganganagar, Kota and Sawai Madhopur) accounted for about 42 per cent of total oilseeds area of the state. So there is possibility of increasing the area under oilseeds in other districts with very thin area under oilseeds. The oilseeds area can also be increased in the districts with low area under oilseeds but high productivity. Some of this type of districts are Churu ( where oilseeds area constitutes only 2.7% of GCA of the district with oilseeds yield of 1375.4 kg/ha), Bikaner (where oilseeds area constitutes 6.9% of GCA of the district with oilseeds yield of 1134 kg/ha), Hanumangarh (2.5% of state oilseeds area, oilseeds area constituting 8.9 % of district GCA with yield of 1268.8 kg/ha), Jhunjhunu (1.2% of state oilseeds area, oilseeds area constituting 12.7% of district GCA with yield of 1165.5 kg/ha) and Sikar (2.2% of state oilseeds area, oilseeds area constituting 12.8% of district GCA with yield of 1133.9 kg/ha). However, there is a need of further irrigation expansion along with subsidized and sufficient power supply for agriculture in these districts to encourage more farmers to adopt these high value crops.

### 6.2 Scope for Enhancing Oilseeds Productivity in the State

Major avenues for increase in oilseed production in the State are expected to come through increase in yield levels of the oilseed crops. The possibility in productivity enhancement in oilseed crops is probably highest among any group of crops in the state. Our study finds that there is a considerable yield gap in cultivation of selected oilseed crop in the State. In the case of our main oilseed crop rapeseed-mustard, the yield gap-II, i.e., the gap between the actual yield and potential yield was found to be 5.6 q/ha. Thus there is huge scope for increasing the yield of oilseeds in major parts of the State.

There were some districts where the share of oilseeds area in GCA is considerably large but the yield levels of oilseeds were very low. Some of such districts were S. Madhopur (oilseeds area constituting 55.8% of district GCA with yield of only 885.0 kg/ha), Tonk (oil seeds area constituting 47.7% of district GCA with yield of only 709.8 kg/ha), Pali (oilseeds area constituting 25.2% of district GCA with yield of only 333.4 kg/ha), Bundi (oilseeds area constituting 40.1 % of district GCA with yield of only 962.4 kg/ha) and Sirohi (oilseeds area constituting 36.7% of district GCA with yield of only 983.0 kg/ha). These are some of the prospective districts where the increase in yield levels should be emphasized in practice by the policy makers.

Since there is limited scope for increasing area under oilseeds, a combination of land saving technologies involving high yielding varieties and hybrids and efficient crop management and nutrient management strategies need to be adopted so as to increase the yield levels. The losses due to incidence of pests and diseases need to be reduced.

### 6.3 Future Strategies for Oilseeds Sector in the State

As discussed in previous section, the expansion of area under oilseeds should be in focus in some parts of the state, while the increase in yield level should be the emphasized in some targeted regions of the state. Incorporating oilseeds in intercropping sequence and inclusion of oilseeds as a component in crop diversification plans may help in further expansion of area under oilseeds in the State.

The major thrust of strategies should be on enhancement of yield of oilseeds. The diverse sources of productivity enhancement such as improved agro-techniques and improvements in input use efficiency and effective technology dissemination are essential for further increase in yield of oilseed crops in the state. The suggested key strategies for the oilseed productivity improvement in the State are:

- ensuring the timely availability of quality/ certified seeds of improved varieties
- providing incentives to promote balanced crop nutrition
- Promoting efficiency in water use through protective irrigation such as drip and sprinkler and other micro irrigation techniques.
- Popularizing the effective crop management techniques
- Encouraging farmers to adopt integrated pest and nutrient management
- Promoting farm mechanization in oilseed cultivation
- Supporting the farmers to use more resource conservation technologies and precision farming technologies
- Providing incentives/subsidies for fencing so as to help farmers protect their crop from crop damaging animals
- Providing better extension services by hiring more extension personnel and equipping them with necessary skill set through proper training.

Removing the marketing constraints is crucial for encouraging the farmers to adopt more oilseed crops in their crop allocation. For reducing the level of market constraint, some policy initiatives are essential. The major functional areas of policy backing are:

- Enhancing the capacity utilization and efficiency of oilseed processing sector in the State
- Effective market interventions for oilseeds and edible oils
- Creating necessary rural and marketing infrastructures such as rural roads and processing units and market wards etc.
- Favourable trade policy

The state government has ungertaken some useful measures for reducing the market constraints in the state (GoR, 2010b). Removing all restriction on direct purchases of all agricultural and horticultural products by agro-processing enterprises, exempting such purchases from Mandi fee, providing the road links for agro-industries clusters and agro-processing units through Marketing Development Fund, setting up private Mandi yards to promote efficiency and competitiveness in the marketing

etc. are highly appreciable. However, the scale of implementation of the initiatives needs to be increased.

Looking at the major constraints faced by the sample farmers, reducing the influence of middlemen intermediaries, better infrastructure and transport facilities with reasonable charges on the services for reducing the transport costs, better storage facilities and stabilizing the prices of chemical fertilizers, seeds and other inputs need a special policy attention. Among others, timely availability of fertilizer, insecticide, herbicide, pesticides in proper quantity at proper price, creating moreWHSs like dug well, tank, cross bund etc. and expansion of irrigation from canal wherever possible, reducing the disruptions in power supply for irrigation purposes may be emphasized by the policy makers.

## *D. Commodity Reviews*

### (i) Foodgrains

During the month of May, 2013 the Wholesale Price Index (Base 2004-05=100) of pulses declined by 0.47%, Foodgrains and cereals increased by 0.18% and 0.33% respectively over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base : 2004-2005=100)

| Commodity | Weight (%) | WPI for the Month of May, 2013 | WPI for the Month of April, 2013 | WPI A year ago | Percentage change during | |
|---|---|---|---|---|---|---|
| | | | | | A month | A year |
| (1 ) | (2) | (3) | (4) | (5) | (6) | (7) |
| Rice | 1.793 | 210.9 | 207.6 | 178.0 | 1.59 | 18.48 |
| Wheat | 1.116 | 201.3 | 204.2 | 178.7 | -1.42 | 12.65 |
| Jowar | 0.096 | 251.5 | 253.2 | 240.8 | -0.67 | 4.44 |
| Bajra | 0.115 | 264.2 | 261.1 | 210.5 | 1.19 | 25.51 |
| Maize | 0.217 | 246.9 | 251.0 | 220.5 | -1.63 | 11.97 |
| Barley | 0.017 | 206.4 | 209.1 | 212.5 | -1.29 | -2.87 |
| Ragi | 0.019 | 349.6 | 334.3 | 228.4 | 4.58 | 53.06 |
| Cereals | 3.373 | 213.8 | 213.1 | 184.3 | 0.33 | 16.01 |
| Pulses | 0.717 | 231.6 | 232.7 | 218.6 | -0.47 | 5.95 |
| Foodgrains | 4.09 | 216.9 | 216.5 | 190.4 | 0.18 | 13.92 |

