AGRICULTURAL SITUATION IN INDIA

SEPTEMBER, 2013

PUBLICATION DIVISION
DIRECTORATE OF ECONOMICS AND STATISTICS
DEPARTMENT OF AGRICULTURE AND CO-OPERATION
MINISTRY OF AGRICULTURE
GOVERNMENT OF INDIA

Publication Division

DIRECTORATE OF ECONOMICS AND STATISTICS
DEPARTMENT OF AGRICULTURE AND CO-OPERATION
MINISTRY OF AGRICULTURE
Government of India
C-1, Hutments, Dalhousie Road,
New Delhi-110011
Phone : 23012669

Subscription

	Inland	Foreign
Single Copy	**: ` 40.00**	**£ 2.9 or $ 4.5**
Annual	**: ` 400.00**	**£ 29 or $ 45**

Available from :

The Controller of Publications,
Ministry of Urban Development,
Deptt. of Publications,
Publications Complex (Behind Old Secretariat),
Civil Lines, Delhi-110 054.
Phone : 23817823, 23817640, 23819689

Agricultural Situation in India

VOL. LXX **SEPTEMBER 2013** **No. 6**

Contents

Part I

170 Agri/2014—1

Officials of the Publication Division, Directorate of Economics and Statistics, Department of Agriculture and Co-operation, New Delhi associated in preparation of this publication :

D. K. Gaur—*Technical Asstt.*

Uma Rani —*Technical Asstt.* (*Printing*)

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.

An honorarium of Rs. 2000/- per article of atleast 2000 words for the regular issue and Rs. 2500/- per article of at least 2500 words for the Special/Annual issue is paid by the Directorate of Economics & Statistics to the authors of the articles accepted for the Journal.

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

Trends in Foodgrain Prices:

During the month of August, 2013 the All India Index Number of Wholesale Price (2004-05=100) of Foodgrains declined by 0.04 per cent from 224.40 in July, 2013 to 224.30 in August, 2013.

The Wholesale Price Index (WPI) Number of Cereals increased by 0.36 per cent from 223.90 to 224.70 whereas the WPI of Pulses declined by 1.90 per cent from 226.70 to 222.40 during the same period.

The Wholesale Price Index Number of Wheat declined by 0.44 per cent from 206.20 to 205.30 while that of Rice increased by 1.28 per cent from 226.6 to 229.20 during the same period.

Weather, Rainfall and Reservoir Situation during September, 2013.

Cumulative Monsoon (June to September) Rainfall for the country as a whole during the period 01st June to 30th September, 2013 is 6% more than LPA. Rainfall in the four broad geographical divisions of the country during the above period was higher than LPA by 9% in North West India, 23% in Central India, 15% in South Peninsula and lower by (-) 28% in East and North East India.

Out of a total of 36 meteorological sub-divisions, 30 sub-divisions received excess/normal rainfall and 06 sub-divisions received deficient rainfall.

Central Water Commission monitors 85 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 26th September, 2013 was 132.66 BCM as against 116.31 BCM on 26-09-2012 (1ast year) and 113.43 BCM of normal storage (average storage of the last 10 years). Current year's storage is 114% of the last year's and 117% of the normal storage.

As per latest information available on sowing of crops, around 99% of the normal, area under kharif crops have been sown upto 27-09-2013. Area sown under all kharif crops taken together has been reported to be1047.07 lakh hectares at All India level as compared to 1008.13 lakh hectares on the corresponding date. Area coverage (as compared to average area) is higher by 15.4 lakh ha. in Rice, 9.1 lakh ha. in Maize,2.7 lakh ha. in Tur,2.8 lakh ha. in Urad, 27.0 lakh ha. in Soyabean and 2.2 lakh ha. in Sugarcane. Area coverage is lower (compared to average area) by (–) 6.4 lakh ha. under Jowar, (–) 2.7 in Bajra, (–) 2.4 lakh ha. under Groundnut and (–) 1.6 lakh ha. under Sunflower.

A statement indicating comparative position of area coverage under major Kharif crops during 2013-14 (upto 27-09-2013) and the corresponding period of last year is given in the following table.

ALL INDIA CROP SITUATION—KHARIF (2013-14) AS ON 27-09-2013

(in lakh hectare)

Crop Name	Normal Area for whole Kharif Season	Normal Area as on date	As sown reported			Absolute Change over (+/-)	
			This Year 2013	% of Normal for whole season	Last Year 2012	Normal as on date	Last Year
Rice	392.18	361.09	376.51	96.0	368.81	15.4	7.7
Jowar	30.65	28.03	21.67	70.7	24.01	-6.4	-2.3
Bajra	89.27	77.32	74.61	83.6	60.85	-2.7	13.8
Maize	72.28	73.03	82.14	113.6	74.04	9.1	8.1
Total Coarse Cereals	**213.15**	**197.38**	**195.84**	**91.9**	**175.93**	**-1.5**	**19.9**
Total Cereals	**605.33**	**558.47**	**572.35**	**94.74**	**544.74**	**13.9**	**27.6**
Tur	37.89	37.66	40.40	106.6	36.60	2.7	3.8
Urad	22.95	22.79	25.61	111.6	23.83	2.8	1.8
Moong	26.41	23.45	23.94	90.6	19.46	0.5	4.5

ALL INDIA CROP SITUATION—KHARIF (2013-14) AS ON 27-09-2013—*Contd.*

(in lakh hectare)

Crop Name	Normal Area for whole Kharif Season	Normal Area as on date	As sown reported			Absolute Change over (+/-)	
			This Year 2013	% of Normal for whole season	Last Year 2012	Normal as on date	Last Year
Others	23.54	20.61	19.24	81.7	19.93	-1.4	-0.7
Total Pulses	**110.78**	**104.51**	**109.18**	**98.6**	**99.81**	**4.7**	**9.4**
Total Foodgrains	716.11	662.98	681.53	95.2	644.55	18.5	37.0
Groundnut	49.02	45.50	43.14	88.0	38.76	-2.4	4.4
Soyabean	95.68	95.21	122.17	127.7	106.94	27.0	15.2
Sunflower	5.13	4.01	2.42	47.2	2.74	-1.6	-0.3
Sesamum	19.07	15.39	14.69	77.0	13.69	-0.7	1.0
Niger	3.82	2.51	1.94	50.8	2.10	-0.6	-0.2
Castor	9.48	9.31	9.60	101.3	10.51	0.3	-0.9
Total Oilseed	**182.20**	**175.88**	**193.96**	**106.5**	**174.74**	**18.1**	**19.2**
Cotton	104.73	114.23	114.37	109.2	116.04	0.1	-1.7
Sugarcane	47.14	46.50	48.74	103.4	50.06	2.2	-1.3
June	9.09	8.54	8.47	93.2	8.60	-0.1	-0.1
All Crops	**1059.26**	**1008.13**	**1047.07**	**98.8**	**993.99**	**38.9**	**53.1**

Source : Crops & TMOP Division, DAC.

Agriculture :

All India Production of Food Grains : As per the 4th advance estimates released by Ministry of Agriculture on 22-7-2013, production of food grains during 2013-13 is estimated at 255.36 million tonnes compared to 259.29 million tonnes (Final estimates) in 2011-12. As per the 1st Advance Estimates for 2013-14, the Kharif foodgrain production is estimated to be 129.3 million tonnes compared to a corresponding figure of 117.2 million tonnes in 2012-2013.

Procurement : Procurement of rice as on 1st August, 2013 was 33.85 million tonnes in Kharif Marketing Season as against 34.71 million tonnes procured last year in the corresponding period respectively. This represents a decrease of 2.48 per cent. Wheat procurement during Rabi Marketing Season 2013-14 is 25.09 million tonnes as compared to 38.11 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	33.96	—
Wheat	22.51	28.34	38.15	25.09*
Total	**56.71**	**63.38**	**72.11**	**25.09**

* Position as on 1-8-2013

Growth of Economy :—

As per the Provisional Estimates of the Central Statistics Office (CSO), the 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 4.4 per cent in the first quarter of 2013-14.

TABLE 2— GROWTH OF GDP AT FACTOR COST BY ECONOMIC ACTIVITY (AT 2004-05 PRICES)

Sector	Growth (in per cent)			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 Source : CSO

TABLE 3—QUARTERLY ESTIMATE OF GDP (PER CENT)

		2011-12				2012-13				2013-14
	Sector	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
1.	**Agriculture, forestry & fishing**	**5.4**	**3.2**	**4.1**	**2.0**	**2.9**	**1.7**	**1.8**	**1.4**	**2.7**
2.	**Industry**	**5.7**	**3.8**	**2.6**	**2.1**	**1.8**	**1.3**	**2.5**	**2.7**	**0.2**
	a Mining & quarrying	– 0.4	– 5.3	– 2.6	5.2	0.4	1.7	– 0.7	– 3.1	– 2.8
	b Manufacturing	7.4	3.1	0.7	0.1	– 1.0	0.1	2.5	2.6	– 1.2
	c Electricity, gas & water supply	6.6	8.4	7.7	3.5	6.2	3.2	4.5	2.8	3.7
	d Construction	3.8	6.5	6.9	5.1	7.0	3.1	2.9	4.4	2.8
3.	**Services**	**8.9**	**8.5**	**8.3**	**7.3**	**7.7**	**7.6**	**6.7**	**6.6**	**6.6**
	a. Trade, hotels, transport & communication	9.5	7.0	6.9	5.1	6.1	6.8	6.4	6.2	3.9
	b. Financing, insurance, real estate & business services	11.6	12.3	11.4	11.3	9.3	8.3	7.8	9.1	8.9
	c. Community, social & personal services	3.5	6.5	6.8	6.8	8.9	8.4	5.6	4.0	9.4
4	**GDP at factor cost**	**7.5**	**6.5**	**6.0**	**5.1**	**5.4**	**5.2**	**4.7**	**4.8**	**4.4**

Source: CSO.

Attention Subscribers

All correspondence regarding subscription of monthly journal "Agricultural Situation in India" should be made on the following address :

The Controller of Publications,
Ministry of Urban Affairs
Department of Publications,
Publication Complex (Behind Old Secretariat)
Civil Lines, Delhi-110054
Phone : 23817640, 23819689, 23817823

B. Articles

Agricultural Diversification in Odisha during Post Reform Period

SARBESWAR MOHANTY*, FALGUNI PATTANAIK** AND RABI N PATRA***

Abstract :

Agricultural diversification refers to the development of greater variety of agricultural crops within space and time. This study analyses the diversity in the agricultural performances in the state of Odisha from 1993/94 to 2010/11. The entire time period is divided into two sub-periods, namely early-reforms period (1993/94-2001/02) and late-reforms period (2002/03-2010/11). With a trend break, diversification in area of production of major crop groups is estimated. It is observed that the diversification has increased but not substantially in area under cultivation at the state level in the second phase. Some diversified results have been observed while examining the diversification of area under cultivation across the physiographic zones and districts for major crop groups. The credit of increasing the diversification in the second period should go to the plan, policy adopted by the state government. However, Odisha's agriculture has to go a long way to achieve self-sufficiency and a high level of diversification. For accelerating agricultural growth and diversification of the state, high yield variety crops are the important preconditions across the districts.

Key Words: Agriculture, Diversification, Economic reform, Production, Productivity

1. Introduction

Sustainable growth of the agriculture depends considerably on the process of.agricultural transformation, which in turn is well connected with shifts in production patterns i.e, on the extent of crop diversification[1]. The importance of crop diversification becomes more pertinent particularly as a strategy to reduce inconsistency in agricultural production and yield (Rahman, 2009). A diversified cropping pattern can be seen as a strategy to cope with production risks and uncertainties associated with climatic and biological vagaries (Shiyani and Pandya, 1998)[2] and a suitable crop mix can help the farmers to cope with the risks of crop loss due to climatic variations[3]. In essence, crop diversification helps the farmers in reducing variability in income (Guvele, 2001), sustaining a reasonable income level and mitigating drought and enhancing water use efficiency (Kar et al., 2004). In recent years, the growing demands for agricultural production has forced the farmers to adopt intensification of agriculture practices along with the increasing use of high yielding crop varieties for maintaining higher levels of production (Weinberger and Lumpkin, 2007).

Agriculture occupies the centre-stage in the overall development of Odisha's economy. Nearly 87 per cent of Odisha's population lives in rural areas. Agriculture remains the mainstay of the state's economy and a major source of livelihood for a large majority of population (Mishra, 2009). Odisha's agriculture continues to provide employment to more than 60 per cent of the total work force. However, over the years, in line with the trends in rest of the economy, agriculture's share to the Gross State Domestic Product (GSDP) has recorded a substantial decline. In the 1950s, the share of agriculture to GSDP was about 70 per cent, which has come down to skimpy less than 20 per cent in 2009-10 (at constant prices 1999-2000) (Economic Survey, Odisha 2010-11). The reasons attributable to such a fall may be inter alia reduction in arable land, deterioration of land productivity, lack of proper land use planning and lack of capital and appropriate technology (Bhattacharya and Bhattacharya, 2007). Such a structural transformation may at times be considered desirable, provided with the fall in the share of agriculture to GSDP, agriculture's share in employment falls commensurately and matching employment is created in two other broad sectors.

*Sarbeswar Mohanty, Assistant Professor (Economics), School of Humanities, KIlT University, Bhubaneswar, Odisha, E-mail: smohantyfhu@kiit.ac.in

** Falguni Pattanaik, Assistant Professor (Economics), School of Humanities, KIlT University, Bhubaneswar, Odisha, E-mail: faiguni@hss.iitkgp.ernet.in

*** Rabi N Patra, Deputy Director, Gopabandhu Academy of Administration, Bhubaneswar, Odisha, E-mail: rabipatra07@gmail.com

[1] By crop diversification we generally refer to a gradual process of moving out of monoculture system of subsistence food crop production to a diversified production system with technological change in production.

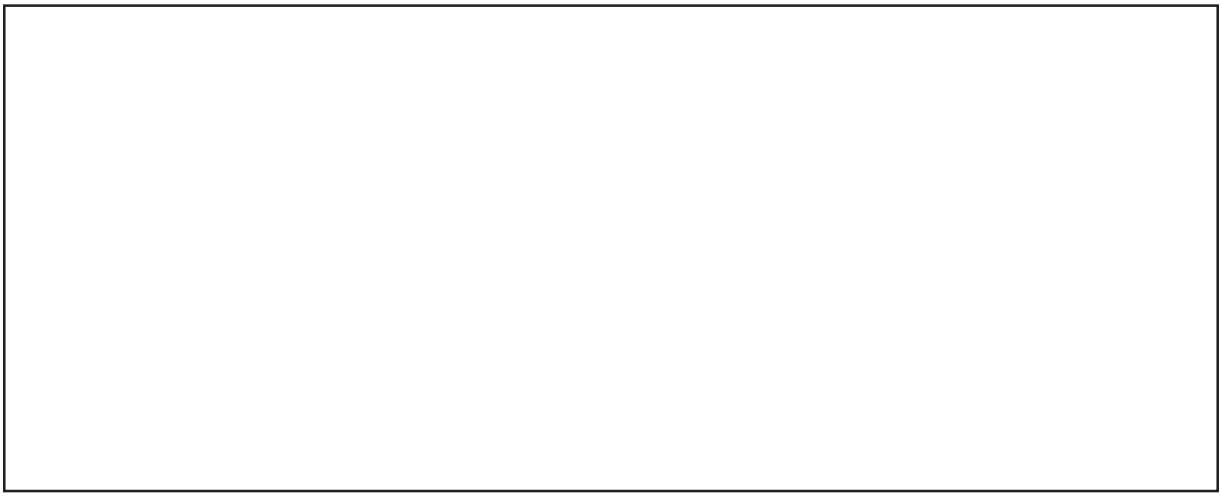
[2] Such production risks and uncertainties generally arise from various diseases of crops and pests along with variations in weather condition and irregular rainfall (Mandal, 2010).

[3] For example, the farmers in drought-hit Rajasthan areas adopt a mixed cropping system with a flexible production schedule as a response to varying rainfalls (Rathore, 2004). A large number of crops and their combinations are used to take care of climatic risks in such areas (Mandal, 2010).

Ironically, the situation speaks otherwise (Pattanaik and Nayak, 2010).

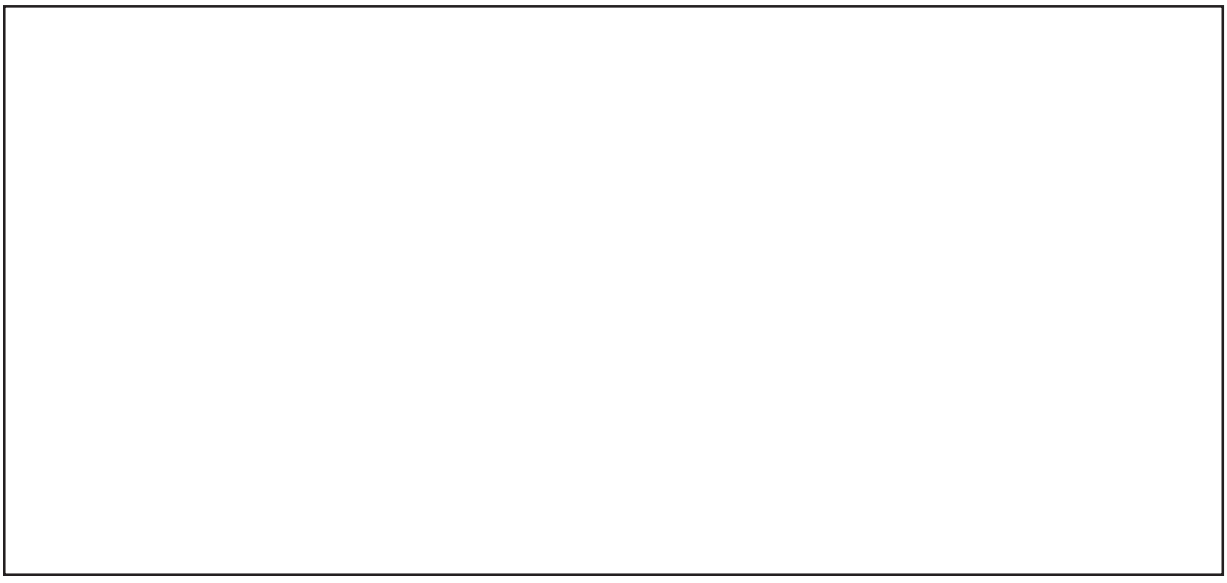
In view of the above particulars, the advantage of the study of diversification in Odisha lies in the fact that it enables to understand the impact of physical and socio-economic conditions on the agriculture. Moreover, it helps in knowing the contemporary competition among crops for area, for rotation and effect on double cropping, total production and per hectare productivity. Changing distribution of land in Odisha across major crop groups during 2005 to 2011 is shown in the figures given below. It is observed that, around 80 per cent of the gross cropped area in the state is still under foodgrains and, more specifically, around 55 per cent of this gross cropped area is under paddy (figure 1). Further, the proportion of gross cropped area under paddy has shown a very less fluctuation during this period. Although proportion of gross cropped area under some of the major crops like oilseeds and vegetables has increased, not much variation is observed for fibers and condiment and spices over the above said period (figure 2).

Fig. 1: Area under Different Category of Food grain Crops in Odisha, 2005-2011



Source : Odisha Agriculture Statistics, Directorate of Agriculture & Food Production, Odisha.

Fig. 2 : Area under Different Category of Non-Food grain Crops in Odisha, 2005-2011



Source : Odisha Agriculture Statistics, Directorate of Agriculture & Food Production, Odisha.

Attention on high value crops with available modern farm inputs may provide a stable economic base for the poor peasants (De and Chattopadhyay, 2010). The incidence of crop diversification in India, however, was very uncommon particularly before the introduction of new agricultural technology in the mid-sixties. With the advent of new agricultural technology particularly, water, seed, fertilizer, technology and a significant change in land allocation towards some high value cash crops such as fruits and vegetables cultivated particularly by the small farmers is observed in India (Joshi et al., 2006). The notion of 'high value' has emerged after liberalization of trade in agriculture. This largely refers to those commodities for which exports were liberalized during the mid-1990s (Jha, et al., 2009). The present study therefore measures diversification with the changes in the per cent of food grain and non-food grain crops at the aggregate level as well as in the district level in the state of Odisha.

Given this backdrop, the objective of this study is to examine the diversification in the cropping pattern of Odisha's agriculture and suggest a perspective for its development. A review of area, production and productivity is indeed an essential prerequisite. It may be pertinent to note that although some such studies have been carried out in other agrarian states of the country (Bhattacharya and Bhattacharya, 2007; Vakulabharanam, 2004; Subrahmanyam and Satya Sekhar, 2003), a comprehensive study considering different dimensions of agricultural diversification in the context of Odisha is seldom found. This study is first of its kind which has included seven principal crop groups cultivated in the state. It has covered 96 per cent to 98 per cent of gross cropped area (GCA) and all districts of the state. The crop groups that are included in the study are total cereals, pulses, food grains, oilseeds, fibres, vegetables and condiments and spices. The database information built upon these statistics is expected to be immensely helpful in formulating plans and policies for the development of the agricultural sector in a more objective way. The analysis of the background of agriculture sector at the national level makes it necessary to analyze the role and importance of agriculture in Odisha, a state heavily reliant on agriculture.

2. Review of Literature

Diversification or crop shift is a new paradigm of growth and becomes a necessity for the survival of agriculture in India (Kumar and Mittal, 2006). Diversification in agriculture refers to adoption of farming system involving shift in cropping pattern from traditionally grown less remunerative crops to more remunerative crops like oil seeds , pulses, fodder crops, horticulture, medicinal and aromatic plants, floriculture etc, and including land-based activities like livestock and fishery enterprises. Crop diversification is desirable in order to boost rural farm incomes and food security (Bhalla and Singh, 2009). By and large the degree of diversification in India is high and it appears that the process of further diversification has set in which is a sign of dynamism. The emerging changes in demand pattern coupled with the increased responsiveness of farmers to the changes suggest that the Indian agricultural sector is poised to move further with crop diversification taking place at micro level (Velayutham and Palaniappan, 2003). The role of price as well as polices, programmes and perspectives has acquired significance in India's agricultural development in recent years, reflecting the growing impact of globalization on domestic farm economy (Rao, 2003). Any long term plan on crops shift must also include food crops where India faces chronic shortages currently met by huge imports, especially in oilseeds and pulses.

Inter and intra crop differences in the rate of return, originating from the type of crops, agro-climatic conditions, productivity, output prices and. input applications have significant impact on crop diversification (Acharya, 2003). Further it is also observed that changes in the aggregate land productivity is associated structurally with inter-crop and inter-district reallocation of land use (Kurosaki, 2003). The studies also revealed that development of irrigation, use of chemical fertilizer, availability of inputs, location of plots and technology of cultivation of crops play some role in the composition of food grains production and crop diversification in the long-run (De, 2003).

Change in consumption pattern has a significant impact on cultivation both traditional and non-traditional products (Chand, 1996). In order to bring diversity in the agricultural production, productivity and profitability must be ensured to increase the pace of growth of eco-friendly crops. The analysis of the background of agriculture sector at the national level makes it necessary to analyze the role and importance of agriculture in Odisha, a state highly dependent on agriculture.

2.1 Shifting Priorities towards the Agriculture sector in the Process of Odisha's Economic Development

Agriculture has played an important role in the development process of Odisha and also the focus of the planners and policy makers has changed from time to time towards the development of this sector. During pre-green revolution period (1950-1965) emphasis was on, to increase production of food grain crops through double cropping, distribution of improved quality seeds, emphasis on green manuring and composting and increased consumption of fertilizers. During this period two schemes were introduced namely Intensive Agricultural District Programme otherwise known as package programme and Intensive Rice Cultivation Scheme in the state to achieve the above said objectives (Vyas, 1996). However, during the green revolution period (1965-1980) the objective was to increase the food grain crops through strategizing for optimum

croppmg pattern under HYV programme, agriculture information service and provision of long term credit facility (Rao, 1996).

In the early 80s (post-green revolution period/ pre-economic reform period: 1980-1991) the effort was made to bring convergence between agricultural development programmes and poverty alleviation programme (Chand, 2003). During this period some new heads were added to the agriculture sector such as food storage and ware housing, agriculture research and education. In the name of New Economic Reforms (1991) a structural change took place at the national as well as state level. However, during the post-economic reform period (1991-onwards) the issues were to raise the productivity, increase the cultivable area of pulses and commercial crops, effective utilization of irrigation facility and development of rural market for the improvement of the agriculture (Mishra and Chand, 1995; Chand, 2001). Other issues such as mechanization of agriculture, development of agro-based industries, promoting private enterprises in marketing of agricultural product were also emphasized. To realize the objectives, targeted was to intervene in the area of seed, fertilizer, farm mechanization, commercial crops, credit and reclamation of problematic soils. It was targeted to achieve significant increase in the seed replacement rate during this period. Efforts were made to increase the consumption of fertilizers, as it is one of the important inputs responsible for increase in production of agriculture. Further, it was also targeted to mechanize the farm sector through provision of updated technological machineries. To strengthen the economic conditions of the farmers, attempt was made' to. diversify the cropping pattern through introduction of commercial crops. In addition, it was also proposed to encourage contract farming, agri-business houses and consortia (Chand, 2003). Special attention was given to problems of soils with highest priority to watershed development. Moreover, it was also proposed to involve commercial banks and co-operative institutions for substantial flow of credit. However, the overall aim for the state was to achieve sustainable growth with equity.

In recognition of the decisive role of the agriculture in the state's economy, the state government has given emphasis on to achieve the above objectives for the development of agriculture through formation of 'pani panchayats' involving the local bodies (panchayats) in the management of the irrigation system, organising 'krushak bazaar' for the marketing of agricultural produce, establishing' krishi vigyan kendras' at the district level to provide effective extension services including supply of improved seeds, chemical fertiliser, pesticides (Govt. of Odisha, State Development Report 2004). However, a lot needs to be done to improve the status of agriculture in the state. In order to accomplish the desired level of food production, it is required to improve the status of agriculture from the present level of subsistence agriculture to a profitable and commercial venture.

