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Problems and Prospects of Oilseeds Production in Gujarat

Mrutyunjay Swain[1]

Abstract

This paper investigates the major problems and prospects of oilseeds production in Gujarat. It examines the trends and pattern of growth of different edible oilseeds over time and across districts and identify the sources of growth in area and production of major oilseeds and competing crops in the state. The paper also determines the impact of price and non-price factors on the productivity and acreage under oilseeds and identifies the major constraints in the edible oilseed cultivation in the state. Though the growth in area under major oilseeds has been poor, the growth in production and yield of major oilseeds has been quite impressive over last three decades. The yield effect was found to play a dominant role in increasing oilseeds production during the reference period (TE1983-84 to TE 2009-10). The area under main oilseed (groundnut) has decreased considerably, whereas that of cotton, the main competing crop, has substaintially increased during the corresponding period. The prevailing level of yield gap in cultivation of both groundnut and cotton was found to be considerably high in the study regions. High level of gaps were observed to prevail in fertilizer dose applied, weeding, disease management, control of pesticides and insecticides. 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. The major economic and institutional constraints faced by selected farmers were high input costs and supply of poor quality inputs, irregular supply of power/electricity, shortage of human labour and inadequate knowledge about disease and pest management, crop damage by blue bull (Nilgai) and pigs.

Keywords: Oilseeds production, constraints and prospects, yield and technology gaps

JEL: Q110, Q180, C510.

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1. Introduction

Oilseeds sector has played a prominent role in agricultural development in India. Oilseeds are important next only to foodgrains in terms of area, production and value in the country. There has been a six times increase in oilseeds production during the period of 1950–2011 under predominantly rainfed (72%) agro-ecological conditions, which is even higher than the production increase in total foodgrains during the corresponding period (Hegde, 2009). Though growth in oilseeds area and production at national level has been impressive, a huge demand-supply gap in oilseeds and vegetable oils prevails in the country (GOI, 2013). Since there is limited scope to bring additional area exclusively under oilseeds as the demand for land for other purposes and for producing other remunerative crops will continue to rise due to population increase and rising living standards, it is crucial to search for newer approaches to expand their cultivation under different farming situations.

A wide range of oilseed crops are grown in different agro-climatic regions of India. Among the oilseeds, groundnut which was the most important crop in triennium ending (TE) 1998-99 in the country has lost its prime position to soybean in TE 2008-09 (Sharma, 2012). Soybean is largely grown in Madhya Pradesh, Maharashtra and Rajasthan, accounting for about 95 per cent of total production in the country. Groundnut, the second most important oilseed, is mainly grown in Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka and Maharashtra. Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka together account for 77 per cent of the *area* and almost 75 per cent of the production of groundnut in India (Mehrotra, 2011).

Oilseeds area and production in Gujarat state constitute about 10.8 per cent of area and 14.5 per cent of production, respectively in India (GOI,

2013). Oilseeds are usually seen as the primary cash crop in the state where the diverse agro-ecological conditions are favourable for growing these crops. A wide range of oilseed crops are grown in different agro-climatic regions of the state. Among the oilseeds, groundnut, castor and sesamum are the major crops grown in the state. The state was the largest producer of groundnut and second largest producer of sesamum in the country in 2010-11. The area and production of groundnut in the state constituted about 30.9 per cent and 37.1 per cent share respectively in India. The state is the India's largest producer of castor. 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 conditions. Groundnut is primarily grown on the coastal belt of Saurashtra. The unirrigated dry lands of Saurashtra are so poor in fertility that except groundnut and inferior cerials, bajra and jowar, no other major food or cash crops can be grown profitably. Groundnut cultivation in summer season is gaining popularity in the state because of high productivity under assured irrigation.

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 (Dholakia, 2010). 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 during 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 increasing oilseeds production in the state.

The state has increased the oilseeds production mainly through increase in yield since a long time. Further increase in yield and area under oilseeds, reducing the 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 a 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 gross cropped area (GCA) was irrigated during 2009-10. However, only 21.5 per cent 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.