*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 May, 2013.

| Commodity | Main Trend | Rising | Falling | Mixed | Steady |
|---|---|---|---|---|---|
| Rice | Rising | Haryana<br>Uttar Pradesh | Jharkhand<br>W.B. | | Gujarat<br>Kerala |
| Wheat | Falling | Gujarat<br>Punjab | Jharkhand<br>Karnataka | Rajasthan<br>U.P. | Maharashtra |
| Jowar | Mixed | Rajasthan<br>U.P. | Gujarat | Maharashtra | A.P.<br>Karnataka |
| Bajra | Rising | A.P.<br>Karnataka<br>Maharashtra<br>Rajasthan<br>Tamilnadu | Gujarat | | U.P. |
| Maize | Falling | | Gujarat<br>Jharkhand | Rajasthan | Karnataka<br>U.P. |

**Procurement of Rice**

3356 thousand tonnes of Rice (including paddy converted into rice) was procured during May, 2013, as against 2048 thousand tonnes of Rice (including paddy converted into rice) procured during May, 2012.The total procurement of Rice in the current marketing season i.e 2012-2013, upto 31.05.2013 stood at 34126 thousand tonnes, as against 32850 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 2012-13 (up to 31-05-2013) | | Corresponding Period of last Year 2011-12 | | Marketing Year (October-September) 2011-12 | | 2010 -11 | |
|---|---|---|---|---|---|---|---|---|
| | 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 | 6080 | 17.82 | 6765 | 20.59 | 7548 | 21.53 | 9609 | 28.10 |
| Chhatisgarh | 4850 | 14.21 | 4114 | 12.52 | 4115 | 11.74 | 3746 | 10.95 |
| Haryana | 2658 | 7.79 | 2007 | 6.11 | 2007 | 5.72 | 1687 | 4.93 |
| Maharashtra | 182 | 0.53 | 190 | 0.58 | 190 | 0.54 | 308 | 0.90 |
| Punjab | 8871 | 25.99 | 7731 | 23.53 | 7731 | 22.05 | 8635 | 25.25 |
| Tamil Nadu | 475 | 1.40 | 1590 | 4.84 | 1596 | 4.55 | 1543 | 4.51 |
| Uttar Pradesh | 2837 | 8.31 | 3310 | 10.08 | 3357 | 9.58 | 2554 | 7.47 |
| Uttarakhand | 736 | 2.16 | 338 | 1.03 | 378 | 1.08 | 422 | 1.23 |
| Others | 7437 | 21.79 | 6805 | 20.72 | 8138 | 23.21 | 5694 | 16.65 |
| **Total** | **34126** | **100.00** | **32850** | **100.00** | **35060** | **100.00** | **34198** | **100.00** |

*Source*: Department of Food and Public Distribution.

**Procurement of Wheat**

The total procurement of wheat in the current marketing season i.e 2013-2014 upto May, 2013 is 25004 thousand tonnes against a total of 34325 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 2013-14 (upto 31-05-2013) | | Corresponding Period of last Year (2012-13) | | Marketing Year (April-March) 2012-13 | | 2011-12 | |
|---|---|---|---|---|---|---|---|---|
| | 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 | 5873 | 23.49 | 8647 | 25.19 | 8665 | 22.71 | 6928 | 24.45 |
| Madhya Pradesh | 6346 | 25.38 | 7876 | 22.95 | 8493 | 22.26 | 4965 | 17.52 |
| Punjab | 10870 | 43.47 | 12775 | 37.22 | 12834 | 33.64 | 10958 | 38.67 |
| Rajasthan | 1228 | 4.91 | 1452 | 4.23 | 1964 | 5.15 | 1303 | 4.60 |
| Uttar Pradesh | 675 | 2.70 | 3073 | 8.95 | 5063 | 13.27 | 3461 | 12.21 |
| Others | 12 | 0.05 | 502 | 1.46 | 1129 | 2.96 | 720 | 2.54 |
| **Total** | **25004** | **100.00** | **34325** | **100.00** | **38148** | **100.00** | **28335** | **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 207.6 in May, 2013 showing a fall of 1.2 per cent over the previous month. However, it increased by 12.9 per cent over the previous year.

The Wholesale Price Index (WPI) of all individual oilseeds showed a mixed trend. The WPI of Safflower (4.3 per cent), Soyabean (3.4 per cent), Cotton Seed (1.0 per cent) and Sunflower (0.1 per cent) increased over the previous month. However, the WPI of Gingelly seed (-8.2 per cent), Groundnut seed (- 3.3 per cent), Niger seed (-2.9 per cent), Copra (-2.5 per cent) and Rape and Mustard (-1.8 per cent) decreased over the previous month. The Wholesale Price Index (WPI) of Edible Oils as a group stood 146.9 in May, 2013 showing an increase of 1.2 per cent and 0.8 per cent over the previous month and over the previous year. The WPI of Groundnut Oil (4.9 per cent), Mustard Oil (2.9 per cent), Cottonseed Oil (2.1 per cent) and Soyabean Oil (0.6 per cent) increased over the previous month. However, the WPI of Gingelly Oil (4.7 per cent), Copra oil (0.8 per cent) and Sunflower 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 214.4 in May, 2013 showing an increase of 3.9 per cent and 2.8 per cent over the previous month and over the previous year.

**Potato** : The Wholesale Price Index (WPI) of Potato stood at 196.5 in May, 2013 showing an increase of 15.9 per cent over the previous month. However, it decreased by 3.4 per cent over the previous year.

**Onion :** The Wholesale Price Index (WPI) of Onion stood 272.8 in May, 2013 showing an increase of 1.9 per cent and 97.4 per cent over the previous month and over the previous year.