Given this national and state scenario, it is imperative to see how Odisha's agriculture has performed over the years particularly in the post reform period. As economic reforms is said to have brought about a clear shift in the focus on growth strategy, it may be useful to analyze the scenario of agriculture in the state comparing the early-reforms scenario with the late-reforms. The present study aims at examining diversification in Odisha agriculture with respect to area under production. The paper is organized into five sections including Introduction. The second section provides a brief review of various studies on diversification at the national and state level and discusses the need to update the analysis on diversification. Data and Methodology used in earlier studies and the present study are presented in section three. The fourth section presents the estimate of diversification at state and physiographic zone level. This section also includes analysis of diversification at disaggregate level by using district level data for the state of Odisha. analysis of diversification at disaggregate level by using district level data for the state of Odisha. Conclusions and policy implications are presented in the section five.

3. Data Source and Methodology

3.1 Data Sources

The study is based on secondary data. Attempt has been made to study the changes in the agricultural diversification in area under production for major crop groups in Odisha. The data have been collected from the various issues of Agriculture Statistics of Odisha published by Directorate of Agriculture and Food Production Odisha. Analysis is extended to disaggregate level using the district level data for the state, as there are vast variations in agro climatic conditions across the districts. The state has been divided into four physiographic zones. The district-wise analysis has been undertaken on the basis of 30 districts (Table 1). The study estimates the diversification in agriculture by dividing the entire study period into two phases (a) Period I is from 1993/94 to 2001/02; (b) Period II is from 2002/03 to 2010/11.

TABLE 1: DIVISION OF DISTRICTS ACCORDING TO THE PHYSIOGRAPHIC CONDITIONS

Odisha			
Northern Plateau	Central Table Land	Eastrn Ghats	Coastal Plains
Keonjhar	Bolangir	Kalahandi	Balasore
Mayurbhanj	Sonepur	Nuapara	Bhadrak
Jharsuguda	Dhenkanal	Koraput	Cuttack
Sundargarh	Angul	Malkangiri	Jagatsinghpur
	Sambalpur	Nawarangpur	Jajpur
	Bargarh	Rayagada	Kendrapara
	Deogarh	Phulbani	Ganjam
		Boudh	Gajapati
			Puri
			Khordha
			Nayagarh

Source: Economic Survey of Odisha-2011/12.

3.2 Methodology

3.2.1 Indicators of Diversification

Given this backdrop, extent of crop diversification at a given point of time may be examined by using several indices namely, Herfindahl Index, Entropy Index, and Ogive Index, the comparative details of which are given in the table 2. In order to test the robustness of the results, the study incorporates all the three indicators of crop diversification simultaneously, while analyzing the results.

TABLE 2: MEASURES OF CROP DIVERSIFICATION V

Measure	Formula	Explanation
Herfindahl Index		P_i is the proportion area (or value) of the i^{th} crop and N is the total number of crops. The index approaches zero for perfect diversification and has upper limit of one, which signifies specialization.
Entropy Index		This index is a weighted sum of proportions [Weights being log (Pi)]. It attains 0 with complete specialization and log (N) with perfect diversification. This is good for capturing the 'diversity' aspect of diversification as N varies, Thus, it shows how diversified is a distribution.
Ogive Index		This index is a measure of deviation of a given distribution from an equal distribution benchmark. It attains 0 with complete diversification and a maximum value (as set by N) for complete specialization. This is good for reflecting the ' deviation' aspect when N is fixed. Thus, it shows how unbalanced is the distribution.

4. Result and Discussion

4.1 Measuring Agricultural Diversification in Odisha

The broad objectives of this study are to analyze whether there exists any kind of diversification at district level. The crop groups that are included in the study are cereals, pulses, food grains, oilseeds, fibres, vegetables and condiments and spices. To take a holistic view of inter-district and inter-temporal variation in crop diversification, above discussed indices of crop diversification are computed. Herfindahl and Ogive indices increase with the increase in crop concentration and specialization and vice-versa. But reverse interpretation applies to Entropy index; increase in which signifies increase in crop diversification. These indices can be used to signify any type of change in crop pattern.

It is observed that, at the state level crop diversification has taken place in second period of the study as compared to the first one. The Herfindahl index has declined from 0.40 in period I to 0.38 in period 11 (table 3). Similar trend is observed in other two indices. Across the physiographic zones Herfindahl index depicts that diversification is observed in the second period of the study, however the pace of diversification is very slow and varies across the zones. Therefore, a detailed analysis is required at the district level across the zones to understand the dynamics happened to the process of diversification.

TABLE 3—EXTENT OF DIVERSIFICATION IN THE STATE AND ACROSS THE PHYSIOGRAPHIC ZONES

	HI		OI		EI	
Zones	PD-I	PD-II	PD-I	PD-II	PD-I	PD-II
Northern Plateau	0.43	0.41	1.67	1.57	0.61	0.61
Central Table Land	0.38	0.36	1.32	1.28	0.66	0.66
Eastern Ghats	0.37	0.36	1.29	1.25	0.66	0.66
Coastal Plains	0.41	0.38	1.52	1.40	0.61	0.62
Odisha	0.40	0.38	1.45	1.37	0.63	0.63

Sources : From various reports of State Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha (Authors' own calculation).

4.1.1 Crop Diversification in the Physiographic Zone (Northern Plateau) across Major Crop Groups

Northern Plateau zone consists of the districts Keonjhar, Mayurbhanj, Jharsuguda and Sundargarh. It is observed that, in Northern Plateau zone Herfindahl index was 0.43 in period-I and decreased to 0.41 during the second period indicating agricultural diversification in the zone. Similar trend is observed for this zone by Ogive and Entropy indices. It is evident from table 4 that, except Mayurbhanj district other three districts Keonjhar, Jharsuguda and Sundargarh have shown a trend towards diversification where Herfindahl index has decreased from 0.39 to 0.34, 0.40 to 0.37 and 0.43 to 0.42 for Keonjhar, Jharsuguda and Sundargarh respectively during the period-I and period-II, which is supported by Ogive and Entropy indices. Mayurbhanj district has shown crop concentration and is a highly specialized district in this zone with value of Herfindahl index greater than 0.5. The above observation on spatial variations in crop diversification in the zone is very slow. The possible reason is that Northern Plateau is mostly dominated by scheduled tribe communities and the tribal economies are still primitive from the view point of resource utilization, technology adoption and diversification of cropping pattern.

TABLE 4—EXTENT OF DIVERSIFICATION IN THE NORTHERN PLATEAU AND ACROSS DISTRICTS

		HI		OI		EI	
Sl. No.	Zones	PD-I	PD-II	PD-I	PD-II	PD-I	PD-II
1.	Keonjhar	0.39	0.34	1.43	1.14	0.65	0.70
2.	Mayurbhanj	0.51	0.51	2.12	2.16	0.55	0.52
3.	Jharsuguda	0.40	0.37	1.46	1.35	0.64	0.64
4.	Sundargarh	0.43	0.42	1.65	1.62	0.60	0.60
	Northern Plateau	0.43	0.41	1.67	1.57	0.61	0.61

Sources : From various reports of State Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha (Authors' own calculation)

4.1.2 Crop Diversification in the Physiographic Zone (Central Table Land) across Major Crop Groups

Central Table Land includes seven districts. The Central table land in the heart of the state mostly consists of fertile valleys, plains and hilly lands. The Herfindahl index for this zone has been estimated to be 0.38 in Period-I and decreased to 0.36 in Period-II showing a slow rate of crop diversification. District wise status indicates that Bolangir and Bargarh districts in the zone have gone towards crop concentration as Herfindahl index increased from Period-I to Period-II (table 5). Other five districts of the zone are diversified districts. Angul is highly diversified with value of Herfindahl index 0.27 and 0.25 during the two time periods followed by Dhenkanal. It is observed that paddy grown on high-lands under rain fed conditions, in the districts like Bolangir, Sonpur and Baragarh is most vulnerable to moisture stress, leading to drastic productivity reduction in years of poor rainfall. A significant proportion of cropped area in these districts is under rainfed agriculture with frequent droughts and low cropping intensity.

TABLE 5—EXTENT OF DIVERSIFICATION IN THE CENTRAL TABLE LAND AND ACROSS DISTRICTS

		HI		OI		EI	
Sl. No.	District	PD-I	PD-II	PD-I	PD-II	PD-I	PD-II
1.	Bolangir	0.33	0.34	1.08	1.12	0.69	0.69
2.	Sonepur	0.50	0.47	2.02	1.91	0.54	0.54
3.	Dhenkanal	0.30	0.28	0.86	0.83	0.72	0.72
4.	Angul	0.27	0.25	0.71	0.61	0.75	0.76
5.	Sambalpur	0.40	0.37	1.43	1.34	0.66	0.66
6.	Bargarh	0.49	0.52	1.97	2.18	0.56	0.50
7.	Deogarh	0.35	0.31	1.20	0.95	0.68	0.71
	Central Table Land	0.38	0.36	1.32	1.28	0.66	0.66

Sources : From various reports of State Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha (Authors' own calculation)

4.1.3 Crop Diversification in the Physiographic Zone (Eastern Ghats) across Major Crop Groups

Eastern Ghats includes eight districts of the state i.e. Kalahandi, Nuapara, Koraput, Malkangiri, Nawarangpur, Rayagada, Phulbani and Boudh. Among them Nawarangpur and Kalahandi districts have shown high concentration during the study period. Herfindahl index in Kahalahandi and Nawarangapur districts have been increased from 0.35 to 0.36, 0.48 to 055 respectively during the period I and period 11 (table 6). Phulbani has shown a high degree of diversification as the value of Herfindahl index is estimated 0.28 in first period and 0.23 in the second period followed by Rayagada. Though districts like Boudh, Koraput and Malkangiri have experienced an increase in crop diversification, it is very moderate during the study period. This region is one of the most backward region, and most of the well known KBK districts fall in this region with high water scarcity and soils have low to medium fertility. Furthermore, a significant proportion of cropped area in these districts is under rain fed agriculture with frequent droughts and low cropping intensity. Since most of the small farmers prefer to grow paddy for reasons of food security it is therefore necessary to diversify these areas.

TABLE 6—EXTENT OF DIVERSIFICATION IN THE EASTERN GHATS AND ACROSS DISTRICTS

		HI		OI		EI	
Sl. No.	District	PD-I	PD-II	PD-I	PD-II	PD-I	PD-II
1.	Kalahandi	0.35	0.36	1.11	1.25	0.68	0.66
2.	Naupara	0.34	0.34	1.08	1.08	0.69	0.67
3.	Koraput	0.40	0.38	1.53	1.45	0.61	0.61
4.	Malkangiri	0.40	0.36	1.49	1.24	0.63	0.65
5.	Nawarangpur	0.48	0.55	1.97	2.42	0.55	0.44
6.	Rayagada	0.30	0.27	0.87	0.76	0.73	0.76
7.	Phulbani	0.28	0.23	0.74	0.53	0.76	0.79
8.	Boudh	0.42	0.36	1.55	1.24	0.59	0.65
	Eastern Ghats	0.37	0.36	1.29	1.25	0.66	0.66

Sources : From various reports of State Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha (Authors' own calculation)

4.1.4 Crop Diversification in the Physiographic Zone (Coastal Plains) across Major Crop Groups

The Coastal Plains region is most prosperous region with an area of 26% and highest land productivity of the state which includes eleven districts. Balasore has been considered as the rice bowl of Odisha and has experienced a low crop diversification (Herfindahl index 0.56 in second period). Gajapati is observed as the most diversified district in this zone which has shown Herfindahl index 0.33 in the first period and 0.26 in the second period, followed by Ganjam and Nayagarh. Cuttack has shown a high degree of diversification with value of Herfindahl index marginally increases from 0.33 to 0.34 during period I to period II. However, there are four districts in the zone whose Herfindahl index is greater than 0.40 in the first period (Bhadrak, Kendrapara, Puri, Khurda) indicating specialization status and a marginal increase in the diversification in the second period for these districts as indicated by the indices. Jagatsinghpur and Jajpur have shown moderate diversification during the study period. Overall, the productivity, area and production of food grains are much higher in this region as compared to the other regions. Most of the districts of this region have shown a moderate degree of crop diversification with high cropping intensity. The agricultural success of the districts of this zone is due to well developed irrigation facilities with higher doses of fertilizer consumption, high literacy rates and infrastructure.

TABLE 7—EXTENT OF DIVERSIFICATION IN THE COASTAL PLAINS AND ACROSS DISTRICTS

		HI		OI		EI	
Sl. No.	District	PD-I	PD-II	PD-I	PD-II	PD-I	PD-II
1.	Balasore	0.53	0.56	2.19	2.40	0.54	0.50
2.	Bhadrak	0.60	0.57	2.62	2.49	0.44	0.45
3.	Cuttack	0.33	0.34	1.09	1.12	0.68	0.66
4.	Jagatsinghpur	0.37	0.33	1.30	1.06	0.65	0.69
5.	Jaipur	0.35	0.34	1.13	1.09	0.69	0.70
6.	Kendrapara	0.41	0.38	1.51	1.31	0.64	0.66
7.	Ganjam	0.36	0.34	1.22	1.16	0.64	0.65

TABLE 7—EXTENT OF DIVERSIFICATION IN THE COASTAL PLAINS AND ACROSS DISTRICTS—*Contd.*

Sl. No.	District	HI		OI		EI	
		PD-I	PD-II	PD-I	PD-II	PD-I	PD-II
8.	Gajapati	0.33	0.26	1.09	0.75	0.68	0.73
9.	Puri	0.43	0.42	1.67	1.63	0.57	0.57
10.	Khurdha	0.40	0.35	1.55	1.25	0.56	0.60
11.	Nayagarh	0.37	0.34	1.36	1.17	0.58	0.62
	Coastal Plains	0.41	0.38	1.52	1.40	0.61	0.62

Sources : From various reports of State Agriculture Statistics, Directorate of Agriculture and Food Production, Odisha (Authors' own calculation)

4.2 Growing inter-district differences in Crop Diversification

While measuring the diversification across the crop groups among the districts, it is observed that there is a diversification in the cropping pattern in the second period of the analysis. Though the diversification among the districts is very marginal but it is noticeable. Based on the Herfindahl index it is found that, the districts like Gajapati, Rayagada, Dhenkanal has joined the group of highly diversified districts in the second period along with Anugul and Phulbani which are already in this group in the first period (table 8). Furthermore, the status of the districts like Khurdha, Malkangiri, Boudh, Jharsugada, Sambalpur, Koraput and Kendrapara have changed from low diversified group to moderate diversified group in the second period. However, still there are some districts like Puri, Sundargarh, Sonepur, Mayurbhanj, Bargarh, Nawarangpur, Balasore, Bhadrak belong to the low diversified group. Similar trend is also observed through other two indices.

TABLE 8—CATEGORIZATION OF HERFINDAHL VALUES BETWEEN PD-I (1993/94 TO 2001/02) AND PD-II (2002/03 TO 2010/11)

	PD-I HI	PD-II HI
HD < 0.30	Angul, Phulbani	Phulbani, Angul, Gajapati, Rayagada, Dhenkanal
MD 0.30 ≥ 0.39	Dhenkanal, Rayagada, Gajapati, Bolangir, Cuttack, Nuapara, Kalahandi, Jajpur, Deogarh, Ganjam, Nayagarh, Jagatsinghpur, Keonjhar	Deogarh, Jagatsinghpur, Nayagarh, Cuttack, Jajpur, Nuapara, Bolagir, Ganjam, Keonjhar, Khordha, Malkangiri, Boudh, Kalahandi, Jharsuguda, Sambalpur, Koraput, Kendrapara
LD 0.40 ≥	Sambalpur, Jharsuguda, Khordha, Koraput, Malkangiri, Kendrapara, Boudh, Puri, Sundargarh, Nawarangpur, Bargarh, Sonepur, Mayurbhanj, Balasore, Bhadrak	Puri, Sundargarh, Sonepur, Mayurbhanj, Bargarh, Nawarangpur, Balasore, Bhadrak

A cautious analysis of the data for different districts reveals that most of the Coastal Plain and few of the Central Table Land districts are agriculturally more advanced than other districts. The agricultural success of Coastal Plain districts is due to well developed irrigation facilities with higher doses of fertilizer consumption, high literacy rates and infrastructure. Districts of Northern Platue region namely Mayurbhanj, Keonjhar and Sundergarh, and Koraput of Eastern Ghats are found to be the most backward districts. A significant proportion of cropped area in these districts is under rainfed agriculture with frequent droughts and low cropping intensity. Improved quality input and output markets like credit facilities, seed production and distribution at local markets, policies to increased use of fertilizer, electricity and technology in backward regions is necessary to increase the crop diversification from the traditional crop paddy to pulses, oil seeds and other High Value Crops. The increase in population has led to fragmentation of land holding in a scenario of little change of the traditional .cultivation method has a significant bearing on the slow rate of crop diversification.

5. Summary and Conclusion

Crop diversification has always been important for liberating the difficult situation of subsistence agricultural economy of Odisha to ensure the varied nutritional requirement of the people. The empirical results reveals that crop diversification in Odisha have been persisting since the economic reforms adopted. The value of diversification indices have improved though not at a very faster rate, but reallocation of land towards a few crop groups has been taking place continuously. Among the varieties of crop groups, the growth of cereals, pulses and vegetables have been accelerating over the years whereas the cultivation of fiber and oilseed etc have been declining. Data analyzed separately for two different sub-periods confirm this phenomenon. The level of diversification has

also been associated with the large scale inter-district variations. Interestingly, the level of diversification is low in the relatively backward agricultural districts like Mayurbhanj, Bolangir, Kalahandi, Nuapara, Nawarangapur as compared to the advanced districts such as Baragarh and Balasore etc. This is reflected through the decline in coefficient of inter-district variations in diversification indices over the years. However, it may be noted that the relatively advanced districts always maintained their relative positions in terms of diversification, due to the better availability of agricultural and supporting infrastructure.

Agriculture in the state is already diversifying toward High Value Crops. However, if this is to continue smoothly, a comprehensive strategy needs to be evolved, which involves a whole new set of technologies, infrastructure, institutions, and policies. The current agricultural policy thrust is founded on the philosophy of ensuring food self-sufficiency and does not provide much emphasis on the role of diversification towards high-value agriculture. For agricultural diversification to succeed, it is imperative for the state to achieve rise in gross cropped area, cropping intensity and yield, and that, in turn, demands adequate availability of basic inputs like quality seeds, fertilisers, improved irrigation facilities and other complementary infrastructure. Minor irrigation facilities supported by the electricity, storage and marketing facilities etc may play an important role with varied degrees for the diversification of crops. Also, availability of fertiliser along with expansion of irrigation and agro-implements through raising yield of crops will help to diversify the selected crops. Therefore, agricultural infrastructures are found to be crucial in promoting diversification of crops and ensure sustainable income and employment of the farmers of the state. The process of economic reforms as initiated in 1990s is unable to increase significantly the health of agriculture in the state. It is time to reform this sector and give importance to food safety issues to meet the growing international demand for processed food items. Given the challenges, the agriculture of Odisha is faced with, market-oriented approach would perhaps fail to bring diversification in a large scale. Deliberate public action is thus the need of the time to replace subsidies with investments and involving greater private sector participation in the form of agribusiness ventures.

REFERENCES

Acharya, S. S. (2003), "Crop Diversification in Indian Agriculture", Agricultural Situation in India, Vol. 60, No. 5, pp. 239-250.

Bhalla, G. S. and Singh, G. (2009), "Economic Liberalization and Indian Agriculture: A State-wise Analysis", Economic and Political Weekly, Vol. 54 No. 52, pp. 34-44.

Bhattacharya, S. and Bhattacharya, M. (2007), "Agrarian Impasse in West Bengal in the Liberalization Era", Economic and Political Weekly, Vol. 42, No. 52, pp. 65-71.

Chand, R. (2001), "Emerging Trends and Issues in Public and Private Investments in Indian Agriculture: A State-wise Analysis", Indian Journal of Agricultural Economics, Vol. 56, No. 2, pp. 161-184.

Chand, R. (1996), "Diversification through High-Value Crops in Western Himalayan Region: Evidence from Himachal Pradesh", Indian Journal of Agricultural Economics, Vol. 41, No. 4, pp. 652-663.

Chand, R. (2003), "Government Intervention in Food Grain Markets in the Changing Context", Policy Paper No. 19, National Centre for Agricultural Economics and Policy Research, New Delhi.

De, U. K. (2003) "Changing Cropping System in Theory and Practice: An Economic Insight into the Agrarian West Bengal", Indian Journal of Agricultural Economics, Vol. 58, No. 1, pp.64-83.

De, U. K. and Chattopadhyay, M, (2010), "Crop Diversification by Poor Peasants and Role of Infrastructure: Evidence from West Bengal. Journal of Development and Agricultural Economics, Vol. 2, No. 10, pp. 340-350.

Government of Odisha, (2004), "State Development Report", Department of Economics and Statistics, Bhubaneswar, Odisha.

Government of Odisha, (2011), "Economic Survey 2010-11", Department of Economics and Statistics, Bhubaneswar, Odisha.

Guvele, C. A. (2001), "Gains from Crop Diversification in the Sudan Gezira Scheme", Agricultural Systems, Vol. 70, No. 1, pp. 319-333.

Jha, B. Kumar, N. and Mohanty, B. (2009), "Pattern of Agricultural Diversification in India", Working Paper Series No, E/302/2009, Institute of Economic Growth, University of Delhi, New Delhi.

Joshi, P. K., Birthal, P. S. and Minot, N. (2006), "Sources of Agricultural Growth in India: Role of Diversification towards High Value Crops", MTID Discussion Paper No. 98, International Food Policy Research Institute, Markets Trade and Institutions Division, Washington, DC.

Kar, G., Singh, R. and Verma, H. N. (2004), "Alternative Cropping Strategies for Assured and Efficient Crop Production in Upland Rainfed Rice Areas of Eastern India Based on Rainfall Analysis", Agricultural Water Management, Vol. 67, No. 3, pp. 47-62.

Kumar, P. and Mital, S. (2006), "Agricultural Productivity Trends in India: Sustainability Issues", Agricultural Economics Research Review, Vol. 19 (Conference No.) 2006 pp. 71-88.

Kurosaki, T. (2003), "Specialization and Diversification in Agricultural Transformation: The Case of West Punjab, 1903-92", American Journal of Agricultural Economics, Vol. 85, No. 2, pp. 372-386,.

Mandal, R. (2010), "Cropping Patterns and Risk Management in the Flood Plains of Assam", Economic and Political Weekly, Vol. 55, No. 33, pp. 78-81.

Mishra, S. (2009), "Poverty and Agrarian Distress in Odisha", Working Paper No. WP-2009-006, Indira Gandhi Institute of Development Research, Mumbai, http://www.igidr.ac.in/pdf/publication/WP- 2009-006.pdf

Mishra, S. N. and Chand, R. (1995), "Private and Public Capital Formation in Indian Agriculture : Comments on Complementarity Hypothesis and Others", Economic and Political Weekly, Vol. 30, No. 24, pp. A 64-79.

Pattanaik, F. and Nayak, N. C. (2010), "Experiences of Structural Transformation in Orissa", Indian Journal of Regional Science, Vol. 43, No. I, pp. 17-26.

Rahman, S. (2009), "Whether Crop Diversification is a Desired Strategy for Agricultural Growth in Bangladesh?", Food Policy, Vol. 34, No. 4, pp. 340-349.

Rao, C.H. Hanumantha. (2003), "Reform Agenda for Agriculture", Economic and Political Weekly, Vol. 33, No. 29, pp. 615-20.

Rao, V.M. (1996), "Agricultural Development with a Human Face", Economic and Political Weekly, Vol. 31, No. 26, pp. A52 -62.

Rathore, J. S. (2004), "Drought and Household Coping Strategies: A Case of Rajasthan", Indian Journal of Agricultural Economics, Vol. 59, NoA, pp. 689-708.

Shiyani, R. L. and Pandya, H. R. (1998), "Diversification of Agriculture in Gujarat: A Spatio- Temporal Analysis", Indian Journal of Agricultural Economics, Vol. 53, No. 4, pp. 627-639.

Subrahmanyam, S. and Satya Sekhar, P. (2003), "Agricultural Growth: Pattern and Prospects", Economic and Political Weekly, Vol. 38, No. 12/13, pp. 1202-1211.

Vakulabharanam, V. (2004), "Agricultural Growth and Irrigation in Telangana: A Review of Evidence", Economic and Political Weekly, Vol. 39, No. 13, pp. 1421-1426.

Velayutham, M. and Palaniappan, S. P. (2003), "Crop Diversification for Sustainable Agriculture", Agricultural Situation in India, Vol. 60, No. 5, pp. 251-254.

Vyas, V. S. (1996), "Diversification in Agriculture: Concept, Rationale and Approaches"'. Indian Journal of Agricultural Economics, Vol. 51, No. 4, pp. 636-643.

Weinberger, K. and Lumpkin, T. (2007), "Diversification into Horticulture and Poverty Reduction : A Research Agenda". World Development, Vol. 35, No. 8, pp. 1464-1480.

Dynamics of Cropping Pattern Shifts in Kerala : Sources and Determinants

SHEEBA ANDREWS*

1. Introduction

In India, crop diversification is taking place at a faster pace since 1990s. It is viewed as a shift from traditionally grown less remunerative crops to more remunerative commercial crops. In fact it can be considered as a kind of commercialization of Indian agriculture. The share of area under non-food grains went up from 30 per cent in triennium (TE) 1981-82 to 35 percent in TE 1998-9 (Joshi, 2010). There are arguments for and against crop diversification. A review of past studies undertaken by Joshi (2010) has shown that such crop diversification has helped in employment generation and income augmentation, poverty alleviation through export promotion. But Crop pattern changes also lead to serious environmental consequences such as ground water depletion, soil fertility loss and water logging and salinity and these can reduce the productive capacity and growth potential of agriculture in the long run (Kalaiselvi, 2012).