The growth performance of oilseeds in the state has been prone to various kinds of risk over time and across the agro-climate regions because of the erratic rainfall behaviour and periodic occurrence of drought. Several biotic, abiotic, technological, institutional and socio-economic constraints affects the realisation of the yield potential of crops which are needed to be addressed. In this context, the present study attempts to analyze the performance and potential of oilseeds sector in Gujarat and identify major problems or constraints facing the sector in the state.

2. Objectives of the Study

(i) To examine the trends and pattern of growth of different edible oilseeds over time and across districts and identify the sources of output growth in major oilseed and competing crop in Gujarat;

(ii) To assess the relative role of various factors in determining the profitability and the acreage allocation between the main oilseeds and competing crops in the state; and

(iii) To identify major constraints in the edible oilseed cultivation and suggest policy options to increase oilseeds production and productivity in the state.

3. Data and Methodology

3.1 Primary and Secondary Data

The 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 analysed to examine the trends and pattern of growth of different edible oilseeds over time and across districts. In order to assess the relative role of various factors in determining the profitability and the acreage allocation between the main oilseeds and competing crops and to identify the major constraints in edible oilseed production in the state, primary data from households growing oilseeds in the selected districts were collected and analyzed.

3.2 Sampling Design

The present study was a part of larger coordinated study on problems and prospects of oilseeds and oil palm production in India. The states growing considerable quantities of oilseeds and having potential were selected for the study. Accordingly, seven major oilseeds producing states were selected (Table 1). 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 Gujarat with a special focus on groundnut.

Table 1 Selected Crops, States and Sample Size

Crop	States	Sample Size (HHs)	Total Sample Size
Ground Nut	**1. Gujarat**	**250**	**500**
	2. Andhra Pradesh	**250**	
Soybean	1. Madhya Pradesh	250	500
	2. Maharashtra	250	
Rapeseed & Mustard	1. Rajasthan	200	500
	2. Uttar Pradesh	200	
	3. Madhya Pradesh	100	
Sunflower	1. Karnataka	250	400
	2. Andhra Pradesh	150	
Sesamum	1. West Bengal	250	250
Oil Palm	1. Andhra Pradesh	75	75
Grand Total		2225	2225

Source: Sharma, 2012.

The multistate, purposive sampling method was used to select the districts, blocks and farm households. At first stage, all districts growing groundnut in the state were categorized into four groups (see Table 2) 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). Since HH, HL and LH categories of districts have the potential for further increase in production of groundnut, it was decided to select at least one district each from these three categories for household survey. Accordingly, Junagadh, Rajkot and Porbandar were selected from Gujarat as HH, HL and LH category of districts respectively for the detailed study.

Table 2 Criteria for Selection of Study Districts (Groundnut)

Area	Yield	
	High	Low
High	High area - High yield (HH) (Junagarh)	High area – Low yield (HL) (Rajkot)
Low	Low area – High yield (LH) (Porbandar)	Low are – Low yield (LL)

Source: Sharma, 2012.

At second stage, about 25 villages from 7 blocks (Visavadar, Una and Manavadar of Junagarh district; Porbandar and Kutiyana of Porbandar district; Gondal and Jasdan of Rajkot district) 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). Among the sample farmers, 15 were marginal farmers (6%), 66 were small farmers (26.4%), 87 were medium farmers (34.8%) and 82 were large farmers (32.8%). The reference year for the household survey was 2011-12.

3.3 Data Analysis Methods and Tools

The simple statistical methods like averages, percentage, coefficient of variation and compound annual growth rate (CAGR) are used 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 the growth parameters.

3.3.1 Decompostion of Output Growth of Oilseeds

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 oilseed (groundnut), competing crop (cotton) and total oilseeds. Several researchers have used this model to study growth performance of the crops (Bhatnagar and Nandal, 1994; Gupta and Saraswat, 1997; Singh and Ashokan, 2000; Siju and Kombairaju, 2001; Kalamkar, 2003). 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.

$$(P_n-P_0) = A_0 (Y_n-Y_0) + Y_0 (A_n - A_0) + (A_n - A_0) (Y_n-Y_0) \text{ ---------- (1)}$$

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

Where, P, A and Y stand for production, area and yield respectively. The subscript ‘n’ stands for the current year and subscript ‘0’ stands for the base year.