**Condiments and Spices :** The Wholesale Price Index (WPI) of Condiments & Spices (Group) stood at 232.0 in May, 2013 showing an increase of 1.0 per cent and 16.6 per cent over the previous month and over the previous year.

The WPI of Black Pepper and Chillies (Dry) decreased by 0.7 per cent and 5.2 per cent, respectively over the previous month. However, the WPI of Turmeric increased by 6.3 per cent over the previous month.

**Raw Cotton** : The Wholesale Price Index (WPI) of Raw Cotton stood at 213.3 in May, 2013 showing a fall of 0.2 per cent over the previous month. However, it increased by 4.3 per cent over the previous year.

**Raw Jute :** The Wholesale Price Index (WPI) of Raw Jute stood at 268.0 in May, 2013 showing a fall of 1.7 per cent over the previous month. However, it increased by 24.0 per cent over the previous year.

WHOLESALE PRICE INDEX OF COMMERCIAL CROPS FOR THE MONTH OF MAY, 2013

(Base Year : 2004-05=100)

| Commodity | Latest | Month | Year | Percentage Variation over | |
|---|---|---|---|---|---|
| | May, 2013 | April, 2013 | May 2012 | Month | Year |
| ***OIL SEEDS*** | 207.6 | 210.1 | 183.8 | -1.2 | 12.9 |
| Groundnut Seed | 260.8 | 269.8 | 234.9 | -3.3 | 11.0 |
| Rape & Mustard Seed | 185.1 | 188.4 | 179.9 | -1.8 | 2.9 |
| Cotton Seed | 168.1 | 166.5 | 146.8 | 1.0 | 14.5 |
| Copra (Coconut) | 90.5 | 92.8 | 90.2 | -2.5 | 0.3 |
| Gingelly Seed (Sesamum) | 349.4 | 380.8 | 257.9 | -8.2 | 35.5 |
| Niger Seed | 177.1 | 182.4 | 195.8 | -2.9 | -,9.6 |
| Safflower (Kardi Seed) | 156.8 | 150.4 | 149.2 | 4.3 | 5.1 |
| Sunflower | 189.3 | 189.2 | 174.7 | 0.1 | 8.4 |
| Soyabean | 248.9 | 240.8 | 202.5 | 3.4 | 22.9 |
| ***EDIBLE OILS*** | 146.9 | 145.2 | 145.8 | 1.2 | 0.8 |
| Groundnut Oil | 201.9 | 192.5 | 192.5 | 4.9 | 4.9 |
| Cotton Seed Oil | 166.4 | 163.0 | 163.2 | 2.1 | 2.0 |
| Mustard & Rapeseed Oil | 151.7 | 147.4 | 151.4 | 2.9 | 0.2 |
| Soyabean Oil | 159.0 | 158.0 | 158.5 | 0.6 | 0.3 |
| Copra Oil | 114.8 | 115.7 | 115.8 | -0.8 | -0.9 |
| Sunflower Oil | 132.3 | 133.1 | 134.3 | -0.6 | -1.5 |
| Gingelly Oil | 187.0 | 196.3 | 155.9 | -4.7 | 19.9 |
| ***FRUITS AND VEGETABLES*** | 214.4 | 206.4 | 208.5 | 3.9 | 2.8 |
| Potato | 196.5 | 169.6 | 203.5 | 15.9 | -3.4 |
| Onion | 272.8 | 267.6 | 138.2 | 1'.9 | 97.4 |
| ***CONDIMENTS AND SPICES*** | 232.0 | 229.8 | 198.9 | 1.0 | 16.6 |
| Black Pepper | 494.9 | 498.4 | 489.5 | -0.7 | 1.1 |
| Chillies (Dry) | 247.5 | 261.2 | 225.1 | -5.2 | 10.0 |
| Turmeric | 225.3 | 211.9 | 143.7 | 6.3 | 56.8 |
| Raw Cotton | 213.3 | 213.7 | 204.5 | -0.2 | 4.3 |
| Raw Jute | 268.0 | 272.6 | 216.1 | -1.7 | 24.0 |

*Source* : Dte. of Eco. and Statistics. Commercial Crops Division.

# *PART II—Statistical Tables*

## *A. Wages*

### 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 | Non Adult | Man | Woman | Non Adult | Man | Woman | Non Adult | Carpenter | Blacksmith | Cobbler |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| *Andhra Pradesh* | | | | | | | | | | | | | | | |
| Krishna | Ghantasala | Sep., 2012 | 8 | 225.00 | 132.05 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Guntur | Tadikonda | Sep., 2012 | 8 | 350.00 | 300.00 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Rangareddy | Arutla | Sep., 2012 | 8 | 250.00 | 120.00 | NA | 150.00 | NA | NA | NA | NA | NA | 250.00 | 250.00 | NA |
| *Karnataka* | | | | | | | | | | | | | | | |
| Bangalore | Harisandra | May to June, 2012 | 8 | 200.00 | 150.00 | NA | 200.00 | 150.00 | NA | 250.00 | 180.00 | NA | 300.00 | 300.00 | NA |
| Tumkur | Gedlahali | May to June, 2012 | 8 | 160.00 | 160.00 | NA | 180.00 | 160.00 | NA | 180.00 | 160.00 | NA | 180.00 | 180.00 | NA |
| *Maharashtra* | | | | | | | | | | | | | | | |
| Nagpur | Mauda | Feb., 2012 | 8 | 100.00 | 100.00 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ahmednagar | Akole | Feb, 2012 | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Jharkhand* | | | | | | | | | | | | | | | |
| Ranchi | Gaintalsood | April, 2012 | 8 | 100.00 | 100.00 | NA | 90.00 | 90.00 | NA | 58.00 | 58.00 | NA | 170.00 | 150.00 | NA |