The trend of crop diversification in Kerala started slowly in favour of non-food crops since mid 1970s (Mahesh, 1999). Although Kerala enjoys natural resource endowments for growing plantation crops and other spices, rice was considered as a prominent food crop and it occupied almost 31 percent of the gross cropped area of the state in the sixties. But the major shift has taken place in the cropping pattern pushing rice to the bottom and the plantation and perennial crops has taken precedence in terms of area over the food crops especially of food grains in Kerala. Unlike the rest of India where the shift is among annual crops, in Kerala the shift has been from seasonal crop such as paddy to perennial crops like coconut and rubber (Kannan and Pushpangadan, 1988). Such diversification has caused a change in land use in Kerala. In this context we would like to pose certain questions. Why is there a crop shift from food to non-food crops? Has it really helped to increase agricultural production ? And is it really desirable ?

The wetland used for the cultivation of rice has been subsequently converted to the growth of export oriented high value crops. The land under food grains underwent a significant reduction from about 35 per cent of gross cropped area in 1960-61 to almost 9 per cent of the gross cropped area in 2010-11 (Table- 3). This has raised serious concerns over food security, employment opportunity and ecological concerns. Moreover, the production of these export oriented crops whose prices are highly volatile in the market has caused distress to farming community. The agricultural growth has been adversely affected due to such crop shifts in kerala (Kannan and Pushpangadhan, 1988, 1990). Considering the effect of crop diversification and land use change in the context of food security, farmers' distress and a balance development of Kerala agriculture, the present work intends to focus on the sources and determinats of cropping pattern change in Kerala. There has not been study on the recent changes in the land use pattern in Kerala exploring the nature of shift, sources, and causes of these shifts. Keeping this in view the main objectives of this present study are: first, to analyze the dynamics of cropping pattern shifts in Kerala, second, to examine the sources of production to examine the crop shift in Kerala and third to find out the possible causes/ factors those determine these shifts.

The paper has been arranged in the following manner. In the first section the importance of the study is discussed in the context of Kerala. In the second section the data and variable description and the methodology is discussed. In the third section, the nature and pattern of cropping pattern shift and land use change is analysed using the data on cropping pattern and area under food and non-food crops. In the fourth section the sources of production is analyzed using decomposition analysis and the fifth section the causes/determinants of the crop shift is explained . Finally in the sixth section concludes the study with policy recommendations.

2. Data and Variable Description

The main variables for the study are area under food and non-food crops and the area, output and yield of important crops in Kerala. Detailed description of the variables and the sources of the data are given in Appendix 1.

2.1 Methodology

To analyze the dynamics of cropping pattern shift, first a graphical presentation of area under food cops and non-food crops has been made. Based on the trends observed, the study period (1960-61-2010-11) is divided into three sub periods Viz, Period I: 1960-61 to 1975-76. The Land reform Phase, Period Il: 1976-77 to 1992-93-the Post Land Reform Phase, and Period Ill: 1993-94 to 2010-11-the Economic Reform Phase. Compound Annual Growth Rates (CAGRs) have been computed for these periods. The

*Assistant Professor, Providence Women's College, Calicut-673009, Kerala

relative shares of different crops in the total area has been computed to understand the dynamics of shift in the cropping pattern. Triennium ending of six years difference data has been calculated for different period.

A change in the cropping pattern also affects agricultural production. An increase or decrease in the production of a crop fundamentally depends on the changes in the area under the crop and its average yield. Minhas and Vaidyanathan (1965) were the first to undertake a decomposition analysis for explaining India's agricultural growth. A simple decomposition analysis has been used to find out the area effect, yield effect and interaction effect in Kerala agriculture.

Production in the base year is given by

$$Q_0 = A_0 * Y_0 \text{ ---------- (1)}$$

Similarly, production in the n^{th} year is given by $Q_n = A_n * Y_n$; If we denote ΔA & ΔY are the change in area and yield in the n^{th} period, then we have

$$Q_n = (A_0 + \Delta A) * (Y_0 + \Delta Y) \text{ ---------- (2)}$$

$$= A_0 * Y_0 + A_0 * \Delta Y + \Delta Y * Y_0 + \Delta A * \Delta Y$$

Subtracting Qo from both sides

$$Q_n - Q_0 = A_0 * Y_0 + A_0 * \Delta Y + \Delta A * Y_0 + \Delta A * Y - A_0 * Y_0$$

$$\Delta Q = A_0 * \Delta Y + \Delta A * Y_0 + \Delta A * \Delta Y$$

The first term on the right hand side can be considered as the yield effect the second term as area effect, and the third as the interaction effect. Thus total change in production can be decomposed into three effects, viz., yield effect, area effect and the interaction effect due to changes in area and yield.

We hypothesize that a change in area has implications for crop shift and this has resulted in decline in production in the absence of significant yield especially for food crops. A crop shift towards perennial crops like coconut, arecanut, cashewnut, tea, coffee and rubber and pepper means a change in land use which is irreversible in nature.

Finally to find out the causes and factors that determine the crop shifts, various Iiterature reviews related to land use change and cropping pattern has been done.

3. Evolution of cropping pattern shift shifts, (1960-61 to 2010-11)

It is hypothesized that the land use has undergone a significant chane from food to non-food crops from mid-seventies onwards as the land reform measures have already been completed by this time in Kerala. Plotting of the area under food crops and non food crops over period from 1960-61 to 2010 in the figurel I, it is found that there is a decline in area under food crops during the mid seventies onwards. The trends in the land use change has been categorized into four; from 1960-61 to 1975-76, marked as Period I - the Land Reform phase, from 1976-1992 as period II - the Post Land Reform phase, and from 1993 to 2010 as period III - the Economic Reform Phase. The calculated compound annual growth rate for these periods are given in Table.2. And the growth rate was found significant at 1 % level except for one period.

FIGURE-1: AREA UNDER FOOD & NON-FOOD CROPS

Note : TFC - Total Area under Food Crops. TNFC - Total Area under Non-Food Crops, and TAS - Total Cropped Area

TABLE 2—THE COMPOUND ANNUAL GROWTH RATE OF AREA UNDER FOOD CROPS AND NON-FOOD CROPS

	Period I	Period 11	Period III	Overall
	1960-61 to 1975-76	1976-77 to 1992-93	1993-94 to 2010-11	1960-2010
Total Area under Food crop	1.55***	-1.56***	-1.7***	-0.89***
Total Area under Non-Food crop	2.63***	2.73***	0.05	1.54***
Total Cropped Area	1.95***	0.26***	-0.73***	0.23***

Note: *** denotes significant at 1% level.

Table 2 shows that during the land reform phase the area under food crops, non-food crops, and total cropped area registered a significant growth with l.5%, 2.6% and l.95% respectively. The total area under food crops showed a declining trend thereafter. Thus from the above analysis it is clear that the land use has undergone significant change with a shift in cropping pattern towards non-food crops since mid-seventies. While the detailed crop-wise of food and non-food crop items revealed the pattern of such shift. This is analyzed in Table-3 based on the relative share of area of crops in the total cropped area in all the three phases and the change in rank of these crops in terms of the change in the relative share of the area under each crop in the total cropped area which is given in Table 4.

TABLE 3 : PERCENTAGE SHARE OF CROPS IN TOTAL AREA SOWN

	The Land Reform Phase (1960-1975)			Post land reform phase (1976-1992)			The Economic Reform Phase (1993-2010)		
Crops (area '000 ha!)	TEI964	TEI970	TEI975	TEI980	TEI986	TEI992	TEI998	TE2004	TE2010
Rice	802.9 (32.5)	874.2(30.4)	877.4(29.2)	798.1 (27.7)	690.8(24.1)	558.1 (18.4)	390.1(13.1)	295.9(9.9)	227.1 (8.5)
Pulses	43.8(1.7)	41.4(1.4)	36.3(13)	34.7(1.2)	28.3(0.98)	23.1 (0.76)	15.3(0.5)	6.7(0.22)	4.0(0.15)
Total foodgrain	860.1(34.8)	928.3(32.0)	926.5(30.8)	838.5(29.1)	724.9(25.2)	578.0(19.1)	412.7(13.9)	307.9(10.3)	234.2(8.7)
Sugarcane	15.6(0.63)	16.0(0.55)	18.1 (0.60)	21.3(0.74)	19.7(0.68)	16.5(0.54)	13.2(0.44)	9.5(0.32)	7.1(0.26)
Pepper	99.4(4.0)	111.5(3.83)	114.9(3.8)	106.8(3,7)	118.7(4.1)	176.7(5.8)	181.8(6.1)	213.8(7.10)	173.1 (6.4)
Ginger	12 (0.48)	11.7(0.40)	11.9(0.39)	13.1 (0.45)	15.6(0.54)	14.5(0.47)	12.2(0.41)	8.6(0.29)	6.7(0.25)
Cardamom	28.6(1.16)	43.8(1.5)	49.3(1.6)	55.2(1.9)	60.7(2.1)	5 1.3 (1.7)	41.2(1.38)	41.3(1.39)	40.8(1.5)
Arecanut	57.1 (2.3)	83.5(2.8)	86.7(2.8)	61.4(2.1)	57.7(2.0)	64.0(2.1)	74.3(2.5)	100.8(3.4)	99.6(3.7)
Banana	10.5(0.4)	9.8(0.3)	9.7(0.3)	13.6(0.47)	17.1(0.6)	22.7(0.75)	30.1 (1.0)	55.8(1.8)	56.4(2.1)
Other									
Plantain	33.4(1.35)	41.4(1.4)	38.9(1.3)	37.0(1.28)	35.4(1.23)	43.43(1.43)	49.9(1.68)	53.9(1.8)	49.4(1.85)
B&O	43.8(1.78)	51.3(1.76)	48.7(1.62)	50.7(1.76)	49.2(1.7)	66.2(2.1)	80.0(2.7)	76.9(2.6)	105.8(3.9)
Cashewnut	83.5(3.4)	99.2(3.4)	105.7(3.5)	139.2(4.8)	136.0(4.7)	112.2(3.7)	94.3(3.1)	87.1 (2.9)	50.4(1.8)
Total Fruits	256.5(I 0.4)	277.3(9.5)	293.1 (9.7)	341.3(11.8)	332.2(11.5)	350.2(11.56)	380.8(12.8)	419.6(14.1)	332.1(12.4)
Tapnioca	213.6(8.6)	295.3(10.1)	317.0(10.5)	254.1 (8.8)	204.2(7.1)	141.1(4.6)	118.2(3.9)	97.6(3.3)	77.1 (2.8)
Total									
Vegetables	249.6(10.1)	333.8(11.5)	342. 7(11.4)	333.1(11.5)	266.5(9.3)	215.6(7.1)	2001(6.7)	177.1 (5.9)	43.1(1.6)
Total Food Crop	1605.1(65.1)	1836.4(63.3)	1884.8(62.7)	1779.6(61.9)	1615.9(56.3)	1482.1(48.9)	1346.6(45.3)	1305.6(43.9)	1063.6(39.8)
Groundnut	15.0(0.6)	13.6(0.4 7)	20.4(0.68)	12.0(0.42)	11.7(0.41)	14.1(0.47)	9.4(0.42)	2.1 (0.07)	1.5(0.06)
Sesamum	11.9(0.49)	I 1.9(0.41)	13.4(0.45)	16.6(0.58)	14.3(0.50)	8.8(0.29)	4.2(0.14)	1.1(0.04)	0.5(0.02)
Coconut	547.7(22.2)	704.3(24.3)	728.5(24.3)	658.2(22.9)	699.4(24.4)	870.0(28.7)	889.5(29.9)	898.7(30.2)	789.3(29.5)
Cotton	8.1(0.33)	6.6(0.23)	7.5(0.25)	5.6(0.20)	5.8(0.20)	11.6(0.38)	12.4(0.42)	2.6(0.09)	0.89(0.03)

TABLE 3 : PERCENTAGE SHARE OF CROPS IN TOTAL AREA SOWN—*Contd.*

Crops (area '000 ha!)	The Land Reform Phase (1960-1975)			Post land reform phase (1976-1992)			The Economic Reform Phase (1993-2010)		
	TEI964	TEI970	TEI975	TEI980	TEI986	TEI992	TEI998	TE2004	TE2010
Tea	38.7(1.5)	1.3(3.5)	1.2(3.3)	1.25(3.4)	1.2(3.5)	1.1(3.3)	I. 16(3.36)	1.3(3.3)	1.4(3.7)
Coffee	20.3(0.82)	29.3(1.0)	38.1 (13)	56.4(19)	65.1 (23)	81.0(2.7)	83.2(2.8)	84.2(2.83)	84.6(3.2)
Rubber	142.6(5.8)	174.4(6.0)	202.8(6.8)	222.5(7.7)	330.0(11.5)	427.1(14.1)	463.6(15.6)	478.3(16.1)	525.7(19.7)
Total Non-Food crop	860.8(34.9)	1037.3(35.7)	1118.1 (37.2)	1095.2(38.1)	1254.5(43.7)	1547.0(51 I)	1622.3(54.6)	1652.9(55.6)	1606.7(60.2)
Others	279.9(11.3)	292.3(I 0.07)	287.3(9.57)	331.9(11.55)	324.2(11.3)	357.6(11.8)	450.7(15.1)	497.3(16.8)	439.1(16.4)
TAS	2465.8(100)	2900.5(100)	3002.9(100)	2874.8(\ 00)	2870.5(100)	3029.2(I 00)	2968.9(I 00)	2973.7(100)	2670.3(100)

Source : Directorate of Economics and Statistics, Agricultural Statistics Kerala.

Note: (i) The figures In parenthesis are the percentage area of total cropped area.

(ii) B&O denotes banana and other plantain and T AS denotes total area sown.

TABLE 4 : RANKING OF CROPS BASED ON CHANGES IN PERCENTAGE SHARE OF TOTAL CROPPED AREA

Crops	The Land Reform Phase(1960-1975)		The Post land Reform Phase (1976-1992)		The Economic Reform Phase (1993-2010)		% Change in area between TE 1964-TE 2010
	TE1964	TE1975	TE1980	TE1992	TE1998	TE2010	
Rice	32.5 (I)	29.2	27.7	18.4 (2)	13.1	8.5 (3)	-71.7
Pulses	1. 7 (8)	1.3	1.2	0.76 (12)	0.5	0.15(15)	-96
Sugarcane	0.63(13)	0.6	0.74	0.54 (14)	0.44	0.26 (13)	-92.9
Pepper	4 (5)	3.8	3.7	5.8 (4)	6.1	6.4 (4)	73.1
Ginger	0.48 (16)	0.39	0.45	0.47 (15)	0.41	0.25(14)	-93.3
Cardamom	1.16(11)	1.6	1.9	1.7 (9)	1.38	1.5(11)	-59.2
Arecanut	2.3 (7)	2.8	2.1	2.1 (8)	2.5	3.7 (5)	-0.4
Banana	0.4 (17)	0.3	0.47	0.75 (13)	I	2.1 (8)	-43.6
Other Plantain	1.35(10)	1.3	1.28	1.43(10)	1.68	1.85 (9)	-50.6
Cashewnut	3.4 (6)	3.5	4.8	3.7 (6)	3.1	1.8 (10)	-49.6
Tapioca	8.6 (3)	0.5	8.8	4.6 (5)	3.9	2.8 (7)	-22.9
Groundnut	0.6(14)	0.68	0.42	0.47(16)	0.42	0.06 (16)	-98.5
Sesamum	0.49 (15)	0.45	0.58	0.29(18)	0.14	0.02(18)	-99.5
Coconut	22.2 (2)	24.3	22.9	28.7 (I)	29.9	29.5(1)	689.3
Cotton	0.33(18)	0.25	0.2	0.38 (17)	0.42	0.03 (17)	-99.11
Tea	1.5 (9)	1.2	1.2	1.1(11)	1.16	1.3 (12)	-63.35
Coffee	0.82 (12)	1.3	1.9	2.7 (7)	2.8	3.2 (6)	-15.4
Rubber	5.8 (4)	6.8	7.7	14.1 (3)	15.6	19.7 (2)	425.7

Source : Directorate of Economics and Statistics, Agricultural Statistics Kerala.

Note : The figures in parenthesis represents the changes in rank of the crops.

In the land reform phase rice occupied the first rank with 32.5 percent of the total cropped area. The second rank in terms of relative share of the total cropped area was coconut with 22.2%. The third and fourth place were occupied by tapioca (8.6%) and rubber (5.8%) respectively. But during the second phase the area under rice has fallen drastically with 18.4% of the total cropped area occupying the second place. The first rank in relative share has been taken over by coconut with 28.7% of the area and the third place was to rubber with substantial increase in area ,of about 14.1 %. By the time of the Economic reform phase the percentage area under rice has been just 8.5 percent. The area under rubber coconut and pepper has taken precedence over rice. This reveals that there is a remarkable crop shift from food crops to non-food crops in the second phase and third phase compared to the first phase. This shift is of a peculiar trend from seasonal and annual crop to perennial crops which contributes a remarkable change in the land use in Kerala causing a land cover change. A detailed description of the pattern of crop shift during different phases could be observed from Table 3 and Table 4.

4. Sources of Growth in Agricultural Production

To analyze what has contributed to increase or decrease in production only taking into consideration of the endogenous factors such as area, yield and its effects on the production of individual crop has been decomposed into area effect, yield effect and interaction effect. Three year average of area and yield is taken for the analysis for both current and base year period. The decomposition analysis here provides an inter-period comparison to understand the role played by each of area and yield in all the three phases.

In Table 5, Table6 and Table7 the percentage contribution of area, yield and the interaction effect contributing to increase or decrease in production of major crops in Kerala is presented during the three phases.

TABLE 5 : THE AREA, YIELD AND INTERACTION EFFECTS IN THE CHANGES IN PRODUCTION OF INDIVIDUAL CROPS DURING THE LAND REFORM PHASE

	1960-1967				1968-1975			
Crops	Area Effect	Yield Effect	Interaction Effect	Change in Production	Area Effect	Yield Effect	Interaction Effect	Change in Production
Rice	253.8	-149	-4.9	(+)	9.45	90.23	0.33	(+)
Pulses	-67.1	-33.4	0.54	(-)	-137.5	42.7	-5.2	(-)
Tapioca	6.1	87.5	6.4	(+)	29.6	65.5	4.8	(+)
Sugarcane	33.8	61.1	5.1	(+)	186.8	-77.1	-9.7	(+)
Pepper	0.5	-100.4	-0.1	(-)	20.1	77.4	2.4	(+)
Ginger	-90.4	-9.8	0.2	(-)	2.4	95.4	2.1	(+)
Cardamom	130.6	-21.4	-9.2	(+)	19.5	71.5	9	(+)
Arecanut	85.8	11.2	3.1	(+)	155.4	-53.4	-2.1	(+)
Banana	-40.2	143.3	-3.1	(+)	-99.9	-0.1	0	(-)
Other Plantain	101.5	-1.4	-0.2	(+)	-99.1	-0.9	0.1	(-)
Cashewnut	321.9	-155.7	-66.2	(+)	108.3	-7.7	-0.5	(-)
Groundnut	-14.1	128.4	-14.3	(+)	266.8	-111.3	-55.5	(+)
Sesamum	-50.4	-50.7	1.1	(-)	265.3	-323.6	-41.7	(-)
Coconut	345.2	-206.5	-38.7	(+)	44.3	-139.5	-4.8	(-)
Tea	41.9	55.6	2.4	(+)	-30.5	135.2	-4.7	(+)
Coffee	117.8	-13	-4.8	(+)	141.1	-31.7	-9.4	(+)
Rubber	17.6	69.7	12.7	(+)	24.7	64.8	10.6	(+)

TABLE 6 : THE AREA, YIELD AND INTERACTION EFFECTS IN THE CHANGES IN PRODUCTION OF INDIVIDUAL CROPS DURING THE POST LAND REFORM PHASE

	1976-1983				1984-1992			
Crops	Area Effect	Yield Effect	Interaction Effect	Change in Production	Area Effect	Yield Effect	Interaction Effect	Change in Production
Rice	-931.6	1106.4	-74.8	(+)	-211	138	-27	(-)
Pulses	-46.7	169.3	-22.7	(+)	-100.4	0.47	-0.1	(-)
Tapioca	-147.8	59.7	-11.9	(-)	-146.9	67.8	-20.9	(-)
Sugarcane	1.4	97.7	1	(+)	-1123	1458.8	-235.9	(+)
Pepper	21.1	77.6	1.3	(+)	58.1	28.1	13.7	(+)
Ginger	107.2	-6.2	-0.9	(+)	-119.4	236.4	-17	(+)
Cardamom	38.1	-134.4	-3.8	(-)	-130.6	272.8	-42.2	(+)
Arecanut	-69.7	-32.2	1.9	(-)	35.7	58	6.3	(+)
Banana	66.5	26.8	6.8	(+)	73.5	19.9	6.6	(+)
Other Plantain	-19.3	-92.9	12.2	(-)	56.8	35.3	7.9	(+)
Cashewnut	122.2	-197.7	-24.5	(-)	-68.7	204.6	-35.8	(+)
Groundnut	-76	-34.8	10.8	(-)	60.3	33	6.7	(+)
Sesamum	-85.7	-16.5	2.2	(-)	-82.6	-28.2	10.8	(-)
Coconut	-3.4	-96.9	0.3	(-)	61.2	31.2	7.6	(+)
Tea	-55.5	-45.5	1.1	(-)	-4.6	105.3	-0.7	(+)
Coffee	424.5	-431.2	-93.3	(-)	117.1	-174.3	-42.7	(-)
Rubber	146.9	-39	-7.9	(+)	38.4	47.6	14	(+)

TABLE 7 : THE AREA, YIELD AND INTERACTION EFFECTS IN THE CHANGES IN PRODUCTION OF INDIVIDUAL CROPS DURING THE ECONOMIC REFORMS PHASE

	1993-2001				2002-2010			
Crops	Area Effect	Yield Effect	Interaction Effect	Change in Production	Area Effect	Yield Effect	Interaction Effect	Change in Production
Rice	-129.3	42.64	-13.3	(-)	-208.7	141.6	-32.9	(-)
Pulses	-105.7	13.4	-7.7	(-)	-83.6	-27.2	10.8	(-)
Tapioca	-396.4	527.5	-31.1	(+)	-552.5	826.3	-173.8	(+)
Sugarcane	-182.9	121.7	-38.8	(-)	-243.5	462.2	-118.6	(+)
Pepper	121.9	-206.5	-15.3	(-)	-38.9	-75.5	14.4	(-)
Ginger	-163.9	72.2	-8.3	(-)	-166.5	85.1	-18.5	(-)
Cardamom	-10.7	117.7	-7	(+)	-16.8	-84.2	1	(-)
Arecanut	5.8	76	18.2	(+)	-0.8	102	-1.2	(+)
Banana	1132.5	-575.8	-456.8	(+)	116	-213.7	-2.3	(-)
Other Plantain	19.5	70.3	10.1	(+)	-76	-26.2	2.2	(-)
Cashewnut	-57.2	-49.4	6.7	(-)	-102.6	4.5	-2	(-)
Groundnut	-99.5	-1.5	1	(-)	-207.1	151.1	-44	(-)
Sesamum	-104.8	18.2	-13.4	(-)	-512.8	800.6	-387.8	(-)
Coconut	28.1	70.6	1.3	(+)	-257.3	179.1	-21.8	(-)
Tea	78.2	20.9	0.9	(+)	-126.5	234.2	-7.8	(+)
Coffee	6.1	91.4	2.5	(+)	185.4	-85	-0.5	(+)
Rubber	22.7	72.3	5.1	(+)	53.4	42.4	4.2	(+)

4.1 The Land Reform Phase (1960-1975)

During the first period (1960-1967), the area effect contributed to increase in production of rice, coconut, arecanut, and coffee whereas the yield effect contributed more for the increase in production of tapioca, sugarcane, banana, groundnut, tea and rubber. The production declined for pulses, pepper, ginger and sesamum because of the area effect in terms of decline area, which is due to lack of any significant breakthrough in yield. During the second half of the first period increase in production is associated with increase in area for following crops like arecanut (155.4%), sugarcane (186.85), cashewnut (108.3%), groundnut (266.8%), coffee (141.5%). The decrease in production of pulses, banana and other plantain has been due to negative area effect despite a positive yield especially for pulses (42.7%). Despite a substantial increase in area under cashewnut, because of the negative yield effect, the production has decreased. This could be either due to the absence of technological improvement or due to an increase in area under new plantation.

The interaction effect of rubber and cardamom constitutes more among all other crops to increase in production of these crops. For rubber it contributes 10.6% and for cardamom 9%. Increase in both area and yield could be due to substantial technological improvement and other exogenous factors like increase in price or incentives given for these crops.

4.2 The Post Land Reform Phase (1976-1992)

The production of rice, pulses, sugarcane, pepper, ginger, banana, and rubber has increased and this is contributed by yield for rice, pulses, sugarcane, and pepper despite of a negative area effect. This reveals that the yield could be sustained but despite that, the area growth did not take place to meet the consumption needs of the state. Whereas for commercial crops like ginger, banana and rubber, the area contributed to the increase in production. Coming to 1984-1992, despite a positive yield effect, the production of rice, tapioca and pulses declined. These are the crops which are grown purely to meet the consumption needs of the state. All the other crops are commercial crops which depends on market (Economic Review, 1968).

The positive and high interaction effect of rubber (14%) and pepper (13.7%) shows both area and yield interaction contributes substantially for the increase in production. The increase in yield could be due to technological improvement and other factors such as price, incentives and profit contributed to increase in area.