The equation-2 states that,

Change in production = Yield effect + Area effect + Interaction effect

The decomposition analysis was carried out mainly for three periods, i.e., Period I (TE1983-84 to TE 1993-94) Period II (TE1993-94 to TE 2009-10) and overall period of TE1983-84 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.

3.3.2 Log-Linear Models for Estimating Oilseeds Production Function and Acreage Allocation Response Function

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 regression model was stated with a log-linear functional form due to the fact that the agricultural production function is usually assumed to follow a Cobb-Douglas type that requires a log-linear transformation for estimation of input coefficients. Thus, the estimable equation is as follows:

$$\mathrm{Ln}Y_i = \mathrm{Ln}\,A + \beta_1 \mathrm{Ln}\,AR_i + \beta_2\,\mathrm{Ln}\,LS_i + \beta_3 \mathrm{Ln}\,SC_i + \beta_4 \mathrm{Ln}\,FC_i + \beta_5 \mathrm{Ln}\,PC_i + \beta_6 \mathrm{Ln}\,HL_i + \beta_7 \mathrm{Ln}\,ML_i + \beta_8 \mathrm{Ln}\,IC_i + e_i$$

Where, Crop yield (Y) was the dependent variable and the area under the crop (AR), Size of operational holdings (LS), Seed cost (SC), Cost of fertilizer and manures (FC), Cost of pesticide and insecticide (FC), Cost of

human labour including family labour (HL), machine charges (ML), Irrigation charges (IC) were the explanatory variables.

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 (A_t) has been considered as the dependant variable. Some price and non-price factors selected as the explanatory variables are the size of land holdings (LS_t), one year lagged area of groundnut (A_{t-1}), lagged yield of groundnut (Y_{t-1}), lagged price of groundnut (P_{t-1}), lagged area of cotton (AC_{t-1}), lagged yield of cotton (YC_{t-1}) and the lagged price of cotton (PC_{t-1}). Thus the fitted model is as follows:

$$\mathrm{Ln}A_t = \alpha + \beta_1 \mathrm{Ln}\,LS_t + \beta_2\,\mathrm{Ln}\,A_{t-1} + \beta_3 \mathrm{Ln}\,Y_{t-1} + \beta_4 \mathrm{Ln}\,P_{t-1} + \beta_5 \mathrm{Ln}\,AC_{t-1} + \beta_6 \mathrm{Ln}\,YC_{t-1} + \beta_7 \mathrm{Ln}\,PC_{t-1} + e_i$$

3.3.3 Yield Gap and Technology Gap Analysis

The yield gap analysis was conducted for the main oilseed crop (groundnut) to ascertain the gap between the potential yield and actual yield and between the experimental yield and actual yield. Potential crop yield is defined in this paper as the maximum achievable yield level assuming water, nutrients, pests, and diseases are not limiting the crop growth. Experimental yield referes to the crop yield on experimental plots with ideal conditions of management of input supply and pest control. Both potential yield and experimental yield are location specific. The actual yield that the sample farmers realised on their own plots were compared with potential yield and experimental yield so as to determine various kinds of yield gap. An index called 'Technology Index' developed following Samui et al (2000) was used

for measuring the feasibility of the evolved technology at the farmer's fields. The Index is stated as follows:

Technology index= {(Potential yield – Experimental yield)/ Potential yield} x 100.

The lower the value of technology index, the more is the feasibility of technology. A detailed analysis on technology gap has been carried out by comparing the farmers' practices with recommended technology for different activities of farm operations which has been presented in tabular form.

3.3.4 Identifying and Prioritizing Major Constraints for Growth in Oilseeds Production

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 as presented below.

The Oilseed Constraint Index (OCI) = $1/n \left(\sum_{i=1}^{n} W_i \, C_i \right)$

Where,

C_i = the number of farmers in a farmer category responded in favour of a particular constraint with a particular rank score or weight (severe =4, Moderate = 3, minor = 2, not important =1).

W_i = the weight attached to *i*th constraint takes the value ranging from 1 to 4. This reflects the severity of impacts of the concerned constraint for the sample farmers.

n = the total number of farmers in a farmer category.