### 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 | Blacksmith | Cobbler |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| *Assam* | | | | | | | | | | | | | |
| Barpeta | Loharapara | March, 12 | M | 8 | 180.00 | 180.00 | 180.00 | 180.00 | 180.00 | 180.00 | 180.00 | 180.00 | 180.00 |
| | | | W | 8 | NA | NA | 160.00 | 160.00 | 160.00 | NA | NA | NA | NA |
| *Bihar* | | | | | | | | | | | | | |
| Muzaffarpur | Bhalui Rasul | April to, June, 2012 | M | 8 | 130.00 | 120.00 | 80.00 | 130.00 | 150.00 | 120.00 | 200.00 | 180.00 | 250.00 |
| | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Shekhpura | Kutaut | May and June, 2012 | M | 8 | NA | NA | 185.00 | NA | 185.00 | NA | 245.00 | NA | NA |
| | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Chhattisgarh* | | | | | | | | | | | | | |
| Dhamtari | Sihaba | March, 2013 | M | 8 | NA | NA | 120.00 | NA | 80.00 | 100.00 | 250.00 | 100.00 | 100.00 |
| | | | W | 8 | NA | NA | 100.00 | NA | 80.00 | 80.00 | 150.00 | 100.00 | 80.00 |
| *Gujarat* | | | | | | | | | | | | | |
| Rajkot | Rajkot | Jan., 2013 | M | 8 | 209.00 | 225.00 | 150.00 | 170.00 | 147.00 | 150.00 | 360.00 | 360.00 | 240.00 |
| | | | W | 8 | NA | 169.00 | 150.00 | 179.00 | 145.00 | 142.00 | NA | NA | NA |
| Dahod | Dahod | Jan., 2013 | M | 8 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | NA | 200.00 | 144.00 | 150.00 |
| | | | W | 8 | NA | 100.00 | 100.00 | 100.00 | 100.00 | NA | NA | NA | NA |
| *Haryana* | | | | | | | | | | | | | |
| Panipat | Ugarakheri | March, 2013 | M | 8 | 180.00 | 180.00 | 180.00 | 200.00 | 180.00 | NA | 400.00 | 400.00 | NA |
| | | | W | 8 | NA | 150.00 | 150.00 | 180.00 | 150.00 | NA | NA | NA | NA |

## 1.1 Daily Agricultural Wages in Some States (Operation-wise)—*Contd.*

(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 | Blacksmith | Cobbler |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| *Himachal Pradesh* | | | | | | | | | | | | | |
| Mandi | Mandi | Nov., to Dec. 2010 | M | 8 | 300.00 | 110.00 | 110.00 | 110.00 | 110.00 | 110.00 | 200.00 | 200.00 | NA |
| | | | W | 8 | NA | 110.00 | 110.00 | 110.00 | 110.00 | 110.00 | NA | NA | NA |
| *Kerala* | | | | | | | | | | | | | |
| Kozhikode | Koduvally | March., 2013 | M | 4 to 8 | 820.00 | 500.00 | NA | 500.00 | 660.00 | NA | 600.00 | NA | NA |
| | | | W | 4 to 8 | NA | NA | 400.00 | 400.00 | 450.00 | NA | NA | NA | NA |
| Palakkad | Elappally | March, 2013 | M | 4 to 8 | NA | NA | NA | 400.00 | 400.00 | NA | 500.00 | NA | NA |
| | | | W | 4 to 8 | NA | NA | NA | 300.00 | 200.00 | NA | NA | NA | NA |
| *Madhya Pradesh* | | | | | | | | | | | | | |
| Hoshangabad | Sangarkhera | March., 2013 | M | 8 | 150.00 | 100.00 | 100.00 | 160.00 | 100.00 | 100.00 | 350.00 | 350.00 | 150.00 |
| | | | W | 8 | NA | 100.00 | 100.00 | 160.00 | 100.00 | 100.00 | NA | NA | NA |
| Satna | Kotar | March, 2013 | M | 8 | | | | | —NA— | | | | |
| | | | W | 8 | | | | | —NA— | | | | |
| Shyopur Kala | Vijaypur | March, 2013 | M | 8 | 150.00 | 150.00 | NA | NA | NA | 50.00 | 200.00 | 200.00 | NA |
| | | | W | 8 | NA | 150.00 | NA | NA | NA | NA | NA | NA | NA |
| *Odisha* | | | | | | | | | | | | | |
| Bhadrak | Chandbali | March, 2013 | M | 8 | 200.00 | 120.00 | 120.00 | 250.00 | 208.33 | 150.00 | 350.00 | 300.00 | 150.00 |
| | | | W | 8 | NA | 100.00 | 100.00 | 200.00 | 153.33 | 140.00 | NA | NA | NA |
| Ganjam | Aska | March, 2013 | M | 8 | 250.00 | 200.00 | 200.00 | 200.00 | 216.66 | 200.00 | 350.00 | 250.00 | 200.00 |
| | | | W | 8 | NA | 130.00 | 150.00 | 150.00 | 130.00 | 150.00 | NA | NA | NA |
| *Punjab* | | | | | | | | | | | | | |
| Ludhiana | Pakhowal | June, 2008 | M | 8 | NA | NA | 90.00 | 95.00 | NA | 99.44 | NA | NA | NA |
| | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Rajasthan* | | | | | | | | | | | | | |
| Barmer | Vishala | March, 2013 | M | 8 | | | | | —NA— | | | | |
| | | | W | 8 | | | | | | | | | |
| Jalore | Panwa | March, 2013 | M | 8 | NA | NA | 200.00 | NA | NA | 200.00 | 350.00 | 300.00 | NA |
| | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Tamil Nadu* | | | | | | | | | | | | | |
| Thanjavur | Pulvarnatham | Feb., 2013 | M | 6 | | | | | —NR— | | | | |
| | | | W | 5 | | | | | | | | | |
| Tirunelveli | Malayakulam (Kurvikulam) | Feb., 2013 | M | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| *Tripura* | | | | | | | | | | | | | |
| Agartala | Govt. Agri. Farm | | M | 8 | | | | | —NR— | | | | |
| | | | W | 8 | | | | | | | | | |
| *Uttar Pradesh** | | | | | | | | | | | | | |
| Meerut | Ganeshpur | Jan., 2013 | M | 8 | 205.00 | 207.00 | 206.00 | 204.00 | 206.00 | NA | 320.00 | NA | NA |
| | | | W | 8 | NA | 180.00 | 180.00 | 180.00 | 180.00 | NA | NA | NA | NA |
| Aurraiya | Aurraiya | Jan., 2013 | M | 8 | 150.00 | 193.00 | 192.00 | 150.00 | 193.00 | NA | 300.00 | NA | NA |
| | | | W | 8 | NA | 160.00 | 167.00 | 120.00 | 167.00 | NA | NA | NA | NA |
| Chandauli | Chandauli | Jan., 2013 | M | 8 | 150.00 | 150.00 | 125.00 | 125.00 | 125.00 | NA | 271.00 | NA | NA |
| | | | W | 8 | NA | 150.00 | 125.00 | 125.00 | 125.00 | NA | NA | NA | NA |

M-Man W-Woman

N. A. —Not Available N. R. —Not Reported

*- Uttar Pradesh reports its district-wise average rural wage data rather than from selected centre/village.