4.3 The Economic Reform Phase (1993-2010)

The same trend of decline in area to decline in production followed in this phase with respect to rice and pulses. From 1993-2001 production of rice has declined and this has been due to a very high percentage of decline in area despite positive yield. The positive yield effect could not compensate the negative area effect. In the case of tapioca, the high yield compensated the decline in area and production shows an increase. For commercial crops like, banana despite a negative yield the area has expanded. For coconut and rubber both area and yield effect were positive during 1993-2001.

The second period of this phase (2002-2010), the picture is very clear. The only crops whose production has increased were arecanut, tea, coffee and rubber, and tapioca and sugarcane. For tapioca and sugarcane, a very high yield effect compensates a large decline in the area. For arecanut and tea the yield effect has been more but the negative area effect has been less. For coffee and rubber the production is due to high increase in area. For rubber both area and yield are positive and almost equally contributes for the production. The increase in yield coupled with other favourable factors like high price and incentives from the part of the government induces farmers to cultivate rubber even on a marginal plot. Here the high yield pushes the area effect and as a result more production as is seen that area effect is positive. All these affect the total production scenario of the state as its area under food crops has substantially fallen and this contributed to the decrease in production.

5. Causes/determinants of crop shifts and land use change

The economic rationale behind the crop shift explained by various authors were maximization of income per hectare approach followed by farmers (Oomman, 1963), The price and non-price factors such as increase in wage rate, and a relative price advantage in favour of non-food grain crops and ill- conceived development of critical factors such as water management and land development (Kannan and Pushpangadan, 1988), the exemption of plantation crops from land reforms act, and the promotional activities by the Government in the area of plantations and cash crops (Pillai, 1994) etc., These encouraged the cultivators in Kerala to opt for higher valued cash crops or plantations wherever possible and to curtail the area under rice and other food grains to the minimum.

These studies do not explain the reasons for such strategy followed by the farmers. We identify the underlying factors and proximate reasons (Lambin et al, 2003) which has led to crop shift and land use change. The underlying factors are the root causes and proximate reasons are the response of the farmers in terms of peasant rationality.

TABLE.8: REASONS FOR LAND USE CHANGE

UNDERLYING FACTORS (Root Causes)	PROXIMATE REASONS (Peasant Rationality)
I) Agrarian Reform Measures • Land Reforms and • Kerala Agricultural workers Act, 1974 These were ineffective and short sighted	• Preference of less labour intensive crops, • More remunerative crops and crops with more incentives
2) Agricultural Development Programmes • Various Agricultural Development programmes which promoted the growth of export oriented crops These programmes were crop oriented and not based on efficient land use	• Maximization of profit amidst increasing cost of cultivation and • More subsidy oriented production

5.1 Agrarian Reforms and Land use change

Agrarian reforms and the related policies could be considered as major underlying causes of land use change in Kerala. The land reforms were ineffective as it has led to uneconomic size of holdings (Oomman, 1963). It has created an agrarian hierarchy where in large group of agricultural labourers could only benefit a tiny piece of homestead land in which they could not make a subsistence living and were still dependent on large farmers for their livelihood (Radhakrishnan, 1981). Along with such a situation the passing of the Kerlala Agricultural Workers Act in 1974, made the agricultural labour costly for farmers.

Agrarian reforms did not enhance agricultural production to a greater extent in the initial years neither in the later period because land has increasingly ceased to be a means of production along with labour and capital and enterprise, and started becoming an appreciating capital asset to be preserved for generating higher margins of income in future (Chandrasekharan Nair, 2010). The failure to locate land reform in the wider framework of agrarian reform by emphasizing what kind of a structural change in production, market and settlement pattern it should pursue (Hall, 2008) would only result in the acquisition of a capital asset through land reform and may not ensure change patterns of investment (capital), productive land use (land) and employment (labour) (Hall, 2008).

5.2 Agricultural Development Programmes

The agricultural development programmes in the state during the land reform phase were mainly confined to increase in the production of paddy as the state was facing serious food deficit (Economic Reviews, 1960 to 1973). An important feature of these programmes were that these were not widespread but centered on a few pockets in the cultivation of rice. Later the abolition of food zones and the distribution of rice at subsidized prices through fair price shops caused a decline in open market prices. The fall in rice price together with the increase in wages of farm. labour turned rice cultivation non-remunerative (Mahesh, 1999). Secondly there was a shift in the programmes and policies of the government from 1975 onwards. The Government of India provided support through its agencies for the development of coconut and spices. Along with it the materialization of Kerala Agricultural Development Project supported by World Bank encouraged the cultivation of export earning crops like coconut, pepper, cashewnut coca and spices during the second phase of land use change (Economic Review, 1977). The development support given to cultivators by the Rubber Board in the form of subsidies and technical assistance led to an incentivized cultivation and brought new area under the crop (Mahesh, 1999).

5.3 Peasant Rationality

This is farmers' response to maximization of profit amidst constraints. Socio-economic and cultural factors affect farmers decision on acreage allocation. In the initial phase the peasant rationality could be analyzed by their migration to areas where an abundance of land was available for cultivation at a cheaper price. The migration from Travancore to Malabar (Tharakan, 1984) also promoted the cultivation of rice in the initial period and later transformation of the area into plantation crops in response to the state policies and programmes. The peasant rationality according to Viswanathan (2012), created a dichotomous agrarian society with a group of capitalist farmers who went for commercial agriculture on one side and a small group of subsistence farmers who continued on traditional crops. The production decisions of the large and medium sized plantation/cash crop producers have always been influenced by 'peasant rationality' or the price (market) factor, which in due course, had resulted in a paradigm shift in cropping pattern in the state (Viswanathan, 2012).

5.4 Phase Ill : The Economic Reform Phase

The crop shift in the third phase has been characterized by more specialization in terms of export oriented crops (Joseph and Joseph, 2005). The rate of increase in area under coconut and rubber that are least labour intensive has been high during this period. The structural adaptation of the regional economy to cope with rising cost of cultivation on account of rising wages could explain this intensive phase of the crop shift. Increase in area under commercial crops is also due to the growth of small holdings (ibid). During the 1960s only large farmers were planting rubber (Guillerme et al, 2011). The small holder dominance is also seen in the case of crops like coffee, cardamom, pepper, rubber and coconut (Joseph and Joseph, 2005). The subsidy for planting rubber and high price for rubber latex were major incentive in the case of rubber (Guillerme et al, 2011). The non agrarian nature of the state's economy in terms employment shift (Kannan, 2011), also could explain the dynamics of crop shift in the recent period.

2. Conclusion

The dynamics of crop shift from food to non-food/ commercial crops and the reasons behind this shift has been the major focus of this study. The crop shift mainly took place after the land reform measures. Thus, the underlying forces behind the crop shift has been identified as the government measures starting with land and labour policies and other institutional measures thereafter to support commercial oriented production. This clearly depicts the absence of an organization for farmers to continue farming and to represent their issues. In the absence of this farmers resorted to an income maximization approach as a part of the peasant rationality which led to a shift in cropping pattern. As a result of such crop shift the crop production has decreased drastically. This has been analyzed through decomposition analysis and has been found that the area effect has been contributing more for increasing, production of commercial crops and decreasing production of food crops such as rice, tapioca and pulses. The largescale conversion of paddy land to coconut and rubber needs to be checked as the wetlands are getting destroyed in Kerala. The indiscriminate use of land for profit oriented crops will lead to serious environment problems in the state. Moreover the initial conversion of paddy land to coconut may ultimately lead to non-agricultural uses of land, at the cost of food security and environment. It is high time to take long term measures for the revival of paddy cultivation to preserve the existing paddy land for the production of the same. In every state agriculture is highly incentivized unlike in Kerala where the incentives are comparatively more mainly for the cultivation of rubber.

Appendix I

TABLE 1 : MEASUREMENT AND DATA SOURCES OF VARIABLES

Variables	Discription of the Variables	Source
Area under food and non-food crops	**Food crops** includes, foodgrains, sugar crops, condiments and spices, fruits and vegetables and **Non-food crops** include, oil seeds, drugs, narcotics and plantation crops, lemongrass, fodder crops, green manure crops and other non-food crops.	Agricultural Statistics, Directorate of Economics and Statistics, Kerala from 1960-61 to 2010-11
Area, output and yield of important crops in Kerala	The area, output and yield of rice, pulses, tapioca sugarcane, pepper, ginger, cardamom, arecanut, banana, other plantain, cashewnut, groundnut, sesamum, coconut, tea, coffee and rubber were taken for the study	Agricultural Statistics Kerala, Directorate of Economics and Statistics, Kerala from 1960-61 to 2010-11

REFERENCES

Chandrasekharan Nair. E (2010), "Revisiting Land Reforms in Kerala", edt book 'Land Reforms' by Raman Pillai (2010), APH *Publishing Corporation,* Thiruvananthapuram.

Guillerme S, Kumar B.M, A. Menon, C. Hinnewinkel • E. Maire • A. V. Santhoshkumar (2011), "Impacts of Public Policies and Farmer Preferences on Agroforestry Practices in Kerala, India", *Environmental Management, Springer Science Business Media.*

Government of Kerala (various issues), Economic Reviews, *Directorate of Economics and Statistics*, Thiruvananthapuram.

Hall. R (2008), "Land reform for what? Land use, production & livelihoods", http://www.plaas.org.za/sites/default/files/publications-pdf/ A C2. pdf

Joseph. B and Joseph K.J (2005), "Commercial Agriculture in Kerala after the WTO", *South Asian Economic Journal*, Vo1.6 No.37, pp. 37-57.

Joshi, P.K. (2010), "Crop Diversification in India: Nature, Pattern and Drivers", in Asian Development Bank (edt), Agriculture, Food Security and Rural Development, pp.184-217, Oxford University Press, New Delhi.

Kalaiselvi K (2012), "Patterns of crop diversification in Indian scenario", *Annals of Biological Research, Economics Wing, DDE, Annamalai University, Annamalai Nagar, India* Vo1.3 No. 4, pp.1914-1918

Kannan K. P. and Pushpangadan K (1988), "Agricultural Stagnation in Kerala : An Exploratory Analysis", *Economic and Political Weekly*, Vo1.23, No. 39, September 24, pp.A-120"to A-132.

Kannan K.P (2011), "Kerala Agriculture in an Emerging Non-Agrarian Regional Economy: Kerala's Challenges" *Economic and Political Weekly*, Vol.XLVI, No.9 pp.64-70

Lambin, Giest J.H, et al (2003), "Dynamics of Land-Use and Land-Cover Changes in Tropical Regions" *Annual Review of Environmental Resource*, Vo1. 28, pp. 205-41.

Mahesh, R. (1999), "Causes and Consequences of Change in Cropping Pattern: Location- specific study", Discussion Paper, Kerala Research Programme on Local Level Development, *Centre for Development Studies*, Thiruvananthapuram

Minhas, B.S, and A. Vaidyanathan (1965), "Growth of Crop Output in India 1951-54 to 1958-61: An analysis by Component Elements", *Journal of the Indian Society of Agricultural Statistics*, Vol. 17, No. 2, pp. 230-252.

Oomman M.A (1963), "The Economics of Cropping Pattern-A Case Study of Kerala", *Indian Journal of Agricultural Economics*, Vo1.18, No.1, and pp.120.

Pillai P.P (1994): "Agricultural Development", in *Kerala Economy Four Decades of Development*, Institute of Planning and Applied Economic Research, John Matthai Centre, University of Calicut, pp 59-101.

Radhakrishnan P (1981) "Land Reforms in Theory and Practice: The Kerala Experience". Economic and Political Weekly, Vo1.16, No. 52, pp.A129-A131 +A133+A135-A137.

Sharma K.L (1977), "Measurement of the Effect of Area, Yield and Prices in the Increase of Value of Crop Output in India", Agricultural Situation in India, Vo1.32, No.6, pp.349-351.

Tharakan P.K.M (1984), "Socio Economic Factors and Educational Development; The Case of 19th Century Travancore", Working Paper No. 190, Centre for Development Studies, Trivandrum

ViswanathanP.K (2012), "Rationalisation of Agriculture in Kerala and its Implications on Natural Environment, Agro-Ecosystems and Livelihoods", Gujarat Institute of. Development Research, Ahmadabad.

Is Employment Generation Scheme Hampering Agricultural Development ?

MAHENDRA SINGH*

Abstract

The paper has critically examined the impact of the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) on wage rates of agricultural labourers, cost of cultivation, agricultural development and rural poverty across major states in India. Analysis has shown that the nominal and real wage rates of agricultural labour (male) have been increased in all the states ranging between 44 to 87 percent in nominal terms and 3 to 50 percent in real terms during the period of agricultural year 2008-09 to 2011-12. Moreover, relatively higher changes were noticed in both nominal and real term of agricultural wage rates during month of July to December in comparison to January to June in corresponding period. The correlation between growth in real wage rates of agricultural labour and National State Domestic Product (NSDP) from agriculture and allied sector; growth in NSDP/ha and decrease in rural poverty were 0.10, 0.22 and 0.29 respectively during financial year 2006-07 to 2011-12. An example of relation between growth in real cost of inputs and value of output in paddy crop verified that laggard states were compensated their higher growth in human labour cost through substitution of human labour by machine labour and higher yield growth, while fron trunner states like Punjab and Haryana have been suffered due to less scope for labour substitution and yield enhancement. The study verified the synergistic relationship between MGNREGS and agriculture development, because over 90 percent of works completed under the scheme were related to the enrichment of precious natural resources.

Introduction

The twin objectives of ensuring to eradication of rural poverty and employment generation have been India's strategies for planned development since independence. The various important employment generation programmes were taken up before implementation of National Rural Employment Guarantee Act (NREGA), such as the Rural Manpower Programme (1960-61), Crash Scheme for Rural Employment (1971), Drought Prone Area Programme (1971), Food for Work Programme (1977), National Rural Employment Programme (1980), Rural Landless Employment Guarantee Programme (1983), Jawahar Rozgar Yojana (1989), Employment Assurance Scheme (1993), Sampoorna Grameen Rozgar Yojana (2001) and National Food for Work Programme (2004), etc. The objectives of these employment generation programmes were to provide the opportunities for wage employment to the rural poor, creating an income generating asset base for self employment and development in fragile regions like dry-land, rain-fed, drought-prone and desert areas. These programmes played important roles to reducing both unemployment and poverty in rural areas, however, the regular programmes were very few and high administrative costs involved in their implementation. To overcome of these drawbacks and to achieve the goal of inclusive growth, NREGA was implemented with effect from 2nd February, 2006 in 200 selected backward districts and extended to another 130 districts during 2007-08 and renamed as Mahatma Gandhi NREGA and extended to all the rural districts of the country from 1st April, 2008 Under MGNREG Act, development scheme implemented to achieve the inclusiveness, employment and reducing poverty among rural people by providing at least one hundred days of guaranteed wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. This programme has successfully raised the negotiating power of agricultural labour, resulting higher agricultural wages, improve economic outcomes and resulted in reduction in distress migration (Planning Commission, 2011). Several studies have been conducted to assess the impact of MGNREGS on rural livelihoods and natural resources (Leelavathi and Valentine, 2011; Kareemulla, et al." 2009; Indian Institute of Science, Bangalore, 2009) have concluded that the scheme helped to improve in livelihood security and natural resources. However, many studies related to the impact of MGNREGS on wage rates and supply of agricultural labourers (Maheshwari and Gangwar, 2011; Vanitha and Murthy, 2011; Channaveer et aI., 2011; Manikandan, 2011) have concluded that supply decreased and wage rates increased of agricultural labourers due to implementation of the scheme. Some studies (Alha and Yonzon, 2011; Sharma and Prakash, 2011) reported that scarcity of agricultural labourers influenced by several factors other than the MGNREGS and they argued that cost of cultivation of crops should bring down through substitution of human labourers by machine and increase in productivity rather than bring down the wages of agricultural labourers. The labour costs have risen rapidly during the last three years,

*Senior Scientist (Agricultural Economics) National Research Centre for Agroforestry, Jhansi-284003.

Key words : Agricultural Labour, Wage rate, Cost of Cultivation, MGNREGS, Migration, Employment Generation

which has pushed the costs of production in agriculture. The reasons were MGNREGS, rural-urban migration, increase in price of other agricultural inputs and lower growth in yield of crops (CACP, 2012).

These conflicting views indicate that a clear picture on overall impact of the MGNREGS on agricultural development has yet to emerge. Therefore, keeping this background in view, this study conducted to have a fresh look toward impact assessment of MGNREGS on agricultural development with the specific objectives as; (i) to study the progress and performance of the MGNREGS; (ii) to analyse the changes in agricultural and MGNREGS wage rates and its impact on rural poverty; (iii) to assess the impact of works completed under the scheme on agricultural development; and (iv) to estimate the growth in agricultural wage rate and other inputs in paddy cultivation to prove the trade-off or synergistic relationship between MGNREGS and cost of production.

Data and Methodology

This study is based on secondary data. The secondary data were collected from various published sources namely, Ministry of Agriculture, Ministry of Rural Development, Ministry of Statistics and Programme Implementation, Planning Commission, Government of India, and Reserve Bank of India.

Results and Discussion

Performance and Progress of the MGNREGS

An overview of MGNREGS progress at national level is presented in Table 1. The progress of the scheme since its inception is showing increasing trend in terms of households provided employment, persondays employment generated, percentage share of SCs, STs and women participation, average persondays per households provided employment up to the year 2009-10. However, after 2009-10, stagnation or declining trend was observed in person-days employment generated and average person-days per household provided employment, might be due to better job opportunities in other sector, rural-urban migration of educated labour, good Monsoon, return of marginal and small farmers to their own land improved under the scheme.

TABLE 1 : PERFORMANCE AND PROGRESS OF THE MGNREGS, INDIA, 2006-7 TO 2011-12

Particular	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Districts covered	200	330	615	619	626	626
Total number of households issued job cards (million)	37.8	64.8	100.1	112.5	119.8·	122.9
Total households provided employment (million)	21.0	33.9	45.1	52.6	54.9	49.9
Total person-days employment generated (million)	905	1436	2163	2836	2572	2123
Average person-days per household provided employment (day)	43	42	48	54	47	42
Total expenditure (Rs million)	88,234	1,58,569	2,72,501	3,79,052	3,93,773	3,77,294
Average wage income per household (Rs/year)	2773	3181	4048	5044	4877	5106
% share of Scheduled caste participation	25	27	29	30	31	22
% share of Scheduled tribes participation	36	29	25	21	21	18
% Women participation	40	43	48	48	48	48

Source : Ministry of Rural Development, GoI, Data accessed from http://nrega.nic.in/MIS report.htm

Changes in Wage Rates for Agricultural Labour and MGNREGS during Agricultural Year (July-June), 2008-09 to 2011-12

The changes in daily agricultural labour and MGNREGS wage rates during 2008-09 to 2011-12 in nominal and real term is presented in Table 2. It revealed that, out of fifteen states only in seven states (Bihar, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh) nominal MGNREGS wage rates were higher than market wage of agricultural labour during 2008-09, which declined in four states (Assam, Bihar, Madhya Pradesh and Maharashtra) during 2011-12. The maximum changes were observed in the state of Maharashtra (87%), followed by Tamil Nadu (86%), Odisha (83%) and Andhra Pradesh (74%) in nominal wage rates of agricultural labour during corresponding period. The changes in normal wage rates under MGNREGS, the state of Maharashtra ranked first (87%), followed by Assam (68%), West Bangal (67%) and Karnataka (58%). The highest changes observed in nominal wage rates of agricultural labourers (65 percent) in comparison to nominal MGNREGS wage rates (27%) at all India level during corresponding period. The similar situatioin was also observed in real wage rates under MGNREGS, which was higher than agricultural labour wage rates in seven states during 2008-09 and declined to four states during 2011-12. The maximum changes were observed in the states of Punjab (50%), followed by Maharashtra (45%). Tamil Nadu (27%) and Andhra Pradesh (27%) and minimum changes in Assam (3%), Rajasthan (6%) and Kerala (10%) in term of real value of agricultural wages during 2008-09 to 2011-12. The relative higher changes were observed in real wage rates of agricultral labourers (23%) in compared to real MGNREGS wage rates (-6%) at all India level during corresponding period, it is verified that wage rates under MGNREGS were not provided floor rate for agricultural labour. It implies that the market wage rates of agricultural labourers was already higher in more than fifty percent of the states during 2008-09, which increased in seventy five percent of the states during 2011-12. The correlation between changes in real agricultural wage rates and MGNREGS real wage rates was 0.06 during 2008-09 to 2011-12. The higher positive changes occurred in the wages of agricultural labour than MGNREGS wage and changes in agricultural wage rates not absolutely influenced by changes in MGNREGS wage rate proved by weak correlation. Hence, the hypothesis of 'MGNREGS wage rates not provide that floor wage rate for agricultural wage rate in rural areas' is accepted and verified that employment generation under MGNREGS not solely reponsible to stimulate the wage rates of agricultural labourers.

TABLE 2—CHANGES IN DAILY WAGE RATES OF AGRICULTURAL LABOUR AND MGNREGS DURING AGRICULTURAL YEAR, 2008-09 TO 2011-12

State	Average nominal wages rate for agricultural labour during agricultural year (Rs./day)					Average nominal wage rate under MGNREGS during agricultural year (Rs./day)				
	2008-09	2009-10	2010–11	2011-12	% change in 2011-12 over 2008-09	2008-09	2009-10	2010-11	2011-12	% change in 2011-12 over 2008-09
Andhra Pradesh	102	129	160	177	74	83	92	97	97	16
Assam	83	96	116	127	52	77	86	105	130	68
Bihar	71	88	100	113	58	87	101	114	129	49
Gujarat	79	84	92	113	44	78	87	92	110	40
Haryana	133	171	195	206	55	138	149	167	180	30
Karnataka	75	88	112	136	80	79	88	105	125	58
Kerala	231	278	330	390	69	124	124	130	150	21
Madhya Pradesh	63	72	85	98	56	81	90	101	118	45
Maharashtra	82	96	122	154	87	90	113	135	168	87
Odisha	74	91	122	135	83	86	103	95	123	42
Punjab	125	143	178	213	70	107	124	123	142	33
Rajasthan	116	126	153	170	47	85	81	83	94	11

TABLE 2—CHANGES IN DAILY WAGE RATES OF AGRICULTURAL LABOUR AND MGNREGS DURING AGRICULTURAL YEAR, 2008-09 TO 2011-12—*Contd.*

State	Average nominal wage rate for agricultural labour during agricultural year (Rs./day					Average nominal wage rate under MGNREGS during agricultural year (Rs./day)				
	2008-09	2009-10	2010--11	2011-12	% change in 2011-12 over 2008-09	2008-09	2009-10	2010-11	2011-12	% change in 2011-12 over 2008-09
Tamil Nadu	112	138	175	208	86	65	71	84	93	42
Uttar Pradesh	83	97	115	125	52	100	100	104	120	20
West Bengal	87	101	120	141	62	80	87	111	134	67
All India	101	120	145	167	65	91	100	110	115	27
State	Average real wage rate for agricultural labour during agricultural year (Rs./day)					Average real wage rate under MGNREGS during agricultural year (Rs./day)				
	2008-09	2009-10	2010--11	2011-12	% change in 2011-12 over 2008-09	2008-09	2009-10	2010-11	2011-12	% change in 2011-12 over 2008-09
Andhra Pradesh	21	23	26	27	27	17	17	16	14	– 15
Assam	18	18	20	19	3	17	17	18	21	22
Bihar	16	18	18	18	14	19	20	21	23	20
Gujarat	17	16	16	21	20	17	16	16	18	3
Haryana	27	29	32	33	24	28	25	26	26	– 6
Karnataka	16	17	18	20	20	17	16	18	18	2
Kerala	51	56	57	56	10	27	25	23	25	– 9
Madhya Pradesh	14	14	15	16	19	18	17	18	19	9
Maharashtra	17	17	21	25	45	19	20	22	24	28
Odisha	17	18	21	20	16	20	21	18	22	12
Punjab	25	24	31	38	50	22	21	20	21	– 4
Rajasthan	24	22	25	25	6	17	14	14	14	– 18
Tamil Nadu	25	27	30	31	27	14	14	15	15	7
Uttar Pradesh	18	18	20	21	18	21	19	18	20	– 5
West Bengal	20	20	21	24	18	18	17	20	23	22
All India	22	23	25	27	23	20	19	19	18	– 6

Source : (a) Author's calculation with data on average daily rates for Agricultural Labour (Man) from Reports of the Commission for Agricultural Costs and Prices (Various issue), Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi and The Economic Times, Delhi Edition on 17 July, 2011.

Comparison of Changes in Wage Rates for Agricultural Labour and MGNREGS during July-December to Average of Entire Agricultural Year, 2008 to 2011

Table 3, depicts the changes in rates of daily agricultural wage and MGNREGS during the period of July to December for the year 2008 to 2011. It shows that the wage rates of agricultural labour have been increased much higher during July-December than entire agricultural year (Table 3), in both nominal and real term. The major changes were observed in all the states, particularly those growing human labour intensive crops like cotton, paddy, groundnut, maize and sugarcane. The changes in MGNREGS wage rates (even negative) unable to reduce the wage rates of agricultural wage in respective states. For example, negative changes in real wage under MGNREGS in the state of Andhra Pradesh, Kerala, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh could not affect

the real wage rates of agricultural labour in respective states. The correlation between percentage of persondays employed during July-December, 2011 to entire year under MGNREGS and wage rates of agricultural labour in nominal and real term was found 0.6. Its implies that the wage rates of agricultural labour have been increased during July-December, 2011, despite the less than 50 per cent of persondays employed in majority of the states under the scheme during an half year. The situation created because of labour scarcity other than MGNREGS such as employment generated at own farm of marginal and small farmers on their improved land and irrigation facilities provided under the scheme, less supervision and drudgery nature of agricultural operations compared to work under MGNREGS and rural-urban migration, which create supply constraints for agricultural labour. Hence, it is concluded that MGNREGS and its wage rates were not solely responsible for spiral of agriculturla wage rates during peak season of agricultural operations (July-December).