4. Results and Discussion

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. As per the cropping pattern in the state, total cereals, oilseeds, pulses, horticultural crops and fodder crops accounted for about 30.2 per cent, 23.4 per cent, 6.7 per cent, 10.6 per cent and 8.4 per cent of GCA, respectively in 2010-11 (Table 3). Among the oilseeds, groundnut (14.4%), castor (3.7%), sesamum (1.9%) and rapeseed-mustard (1.7%) were the major ones in 2010-11. During the overall period (1990-91 to 2010-11), the share of the area under total oilseeds, total cereals, total pulses and total food grains has declined; whereas the share of cotton and horticultural crops has increased. Though the share of the area under total oilseeds has decreased from 26.5 per cent in 1990-91 to 23.4 per cent in 2010-11, the absolute area under the oilseeds in the state has increased by 10.4 per cent from 2818 thousand ha in 1990-91 to 3110 thousand ha in 2010-11. The area share of the main oilseed crop (groundnut) has continuously decreased from 17.2 per cent (18.3 lakh ha) in 1990-91 to 16.6 per cent (17.5 lakh ha) in 2000-01 and further to 14.4 per cent during 2010-11. On the other hand, the share of area under cotton, which is considered as a main competing crop, has significantly increased from 9.8 per cent (10.4 lakh ha) in 1990-91 to 15.4 per cent (16.2 lakh ha) in 2000-01 and further to 19.7 per cent (26.4 lakh ha) in 2010-11.

The cropping pattern has changed over the last four decades as a result of development of irrigation potential, production technology, increased market prices and industrial demand in the state. Better price and better marketing facilities available in the state are the major factors contributing more to the adoption of cotton replacing the main oilseed crop (groundnut).

Table 3: Change in Cropping Pattern in Gujarat

(Area in 000' Hectare)

Major crops	1990-91		2000-01		2010-11	
	Area (000' ha)	(% of GCA)	Area (000' ha)	(% of GCA)	Area (000' ha)	(% of GCA)
Rice	623.0	(5.9)	583.5	(5.6)	808.0	(6.1)
Bajra	1394.3	(13.1)	989.2	(9.4)	873.0	(6.6)
Wheat	608.7	(5.7)	286.1	(2.7)	1589.0	(11.9)

Maize	366.2	(3.4)	382.9	(3.6)	566.0	(4.3)
Total Cereals	3799.8	(35.7)	2435.6	(23.2)	4014.4	(30.2)
Tur	428.9	(4.0)	317.9	(3.0)	277.0	(2.1)
Total Pulses	948.7	(8.9)	634.6	(6.0)	890.1	(6.7)
Total Foodgrains	4748.5	(44.7)	3070.2	(29.2)	4904.5	(36.9)
Seasmum	237.0	(2.2)	356.9	(3.4)	251.1	(1.9)
Groundnut	1826.1	(17.2)	1744.8	(16.6)	1922.0	(14.4)
Rape and Mustard	348.6	(3.3)	186.6	(1.8)	222.7	(1.7)
Castor	384.9	(3.6)	458.6	(4.4)	490.6	(3.7)
Total Oilseeds	2818	(26.5)	2746.9	(26.2)	3110.0	(23.4)
Cotton	1041.6	(9.8)	1615.4	(15.4)	2623.0	(19.7)
Tobacco	141.6	(1.3)	87.8	(0.8)	148.0	(1.1)
Horticultural crops	337.4	(3.2)	593.34	(5.7)	1404.0	(10.6)
Fodder crops	1325.1	(12.5)	1371.1	(13.1)	1111.8	(8.4)
Other crops	222.6	(2.1)	1012.3	(9.6)	0.0	(0.0)
All Crops	10634.8	(100.0)	10497.0	(100.0)	13301.3	(100.0)

Notes: (1) GCA for 2010 is provisional since the area under other crops is assumed to be zero due to unavailability.

(2) Area under fodder crops in 2006-07 has been taken as proxy for the same in 2010-11.
(3) Figures in parentheses are the percentages of GCA.
Sources: GoG (2003), various issues; GoG (2011).

Overall, the gross cropped area (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 4). The overall area expansion effect has been better for the irrigated area than the cultivated area during all reference periods.