*Source :* Dte. of Eco. and Statistics, Wages Division.

## *B. PRICES*

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

(Month-end Prices in Rupees)

| Commodity | Variety | Unit | State | Centre | May-13 | Apr.-13 | May-12 |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Wheat | PBW 343 | Quintal | Punjab | Amritsar | 1375 | 1350 | 1280 |
| Wheat | Dara | Quintal | Uttar Pradesh | Chandausi | 1390 | 1355 | 1190 |
| Wheat | Lokvan | Quintal | Madhya Pradesh | Bhopal | 1650 | 1555 | 1300 |
| Jowar | — | Quintal | Maharashtra | Mumbai | 2600 | 2400 | 2400 |
| Gram | No III | Quintal | Madhya Pradesh | Sehore | — | — | 2000 |
| Maize | Yellow | Quintal | Uttar Pradesh | Kanpur | — | 1260 | 1275 |
| Gram Split | — | Quintal | Bihar | Patna | 5140 | 5200 | 4900 |
| Gram Split | — | Quintal | Maharashtra | Mumbai | 6200 | 6300 | 4400 |
| Arhar Split | — | Quintal | Bihar | Patna | 6100 | 5800 | 6275 |
| Arhar Split | — | Quintal | Maharashtra | Mumbai | 6800 | 6800 | 5100 |
| Arhar Split | — | Quintal | NCT of Delhi | Delhi | 6400 | 6500 | 6100 |
| Arhar Split | Sort II | Quintal | Tamil Nadu | Chennai | 6300 | 6400 | 6200 |
| Gur | — | Quintal | Maharashtra | Mumbai | 3500 | 3450 | 3250 |
| Gur | Sort II | Quintal | Tamil Nadu | Coimbatore | 3400 | 3400 | 2950 |
| Gur | Balti | Quintal | Uttar Pradesh | Hapur | 2800 | 2650 | 2700 |
| Mustard Seed | Black (S) | Quintal | Uttar Pradesh | Kanpur | 3160 | 3250 | 3325 |
| Mustard Seed | Black | Quintal | West Bengal | Raniganj | 3900 | 4300 | 3500 |
| Mustard Seed | — | Quintal | West Bengal | Kolkata | 3700 | 3750 | 3900 |
| Linseed | Bada Dana | Quintal | Uttar Pradesh | Kanpur | 3875 | 4125 | 3340 |
| Linseed | Small | Quintal | Uttar Pradesh | Varanasi | 3220 | 3380 | 3060 |
| Cotton Seed | Mixed | Quintal | Tamil Nadu | Virudhunagar | 1600 | 1600 | 1250 |
| Cotton Seed | MCU5 | Quintal | Tamil Nadu | Coimbatore | 1550 | 1550 | 1550 |
| Castor Seed | — | Quintal | Andhra Pradesh | Hyderabad | 3050 | 3200 | 3200 |
| Sesamum Seed | White | Quintal | Uttar Pradesh | Varanasi | 6250 | 6325 | 6200 |
| Copra | FAQ | Quintal | Kerala | Alleppey | 4350 | 4225 | 3975 |
| Groundnut | Pods | Quintal | Tamil Nadu | Coimbatore | 4000 | 4000 | 3850 |
| Groundnut | — | Quintal | Maharashtra | Mumbai | 7600 | 7800 | 6250 |
| Mustard Oil | — | 15 Kg. | Uttar Pradesh | Kanpur | 1239 | 1249 | 1215 |
| Mustard Oil | Ordinary | 15 Kg. | West Benaal | Kolkata | 1140 | 1155 | 1275 |
| Groundnut Oil | — | 15 Kg. | Maharashtra | Mumbai | 1650 | 1800 | 1950 |
| Groundnut Oil | Ordinary | 15 Kg. | Tamil Nadu | Chennai | 1650 | 1800 | 1815 |
| Linseed Oil | — | 15 Kg. | Uttar Pradesh | Kanpur | — | 1298 | 1350 |
| Castor Oil | — | 15 Kg. | Andhra Pradesh | Hyderabad | 1065 | 1110 | 1050 |
| Sesamum Oil | — | 15 Kg. | NCT of Delhi | Delhi | 1700 | 1700 | 1350 |
| Sesamum Oil | Ordinary | 15 Kg. | Tamil Nadu | Chennai | 2550 | 3150 | 1800 |
| Coconut Oil | — | 15 Kg. | Kerala | Cochin | 923 | 938 | 908 |
| Mustard Cake | — | Quintal | Uttar Pradesh | Kanpur | 1675 | 1710 | 1650 |
| Groundnut Cake | — | Quintal | Andhra Pradesh | Hyderabad | 3143 | 3214 | 2471 |
| Cotton/Kapas | NH44 | Quintal | Andhra Pradesh | Nandyal | 4300 | 4000 | 3450 |
| Cotton/Kapas | LRA | Quintal | Tamil Nadu | Virudhunagar | 4000 | 4200 | 3400 |
| Jute Raw | TD5 | Quintal | West Benaal | Kolkata | 2785 | 2809 | 2425 |
| Jute Raw | W5 | Quintal | West Benaal | Kolkata | 2785 | 2805 | 2425 |