TABLE 3—CHANGES IN NOMINAL WAGE RATES OF AGRICULTURAL LABOUR AND UNDER MGNREGS DURING JULY TO DECEMBER, 2008 TO 2011

State	Average nominal wage rate for agricultural labour during July-December (Rs./day)					Average nominal wage rate under MGNREGS during July-December (Rs./day)					% of person-days
	2008	2009	2010	2011	% change in 2011 over 2008	2008	2009	2010	2011	% change in 2011 over 2008	employed during July-December, 2011 to entire year under MGNREGS
Andhra Pradesh	94	122	147	177	88	83	92	93	94	13	27
Assam	83	93	111	126	53	77	83	100	130	69	34
Bihar	70	86	99	113	60	88	104	114	127	45	40
Gujarat	78	82	89	113	45	79	87	93	112	41	25
Haryana	128	165	188	207	62	138	150	166	180	30	42
Karnataka	73	86	104	134	85	80	85	100	125	57	35
Kerala	218	270	319	388	78	124	124	125	150	21	57
Madhya Pradesh	62	70	82	98	58	83	89	99	119	44	30
Maharashtra	79	93	113	154	94	89	112	134	174	95	24
Odisha	67	87	114	136	102	83	102	90	124	49	20
Punjab	118	138	177	208	75	106	124	123	146	38	40
Rajasthan	109	123	149	179	64	86	83	84	99	14	23
Tamil Nadu	107	132	166	20	94	64	67	83	93	46	50
Uttar Pradesh	81	93	113	124	53	100	100	100	120	20	50
West Bengal	86	96	114	140	63	77	82	106	133	71	25
All India	97	116	139	167	72	89	88	98	115	30	36

TABLE 3(A)—CHANGES IN REAL WAGE RATES OF AGRICULTURAL LABOUR AND UNDER MGNREGS DURING JULY TO DECEMBER, 2008 TO 2011

State	Average real wage rate for agricultural labour during July-December (Rs./day)					Average real wage rate under MGNREGS during July-December (Rs./day)					% of person-days of whole year employed under MGNREGS during July-December, 2011
	2008	2009	2010	2011	% change in 2011 over 2008	2008	2009	2010	2011	% change in 2011 over 2008	
Andhra Pradesh	20	23	25	29	46	17	17	16	16	– 9	27
Assam	19	18	20	19	3	17	16	18	20	14	34
Bihar	16	18	19	18	16	20	21	22	21	4	40
Gujarat	17	16	15	21	19	18	16	16	20	16	25
Haryana	26	29	30	34	28	28	26	26	29	3	42
Karnataka	16	16	18	20	22	18	16	18	18	3	35
Kerala	49	56	58	60	22	28	26	23	23	– 17	57
Madhya Pradesh	14	14	15	16	18	18	17	18	20	8	30
Maharashtra	17	17	19	25	50	19	20	22	29	51	24
Odisha	16	18	21	20	28	19	21	17	18	– 5	20
Punjab	24	24	29	37	55	22	22	20	26	22	40
Rajasthan	23	22	25	27	17	18	15	14	15	– 19	23
Tamil Nadu	24	26	30	31	32	14	13	15	14	– 1	50
Uttar Pradesh	18	18	20	21	21	22	19	18	20	– 6	50
West Bengal	20	20	20	24	18	18	17	19	22	24	25
All India	21	22	25	27	27	20	17	17	19	– 4	36

Source : (a) Author's calculation with data on average daily rates for Agricultural Labour (Man) from Reports of the Commission for Agricultural Costs and Prices (Various issue), Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi and The Economic Times, Delhi Edition on 17 July, 2011.

Has MGNREGS affected Agricultural Production and Rural Poverty ?

The annual compound growth rate in real wage rate of agricultural labour and Net State Domestic Product (NSDP) from agricultural and allied sector during 2006-07 to 2011-12 is presented in Table 4. It shows that the growth in real wage rates of agricultural labour have been observed in all the states and the highest growth rate was recorded in the state of Andhra Pradesh, followed by Punjab, Maharashtra and Haryana. The highest growth the NSDP from agriculture and allied sector was observed in the state of Uttar Pradesh, Madhya Pradesh and Rajasthan (BIMARU or laggard category) where Green Revolution Technologies reached in latter stage. The correlation between growth in real wage rates of agricultural labour; NSDP from agriculture and allied sector; growth in NSDP Rs/ha; NSDP Rs/ha and changes in rural poverty were 0.10, 0.22, 0.45 and 0.29 respectively. The values of positive correlations indicate that higher wage rates of agricultural labour have not hampered the agricultural development, even helped to reduce poverty in respective states.

TABLE 4—GROWTH IN REAL WAGE RATES OF AGRICULTURAL LABOUR AND NET STATE DOMESTIC PRODUCT FROM AGRICULTURE AND ALLIED SECTOR IN MAJOR STATES, 2006-07 TO 2011-12

(Value of constant price at base year 2004-05)

State	ACGR in NSDP from agriculture and allied sector (2006-07) to 2011-12)(%)	Average NSDP Rs/ ha (2006-07 to 2011-12)	ACGR in NSDP Rs/ha (2006-07 to 2011-12) (%)	%Change in poverty in 2009-10 over 2004-05	Per capita rural population expenditure on MGNREGS, TE-2010 11 (Rs.)	Real wage rates of agricultural labour (man) (Base : 1986-87) 2006-07	ACGR in real wage rates of agricultural labour (man) (Base : 1986-87) 2006-7 to 2011-12
Andhra Pradesh	4.9	54758	5.6	9.5	421	16.4	11.2
Assam	5.3	44110	4.9	– 3.5	278	18.5	0.4
Bihar	0.9	40022	2.8	0.4	115	15.7	3.7
Gujarat	0.6	31673	– 0.4	12.4	146	16.7	1.7
Haryana	3.4	66657	3.5	6.2	166	25.2	6.3
Karnataka	5.4	29964	4.5	11.4	683	16.2	3.8
Kerala	1.3	63216	1.1	8.2	424	57.2	1.5
Madhya Pradesh	6.2	20616	5.4	11.6	423	13.0	3.6
Maharashtra	4.4	23838	4.0	18.4	384	16.8	6.7
Odisha	3.3	28549	4.3	21.6	282	16.2	6.0
Punjab	1.5	73746	1.6	7.5	271	22.9	9.5
Rajasthan	5.6	17767	6.0	9.4	616	20.2	4.5
Tamil Nadu	1.1	49258	2.0	16.3	503	23.0	6.1
Uttar Pradesh	6.4	43440	2.5	3.3	223	15.9	5.6
West Bengal	2.2	79012	2.5	9.4	326	20.3	2.2
All India	3.1	47783	3.2	8.2	368	21.0	5.0

Source : Author's calculation data from National Accounts Division, Ministry of Statistics and Programme Implementation, Government of Inda, New Delhi, (Http://mospi.nic.in/mospi new/upload/SDP main– 04.05.htm Ministry of Rural Development, Government of India, New Delhi. Data accessed from http;//nrega.nic.in/MIS report. htm.

Data on Rural poverty based on Tendulkar methodology and taken from Planning Commission, Government of India (http://Planning Commission.nic.in/news/press-pov 1903.pdf.).

Impact of Nature of Works Completed under MGNREGS on Agricultural Development

The share of expenditure on various categories of works completed under MGNREGS in major states during 2011-12 is presented in Table 5. It shows that the maximum share of expenditure on rural road connectivity ranks first, followed by water conservation and water harvesting at all India level. Rural connectivity provides all weather access and plays vital role in input and output supply and overall social-economic development of rural areas. The state of Assam ranks first, followed by Uttar Pradesh in highest expenditure on rural road connectivity. The activities under water conservation and water harvesting are very much important for water management and water use efficiency for all states in general and rainfed-prone states in particular for sustainable agricultural production. The state of Jharkhand ranks first, followed by Andhra Pradesh in terms of highest expenditure on water conservation and water harvesting. The expenditure on other activities such as land development, renovation of traditional bodies, micro-irrigation, fllood control, drought proofing, provision of irrigation facilities to SCs and STs are very important for sustainable agricultural development and inclusive growth through natural resource management. This scheme is playing as a catalyst for agricultural development through its own activities and convergence

with National Food Security Mission, Rastrya Krishi Vikas Yojana, National Horticulture Mission, Watershed programmes and Fisheries, etc. It is very clear that over 90 per cent of expenditures under the scheme treated as investment in agriculture and help through directly as well as its multiplier effects for the sustainability of the agriculture system. Recently, government has included some other activities on the basis of recommendation of Mihir Shah Committee (2012) namely NADEP-composting, vermi-composting, liquid bio-manures, bio-gas plant, poultry shelter, goat shelter, construction of pucca floor for urine tanks and fodder shed for livestock, fish drying yards, etc. under the MGNREGS. These activities would be creating stronger positive synergy between MGNREGS and sustainable agricultural development and rural livelihood security.

TABLE 5—SHARE OF EXPENDITURE UNDER MGNREGS FOR VARIOUS CATEGORIES OF WORKS IN MAJOR STATES, 2011-12
(PERCENT EXPENDITURE)

State	Flood Control	Rural Connectivity	Water Conservation and Water Harvesting	Renovation of Traditional Water Bodies	Drought Proofing	Irrigation canals	Irrigation facilities to SC/ST/ IAY/LR	Land development	Rajiv Gandhi Seva Kendra	Other works	% wage expenditure of total expenditure	Total expenditure (Rs. million)
Andhra Pradesh	3.1	19.8	39.6	4.9	7.6	14.9	3.1	1.8	5.3	0.0	67	41542
Assam	8.4	56.7	5.0	1.9	4.6	3.7	0.3	12.7	0.9	5.8	64	7483
Bihar	2.2	47.5	6.8	3.2	27.2	6.5	0.1	4.8	0.2	1.6	55	15134
Chattisgarh	1.9	44.1	16.5	14.2	5.0	5.5	4.2	7.2	0.8	0.5	72	20470
Gujarat	16.0	33.0	17.8	3.2	9.5	0.4	6.5	4.2	4.8	4.6	54	6533
Haryana	3.6	35.6	15.1	5.7	0.8	12.9	0.3	14.3	10.5	1.3	64	3166
Himachal Pradesh	14.5	32.5	15.5	2.2	1.9	10.1	6.5	15.4	0.2	1.3	67	5045
Jammu and Kashmir	19.5	42.8	6.4	2.0	1.2	10.1	0.1	12.7	0.0	5.2	59	4091
Jharkhand	0.3	15.9	49.8	3.6	3.5	0.5	16.5	3.2	4.6	2.1	65	11435
Karnataka	20.4	19.8	14.9	5.4	8.7	5.6	4.2	13.9	3.2	3.9	62	21522
Kerala	15.0	2.3	16.2	8.7	2.6	6.9	4.8	42.8	0.0	0.6	93	10045
Madhya Pradesh	0.4	34.0	32.2	2.9	5.4	0.7	14.8	9.2	0.0	0.4	57	34179
Maharashtra	0.6	31.9	29.8	4.4	12.0	0.6	16.4	2.2	0.9	1.2	71	15865
Odisha	0.5	42.4	11.3	10.5	4.3	1.3	4.0	1.5	19.5	4.7	55	10322
Punjab	5.1	27.5	0.7	25.8	3.5	4.9	0.0	15.4	13.7	3.3	61	1585
Rajasthan	1.7	30.9	20.3	9.1	5.8	4.1	6.9	5.4	14.2	1.4	64	31845
Tamil Nadu	0.5	24.4	17.3	43.5	0.0	14.2	0.0	0.1	0.0	0.0	96	29228
Uttar Pradesh	5.7	52.7	12.6	3.4	4.6	5.7	1.6	7.4	0.3	6.1	64	50712
Uttarakhand	38.5	7.8	11.2	3.5	6.6	11.1	0.3	18.7	0.4	2.0	64	3994
West Bengal	7.1	40.7	18.8	12.5	4.7	5.1	2.2	7.8	0.4	0.7	69	29763
India	5.4	34.5	20.1	9.2	6.0	6.1	4.8	8.0	3.2	2.4	68	377294

Source : Author's calculation data from Ministry of Rural Development, Government of India, New Delhi. Data accessed from http://mrega.nic.in/MIS_report.htm.

Is Growth in Real Cost of Agricultural Labour Affects Profitability of Paddy Cultivation ?

To test the hypothesis that spiral in the rates of daily wage of agricultural labour is not fully responsible for increase in cost of cultivation of a crop; paddy crop has been selected, because of its main growing season during July to December, the period of spiral for daily wage of agricultural labourers; it requires relatively higher human labour hours/ha for cultivation and its wide coverage of area across the states. Table 6 depicts the annual compound growth rates of real value for inputs used, value of main product and net profit during 2005-06 to 2009-10. The growth rate in value of main product and profit were higher than growth rate in cost (C2) of cultivation in all selected states, which verified the fact that paddy cultivation is not adversely affected by higher growth in price of inputs. The growth rates in cost of production; change in share of human labour cost in total operational cost have been found negative in the Assam, West Bengal, Uttar Pradesh and Madhya Pradesh probably due to late adoption of Green revolution technologies in general and human labour substituted by machine labour in special among these laggard states and were found positive for other states because of negative effect of injudiciously adoption and stagnation of Green Revolution Technologies in front runner states. An inverse relationship has been found between growth rates for yield and cost of cultivation in all states except Haryana, the argument being supported by the Commission for Agricultural Costs and Prices in the Report on Policy for Kharif Crops-2012-13.

It is noticed that cost of the total human labour has been increased as slower rate in laggard states, compared to growth in total operational cost despite of higher growth in cost of casual labour and its lion's share in total operational cost. This happened because of human labour has been substituted by machine labour and growth in fertilizer cost more than growth in total human labour cost in these laggard states. However, in front runner states like Punjab and Haryana, the growth rates of total human labour cost were higher than machine labour cost, fertilizer costs and total operational cost because of lesser scope of substitution of human labour by machine labour due to stagnation in appropriate technology generation and peak level of fertilizer consumption per ha along with the lower yield growth even negative was also observed in these states. The situation of 'Technology Fatigue' has been occurred because of deceleration of yield potential of existing varieties in these states and lesser scope of increase in per ha fertilizer and pesticides consumption, irrigation water and machine labour. These two states are front runner in adoption of 'Green Revolution Technologies' and highest yield with minimum yield gap in rice production (Singh, 2011) and require break in yield barrier through breakthorugh in paddy technologies particularly by development of higher yielder varieties. The other factors such as monotonous Rice-Wheat system and deceleration in soil health and quality of groundwater might partially responsible for yield stagnation in these two states. The role of other associated policy instruments, such as extension gap, hard and soft infrastructue, availability of inputs and ouput marketing are not a problem except rational pricing of electricity charges for exploitation of groundwater; no symptoms of 'policy fatigue', are diagnose because there is low poverty, higher level of awareness and higher level of infrastructure development in rural areas and higher priority in procurement of rice and wheat from these two states.

TABLE 7—GROWTH IN REAL VALUE OF INPUTS AND OUTPUT IN PADDY CULTIVATION IN MAJOR STATE, 2005-06 TO 2009-10

(Costant price 2004-05 = 100)

State	Growth in value of main product Rs/ha (%)	Growth in cost (C2) of cultivation Rs/ha (%)	Growth in net profit Rs./ha (%)	Growth in cost of production Rs/Q (%)	Growth in operational cost (%)					Average share of human labour cost in total operational cost(%)	Change in share of human labour cost in 2009-10 over 2005-06 (%)	Growth in yield (%)
					Casual human labour	Total Human labour	Machine labour	Fertilizer	Total operational cost			
Eastern Region												
Assam	5	1	43	– 4	16	2	49	11	3	62	– 3	5
West Bengal	4	0	27	– 1	4	3	20	13	4	60	– 4	2

TABLE 7—GROWTH IN REAL VALUE OF INPUTS AND OUTPUT IN PADDY CULTIVATION IN MAJOR STATE, 2005-06 TO 2009-10—*Contd.*

(Costant price 2004-05 = 100)

State	Growth in value of main product Rs/ha (%)	Growth in cost (C2) of cultivation Rs/ha (%)	Growth in net profit Rs./ha (%)	Growth in cost of production Rs/Q (%)	Growth in operational cost (%)					Average share of human labour cost in total operational cost(%)	Change in share of human labour cost in 2009-10 over 2005-06 (%)	Growth in yield (%)
					Casual human labour	Total Human labour	Machine labour	Fertilizer	Total operational cost			
Northern Region												
Haryana	8	3	29	7	11	8	4	– 3	4	43	25	– 4
Punjab	7	4	18	2	16	12	11	4	7	38	20	2
Uttar Pradesh	8	2	57	– 1	10	3	15	11	5	44	– 8	4
Western Region												
Madhya Pradesh	19	6	94	– 5	22	5	14	17	7	45	10	12
Southern Region												
Andhra Pradesh	9	6	73	4	7	7	19	3	9	51	– 2	3

Source : (a) Author's with data from Reports of the Commisison for Agricultural Costs and Prices (Various issue), Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

Conclusions and Policy Implications

This study examines the impact of MGNREGS on employment generation for rural unskilled labour, sustainable agricultural development in India. The boost in the daily human agricultural wage rate influenced by MGNREGS wage rates were not exclusively responsible for growth in operational cost but yield growth plays seminal role to compensate the growth in operational cost. The ACGR of the total human labour and total operational costs in paddy cultivation have increased in all producing states but less than the growth rate of value of main product during 2005-06 to 2009-10. The ACGR of the paddy yield was responsible to compensate the growth in operational cost, however, the state of Punjab and Haryana were not able to compensate operational cost through yield growth because of low and negative growth respectively in yield of paddy during corresponding period. Study also verified the contribution of the MGNREGS through works completed which related to water conservation, water harvesting, irrigation, renovation of water bodies, drought proofing, plantation and afforestation, flood control measures and rural road connectivity. The convergence of various schemes operated under Ministry of Rural Development and Agriculture, Government of India also strengthening the path of sustainable agriculture through MGNREGS.

REFERENCES

Alha, A. and Bijoyata Yonzon (2011) Recent Development in Farm Labour Availability in India and Reasons behind its Short Supply. Agricultural Economics Research Review. Vol. 24 (Conference Number): pp 381-390.

Channaveer, H. Lokesha, L.B. Hugar, J.B. Deshmanya and S.B. Goudappa (2011) Impact ofMGNREGA on Input-use Pattern, Labour Productivity and Returns of Selected Crops in Gulbarga District, Karnataka. Agricultural Economics Research Review. Vol. 24 (Conference Number): pp 517- 523.

The Economic Times, Delhi Edition 17 July, 2011.

GoI (2009) Environmental Services, Vulnerability Reduction and Natural Resource Conservation for NAREGA Activities- A Case Study of Chitradurga District. Indian Institute of Science, Bangalore. Report submitted to Ministry of Rural Development, New Delhi.

GoI (2010) Annual Report to the People on Employment. Ministry of Labour and Employment, New Delhi.

GoI (2012) Annual Report, 2011-12. Ministry of Rural Development, New Delhi. http://nrega.nic.in /MIS report.htm

Gol (2012) Reports of the Commission for Agricultural Costs and Prices, Department of Agriculture and Cooperation, Ministry of Agriculture, Govern-ment of India, New Delhi. Commission for Agricultural Costs and Prices in a Report on Policy for Kharif Crops-2012-13.

Gol (2012) The Mahatma Gandhi National Rural Employment Guarantee Act, 2005-Operational Guidelines, 2012, 4th Edition, Mihir Shah Committee's Draft Report submitted to Ministry of Rural Development, Government of India.

Kareemulla, K., K. Srinivas Reddy, C.A. Rama Rao, Shalander Kumar and B. Venkateswarlu (2009) Soil and Water Conservation Works through National Rural Employment Guarantee Scheme (NREGS) in Andhra Pradesh-An Analysis of Livelihood Impact. *Agricultural Economics Research Review*. Vol. 22 (Conference Number): pp 443-450.

Leelavathi, P. and G. Valentine (2011) Study on Impact of MGNREGS on Migration. Research Highlights, 2010-11. National Institute of Rural Development. Hyderabad. http://www.nird.org.in/publications

Maheshwari, M. Selva and L.S. Gangwar (2011) Impact of Rural Development Scheme on Availability of Agricultural Labour-A Study of Dairy Farms in Thanjavur District of Tamil Nadu. *Agricultural Economics Research Review.* Vol. 24 (Conference Number): pp 409-414.

Mahendra Singh (2010) Yield Gap and Constraints in Rice production in India. Agricultural Situation in India. May issue Vol. 67 (2) pp 69-74.

Manikandan, A. D. (2011) Paddy Cultivation and MGNREGA: A Study of Kerala. Financing Agriculture. Vot. 43 (9) : pp 33-35.

Narayanamoorthy, A. (2007) Deceleration in Agricultural Growth: Technology Fatigue or Policy Fatigue? Economic and Political Weekly. Vol.42 (25) : pp 2375-79.

Sharma, A.K. and Brahm Prakash (2011) Causes and Consequences of Supply-demand gap for Labour in Sugarcane in India. Agricultural Economics Research Review. Vol. 24 (Conference Number): pp 401-408.

Vanitha, S.M. and P.S. Srikantha Murthy (2011) An Economic Analysis of MGNREG Programme in Mysore District of Karnataka. Agricultural Economics Research Review. Vol. 24 (Conference Number): pp 45-422.

Planning Commission (2008). Eleventh Five Year Plan (2007-12) Document, Volume-I &III, Government, of India, New Delhi. http://planningcommission.nic.in .

Planning Commission (2008). All India Report on Evaluation of NREGA: A Survey of Twenty Districts. Government of India, New Delhi.

Planning Commission (2011) Approach to the Twelfth Five Year Plan. Government of India, New Delhi.

RBI (2012) RBI Bulletin (various issue) and Hand Book of Statistics on the Indian Economy, 2011-12, Mumbai. http://www.rbi.org.in/scripts/publications

Problems and Prospects of Oilseeds Production in Gujarat : Special Reference to Groundnut*

1. Introduction

Oilseeds sector has played a prominent role in agricultural development in India. Gujarat plays a pivotal role in oilseed production in the country. Oilseeds are important next only to foodgrains in terms of area, production and value in the state. Oilseeds area and production in the state constitute about 10.8 per cent and14.5per cent respectively in India. Oilseeds are usually seen as the primary cash crop in the state where the diverse aqro-ecological conditions are favourable for growing these crops. A wide range of oilseed crops is grown in different agro-climtic regions of the state. Among the oilseeds, groundnut is the most important crop produced in the state. The state is the largest producer of groundnut and second largest producer of sesame in the country. The area and production of groundnut in the state constitute about 30.9 per cent and 37.1 per cent respectively in India. The state is the India's largest producer of castor in India. The productivity of castor in the state is the highest not only in, India but also in the world. Though the state ranks first in area and production of groundnut in India, the average productivity is relatively low as groundnut is mostly grown under rainfed condition. Because of high productivity under assured irrigation, groundnut cultivation in summer season is gaining popularity in the state. There has been a significant increase in production of oilseeds in the state during last three decades mainly due to increase in yield.

Besides, the productivity of rapeseed-mustard, cotton, onion and potato in the state is the highest in India. The productivity of groundnut, bajra and banana is second highest in India. There are some factors those positively contributed to the success stories in Gujarat. Completion of Sardar Sarovar Project on a war footing basis, consolidating the gains from the check dam program, expediting the spread of micro irrigation have helped in further diversification towards high value crops like oilseeds in the state. Better adoption of technology in agriculture has generated a positive impact in the state through increase in the yield per hectare. The irrigated area as a percentage of the total area under oilseeds also increased significantly duing last three decades. Furthermore, the use of fertilizer, plant protection and agronomic practices has considerably increased during last couple of decades that has helped in oilseeds production in the state.

The state has increased the oilseeds production mainly through increase in yield since a long time. Further expansion in area under oilseeds, further increase in yield levels of oilseeds, reducing the levels of production risks, increase in irrigation coverage and water use efficiency, stability in input prices and timely supply of quality inputs in required quantity seem to play critical role in further development of oilseeds sector in the state. Further expansion in area under oilseeds is possible through more adoption of oilseeds as inter crops and replacement of low remunerative crops. The replacement of low remunerative crops is largely dependent on the, increase in irrigation coverage and irrigation efficiency. Near about 42.1 per cent of net sown area and 44.3 per cent of GCA was irrigated during 2009-10., However, only 21.5. percent of total area under oilseeds was irrigated in Gujarat during 2003-04 (GoG, 2008). The irrigated area under groundnut was only 7.5 per cent during the corresponding year in the state.

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 in the state. The growth performance of these crops in the state had been prone to various kinds of risk over time and across the agro-climate regions because of the erratic rainfall behavior, frequent drought occurrence in the state. Several biotic, abiotic, technological, institutional, and socio-economic constraints inhibit exploitation of the yield potential of crops and 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 Gujarat and identify major problems or constraints facing the sector in the state.

2. 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 Gujarat 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 Gujarat; (ii) to determine the impact of price and non-price factors influencing the supply response behavior and demand for edible oil seeds and oil in the state; and (iii) to identify major constraints in the

*A.E.R.C. Sardar Patel University, Vallabh Vidyanagar, Distt. Anand, Gujarat.

edible oilseed cultivation and suggest policy options to increase 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 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. Data and Methodology

3.1 Sampling Design

The multistate, purposive sampling method was used to select the states, districts, blocks and farm households. At first 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. Gujarat and Andhra Pradesh were chosen for the detailed study on groundnut since these states were 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 Gujarat with a special focus on groundnut.

In the second stage, all districts growing groundnut 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.). Junagadh, Rajkot and Porbandar were selected from Gujarat as HH, HL and LH category of districts, respectively for a detailed study. At third stage, about 25 villages from 7 blocks of three study districts were covered to get the desired number of sample households (250) representing different farm categories (Marginal 0-1 ha, Small 1-2 ha, Medium 2-4 ha; Large > 4 ha). 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 'β'. To measure the relative contribution of area and yield towards the total output change with respect of individual crop; the exercise on 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 (TE1983-84 to TE 1993-94) Period 11 (TE 1993-94 to TE 2009-10) and overall period II 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 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 the main oilseed crop (groundnut) and the main competing crop (cotton) 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, bullock labour cost, machine charges, 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 factors that actually influence the farmers' decision to allocate the available cultivable area for different crops have been taken into account as explanatory variables and the area allocated for main oilseed (groundnut) has been considered as the dependant variable. Some price and non-price factors were selected as the explanatory variables for the fitted regression model which were the size of land holdings (LS_t), one year lagged area of groundnut ($At-_1$), lagged yield of groundnut ($Yt-_1$), lagged price of groundnut ($Pt-_1$), lagged area of cotton ($ACt-_1$), lagged yield of cotton ($YCt-_1$) and the lagged price of cotton ($PCt-_1$).

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. Major Findings of the Study

4.1 Nature and Causes of Change in Cropping Pattern

The major crops grown in different parts of Gujarat are bajra, wheat, jowar, maize, cotton, castor, groundnut, rapeseed-mustard, fodder and horticultural crops. The cropping pattern has changed over the last four decades as a result of'developrnent of irrigation potential, production technology, increased market prices and industrial demand in the state. It is evident that the share of area under oilseeds has been stagnated since 1980s. The share of the area under total cereals, total pulses and total foodgrains has also decreased over last three decades. There has been very high growth in area under cotton and there has been moderate growth in area under rapeseed-mustard and other oilseeds while the area under groundnut has been declining in the state since 1980s. The area under total oilseeds as a per cent of gross cropped area (GCA), has decreased from 24.8 per cent in TE 1983-84 to 24.1 per cent in TE 2009-10. In absolute term, it has marginally increased from 2733.5 thousand ha in TE 1983-84 to2803.9 thousand ha in TE 2009-10. The area under the main oil seed crop groundnut has decreased continuously from 21.5 lakh ha in TE1983-84 to 19.7 lakh ha in TE 2003-04 and further to 18.6 lakh ha during TE 2009-10. On the other hand, the area under the main competing crop (cotton) has steadily increased from 13.0 per cent of GCA inTE 1993-94 to 20.7 per cent in TE 2009-10. In absolute term, the area under the cotton has increased from 14.37 lakh ha during TE 1993-94 to 24.13 lakh ha during TE 2009-10. Better price and better marketing facilities available in the state are the major factors contributing more to adoption of cotton replacing the main oilseed crop (groundnut) in the state.

Overall, the GCA in the state has fluctuated a lot. The GCA in the state has marginally increased from 110.34·lakh ha in TE 1983-84 to 116.33 lakh ha in TE 2009-10 (Table 1). The overall area expansion effect has been better for the irrigated area than the cultivated area during all reference periods. The gross irrigated area and net irrigated area has increased by 2603.9 thousand ha and 2113.9 thousand ha, respectively between TE 1983-84 and TE 2009-10 which was nearly 4.3 times and 3.0. times of increase in GCA and NSA respectively.

TABLE 1: CHANGES IN GROSS CROPPED AREA: AREA EXPANSION AND CROP INTENSIFICATION EEFFECTS: TE 1983-84 TO TE 2009-10

Indicators	TE 1983-84	TE 1993-94	TE 2003-04	TE 2009-10
GCA	11034.0	10744.7	10947.6	11632.7
GIA	2644.8	3269.9	3773.7	5248.7
NSA	9592.7	9440.6	9670.3	10302.0
NIA	2222.2	2518.2	3142.7	4336.0
Crop intensification effects				
GCA-NSA	1441.3	1304.1	1277.3	1330.7
GIA-NIA	422.6	751.8	631.0	912.6
Area expansion effects				
Indicators	TE 1983-84 to 1993-94	TE 1993-94 to 2003-04	TE 2003-04 to 2009-10	TE 1983-84 to 2009-10
Change in GCA	– 289.3	202.9	685.1	598.7
Change in GIA	625.1	503.7	1475.0	2603.9
Change in NSA	– 152.1	229.7	631.7	709.3
Change in NIA	296.0	624.5	1193.4	2113.9

Notes : GCA: Gross cropped area, NSA: Net sown area, GIA: Gross irrigated area, NIA: Net irrigated area.

Sources: (1) Agriculture Statistics of Gujarat, 1980-81 to 1999-2000, Directorate of Economics and Statistics, Government of Gujarat, Gandhinagar.

(2) Annual Season & Crop Reports, year 2002-03 to 2006-07 Krishi Bhavan, Government of Gujarat, Gandhinagar.

(3) Socio-Economic Review, various years (2007-08 to 2009-10), Directorate of Economics and Statistics, Government of Gujarat, Gandhinagar.

The district level analysis of cropping pattern reveals that the area under all major crops has declined in 8 districts out of 26 districts between TE 1993-94 and TE 2009-10. The area under groundnut has declined by 98.5 thousand ha (-5.0%) whereas the area under cotton has increased by 1221.6 thousand ha (102.5%) between TE 1993-94 and TE 2009-10 in the state. Significant rise in area under cotton has been observed in Bhavnagar, Amreli,· Jamnagar, Rajkot and Surendranagar districts. On the other hand, the significant increase in area under groundnut was found in few districts like Porbandar, Sabarkanta and Banaskantha.

Among various factors responsible for changes in cropping pattern, profitability, change in tastes and preferences, familiarity of HYVs for better returns, availability of irrigation provisions and climatic aberrations. are the major ones in the state of Gujarat. The decline in groundnut area was basically due to poor post harvest price and higher level of production risk. On the other hand, the area under cotton has significantly increased due to

better market price and lesser production risk. However, the area under other oilseeds like sesamum, rapeseed-mustard and castor has increased considerably mainly because these crops yielded better returns and promote value-added agri-business enterprises. The expansion of area under horticultural crops, pulses and oilseeds have been promoted through various programmes like NHM, NFSM, ISOPOM, ATMA etc. in the state in recent years compared to earlier periods in most of the districts in Gujarat.

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

Though the growth in area under some major oilseeds has been poor in Gujarat, the growth in production and yield of major oilseeds has been magnificent over last 3 decades. Though the growth in production and yield of major oilseeds has been satisfactory since 1950s, significant level of variability in these variables has been observed over the years. The average annual area under total oilseeds Has increased from 1545.9 thousand ha in 1950s to 2596.9 thousand ha in 1980s, that has declined to 2862.7 thousand ha in 2000s, (Table 2). On the other hand, the annual production and yield of total oilseeds in the state have increased from 773.1 thousand tonnes and 500.1 kg/ha, respectively during 1950s to 3686.2 thousand tonnes and 1287.7 kg/ha, respectively during 2000s. Thus the oilseed production and yield have increased by 4.8 times and 2.6 times respectively during last six decades.

TABLE 2—TRENDS IN AVERAGE AREA, PRODUCTION, AND YIELD OF OILSEEDS IN GUJARAT

A/P/Y	1951-52 to 1960-61		1981-82 to 1990-91		1991-92 to 2000-01		2001-02 to 2009-10		1951-52 to 2009-10	
	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR
Total Oilseeds										
Area (000 hectares)	1545.9 (27.8)	7.5	2596.9 (11.8)	0.4	2894.5 (2.7)	– 0.5	2862.7 (3.4)	– 0.6	2391.1 (22.1)	1.5
Production ('000 tonnes)	773.1 (52.2)	22.4	2126.9 (42.9)	– 3.4	2746.0 (38.1)	0.0	3686.2 (32.5)	– 2.3	2041.0 (60.0)	4.8
Yield (kg/ha)	500.1 (33.6)	13.9	819.0 (39.7)	– 3.8	948.7 (37.5)	0.5	1287.7 (30.7)	– 1.7	853.6 (43.4)	3.2
Total Agriculture Crops										
Area (000 hectares)	8494.5 (4.8)	1.7	9140.1 (9.7)	– 1.0	9122.7 (5.8)	– 1.5	9072.2 (7.4)	1.0	9035.8 (6.6)	0.3
Production (000 tonnes)	3882.0 (27.0)	11.8	9920.1 (25.9)	– 1.3	12497.8 (25.4)	– 1.6	17747.9 (25.8)	5.1	9622.5 (53.1)	4.1
Yield (kg/ha)	457.0 (23.9)	9.9	1085.3 (21.2)	– 0.3	1370.0 (21.7)	– 0.1	1956.3 (20.0)	4.0	1064.9 (50.4)	3.8

Notes : Figures in parentheses are the CV in per cent.

Sources: Gujarat Agricultural Statistics at a Glance 2010-11, Directorate of Agriculture, Gujarat State, Gandhinagar.

However, the intra-year variation in area, production and yield of total oilseeds is considerably large as noticed from variation in compound annual growth rates across last five decades. Particularly, the annual growth of area under total oilseeds has exhibited negative growth during 1960s and 1990s in the state. The annual growth of oilseeds production has recovered from -3.38 per cent during 1980s to 0.04 per cent during 1990s. The same has again dropped to -2.32 per cent during 2000s. Thus, the prevailing risk in production of oilseeds has been quite high in the state.

The district level analysis of area under oilseeds reveals that Rajkot(16.6%), Junagadh (14.8%), jamnagar (13.8%), Amreli (12.0%), Bhavnagar (9.3%) and Banaskantha (8.4%) accounted for major share of total area under oilseeds in the state during TE 1993-94. The share of some of these districts has declined marginally during TE 2009-10. Some of the districts where the share of area has increased during TE 2009-10 over TE 1993-94 were Junagadh (14.9%), Jamnagar (14.5%), and Banaskantha (9.8%).

As far as the oilseeds production in the state is concerned,the four out of six districts having the major share of oilseed acreage are among the six major districts producing oilseeds during both the reference periods with some changes in their ranks. They were Banaskantha (14.4%), Junagadh (13.9%), Bhavnagar (10.5%) and Rajkot (8.0%) during TE 1993-94; and Jamnagar (17.6%), Junagadh (16.6%)" Rajkot (11.9%) and Banaskantha (11.4%) during TE 2009-10.

The major districts growing Kharif oilseeds were Rajkot, Junagadh, Jamnagar, and Amreli during both the reference periods, viz., TE 1993-94 and TE 2009-10. The share of Bhavnagar in total Kharif oilseeds acreage has declined from 10.6 per cent in TE 1993-94 to 5.6 per cent in TE 2009-10; whereas the share of Kachchh in totalKharif. oilseeds acreage has increased from 4.3 per cent in TE 1993-94 to 6.6 per cent in TE 2009-10. Thus there have been minor changes in share of the districts with respect to Kharif oilseeds acreage between the two reference periods. The major districts growing Rabi oilseeds during TE 1993-94 were Banaskantha (42.8%), Mehsana (40.1 %)1 Sabarkantha (3.8%) and Ahmedabad (2.5%). There have not been any major changes in the share of the districts with respect to Rabi oilseeds acreage between two reference periods.

The analysis on the change in performance of individual oilseed crops in terms of acreage and production between the two reference periods (TE1993-94 and TE 2009-10) revealed that Rajkot, Junagadh, Jamnagar and Amreli were the major districts cultivating groundnut during both the reference periods; while Banaskantha, Mehsana, Sabarkantha, Kachchh and Patan were emerged as the major districts producing rapeseed-mustard and castor in the state. Surendranagar, Bhavnagar, Amreli, Kachhh, Jamnagar and Rajkot were found to be the major sesamum growing districts of the state.

Irrigation provision plays a critical role in expansion and stability in production and productivity of oilseeds. Expansion of irrigation facilities would also help in area expansion under various oilseeds in the state. Banaskantha, Mehsana, Kachchh, Patan, Sabarkantha and Gandhinagar were the major districts where more irrigated oilseeds were grown during both Kharif and Rebi seasons. The shares of other districts were very less ranging from 0.1 per cent to 3.9 per cent of state irrigated oilseeds acreage.

4.3 Variability in Area, Production and Yield of Major Oilseed (Groundnut) vis-a-vis-Competing Crop (Cotton)

Groundnut was found to be the major oilseed crop while the cotton was found to be its major competing crop in Gujarat in TE 2009-10. The share of groundnut in total oilseeds in the state was about 66.4 per cent in the corresponding period. The growth in area, under groundnut was considerably high during 1950s (10.3%). However, it has exhibited negative trend since 1960s (except 1970s the compound annual' growth rate of area under groundnut was -2.7 per cent during1960s that has marginally increased to 1.0 per cent during1970s and thereafter continued to exhibit negative annual growth. In absolute term, the annual average area under groundnut has increased from 1245.9 thousand ha during 1950s to 2252.8 thousand ha during 1970s and thereafter continued to fall to 1879:2 thousand ha during 1990s. There has been some marginal increase in area during 2000s.

The average annual production and yield of groundnut has significantly increased from 703.4 thousand tonnes and 564.6 kg/ha during 1950s to 2550.7 thousand tonnes and 1327.9 kg/ha -during 2000s (see Table 3).

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

A/P/Y	1951-52 to 1960-61		1981-82 to 1990-91		1991-92 to 2000-01		2001-02 to 2009-10		1951-52 to 2009-10	
	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR
Groundnut (Main Oilseed Crops)										
Area (000 hectares)	1245.9 (38.0)	10.3	1928.8 (12.8)	-1.9	1879.2 (4.4)	-1.4	1920.8 (3.8)	-0.4	1868.3 (29.5)	1.4
Production (000 tonnes)	703.4 (57.0)	25.3	1435.7 (55.0)	-8.4	1559.1 (55.2)	-0.4	2550.7 (41.0)	-5.0	1486.4 (58.5)	4.2
Yield (kg/ha)	564.6 (33.5)	13.6	744.4 (54.0)	-6.6	829.7 (56.3)	1.0	1327.9 (39.8)	-4.6	795.6 (53.5)	2.8
Total Agriculture Crops										
Area (000 hectares)	1561.0 (18.2)	4.3	1257.6 (18.5)	-4.1	1443.8 (13.9)	3.7	2061.6 (16.8)	4.4	1650.6 (21.2)	1.2
Production (000 tonnes)	1000.0 (33.4)	14.7	1597. (32.9)	-3.1	2348.8 (38.5)	-0.4	5599.6 (45.6)	20.2	2289.2 (79.2)	5.0
Yield (kg/ha)	640.6 (24.1)	10.0	1270.3 (26.6)	1.0	1626.8 (30.8)	-3.9	2716.1 (35.4)	15.1	1386.8 (54.7)	3.8

Notes : Figures in parentheses are the CV in per cent.

Sources: Gujarat Agricultural Statistics at a Glance 2010-11, Directorate of Agriculture, Gujarat State, Gandhinagar.

Particularly, the growth in production and yield of groundnut has been quite impressive during 1980s and 2000s. 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 and production of the main competing crop (cotton) has been better. Not only the production and yield of groundnut were less, the variability in production and yield of groundnut was much larger than that of cotton. The CV of area and production of groundnut during the reference periods was higher than that of cotton.

Over the last three decades, some districts like Rajkot, Junagadh, Jamnagar, Amreli and Bhavnagar have dominate in terms of area and production of groundnut. These five districts accounted for about 90 per cent of total groundnut area of the state. However, the share of these major districts has marginally declined over the years. Some districts whose share in area under groundnut has remained somewhat stagnant are Mehsana, Banaskantha, Kheda, Vadodara and Bharuch. The districts with higher area under groundnut such as Rajkot, Junagadh, Jamnagar, Amreli and Bhavnagar have dominated in terms of their share in production of groundnut in the state. The district's share in state's total production of groundnut in Amreli, Bhavnagar and Kachchh has declined from 14.5 per cent, 18.0 per cent and 9.6 per cent in TE 1993-94 to 7.7 per cent, 5.3 per cent and 4.7 per cent in TE 2009-10 respectively.

The variability in area and production of oilseeds is largely linked to availability of irrigation facilities. The share of irrigated area under groundnut to total area under groundnut in the state has marginally increased from 8.3 per cent in TE 1993-94 to 10.5 per cent in TE 2007-08. On the other hand, the share of irrigated area under groundnut to total irrigated area of the state has declined from 5.3 per cent in TE 1993-94 to 3.8 per cent in TE 2007-08. There is a need to increase the irrigated groundnut acreage so as to enhance the groundnut production and productivity in the state.

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 total oilseeds, major oilseed (groundnut) and the major competing crop (cotton) was assessed. Among the three effects i.e., area effect, yield effect and interaction effect, the yield effect Was found to contribute more to the change in output during the all the reference periods and the overall period of TE 1983-84 to TE 2009-10. The same was the case for the study districts, except Rajkot during Period I (TE 1983-84 to TE1993-94). The expansion of area under oilseeds was the major source of growth in oilseeds production in Rajkot during Period I. The yield effects also played a dominant role for the main oilseed (groundnut) throughout the reference periods in the state. As presented in Table 4, about 110.8 per cent of growth in total oilseeds in Gujarat was due to yield effects during Period 11 (TE 1993-94 to TE 2009-19). As far as the main oilseed (groundnut) of the state is concerned, the yield effect accounted for 110.0 per cent of total output growth during the corresponding period. However, the area effect was dominant during Period I (703.3%) and interaction effect played a dominant role during Period II (35.9%) for the main competing crop (cotton) in the state.

TABLE 4 : DECOMPOSITION OF OUTPUT GROWTH OF MAIN OILSEED (GROUNDNUT) AND COMPETING CROP (COTTON) IN GUJARAT

State	Crop	Effects	Period I TE 1983-84 to TE 1993-94	Period II TE 1993-94 to TE 2009-10	Period III TE 1983-84 to TE 2009-10
		Area	– 83.93	– 5.79	4.12
	Total oilseeds	Yield	171.19	110.81	93.47
		Interaction	12.74	– 5.02	2.41
		Area	25.97	– 4.31	– 28.80
Gujarat	Groundnut (main oilseed)	Yield	81.07	109.99	148.73
		Interaction	– 7.03	– 5.68	– 19.93
		Area	703.27	29.15	19.89
	Cotton (main competing crop)	Yield	– 728.40	34.94	47.69
		Interaction	125.13	35.92	32.41

Source : Computed from data collected from : (1) Agriculture Statistics of Gujarat 1996, Directorate of Economics and Statistics, Government of Gujarat, Gandhinagar.

(2) Gujarat Statistical at a Glance 2010-11, Directorate of Agriculture, Government of Gujarat, Gandhinagar.

The logical sequence of arguments brings us to know about the factors responsible for significant. increase in yield during this period. The 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 fertilizer use and gross irrigated area was good in the state where as the growth in irrigated area under total oilseeds was not satisfactory since the annual growth in irrigated oilseeds was -7.3 per cent during a period of TE 1993-94 to TE 2009-10. The fertilizer use has increased in the state by annual growth of 5.1 per cent.

The growth in annual prices of maior oilseeds has been impressive in Gujarat. The farm harvest price (FHP) of groundnut and sesamum, which are the major Kharif oilseeds in the state, has increased from Rs 1360 and Rs 2352 in TE1998-99 to Rs 2318 and Rs 5272 in TE 2009-10, respectively. Similarly, the annual price of rnajor Rabi oilseed (rapeseed-mustard) has increased from Rs 1226 in TE 1998-99 to Rs 2222 in TE2009-10. It was good to find that the FHP of all major oilseeds was much more than their MSPs in the state.

5 Household characteristics, Cropping Pattern and Production Structure

5.1 Socio-Economic Status of Sample Households

Among the sample farmers, 15 were marginal farmers, 66 were small farmers, 87 were medium farmers. and 82 were large farmers. The average household (HH) size for entire sample was of 6.3 persons. About 68.4 per cent sample households belonged to general caste category, 30.8 percent HHs belonged to OBC category and remaining 0.8 per cent HHs belonged to SC/ST category. The average off-farm income per sample household was Rs 43207 per annum. Near about 96.8 per cent members had crop farming as the main source of livelihood. The average number of years of schooling was 7.8 years for the sample households.

The net sown area (NSA) and gross cropped area (GCA) of a sample household was found to be 3.75 ha and 4.81 ha, respectively which imply that the cropping intensity in the study area was 128.3 per cent. The size of operational holding in the case of small, medium and large farmers was 1.62 ha, 3.20 ha, and 6.59 ha, respectively. It was good to see that the area under protective irrigation was 81.9 per cent of total operated area.

As regards the land tenancy, only about 6,4 per cent of sample HHs were having leased in land constituting about 3.6 per cent of total operated area. The term of lease for about 68.8 per cent of HHs with leased-in lands was share cropping and for remaining 31 per cent HHs, it was fixed rent in cash.

As far as different sources of irrigation are concerned, as high as 83.1 per cent of total operated area of sample farmers was irrigated by open well or dug wells followed by tube wells (14.6%), usually energized 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 2.2 percent in the case of our sample farmers.

5.2 Cropping Pattern and Yield of Major Crops

The GCA per HH was 4.8 ha for all farmers taken together whereas the large farmer had highest GCA of 8.2 ha and marginal farmers had minimum GCA of 1.4 ha. Medium and small farmer had 4.1 ha and 2.3 ha of GCA, respectively. Overall, the per-HH area under Kharif crops and Rabi crops cultivated by the sample farmers was 3.7 ha and 0.94 ha, respectively.

The share of cereals and pulses was 0.2 per cent each, whereas the share of oilseeds and other Kharif crops including cotton was 71.2 per cent and 28.3 per cent, respectively. Thus oilseeds and cotton have occupied prominent postion in the cropping pattern in the state. Among Kharif oilseeds, groundnut was found to be the major crop cultivated by the sample farmers of all categories, whose share in total Kharif crops was 69.3 per cent. The second major Kharif oilseed was castor whose share in total Kharif. crops was 1.3 per cent. The area under Rabi oilseeds for the samples farmers was almost nil in the region, About 48.9 per cent of total Rabi acreage was under spices and vegetables among which cumin was major one. Groundnut and sesamum were found to be cultivated by the sample farmers during summer season.

The average yield of Kharif crops and Rabi crops under rainfed conditions was 9.9 quintals per hectare and 3.4 quintals per hectare, respectively; whereas the average yield of Kharif crops and Rabi crops under irrigated-conditions was 21.5 quintals per hectare and 41.8 quintals per hectare, respectively. The average yield of Kharif oilseeds under rainfed and irrigated conditions was 7.1 quintals per hectare and 18.1 quintals per hectare, respectively. Among summer oilseeds, sesamum and groundnut were major ones. The average yield of groundnut and sesamum under irrigated conditions was 23.4 quintals per hectare and 11.1 quintals per hectare, respectively.

5.3 Production, Retention and Marketed Surplus Pattern of Oilseeds

The major oilseeds cultivated by our sample households were groundnut, castor and sesamum. The main competing crop for groundnut was found to be cotton which was grown by 124 out of 200 sample farm households. The sample farmers growing groundnut produced 39.9 quintals per household on an average, out of which 38.2 quintals of groundnut was sold at the average price of Rs 3518 per quintal. About 1.8 quintals of

groundnut (4.5%) was retained per household for household consumption and for use as seed.

As far as the case of main competing crop (cotton) is concerned, 45.0 quintals was produced per household, all of which was sold at the average price of Rs 4091 per quintal. No significant variation in prices of oilseeds and competing crops was observed across farm size classes. In the case of groundnut, the highest selling price was realized by the small farmers (Rs 3559 per quintal) followed by the large farmers (Rs3524). In case' of main competing crop cotton, the highest selling price was realized by the large farmers (Rs 4131 per quintal), followed by the medium farmers (Rs 4091). The lowest price was realized by the marginal farmers (Rs 3775 per quintal).

5.4 Comparative Eonomics/Profitability of Oilseeds vis-a-vis Competing Crops

The cultivation of the major oilseed crop (groundnut) was less profitable over the major competing crop (cotton) in the study areas. The gross value of main product and value of by-product of groundnut across all size groups of farmers was found to be Rs 54532.7 and Rs 6242.0 per hectare, respectively. The total variable cost of cultivation of the crop including material cost and labour cost was Rs 37932.6 per hectare. Thus the net income derived from cultivation of groundnut was Rs 22842.1 per hectare (see Table 5). On the other hand, the net income derived from the cultivation of cotton was Rs 54454.7 per hectare which was more than double of net income generated from cultivation of main oilseed groundnut (Rs 22842.1). That is why, the share of cotton in the cropping pattern of the farmers is gradually growing and that of groundnut is falling.

Among the cost components, labour charges accounted for the largest share of the total operational costs for both main oilseed crop and major competing crop. For cultivation of groundnut, total human labour and seed cost accounted for 34.8 per cent and 25.4 per cent of total operational cost, respectively. Fertilizer consumption accounted for 11.1 per cent of total operational cost of cultivation of groundnut. The overall pattern of cost of cultivation for the selected competing crop was similar. However, the fertilizer and manure cost was the second highest cost component in the case of cotton. Total human labour and fertilizer consumption accounted for 48.5 per cent and 20.4 per cent, respectively of total operational cost of cultivation of cotton. The per-hectare irrigation charges and the seed cost for cultivation of cotton was 4.6 per cent and 10.0 per cent of total operational cost, respectively.