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 | May-13 | Apr.-13 | May-12 |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Oranges | — | 100 No | NCT of Delhi | Delhi | NA | 625 | NA |
| Oranges | Big | 100 No | Tamil Nadu | Chennai | 610 | 550 | 550 |
| Oranges | Nagpuri | 100 No | West Benaal | Kolkata | — | NA | N.A. |
| Banana | — | 100 No. | NCT of Delhi | Delhi | 183 | 200 | 233 |
| Banana | Medium | 100 No. | Tamil Nadu | Kodaikkanal | 388 | 380 | 316 |
| Cashewnuts | Raw | Quintal | Maharashtra | Mumbai | 48000 | 46000 | 42000 |
| Almonds | — | Quintal | Maharashtra | Mumbai | 46000 | 45800 | 42500 |
| Walnuts | — | Quintal | Maharashtra | Mumbai | 62500 | 58000 | 52000 |
| Kishmish | — | Quintal | Maharashtra | Mumbai | 13500 | 12300 | 12000 |
| Peas Green | — | Quintal | Maharashtra | Mumbai | 3650 | 3300 | 2800 |
| Tomatoes | Ripe | Quintal | Uttar Pradesh | Kanpur | 1150 | 785 | 780 |
| Ladyfinger | — | Quintal | Tamil Nadu | Chennai | 2200 | 3000 | 2000 |
| Cauliflower | — | 100 No. | Tamil Nadu | Chennai | 1850 | 1100 | 1200 |
| Potatoes | Red | Quintal | Bihar | Patna | 720 | 685 | 880 |
| Potatoes | Desi | Quintal | West Bengal | Kolkata | 840 | 920 | 1100 |
| Potatoes | Sort I | Quintal | Tamil Nadu | Mettuppalayam | — | 2018 | — |
| Onions | Pole | Quintal | Maharashtra | Nashik | 950 | 700 | 350 |
| Turmeric | Nadan | Quintal | Kerala | Cochin | 10500 | 10500 | 7200 |
| Turmeric | Salam | Quintal | Tamil Nadu | Chennai | 9700 | 9500 | 5400 |
| Chillies | — | Quintal | Bihar | Patna | 7920 | 7600 | 8125 |
| Black Pepper | Nadan | Quintal | Kerala | Kozhikode | 31000 | 32500 | 36000 |
| Ginger | Dry | Quintal | Kerala | Cochin | 15500 | 17500 | 7500 |
| Cardamom | Major | Quintal | NCT of Delhi | Delhi | 100000 | 90000 | 69000 |
| Cardamom | Small | Quintal | West Bengal | Kolkata | 110000 | 110000 | 100000 |
| Milk | Cow | 100 Liters | NCT of Delhi | Delhi | 3800 | 3600 | 3400 |
| Milk | Buffalo | 100 Liters | West Bengal | Kolkata | 3200 | 3200 | 3200 |
| Ghee Deshi | Deshi No 1 | Quintal | NCT of Delhi | Delhi | 28681 | 27347 | 24679 |
| Ghee Deshi | — | Quintal | Maharashtra | Mumbai | 25500 | 25500 | 25500 |
| Ghee Deshi | Desi | Quintal | Uttar Pradesh | Kanpur | — | 27650 | 28200 |
| Fish | Rohu | Quintal | NCT of Delhi | Delhi | 8500 | 9500 | 6500 |
| Fish | Pomphrets | Quintal | Tamil Nadu | Chennai | 30000 | 29000 | 25500 |
| Eggs | Madras | 1000 No, | West Bengal | Kolkata | 3500 | 3500 | 3000 |
| Tea | — | Quintal | Bihar | Patna | 19900 | 19900 | 19650 |
| Tea | Atti Kunna | Quintal | Tamil Nadu | Coimbatore | 9000 | 9000 | 13000 |
| Coffee | Plant-A | Quintal | Tamil Nadu | Coimbatore | 26000 | 26000 | 28000 |
| Coffee | Rubusta | Quintal | Tamil Nadu | Coimbatore | 14000 | 14000 | 13200 |
| Tobacco | Kampila | Quintal | Uttar Pradesh | Farukhabad | 2625 | 2700 | 2300 |
| Tobacco | Raisa | Quintal | Uttar Pradesh | Farukhabad | 2560 | 2600 | 2250 |
| Tobacco | Bidi Tobacco | Quintal | West Benaal | Kolkata | 3450 | 3450 | 4500 |
| Rubber | — | Quintal | Kerala | Kottayam | 15000 | 15000 | 18900 |
| Arecanut | Pheton | Quintal | Tamil Nadu | Chennai | 28000 | 28000 | 27700 |

*Source* : Dte. of Eco. and Statistics, Prices and Market Division.

3. Month-end Wholesale Prices of Some Important Agricultural Commodities in International Markets During Year, 2013

| Commodity | Variety | Country | Centre | Unit | Jan. | Feb. | Mar. | April | May |
|---|---|---|---|---|---|---|---|---|---|
| Cardamom | Guatmala Bold Green | U.K. | — | Dollar/M.T. | 16500.00 | 16500.00 | 16500.00 | 17000.00 | 17000.00 |
| | | | | Rs./Qtl. | 139788.00 | 137164.50 | 135762.00 | 142290 | 142953.00 |
| Cashew Kernels | Spot U.K. 320s | U.K. | — | Dollar/1bs | 3.60 | 3.60 | 3.66 | 3.64 | 3.58 |
| | | | | Rs./Qtl. | 67220.24 | 65958.67 | 66372.31 | 67148.83 | 66349.70 |
| Castor Oil | Any Origin ex tank Rotterdam | Nether-lands | — | Dollar/M.T. | 1690.00 | 1650.00 | 1650.00 | 1600.00 | 1550.00 |
| | | | | Rs./Qtl. | 9071.92 | 8987.55 | 8974.35 | 8675.20 | 8635.05 |
| Celery Seed | ASTA cif | India | — | Dollar/M.T. | 1500.00 | 1500.00 | 1500.00 | 1500.00 | 1500.00 |
| | | | | Rs./Qtl. | 8052.00 | 8170.50 | 8158.50 | 8133.00 | 8356.50 |
| Chillies | Birds eye 2005 crop | Africa | — | Dollar/M.T. | 5000.00 | 4250.00 | 4250.00 | 4100.00 | 4100.00 |
| | | | | Rs./Qtl. | 26840.00 | 23149.75 | 23115.75 | 22230.20 | 22841.10 |
| Cinnamon Bark | | Mada-gascar | — | Dollar/M.T. | 1100.00 | 1100.00 | 1100.00 | 1100.00 | 1100.00 |
| | | | | Rs./Qtl. | 5904.80 | 5991.70 | 5982.90 | 5964.20 | 6128.10 |
| Cloves | Singapore | Mada-gascar | — | Dollar/M.T. | 9500.00 | 9500.00 | 9500.00 | 12000.00 | 12000.00 |
| | | | | Rs./Qtl. | 50996.00 | 51746.50 | 51670.50 | 65064.00 | 66852.00 |
| Coconut Oil | Crude Phillipine/ Indonesia | Nether-lands | — | Dollar/M.T. | 815.00 | 850.00 | 805.00 | 800.00 | 815.00 |
| | | | | Rs./Qtl. | 4374.92 | 4629.95 | 4378.40 | 4337.60 | 4540.37 |
| Copra | Phillipines cif Rotterdam | Philli pine | — | Dollar/M.T. | 538.00 | 530.00 | 505/.00 | 476.00 | 517.50 |
| | | | | Rs./Qtl. | 2887.98 | 2886.91 | 2746.70 | 2580.87 | 2882.99 |
| Corriander | | India | — | Dollar/M.T. | 1150.00 | 1150.00 | 1150.00 | 1150.00 | 1150.00 |
| | | | | Rs./Qtl. | 6173.20 | 6264.05 | 6254.85 | 6235.30 | 6406.65 |
| Cummin Seed | | India | — | Dollar./M.T. | 2889.00 | 2889.00 | 2889.00 | 2889.00 | 2889.00 |
| | | | | Rs./Qtl. | 15508.15 | 15736.38 | 15713.27 | 15664.16 | 16094.62 |
| Fennel seed | | India | — | Dollar/M.T. | 2600.00 | 2600.00 | 2600.00 | 2600.00 | 2600.00 |
| | | | | Rs./Qtl. | 13956.80 | 14162.20 | 14141.40 | 14097.20 | 14484.60 |
| Ginger | Split | Nigeria | — | Dollar/M.T. | 2400.00 | 2400.00 | 2400.00 | 2400.00 | 2400.00 |
| | | | | Rs./Qtl. | 12883.20 | 13072.80 | 13053.60 | 13012.80 | 13370.40 |
| Groundnut kernels | US 2005, 40/50 | European Ports | — | Dollar/M.T | 1275.00 | 1350.00 | — | — | 1350.00 |
| | | | | Rs./Qtl. | 6844.20 | 7353.45 | — | — | 7520.85 |
| Groundnut Oil | Crude Any Origin cif Rotterdam | U.K. | — | Dollar/M.T | 2200.00 | — | — | — | — |
| | | | | Rs./Qtl. | 18638.40 | — | — | — | — |
| Lentils | Turkish Red Split Crop 1+1 water | U.K. | — | Pound/M.T | 522.72 | 655.20 | 660.98 | 647.80 | 662.47 |
| | | | | Rs./Qtl. | 4428.48 | 5446.68 | 5438.54 | 5422.09 | 5570.71 |
| Maize | | U.S.A | Chic-ago | C/56 lbs. | 720.75 | 299.95 | 735.25 | 278.00 | 658.50 |
| | | | | Rs./Qtl | 1520.51 | 642.09 | 1571.62 | 592.38 | 1441.72 |
| Oats | | Canada | Winni-peg | CanDollar/M.T. | 359.83 | 384.62 | 406.44 | 401.94 | 366.80 |
| | | | | Rs./Qtl. | 1926.89 | 2058.87 | 2175.67 | 2136.31 | 1980.35 |
| Palm Kernal Oil | Crude Malaysia/ Indonesia | Nether-lands | — — | Dollar/M.T. | 795.00 | 855.00 | 815.00 | 840.00 | 810.00 |
| | | | | Rs./Qtl. | 4267.56 | 4657.19 | 4432.79 | 4554.48 | 4512.51 |
| Palm Oil | Crude Malaysian/ Sumatra | Nether-lands | — — | Dollar/M.T. | 855.00 | 860.00 | 850.00 | 830.00 | 860.00 |
| | | | | Rs./Qtl. | 4589.64 | 4684.42 | 4623.15 | 4500.26 | 4791.06 |

3. MONTH-END WHOLESALE PRICES OF SOME IMPORTANT AGRICULTURAL COMMODITIES IN INTERNATIONAL MARKETS DURING YEAR, 2013—*Contd.*

| Commodity | Variety | Country | Centre | Unit | Jan. | Feb. | Mar. | April | May |
|---|---|---|---|---|---|---|---|---|---|
| Pepper (Black) | Sarawak Black lable | Malaysia | — | Dollar/M.T. | — | 7300.00 | — | — | — |
| | | | — | Rs./Qtl. | — | 39763.10 | — | — | — |
| Rapeseed | Canola | Canada | Winnipeg | Can Dollar/M.T | 605.80 3244.06 | 644.20 3448.40 | 638.00 3415.21 | 637.60 3388.84 | 647.30 3494.77 |
| Rapeseed | UK Rapeseed Buyer Price DAP | U.K. | — | Pound/M.T. Rs/Qtl. | 379.00 3210.89 | 389.00 3233.76 | 393.00 3233.60 | 394.00 9297.78 | 354.00 2976.79 |
| Rapeseed Oil | Refined bleached and deodorised | U.K. | — | Pound/M.T. Rs/Qtl. | 871.00 7379.11 | 908.00 7548.20 | 867.00 7133.68 | 819.00 6855.03 | 848.00 7130.83 |
| Soyabean Meal | U.K. produced 49% oil & protein | U.K. | — | Pound/M.T. Rs./Qtl. | 351.00 2973.67 | 379.00 3150.63 | 376.00 3093.73 | — — | 400.00 3363.60 |
| Soyabean Oil | | U.S.A. | — | C/lbs Rs./Qtl. | 52.03 6155.71 | 52.07 6251.10 | 50.82 6092.08 | 49.18 5877.05 | 49.64 6095.04 |
| | Refined bleached and deodorised | U.K. | — | Pound/M.T. Rs/Qtl. | 826.00 6997.87 | 849.00 7057.74 | 839.00 6903.29 | 768.00 6428.16 | 777.00 6533.79 |
| Soyabeans | | U.S.A. | — | C/60 lbs Rs./Qtl | 1437.00 2830.97 | 1482.75 2964.09 | 1453.75 2901.85 | 1345.25 2676.88 | 1494.25 3055.08 |
| | US No. 2 yellow | Netherlands | Chicago | Dollar/M.T. Rs./Qtl | 596.70 3203.09 | 594.10 3236.06 | 580.10 3155.16 | 569.20 3086.20 | 494.30 2753.75 |
| Sunflower Seed Oil | Refined bleached and deodorised | U.K. | — | Pound/M.T. Rs./Qtl | 983.00 8327.98 | 1018.00 8462.63 | 963.00 7923.56 | 934.00 7817.58 | 836.00 7029.92 |
| Tallow | High grade delivered | U.K. | London | Pound/M.T. Rs./Qtl | 550.00 4659.60 | 460.00 3823.98 | 440.00 3620.32 | 440.00 3682.80 | 440.00 3699.96 |
| Turmeric | Madras finger spot/cif | India | — | Dollar/M.T. Rs./Qtl | 850.00 4562.80 | 850.00 4629.95 | 850.00 4623.15 | 850.00 4608.70 | 850.00 4735.35 |
| Walnuts | Indian light halves | U.K. | — | Pound/M.T. Rs./Qtl | 7500.00 63540.00 | 7500.00 62347.50 | 7950.00 65412.60 | 7750.00 64867.50 | 7980.00 67103.82 |
| Wheat | | U.S.A. | Chicago | C/60 lbs Rs../Qtl | 774.75 1526.30 | 738.50 1476.30 | 736.75 1470.64 | 691.75 1376.50 | 688.50 1407.68 |

*Source* : Public Ledger.