TABLE 5—PROFITABILITY OF MAJOR OILSEEDS AND COMPETING CROPS

(Rs./ha)

Cost items	Main Oilseed (Groundnut)				
	Marginal	Small	Medium	Large	All Farms
1. Total Operational cost (TC)	46483.2	39848.1	38098.3	34650.9	37932.6
Yield (Quintals)	16.2	14.8	15.4	15.7	15.6
Price	3290.0	3559.1	3521.6	3523.5	3518.2
2. Value of main-product	53298	52674.5	54232.8	55297.4	54532.7
3. Value of by-product	5656.9	5983	6776.2	6002.2	6242.0
Net Income (2 + 3) – (1)	12471.6	18809.4	22910.6	26648.7	22842.1
Cost of production/q [TC/Q]	2869.3	2692.4	2473.9	2207.9	2447.3
Total Cost of Cultivation(TC/Ha)	46483.2	39848.1	38098.3	34650.9	37932.6
Cost items	Main Competing Crop (Cotton)				
	Marginal	Small	Medium	Large	All Farms
1. Total Operational costs (TC)	54735.4	52036.9	42943.2	34003.2	41414.1
Yield (Quintals)	25.5	25.7	23	23.7	23.4
Price	3775.0	4037.0	4091.0	4130.5	4087.6
2. Value of main-product	96262.5	103750.9	94092	97892.9	95837.9
3. Value of by-product	0.0	50.0	0.0	51.0	30.9
Net Income (2 + 3) – (1)	41527.1	51764	51148.8	63940.6	54454.7
Cost of production/q [TC/Q]	2146.5	2024.8	1867.1	1434.7	1766.4
Total Cost of Cultivation (TC/Ha)	54735.4	52036.9	42943.2	34003.2	41414.1

Source : Field Survey

Among the cost components, labour charges accounted for the largest share of the total operatioal costs for both main oil seed crop and major competing crop. For cultivation of groundnut, total human labour and seed cost accounted for 34.8 per cent and 25.4 percent of total operational cost, respectively. Fertilizer consumption accounted for 11.1 per cent of total operational cost of cultivation of groundnut. The overall pattern of cost of cultivation for the selected competing crop was similar. However, the fertilizer and manure cost was the second highest cost component in the case of cotton. Total human labour and fertilizer consumption accounted for 48.5 per cent and 20.4 per cent, respectively of total operational cost of cultivation of cotton. The per-hectare irrigation charges and the seed cost for cultivation of cotton was 4.6 per cent and 10.0 per cent of total operational cost, respectively.

5.5 Profitability vis-a-vis Risks in Oilseeds Production

From the profitability point of view, the main competing crop cotton has proved to be much better option than the main oilseed crop groundnut. On the production, income and price risk perspectives, the main oilseed crop also exhibited poor results. The yield variability and net income variability were substantially higher for the main crop. The coefficient of variation (CV) in yield and net income as the measure of yield risk and net income risk for groundnut was 65.1 per cent and 146.2 per cent, respectively; whereas the same for cotton was only 27.1 per cent and 64.8 per cent, respectively (Table 6). The price variability of groundnut (17.7%) was also higher than that of cotton (11.8%). The acreage risk was found to be little higher for the major competing crop (cotton) than the main oilseed (groundnut). Since the growth in area under groundnut has been stagnated and that of cotton is increasing, the acreage variability of cotton was slightly higher.

TABLE 6—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 (groundnut)		
Acreage variability	48.5	35.7	43.7	50.1	73.8
Yield variability	54.8	62.6	63.3	72.3	65.1
Price variability	18.2	18.9	20.0	13.8	17.7
Net income variability	154.1	162.2	139.6	142.1	146.2
			Main competing crop (cotton)		
Acreage variability	28.3	32.5	49.5	50.7	77.8
Yield variability	14.1	23.0	27.7	29.5	27.1
Price variability	8.4	12.1	12.7	11.0	11.8
Net income variability	86.9	74.9	69.6	54.2	64.8

Source : Field survey.

The CV in both yield and price was substantially higher for groundnut than that of cotton. More importantly, the gap between expected yield and realized yield was considerably high for both the crops. The yield gap was higher for groundnut (11) than that of cotton (10) in 2011-12. However, the average price gap was higher for cotton (1188) than that of groundnut (768). This was mainly because of higher price expectation by the prospective cotton growers in the state in the corresponding year.

5.6 Yield and Technology Gap Analysis

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. The average potential yield of groundnut was 31.7 quintal per hectare and the average experimental yield of the main crop was 29.7 quintal per hectare (Table 7). However, the average actual yield of the crop was found to be only 15.5 quintal per hectare.

Thus, the yield gap-I, i.e., the gap between the experimental yield and potential yield was 1.8 q/ha, whereas the yield gap-II, ie., the gap between the actual yield and potential yield was quite high (16.2 q/ha). The yield gap-III, i.e., the gap between the experimental yield and actual yield (often known as extension gap) was also found to be quite high of 14.2 q/ha. Among the.three types of yield gap, the yield gap-II was found to be largest. Thus the prevailing level of yield gap is considerably high in the study regions of Gujarat.

TABLE 7—YIELD GAP ANALYSIS

(Quintal/Ha)

Yield	Marginal	Small	Medium	Large	All Farms
1. Experimental farm yield	30.5	29.9	29.7	29.5	29.7
2. Potential farm yield	32.1	31.6	31.5	31.3	31.5
3. Actual farm yield	16.2	14.8	15.4	15.7	15.5
Yield gap I (1–2)	1.5	1.7	1.8	1.8	1.8
Yield gap II (2–3)	16.3	17.1	16.3	15.8	16.2
Yield gap III (1–3)	14.3	15.1	14.3	13.8	14.2
Technology index	6.15	6.27	6.31	6.34	6.30

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.

Surprisingly, the feasibility of technology is found to be more in the case of marginal and small farmers as the Technology Index for the corresponding farmer categories were lower of 6.15 per cent and 6.27 per cent, respectively. The detailed analysis on technology gap in cultivation of groundnut in Gujarat reveals that, there was huge gap found in fertilizer dose applied, weeding, disease management, control of pesticides and insecticides. Less gaps were found in the case of kind of crop variety used, seed rate and harvesting methods.

5.7 Access to Improved Technology and Markets for Oilseeds

Better returns on cultivation of agricultural crops largely depend on better price on the agricultural produces that, in turn, depends on the availability and access to improved technology and markets for oilseeds. It is good to find that about 96.8 per cent of the sample farmers have used HYVs for getting better yield of oilseeds. The major source of seeds was market. Only 15.6 per cent of sample farmers used own seed while 96.8 per cent farmers purchased the seeds from the nearby markets.

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 84.4 per cent of sample farmers have received the price of groundnut which was higher than the prevailing MSP. It was found that the majority of farmers used more than recommended doses of fertilizers and pesticides. About 52.8 per cent of sample farmers stated that they faced marketihg problems for selling groundnut output.

5.8 Marketing Pattern of Oilseeds

About 65.2 per cent of farmers cultivating groundnut have sold their output to village traders, not directly at Agricultural Produce Marketing Committee (APMC) or market ward (mandi). Since the distance from APMC market ward was considerably high and the transportation cost was also high, they preferred to sell their output to village traders. Processing mills and commission agents were next best options for the sample farmers to sell their output. Some of the farmers (4.8% of all sample farmers) including 13.3 per cent of marginal farmers could sell their output to Government agency, i.e., National Agricultural Cooperatives Marketing Federation of India Ltd. (NAFED), that procured. groundnut on the commercial basis. The average price received from various sources ranged from

Rs. 3250 per quintal to Rs. 4750 per quintal for the sample farmers. The average price received from the commission agent was the lowest of Rs 3175 per quintal. The average price of groundnut was received from processing mills was Rs 3771. A majority of farmers (65.2%) sold their output to local village traders that fetched a price of Rs 3560, per quintal for the farmers.

The sale of main competing crop (cotton), exhibited slightly different pattern. Here the local village traders purchased slightly less output from the sample farmers where the Government agency, i.e., Cotton Corporation of India (CCI) purchased relatively more output from the farmers. About 12.9 per cent sample farmers sold their cotton output to Government agency at CCI outlets. About 28. 7 per cent of sample farmers sold the output to local village traders at the average price of Rs 4065 per quintal. As far as the prices of cotton from different market agencies are concerned, it may be noted that the Government agency i.e., CCI offered better price (Rs. 4234 per quintal) than all other market agencies. CCI has very good presence in the cotton growing areas of the state, particularly in Saurashtra area that supplies best quality cotton.

The average distance travelled by the farmers to sell their produce was reasonable of 5.6 km. The average distance travelled was lowest for the marginal farmers (2.0) since most of them sold their output to the local village traders.

5.9 Sources of Technology and Market Information

The major sources of information on seeds were found to be local input market (89.2%), specialized organizations like ICAR/SAU/KVK (71.6%) and fellow farmers (60.8%). The major sources of information on extension services were found to be specialized organizations like ICAR/SAU/KVK (84.4%), input dealers (82.4%) and fellow farmers (62.0%). Input dealers, agricultural supervisors on behalf of Department of Agriculture and specialized organizations like ICAR/SAU/KVK have played key role in the 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 andAcreage 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, bullock labour cost, machine charges, 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 major explanatory variables as the major determinants of groundnut yield in the study area got positive sign as expected. Only the area under the concerned crop, irrigation charges and interest on working capital along with size of land holding and area under the crop were found to affect significantly to the groundnut yield. In the case of cotton which is the main competing crop grown in the state, the fitted regression model was overall insignificant with very low value of R^2 and F statistic. The constant term A in Cobb-Douglas Production Function that stands for other exogenous factors such as technological change, exposure to weather related risks such as dry spell, drought, and pest attack etc was found to significantly influence the yield of both groundnut and cotton.

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 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 (groundnut) was considered as the dependant variable. Only the one year lagged area under groundnut (A_{t-1}) and the lagged yield of cotton (YC_{t-1}) were found to have statistically significant influence on the area allocated for the main oilseed crop groundnut. Among these variables, one year lagged area under groundnut positively influenced the area allocation for groundnut, whereas lagged yield of main competing crop cotton negatively influenced the area allocation for the main oil seed crop groundnut.

5.11 Perceived Constraints in Cultivation of Oilseeds

Among the major technological constraints, lack of irrigation facilities, incidence of diseases, incidence of insect pests and weed infestation were the major ones for our sample farmers (see Table 8). These factors have affected to all farmers irrespective their categories or land holding sizes. The incidence of diseases and pests and weed infestation has affected more to marginal and small farmers. The poor quality of soils has affected more to medium farmers. Among the agro-climatic factors, excessive rain during critical stages of crop growth and the risk of crop failure/yield variability due to biotic and abiotic stresses were found as major agro-climatic constraints for the sample farmers. Among economic and institutional constraints, high input costs, shortage of human labour, and wide variability in crop yield were found to be major ones. The Inadequate knowledge about disease and pest management, irregular supply of power/electricity, supply of poor quality inputs were also found to create difficulties for the sample farmers.

TABLE 8 : MAJOR CONSTRAINTS IN CULTIVATION OF OILSEED CROPS

(Composite index value*)

Major Constraints	Marginal	Small	Medium	Large	All Farms
Technological					
Lack of irrigation facilities	3.07	2.96	2.80	2.79	2.86
Incidence of diseases	3.21	3.12	3.01	3.12	3.09
Incidence of insect pests	3.36	3.15	3.01	3.00	3.06
Agro-climatic factors					
Excessive rains	3·93	3.54	3.47	3.38	3.48
Risk of crop failure/yield variability due to biotic & a biotic stresses	3.14	3.07	2.80	2.94	2.94
Economic					
High-input cost (diesel, fertilizers, agrochemicals)	3.29	3.43	3.24	3.35	3.33
Shortage of human labour	3.29	2.76	2.98	3.02	2.95
Price risks - fear of glut leading to low price	2.64	2.22	2.49	2.35	2.38
Institutional					
Poor quality of inputs	2.50	2.12	2.14	2.27	2.24
Lack/Poor extension services	2.71	2.28	2.08	2.11	2.08
Inadequate knowledge about disease and pest management	2.93	1.31	2.59	2.63	2.65
Irregular supply of power/electricity	3.14	2.70	2.74	2.82	2.79
Post-harvest, marketing and value-addition					
Exploitation by market intermediaries	2.21	1.57	1.61	1.54	1.61
Lack of processing facilities in the area	2.50	1.69	1.75	1.79	1.79
Inadequate storage facilities	2.71	1.91	2.03	1.91	2.00
High transportation costs	2.71	2.60	2.57	2.54	2.58

Note : *Composite index will be constructed based on weights (severe =4, Moderate = 3, minor = 2, not important =1) and number of households in each category. The higher the composite vale, the higher the severity of constraints for the sample farmers.

Source : field survey

5.12 Farmers' Suggestions for Improving Production and Productivity of Oilseeds

The larger proportion of the sample farmers suqqested to take necessary measures for alleviating the major constraints through necessary policy instruments so as to increase the production and productivity of oilseeds in the state. About 14.8 per cent of sample farmers have suggested to reduce or to stabilize the prices of chemical fertilizers, seeds and other inputs. Since the prices of agricultural inputs are rising year after year, a good number of farmers have suggested that government should provide more subsidies on fertilizer, seeds and other inputs,

particularly to marginal and small farmers. A good number of farmers. have also suggested to cover more farmers under subsidized credit provisions and crop insurance. Near about 18.4 per cent sample farmers expressed that they needed better pesticides/plant protection chemicals for preventing or eradicating the crop diseases. Since irrigation water was inadequate, the area under Rabi crops and summer crops was very less in the study areas. So about 19.6 per cent of respondents have suggested to expand the irrigation facilities in their districts.

Since the farmers normally used electric pump sets for lifting water, availability of electricity for reasonable duration is essential. About 13.2· 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, 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. As far as the marketing of oil seeds is concerned, the market intermediaries/middlemen enjoyed a sizeable proportion of returns on groundnut and cotton. Thus some farmers have suggested to devise policies to check the influence of market intermediaries.

6. 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 and 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.

6.1 Scope for Expansion of Area under 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 Gujarat, it was found that the yield effect was found to contribute more to the change in output during all reference periods and the overall period of TE 1983-84 to TE 2009-10. The area under oilseeds has not increased at the satisfactory rate in the state so far.

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 further irrigation expansion and offering better prices. The district level, analysis reveals that 7 out of 26 districts (Junagadh, Jamnagar, Rajkot, Amreli, Bhavanagar, Porbandar and Kachchh) accounted for about 91.3 per cent of total ollseeds area of the state. So there is possibility of increasing the area under oilseeds in other districts with very thin area under these crops. The oilseeds area can also be increased in the districts with low area but high productivity of oilseed crops, Some of this type of districts. are Tapi (where oilseeds area constitutes only 7.7% of GCA of the district with oilseeds yield of 2232 kg/ha, with 0.94% of state oilseeds area), Narmada (where oilseeds area constitutes only 2.1% of GCA of the district with oilseeds yield of 1882 kg/ha, and with 0.13% of state oilseeds area), Vadodara (0.94% of state oilseeds area, oilseeds area constituting 3.5 % of district GCA with yield of 1607kg/ha); Panchmahals (0.23% of state oilseeds area, oilseeds area constituting 1.1% of district GCA with yield of. 1429 kg/ha) and Surat (0.31% of state oilseeds area, oilseeds area constituting 2.0% of district GCA with yield of 1325 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 these 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 oilseeds in the state. In the case of our main oilseed crop (groundnut), the yield gap-II, i.e., the gap between the actual yield and potential yield was found to be very high (16.2 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 Rajkot (oilseeds area constituting 42.2% of district GCA with yield of only 406 kg/ha), Amreli (oilseeds area constituting 38.8% of district GCA with yield of only 187 kg/ha), Junagadh (oilseeds area constituting 45.1 % of district GCA with yield of only 911 kg/ha), Bhavnagar (oilseeds area constituting 18.1 % of district GCA with yield of only 585 kg/ha) and Surendranagar (oilseeds area constituting 13.4% of district GCA with yieid of only 869 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 minimized.

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 emphasized in some other targeted regions of the state. As far as the area expansion in oil seed crops in the state is concerned, oilseed cultivation in rice fallows and non-traditional areas may be emphasized by the policy makers. Besides, 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 improvement 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 :

- Irrigation expansion through promotion of water harvesting structures and further expansion of canal command area
- 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 :

- Reducing the distress sale by limiting the influence of the market intermediaries in deciding the farm harvest price actually offered to the farmers.
- Effective market interventions for oilseeds and edible oils by increasing the volume of procurement by NAFED and CCI.
- Creating necessary rural and marketing infrastructures such as processing units and market wards etc.
- Favourable trade policy

The State Government has taken some useful measures for reducing the market constraints in the state. However, there is a need of radical changes in the policy front to enable the traditional oilseeds processing sectors to increase their efficiency and capacity utilization. Implementation of decontrolling of traditional oilseeds processing from small scale sector would help in this direction. The effective market interventions like price support system, price signaling etc. have to be strengthened.

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 more WHSs 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. There is an urgent need to invent and popularise oilseed varieties, which require less water and have more productivity and at the same time are affordable to farmers.

D. Commodity Review

(i) Foodgrains

During the month of August, 2013 the Wholesale Price Index (Base 2004-05=100) of pulses and foodgrains declined by 1.90% and 0.04% and of cereals incresed by 0.36% respectively over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base : 2004-2005=100)

Commodity	Weight (%)	WPI for the Month of August, 2013	WPI for the Month of July, 2013	WPI A year ago	Percentage change during	
					A month	A year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rice	1.793	229.2	226.3	190.8	1.28	20.13
Wheat	1.116	205.3	206.2	190.8	–0.44	7.60
Jowar	0.096	240.7	245.7	236.5	–2.04	1.78
Bajra	0.115	252.2	261.9	235.5	–3.70	7.09
Maize	0.217	255.5	255.4	229.5	0.04	11.33
Barley	0.017	210.3	210.1	203.8	0.10	3.19
Ragi	0.019	356.9	348.0	252.3	2.56	41.46
Cereals	3.373	224.7	223.9	196.5	0.36	14.35
Pulses	0.717	222.4	226.7	259.8	–1.90	–14.40
Foodgrains	4.09	224.3	224.4	207.6	–0.04	8.04

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 August, 2013.

Commodity	Main Trend	Rising	Falling	Mixed	Steady
Rice	Rising	Assam Jharkhand U.P.			
Wheat	Rising	Haryana Jharkhand Karnataka Rajasthan	M.P.	UP	
Jowar	Falling		A.P. Guiarat Rajasthan		Karnataka Maharashtra
Bajra	Steady			Gujarat	Karnataka Rajasthan Tamilnadu
Maize	Rising	Jharkhand Karnataka Rajasthan U.P.	Haryana		

Procurement of Rice

0.12 million tones of Rice (including paddy converted into rice) was procured during August, 2013, as against 0.12 million tones of rice (including paddy converted into rice) procured during August 2013.The total procurement of Rice in the current marketing season i.e 2012-2013, upto 30.08.2013 stood at 33.97 million tonnes, as against 33.85 million 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 30-08-13)		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	6439	18.95	7510	21.58	7548	21.53	9609	28.10
Chhatisgarh	4804	14.14	4115	11.82	4115	11.74	3746	10.95
Haryana	2609	7.68	2007	5.77	2007	5.72	1687	4.93
Maharashtra	191	0.56	190	0.55	190	0.54	308	0.90
Punjab	8558	25.19	7731	22.20	7731	22.05	8635	25.25
Tamil Nadu	481	1.42	1596	4.59	1596	4.55	1543	4.51
Uttar Pradesh	2286	6.73	3345	9.61	3357	9.58	2554	7.47
Uttarakhand	497	1.46	368	1.06	378	1.08	422	1.23
Others	8105	23.86	7946	22.83	8138	23.21	5694	16.65
Total	**33970**	**100.00**	**34808**	**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 August, 2013 is 25.09 million tonnes against a total of 38.11 million 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 (up to 01-08-2013)		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	23.41	8666	22.74	8665	22.71	6928	24.45
Madhya Pradesh	6355	25.33	8507	22.32	8493	22.26	4965	17.52
Punjab	10897	43.43	12836	33.68	12834	33.64	10958	38.67
Rajasthan	1268	5.05	1964	5.15	1964	5.15	1303	4.60
Uttar Pradesh	683	2.72	5063	13.29	5063	13.27	3461	12.21
Others	16	0.06	1071	2.81	1129	2.96	720	2.54
Total	**25092**	**100.00**	**38107**	**100.00**	**38148**	**100.00**	**28335**	**100.00**

Source : Department of Food and Public Distribution.

(ii) Commercial Crops

Oilseeds and Edible Oils : The Wholesale Price Index (WPI) of nine major oilseeds as a group stood at 192.8 in August, 2013 showing a fall of 3.7 per cent and 7.2 per cent over the previous month and over the previous year. The Wholesale Price Index (WPI) of all individual oilseeds showed a mixed trend. The WPI of Copra (5.0 per cent), Cotton Seed (2.2 per cent), Sunflower (2.2 per cent) and Gingelly seed (0.4 per cent) increased over the previous month. However, the WPI of Soyabean (11.8 per cent), Groundnut seed (4.8 per cent), Safflower (3.4 per cent), Niger seed (2.0 per cent), and Rape & Mustard (1.7 per cent) decreased over the previous month.

The Wholesale Price Index (WPI) of Edible Oils as a group stood l44.6 in August, 2013 showing a fall of 0.2 per cent and 3.9 per cent over the previous month and over the previous year. The WPI of Groundnut Oil (-1.9 per cent), Cottonseed Oil (-0.8 per cent), Soyabean Oil (-0.4 per cent), Mustard Oil (-0.3 per cent) and Sunflower Oil (-0.3 per cent) increased over the previous month. However, the WPI of Copra Oil (8.9 per cent) and Gingelly Oil (0.9 per cent) increased over the previous month. .

Fruits & Vegetable: Tile Wholesale Price Index (WPI) of Fruits & Vegetable as a group stood at 287.4 in August, 2013 showing an increase of 12.9 per cent and 42.4 per cent over the previous month and over the previous year.

Potato : The Wholesale Price Index (WPI) of Potato stood at 224.3 in August, 2013 showing a fall of 3.3 per cent and 15.1 per cent over the previous month and year, respectively.

Onion : The Wholesale Price Index (WPI) of Onion stood 668.9 in August, 2013 showing an increase of 51.1 per cent and 244.6 per cent over the previous month and over the previous year.

Condiments & Spices : The Wholesale Price Index (WPI) of Condiments & Spices (Group) stood at 232.3 in August, 2013 showing an increase of 0.3 per cent and 10.4 per cent over the previous month and over the previous year.

The WPI of Black Pepper and Chillies (Dry) increased by 2.1 per cent and 1.9 per cent over the previous month. However, the WPI of Turmeric decreased by 2.9 per cent over the previous month.

Raw Cotton : The Wholesale Price Index (WPI) of Raw Cotton stood at 247.8 in August, 2013 an increase of 3.3 per cent and 11.5 per cent over the previous month and over the previous year.

Raw Jute : The Wholesale Price Index (WPI) of Raw Jute stood at 244.0 in August, 2013 showing a fall of 4.1 per cent and 3.0 per cent over the previous month.