**Exchange Rate**

| | Jan. | Feb. | Mar. | April | May |
|---|---|---|---|---|---|
| US Dollar | 53.68 | 54.47 | 54.39 | 54.22 | 55.71 |
| CAN Dollar | 53.55 | 53.53 | 53.53 | 53.15 | 53.99 |
| UK Pound | 84.72 | 83.13 | 82.28 | 83.70 | 84.09 |

## *C. CROP PRODUCTION*

### 4. Sowing and Harvesting Operations Normally in Progress During July, 2013

| State | Sowing | Harvesting |
|---|---|---|
| (1) | (2) | (3) |
| Andhra Pradesh | Winter Rice, Jowar (K), Bajra, Maize (K), Ragi (K), Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Ginger, Chillies (Dry), Groundnut, Castorseed, Sesamum, Cotton, Mesta, Sweet Potato, Turmeric, Sannhemp, Nigerseed, Onion, Tapioca. | Autumn Rice |
| Assam | Winter Rice, Castorseed. | Autumn Rice, Jute |
| Bihar | Autumn Rice, Winter Rice, Jowar (K), Bajra, Maize, Ragi, Small Millets (K), Tur (K), Groundnut, Castorseed, Sesamum, Cotton, Jute, Mesta. | Jute |
| Gujarat | Winter Rice, Jowar (K), Bajra, Maize, Ragi, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Chillies (Dry), Tobacco, Groundnut, Castorseed, Sesamum, Cotton, Sannhemp. | — |
| Himachal Pradesh | Summer Rice, Jowar (K), Bajra, Ragi, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Chillies (Dry), Sesamum, Sannhemp, Summer Potato (Plains). | Winter Potato (Hills) |
| Jammu & Kashmir | Autumn Rice, Jowar (K), Bajra, Small Millets (K), Urad (K), Mung (K), Winter Potato, Ginger, Tobacco, Sesamum, Jute, Onion. | Tobacco, Sesamum, Onion |
| Karnataka | Autumn Rice, Winter Rice, Jowar(K), Bajra, Maize, Ragi, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Winter Potato (Plains), Summer Potato (Plains), Black Pepper, Chillies (Dry), Tobacco, Groundnut, Castorseed Sesamum, Cotton Mesta, Sweet Potato, Turmeric, Sannhemp, Nigerseed, Kardiseed, Onion, Tapioca. | Summer Rice, Maize, Sweet Potato, Sannhemp |
| Kerala | Ragi, Sweet Potato, Tapioca. | Sesamum, Tapioca |
| Madhya Pradesh | Autumn Rice, Jowar (K), Bajra, Maize, Ragi, Small Millets (K), Tur (K), Mung (K), Other Kharif Pulses, Summer Potato, Ginger, Chillies (Dry), Tobacco, Groundnut, Castorseed, Sesamum, Cotton, Jute, Mesta, Sweet Potato, Turmeric, Sannhemp, Nigerseed. | — |
| Maharashtra | Winter Rice, Jowar ( K), Bajra, Maize, Ragi Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Summer Potato (Plains), Chillies (Dry), Tobacco, Groundnut, Castorseed, Sesamum, Cotton, Jute, Mesta, Sannhemp, Nigerseed. | — |
| Manipur | Winter Rice, Tur (K), Sesamum (K), Sweet Potato, Maize. | — |
| Orissa | Winter Rice, Jowar (K), Bajra, Maize, Ragi, Small Millets (K), Summer Potato (Plains), Chillies (Dry), Groundnut, Castorseed, Cotton, Mesta. | Chillies (Dry) |
| Punjab and Haryana | Autumn Rice, Summer Rice, Jowar (K), Bajra, Maize, Ragi, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Groundnut, Castorseed, Sweet Potato, Turmeric, Sannhemp. | Small Millets (K), Potato |

4. Sowing and Harvesting Operations Normally in Progress During July, 2013—*Contd.*

| State | Sowing | Harvesting |
|---|---|---|
| (1) | (2) | (3) |
| Rajasthan | Autumn Rice, Jowar (K), Bajra, Maize, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Chillies (Dry), Groundnut, Castorseed, Sesamum, Cotton, Sannhemp. | — |
| Tamil Nadu | Autumn Rice, Jowar (K), Bajra, Ragi, Small Millets (K), Tur (K), Urad (K), Sumer Potato (Hills), Sugarcane, Chillies (Dry), Groundnut, Castorseed, Sesamum, Cotton, Sannhemp, Onion, Tapioca. | Jowar (R), Summer Potato (Hills), Sugarcane, Chillies (Dry), Sesamum, Cotton, Sannhemp. |
| Tripura | Winter Rice, Urad (K), Mung (K), Sesamum. | Onion, Autumn Rice |
| Uttar Pradesh | Autumn Rice, Winter Rice, Joar (K), Bajra, Maize, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Ginger, Groundnut, Castorseed, Sesamum, Jute, Mesta, Sweet Potato, Turmeric, Sannhemp, Nigerseed, Tapioca. | Small Millets (R), Chillies (Dry). |
| West Bengal | Autumn Rice, Winter Rice, Tur (K), Ginger, Chillies (Dry). | Autumn Rice, Maize, Chillies (Dry), Sesamum, Jute |
| Delhi | Summer Rice, Jowar (K), Bajra, Maize, Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Summer Potato (Plains), Chillies (Dry), Cotton, Sweet Potato. | Winter Potato (Plains), Onion. |
| Andaman & Nicobar Islands. | Autumn Rice, Winter Rice. | |

(K)—Kharif. (R)—Rabi.


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