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

(Base Year : 2004-05=100)

Commodity	Latest	Month	Year	Percentage Variation over	
	August, 2013	July, 2013	August, 2012	Month	Year
Oil Seeds	192.8	200.2	207.8	–3.7	–7.2
Groundnut Seed	218.2	229.2	239.4	–4.8	–8.9
Rape and Mustard Seed	184.6	187.8	203.8	–1.7	–9.4
Cotton Seed	174.4	170.6	171.5	2.2	1.7
Copra (Coconut)	102.2	97.3	90.3	5.0	13.2
Gingelly Seed (Sesamum)	382.3	380.9	309.3	0.4	23.6
Niger Seed	166.3	169.7	212.6	–2.0	–21.8
Safflower (Kardi Seed)	158.0	163.5	147.2	–3.4	7.3
Sunflower	197.6	193.3	177.7	2.2	11.2
Soyabean	203.9	231.2	257.9	–11.8	–20.9
Edible Oils	144.6	144.9	150.4	–0.2	–3.9
Groundnut Oil	175.2	178.6	194.3	–1.9	–9.8
Cotton Seed Oil	171.2	172.5	178.9	–0.8	–4.3
Mustard and Rapeseed Oil	152.2	152.6	157.8	–0.3	–3.5
Soyabean Oil	158.1	158.7	166.5	–0.4	–5.0
Copra Oil	118.0	108.4	114.2	8.9	3.3
Sunflower Oil	133.4	133.8	139.9	–0.3	–4.6
Gingelly Oil	170.9	169.3	165.0	0.9	3.6
Fruits and Vegetables	287.4	254.6	201.8	12.9	42.4
Potato	224.3	231.9	264.3	–3.3	–15.1
Onion	668.9	442.6	194.1	51.1	244.6
Condiments and Spices	232.3	231.5	210.4	0.3	10.4
Black Pepper	532.1	521.1	533.7	2.1	–0.3
Chillies (Dry)	252.3	247.5	233.7	1.9	8.0
Turmeric	212.5	218.8	173.8	–2.9	22.3
Raw Cotton	247.8	239.9	222.2	3.3	11.5
Raw Jute	244.0	254.3	251.6	–4.1	–3.0

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	Feb., 2013	8	250	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Guntur	Tadikonda	Feb., 2013	8	250	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA
Rangareddy	Arutla	Feb., 2013	8	225	175	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Karnataka															
Bangalore	Harisandra	May to June, 2012	8	200	150	NA	200	150	NA	250	180	NA	300	300	NA
Tumkur	Gedlahali	May to June, 2012	8	160	160	NA	180	160	NA	180	160	NA	180	180	NA
Maharashtra															
Nagpur	Mauda	Feb., 2012	8	100	100	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	100	NA	90	90	NA	58	58	NA	170	150	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, 2012	M	8	180	180	180	180	180	180	180	180	180
			W	8	NA	NA	160	160	160	NA	NA	NA	NA
Bihar													
Muzaffarpur	Bhalui Rasul	April to,	M	8	130	120	80	130	150	120	200	180	250
		June, 2012	W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shekhpura	Kutaut	May &	M	8	NA	NA	185	NA	185	NA	245	NA	NA
		June, 2012	W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chhattisgarh													
Dhamtari	Sihaba	Aprl, 2013	M	8	NA	NA		100	80	100	250	100	100
			W	8	NA	NA		80	80	80	150	100	80
Gujarat													
Rajkot	Rajkot	Jan., 2013	M	8	209	225	150	170	147	150	360	360	240
			W	8	NA	169	150	179	145	142	NA	NA	NA
Dahod	Dahod	Jan., 2013	M	8	100	100	100	100	100	NA	200	144	150
			W	8	NA	100	100	100	100	NA	NA	NA	NA
Haryana													
Panipat	Ugarakheri	March, 2013	M	8	180	180	180	200	180	NA	400	400	NA
			W	8	NA	150	150	180	150	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	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	110	110	110	110	110	200	200	NA
			W	8	NA	110	110	110	110	110	NA	NA	NA
Kerala													
Kozhikode	Koduvally	March, 2013	M	4 to 8	820	500	NA	500	660	NA	600	NA	NA
			W	4 to 8	NA	NA	400	400	450	NA	NA	NA	NA
Palakkad	Elappally	March, 2013	M	4 to 8	NA	NA	NA	400	400	NA	500	NA	NA
			W	4 to 8	NA	NA	NA	300	200	NA	NA	NA	NA
Madhya Pradesh													
Hoshangabad	Sangarkhera	March., 2013	M	8	150	100	100	160	100	100	350	350	150
			W	8	NA	100	100	160	100	100	NA	NA	NA
Satna	Kotar	March, 2013	M	8	NA								
			W	8	NA								
Shyopur Kala	Vijaypur	March, 2013	M	8	150	150	NA	NA	NA	50	200	200	NA
			W	8	NA	150	NA	NA	NA	NA	NA	NA	NA
Odisha													
Bhadrak	Chandbali	April, 2013	M	8	150	NA	NA	160	216.66	150	250	180	150
			W	8	NA	NA	NA	120	175	140	NA	NA	NA
Ganjam	Aska	April, 2013	M	8	200	200	200	200	203.33	200	350	250	300
			W	8	NA	100	150	150	120	100	NA	NA	NA
Punjab													
Ludhiana	Pakhowal	June, 2008	M	8	NA	NA	90	95	NA	99.44	NA	NA	NA
					NA	NA	NA	NA	NA	NA	NA	NA	NA
Rajasthan													
Barmer	Vishala	March, 2013	M	8	NA								
			W	8	NA								
Jalore	Panwa	March, 2013	M	8	NA	NA	200	NA	NA	200	350	300	NA
			W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tamil Nadu													
Thanjavur	Pulvarnatham	Feb., 2013	M	6	NR								
			W	5	NR								
Tirunelveli	Malayakulam	Feb., 2013	M	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
			W	8	NA	120	NA	NA	NA	NA	NA	NA	NA
Tripura													
State average		April, 2011 to March, 2012	M	8	238	201	203	209	207	199	253	235	240
			W	8	NA	154	152	154	154	149	NA	NA	NA
*Uttar Pradesh**													
Meerut	Ganeshpur	Jan., 2013	M	8	205	207	206	204	206	NA	320	NA	NA
			W	8	NA	180	180	180	180	NA	NA	NA	NA
Aurraiya	Aurraiya	Jan., 2013	M	8	150	193	192	150	193	NA	300	NA	NA
			W	8	NA	160	167	120	167	NA	NA	NA	NA
Chandauli	Chandauli	Jan., 2013	M	8	150	150	125	125	125	NA	271	NA	NA
			W	8	NA	150	125	125	125	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.

B. PRICES

2. Wholesale Prices of Certain Important Agricultural Commodities and Animal Husbandry Products at Selected Centres in India

(Month-end Prices in Rupees)

Commodity	Variety	Unit	State	Centre	Aug.-13	Jul.-13	Aug.-12
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wheat	PBW 343	Quintal	Punjab	Amritsar	1450	1450	1350
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	1500	1500	1350
Wheat	Lokvan	Quintal	Madhya Pradesh	Bhopal	1514	1511	1500
Jowar	—	Quintal	Maharashtra	Mumbai	2350	2650	1950
Gram	No III	Quintal	Madhya Pradesh	Sehore	3380	3665	3000
Maize	Yellow	Quintal	Uttar Pradesh	Kanpur	—	1350	1090
Gram Split	—	Quintal	Bihar	Patna	4820	4825	5400
Gram Split	—	Quintal	Maharashtra	Mumbai	5700	5700	5400
Arhar Split	—	Quintal	Bihar	Patna	6350	6220	6000
Arhar Split	—	Quintal	Maharashtra	Mumbai	6250	6550	5750
Arhar Split	—	Quintal	NCT of Delhi	Delhi	6350	6200	7500
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	6500	6345	6400
Gur	—	Quintal	Maharashtra	Mumbai	3400	3400	3300
Gur	Sort II	Quintal	Tamil Nadu	Coimbatore	4000	3400	3100
Gur	Balti	Quintal	Uttar Pradesh	Hapur	3140	3150	3275
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	3160	3315	4080
Mustard seed	Black	Quintal	West Bengal	Raniganj	3600	3500	4800
Mustard Seed	—	Quintal	West Bengal	Kolkata	3900	3700	4700
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	4160	4325	4100
Linseed	Small	Quintal	Uttar Pradesh	Varanasi	3640	3550	3325
Cotton Seed	Mixed	Quintal	Tamil Nadu	Virudhunagar	1850	1750	1800
Cotton Seed	MCU 5	Quintal	Tamil Nadu	Coimbatore	1550	1550	1550
Castor Seed	—	Quintal	Andhra Pradesh	Hyderabad	3300	3250	3780
Sesamum Seed	White	Quintal	Uttar Pradesh	Varanasi	6550	6470	6700
Copra	FAQ	Quintal	Kerala	Alleppey	5425	4875	4050
Groundnut	Pods	Quintal	Tamil Nadu	Coimbatore	3800	4000	3850
Groundnut	—	Quintal	Maharashtra	Mumbai	7100	7400	7000
Mustard Oil	—	15 Kg.	Uttar Pradesh	Kanpur	1170	1200	1352
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1215	1200	1470
Groundnut Oil	—	15 Kg.	Maharashtra	Mumbai	1425	1470	1883
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	1380	1365	1800
Linseed Oil	—	15 Kg.	Uttar Pradesh	Kanpur	—	1275	1494
Castor Oil	—	15 Kg.	Andhra Pradesh	Hyderabad	1133	1088	1275
Sesamum Oil	—	15 Kg.	NCT of Delhi	Delhi	1480	1400	1500
Sesamum Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2400	2400	1950
Coconut Oil	—	15 Kg.	Kerala	Cochin	1185	1050	900
Mustard Cake	—	Quintal	Uttar Pradesh	Kanpur	1660	1725	2050
Groundnut Cake	—	Quintal	Andhra Pradesh	Hyderabad	3071	3214	3857
Cotton/Kapas	NH44	Quintal	Andhra Pradesh	Nandyal	4700	4500	4600
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Virudhunagar	—	NT	NT
Jute Raw	TD 5	Quintal	West Bengal	Kolkata	2450	2675	2725
Jute Raw	W5	Quintal	West Bengal	Kolkata	2430	2605	2700

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	Aug.-13	Jul.-13	Aug.-12
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Oranges	—	100 No.	NCT of Delhi	Delhi	NA	NA	NA
Oranges	Big	100 No.	Tamil Nadu	Chennai	650	640	540
Oranges	Nagpuri	100 No.	West Bengal	Kolkata	NA	—	NA
Banana	—	100 No.	NCT of Delhi	Delhi	208	167	183
Banana	Medium	100 No.	Tamil Nadu	Kodaikkanal	410	398	322
Cashewnuts	Raw	Quintal	Maharashtra	Mumbai	53000	50000	52500
Almonds	—	Quintal	Maharashtra	Mumbai	48000	45000	45,800
Walnuts	—	Quintal	Maharashtra	Mumbai	66000	54500	52500
Kishmish	—	Quintal	Maharashtra	Mumbai	12800	13000	11000
Peas Green	—	Quintal	Maharashtra	Mumbai	4100	4500	3600
Tomatoes	Ripe	Quintal	Uttar Pradesh	Kanpur	2240	2715	1950
Ladyfinger	—	Quintal	Tamil Nadu	Chennai	2500	2635	1700
Cauliflower	—	100 No.	Tamil Nadu	Chennai	1600	1800	1300
Potatoes	Red	Quintal	Bihar	Patna	990	990	1200
Potatoes	Desi	Quintal	West Bengal	Kolkata	810	820	1160
Potatoes	Sort I	Quintal	Tamil Nadu	Mettuppalayam	2511	2726	2366
Onions	Pole	Quintal	Maharashtra	Nashik	3500	2000	600
Turmeric	Nadan	Quintal	Kerala	Cochin	9500	10000	7700
Turmeric	Salam	Quintal	Tamil Nadu	Chennai	9600	9770	6800
Chillies	—	Quintal	Bihar	Patna	7800	8100	7350
Black Pepper	Nadan	Quintal	Kerala	Kozhikode	39000	37000	38500
Ginger	Dry	Quintal	Kerala	Cochin	15500	15500	10900
Cardamom	Major	Quintal	NCT of Delhi	Delhi	112000	112500	75000
Cardamom	Small	Quintal	West Bengal	Kolkata	85000	85000	110000
Milk	Cow	100 Liters	NCT of Delhi	Delhi	NA	NA	3600
Milk	Buffalo	100 Liters	West Bengal	Kolkata	3600	3400	3200
Ghee Deshi	Deshi No 1	Quintal	NCT of Delhi	Delhi	29015	29015	27347
Ghee Deshi	—	Quintal	Maharashtra	Mumbai	30500	26000	NA
Ghee Deshi	Desi	Quintal	Uttar Pradesh	Kanpur	—	29500	28250
Fish	Rohu	Quintal	NCT of Delhi	Delhi	9500	9500	9000
Fish	Pomphrets	Quintal	Tamil Nadu	Chennai	29500	32500	26000
Eggs	Madras	1000 No.	West Bengal	Kolkata	3750	3700	3800
Tea	—	Quintal	Bihar	Patna	20000	20000	19675
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	9000	9000	—
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	26000	26000	26000
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	14000	14000	14000
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	2780	2750	2225
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	2725	2700	2125
Tobacco	Bidi Tobacco	Quintal	West Bengal	Kolkata	3600	3600	4000
Rubber	—	Quintal	Kerala	Kottayam	17600	18000	15800
Arecanut	Pheton	Quintal	Tamil Nadu	Chennai	28900	28600	28000

NA :—Not Available

NT :—Not Transaction

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

Commodity	Variety	Country	Centre	Unit	Jan.	Feb.	Mar.	Apri	May	Jun.	Jul.	Aug.
Cardamom	Guatmala Bold Green	U.K.	—	Dollar/M.T.	16500.00	16500.00	16500.00	17000.00	14250.00	14250.00	14250.00	14250.00
				Rs./Qtl.	88572.00	89875.50	89743.50	92174.00	80341.50	85770.75	84018.00	96030.75
Cashew Kernels	Spot U.K. 320s	U.K.	—	Dollar/1bs	3.60	3.60	3.66	3.64	3.55	3.56	3.55	3.50
				Rs./Qtl.	42591.86	43218.68	43874.45	43498.32	44112.84	47226.52	46131.48	51984.65
	Spot U.K. 320s	U.K.	—	Dollar/1bs	7915.09	7898.35	8056.22	8024.08	7861.23	7844.30	7869.32	7719.15
				Rs./Qtl.	42488.20	43022.31	43817.78	43506.56	44321.61	47214.84	46397.51	52019.35
Castor Oil	Any Origin ex tank Rotterdam	Nether-lands	—	Dollar/M.T.	1690.00	1650.00	1650.00	1600.00	1500.00	1510.00	1480.00	1420.00
				Rs./Qtl.	9071.92	8987.55	8974.35	8675.20	8457.00	9088.69	8726.08	9569.38
Celery Seed	ASTA cif	India	—	Dollar/M.T.	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00
				Rs./Qtl.	8052.00	8170.50	8158.50	8133.00	8457.00	9028.50	8844.00	10108.5
Chillies	Birds eye 2005 crop	Africa	—	Dollar/M.T.	5000.00	4250.00	4250.00	4100.00	4100.00	4100.00	4100.00	4100.00
				Rs./Qtl.	26840.00	23149.75	23115.75	22230.20	23115.80	24677.90	24173.60	27629.90
Cinnamon Bark		Mada-gascar	—	Dollar/M.T.	1100.00	1100.00	1100.00	1100.00	1100.00	1100.00	1100.00	1100.00
				Rs./Qtl.	5904.80	5991.70	5982.90	5964.20	6201.80	6620.80	6485.60	7412.90
Cloves	Singapore	Mada-gascar	—	Dollar/M.T.	9500.00	9500.00	9500.00	12000.00	12000.00	11850.00	13500.00	13500.00
				Rs./Qtl.	50996.00	51746.50	51670.50	65064.00	67656.00	71325.15	79596.00	90976.50
Coconut Oil	Crude Phillipine/ Indonesia	Nether-lands	—	Dollar/M.T.	815.00	850.00	805.00	800.00	850.00	890.00	850.00	930.00
				Rs./Qtl.	4374.92	4629.95	4378.40	4337.60	4792.30	5356.91	5011.60	6267.27
Copra	Phillipines cif Rotterdam	Philli pine	—	Dollar/M.T.	538.00	530.00	505.00	476.00	527.50	559.00	546.00	578.00
				Rs./Qtl.	2887.98	2886.91	2746.70	2580.87	2971.23	3364.62	3219.22	3895.14
Corriander		India	—	Dollar/M.T.	1150.00	1150.00	1150.00	1150.00	1150.00	1150.00	1150.00	1150.00
				Rs./Qtl.	6173.20	6264.05	6254.85	6235.30	6483.70	6921.85	6780.40	7749.85
Cummin Seed		India	—	Dollar./M.T.	2889.00	2889.00	2889.00	2889.00	2889.00	2889.00	2889.00	2889.00
				Rs./Qtl.	15508.15	15736.38	15713.27	15664.16	16288.18	17388.89	17033.54	19468.97
Fennel seed		India	—	Dollar/M.T.	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
				Rs./Qtl.	13956.80	14162.20	14141.40	14097.20	14658.80	15649.40	15329.60	17521.40
Ginger	Split	Nigeria	—	Dollar/M.T.	2400.00	2400.00	2400.00	2400.00	1810.00	2005.00	2300.00	2300.00
				Rs./Qtl.	12883.20	13072.80	13053.60	13012.80	10204.78	12068.10	13560.80	15499.70
Groundnut kernels	US 2005, 40/50	European Ports	—	Dollar/M.T	1275.00	1350.00	—	—	1350.00	1380.00	1400.00	1310.00
				Rs./Qtl.	6844.20	7353.45	—	—	7611.30	8306.22	8254.40	8828.09
Groundnut Oil	Crude Any Origin cif Rotterdam	U.K.	—	Dollar/M.T	2200.00		—	—	—	—	1700.00	1700.00
				Rs./Qtl.	11809.60	—	—	—	—	—	10023.20	11456.30
Lentils	Turkish Red Split Crop 1+1 water	U.K.	—	Pound/M.T	522.72	655.20	660.98	647.80	656.64	655.38	650.12	644.89
				Rs./Qtl.	4428.48	5446.68	5438.54	5422.09	5637.94	6019.01	5895.94	6739.10
Maize		U.S.A	Chic-ago	C/56 lbs.	720.75	700.50	735.25	639.50	665.00	664.50	508.25	504.25
				Rs./Qtl	1520.51	1499.54	1571.62	1362.68	1473.46	1571.85	1177.68	1335.47
Oats		Canada	Winni-peg	Dollar/M.T.	359.83	384.62	406.44	401.94	366.25	405.76	362.84	389.94
				Rs./Qtl.	1931.57	2095.03	2210.63	2179.32	2064.92	2442.27	2139.30	2627.81
Palm Kernal Oil	Crude Malaysia/ Indonesia	Nether-lands	— —	Dollar/M.T.	795.00	855.00	815.00	840.00	840.00	840.00	830.00	905.00
				Rs./Qtl.	4267.56	4657.19	4432.79	4554.48	4735.92	5055.96	4893.68	6098.80

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

Commodity	Variety	Country	Centre	Unit	Jan.	Feb.	Mar.	Apri	May	Jun.	Jul.	Aug.
Palm Oil	Crude Malaysian/ Sumatra	Nether-lands	— —	Dollar/M.T. Rs./Qtl.	855.00 4589.64	860.00 4684.42	850.00 4623.15	830.00 4500.26	860.00 4848.68	855.00 5146.25	825.00 4864.20	850.00 5728.15
Pepper (Black)	Sarawak Black lable	Malaysia	— —	Dollar/M.T. Rs./Qtl.	— —	7300.00 39763.10	— —	— —	— —	— —	— —	— —
Rapeseed	Canola	Canada	Winni-peg	Can Dollar/M.T	605.80 3244.06	644.20 3448.40	638.00 3415.21	637.60 3388.84	640.50 3505.46	613.10 3521.65	505.20 2895.81	527.40 3372.20
	UK delivered ropseed delivered	U.K.	—	Pound/M.T. Rs/Qtl.	379.00 3210.89	389.00 3233.70	393.00 3233.60	394.00 3297.78	375.00 3219.75	330.00 3030.72	318.00 2883.94	320.00 3344.00
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	855.00 7341.03	826.00 7585.98	731.00 6629.44	752.00 7858.40
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	— —	409.00 3511.67	395.00 3627.68	422.00 3827.12	426.00 4451.70
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	48.63 6042.84	46.63 6185.88	44.26 5751.49	44.31 6581.26
	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	774.00 6645.56	716.00 6575.74	720.00 6529.68	758.00 7921.10
Soyabeans	US No. 2 yellow	Nether-lands	Chi-cago	Dollar/M.T. Rs./Qtl	596.70 3203.09	594.10 3236.06	580.10 3155.16	569.20 3086.20	510.00 2875.94	513.00 3087.75	511.50 3015.80	561.70 3785.30
		U.S.A.	—	C/60 lbs Rs./Qtl	1437.00 2830.97	1482.75 2964.09	1453.75 2901.85	1345.25 2676.88	1501.75 3107.34	1534.75 3389.12	1392.50 3013.14	1433.00 3544.11
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	845.00 7255.17	787.00 7227.81	843.00 7645.17	829.00 8663.05
Tallow	High grade delivered	U.K.	Lon-don	Pound/M.T. Rs./Qtl	550.00 4659.60	460.00 3823.98	440.00 3620.32	440.00 3682.80	440.00 3777.84	440.00 4040.96	445.00 4035.71	445.00 4650.25
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 4792.30	850.00 5116.15	850.00 5011.60	850.00 5728.15
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 68516.28	7980.00 73288.32	78 00.00 70738.20	7980.00 81510.00
Wheat		U.S.A.	Chic-ago	C/60 lbs Rs../Qtl	774.75 1526.30	738.50 1476.30	736.75 1470.64	691.75 1376.50	702.75 1454.09	667.00 1473.38	653.25 1413.52	646.50 1598.93

Source : Public Ledger

Exchange Rate

	Jan.	Feb.	Mar.	Apri	May	Jun.	Jul.	Aug.
US Dollar	53.68	54.47	54.39	54.22	56.38	60.19	58.96	67.39
CAN Dollar	53.55	53.53	53.53	53.15	54.73	57.44	57.32	63.94
UK Pound	84.72	83.13	82.28	83.70	85.86	91.84	90.69	104.50

C. CROP PRODUCTION

4. SOWING AND HARVESTING OPERATIONS NORMALLY IN PROGRESS DURING THE MONTH OF OCTOBER, 2013

State	Sowing	Harvesting
(1)	(2)	(3)
Andhra Pradesh	Paddy, Jowar, Maize, Tobacco, Groundnut, Mesta and Linseed.	Paddy, Bajra, Ragi, Groundnut, Sesamum and Ginger.
Assam	Paddy, Gram, Pulses, Potato and Linseed.	Paddy and Mesta.
Bihar	Wheat, Barley, Gram, Rapeseed & Mustard, Linseed and Potato.	Paddy, Jowar, Bajra, Maize, Ragi and Sesamum.
Gujarat	Paddy, Gram, Pulses and Potato.	Paddy, Jowar, Groundnut, Bajra and Cotton.
Himachal Pradesh	Wheat, Barley, Gram, Rapeseed & Mustard and Linseed.	Paddy, Bajra, Maize, Pulses, Potato and Groundnut.
Jammu & Kashmir	Wheat, Barley, Rapeseed & Mustard and Onion.	Paddy, Bajra, Maize, Small Millets, Pulses, Potato and Chillies.
Karnataka	Jowar, Potato, Tobacco, Linseed, Sweet Potato and Onion.	Kharif Jowar, Ragi, Small Millets, Chillies and Groundnut.
Kerala	Paddy, Pulses and Sesamum.	Paddy, Sweet Potato and Lemongrass.
Madhya Pradesh	Wheat, Barley, Gram, Jowar, Rabi Pulses, Potato, Chillies, Rapeseed & Mustard and Onion.	Paddy, Ragi, Kharif Pulses, Potato, Ginger, Chillies and Groundnut.
Maharashtra	Wheat, Gram, Jowar, Barley and Pulses.	Kharif Paddy, Jowar, Bajra, Maize, Groundnut and Sesamum.
Manipur	Wheat, Potato and Rapeseed & Mustard.	Sugarcane and Late Paddy.
Orissa	Wheat, Jowar, Gram, Rapeseed & Mustard and Linseed.	Paddy, Kharif, Jowar and Sesamum.
Punjab	Wheat and Gram.	Paddy, Cotton, Pulses and Early Sugarcane.
Rajasthan	Wheat, Barley, Rapeseed & Mustard and Linseed.	Jowar, Bajra, Maize, Cotton and Sannhemp.
Tamil Nadu	Paddy, Jowar, Groundnut, Small Millets, Tobacco and Cotton.	Kharif Paddy, Jowar, Maize, Cotton, Tapioca, Mesta and Ginger.
Tripura	Pulses and Potato.	Til.
Uttar Pradesh	Wheat, Barley, Gram, Linseed and Rapeseed & Mustard.	Paddy, Jowar, Bajra, Sesamum and Groundnut.
West Bengal	Wheat, Barley, Rapeseed & Mustard, Tobacco, Chillies, Til, Potato and Pulses.	Paddy, Jute and Red Chillies.
Delhi	Wheat, Barley and Pulses.	Paddy, Jowar, Bajra, Maize and Sugarcane.

METRIC WEIGHTS AND MEASURES

SIMPLE CONVERSION TABLES

I. WEIGHTS

Tons to metric Tonnes

Tons	..	..	1	2	3	4	5	6	7	8	9	10
Metric tonnes	..	..	1.02	2.03	3.05	4.07	5.08	6.10	7.11	8.13	9.14	10.16

Pounds (av.) to Kilograms

Pounds	..	..	1	2	3	4	5	6	7	8	9	10
Kilograms	..	..	0.45	0.91	1.36	1.81	2.27	2.72	3.18	3.63	4.08	4.54

Tolas to grams

Tolas	..	..	1	2	3	4	5	6	7	8	9	10
Grams	..	..	11.66	23.33	34.99	46.66	58.32	69.98	81.65	93.31	104.97	116.64

Seers to Kilograms

Seers	..	..	1	2	3	4	5	6	7	8	9	10
Kilograms	..	..	0.93	1.87	2.80	3.73	4.67	5.60	6.53	7.46	8.40	9.33

Maunds to Quintals

Maunds	..	..	1	2	3	4	5	6	7	8	9	10
Quintals	..	..	0.37	0.75	1.12	1.49	1.87	2.24	2.61	2.99	3.36	3.73

II. LENGTHS

Miles to Kilometres

Miles	..	..	1	2	3	4	5	6	7	8	9	10
Kilometres	..	..	1.61	3.22	4.83	6.44	8.05	9.66	11.27	12.87	14.47	16.09

Yards to Metres

Yards	..	..	1	2	3	4	5	6	7	8	9	10
Metres	..	..	0.91	1.83	2.74	3.66	4.57	5.49	6.40	7.32	8.23	9.14

Inches to Millimetres

Inches	..	..	1	2	3	4	5	6	7	8	9	10	11	12
Millimetres	..	..	25.40	50.80	76.20	101.60	127.00	152.40	177.80	203.20	228.60	254.00	279.40	304.80

III. AREA

Acres to Hectares

Acres	..	..	1	2	3	4	5	6	7	8	9	10
Hectares	..	..	0.40	0.81	1.21	1.61	2.02	2.43	2.83	3.24	3.64	4.04

Square Yards to Square Metres

Square Yards	..	..	1	2	3	4	5	6	7	8	9	10
Square Metres	..	..	0.84	1.67	2.51	3.34	4.18	5.02	5.85	6.69	7.53	8.36

IV. CAPACITY

Gallons (Imperial) to Litres

Gallons	..	..	1	2	3	4	5	6	7	8	9	10
Litres	..	..	4.55	9.09	13.64	15.14	22.73	27.28	31.82	36.37	40.91	45.44

MGIPRRND—170 Agri/2014—600.

ISSN 0002—167
Regn. No. : 840

P. Agri. 21-9-2013
600

LIST OF PUBLICATIONS

Journal

Agricultural Situation in India (Monthly)

Periodicals

Agricultural Prices in India

Agricultural Wages in India

Cost of Cultivation of Principal Crops

Land Use Statistics at a Glance

District-wise Area and Production of Principal Crops in India

Year Book of Agro-Economic Research Studies

Farm Harvest Prices of Principal Crops in India

Agricultural Statistics at a Glance

Copies are available from : The Controller of Publications, Civil Lines, Delhi-110054. (Phone 23817640)

PRINTED BY THE MANAGER, GOVERNMENT OF INDIA PRESS, RING ROAD, MAYAPURI, NEW DELHI-110064
AND PUBLISHED BY THE CONTROLLER OF PUBLICATIONS, DELHI-110054—2014.