Table 4 : Changes in Gross Cropped Area, Area Expansion Effects and Crop Intensification Effects (TE 1983-84 to TE 2009-10)

(Area in '000 ha)

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, TE: Triennium Ending

Sources: GoG (2009), various issues (1980-81 to 1999-2000); GoG (2003), various issues (2002-03 to 2006-07); GoG (2011).

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 during the corresponding period. The crop intensification effects (GCA less NSA or GIA less NIA) has gradually decreased from TE 1983-84 to TE 2003-04, though has improved during TE 2009-10. The cropped area intensification effect (GCA less NSA) has declined from 1441.3 thousand ha in TE 1983-84 to 1277.3 thousand ha in TE 2003-04, which has recovered to 1330.7 thousand ha in TE 2009-10. The irrigated area intensification effect, i.e., GIA less NIA has increased from 422.6 thousand ha in TE 1983-84 to 912.6 thousand ha in TE 2009-10.

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. 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, increasing adoption of HYVs for better returns, availability of irrigation provisions and climatic aberrations are the major ones in the state of Gujarat (Swain et. al., 2012). 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 promoted value-added agri-business enterprises. The expansion of area under horticultural crops, pulses and oilseeds have been promoted through various programmes like National Horticulture Mission (NHM); National Food Security Mission (NFSM); Integrated Scheme of Oilseeds, Pulses, Oilpalm and Maize (ISOPOM); Rashtriya Krishi Vikas Yojana (RKVY); Agriculture Technology Management Agency (ATMA) etc. in the state in recent years (Dutta and Kapadia, 2011; Swain et al., 2011).

4.2 Spatial and Temporal Growth 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 significant over the last three 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 (Figure 1). 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 5). 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. On the other hand, the production and yield of all agricultural crops taken together have increased by 2.5 times and 2.3 times respectively during the corresponding period.

Figure 1. Trends in Area, Yield and Production of Total Oilseeds in Gujarat (1951-52 to 2009-10)

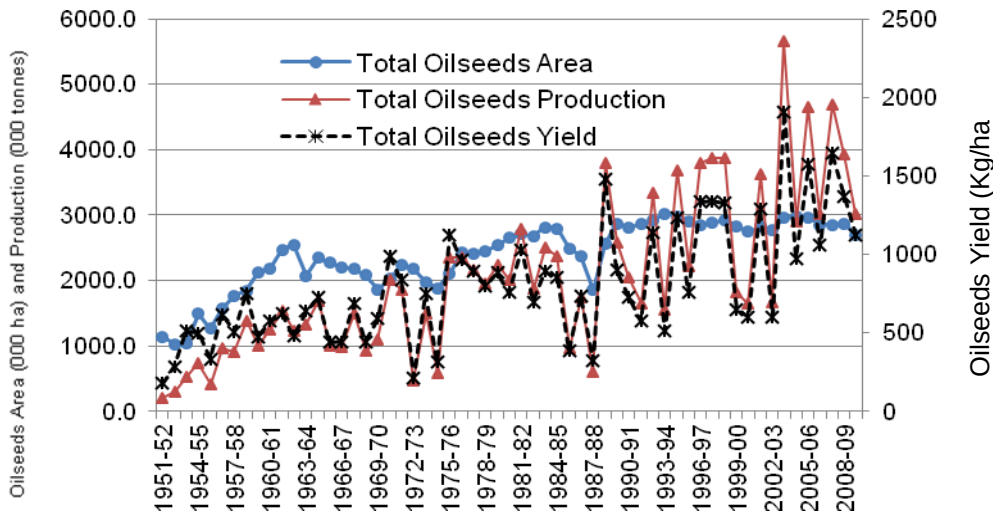


Table 5: Trends in average area, production, and yield of Oilseeds in the Gujarat State

A/P/Y	1951-52 to 1960-61		1961-62 to 1970-71		1971-72 to 1980-81		1981-82 to 1990-91		1991-92 to 2000-01		2001-02 to 2009-10		1951-52 to 2009-10	
	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR
Total Oilseeds														
Area (000 hectares)	1545.9	7.5	2207.3	-2.2	2286.7	1.9	2596.9	0.4	2894.5	-0.5	2862.7	-0.6	2391.1	1.5
	(27.8)		(9.5)		(10.9)		(11.8)		(2.7)		(3.4)		(22.1)	
Production ('000 tonnes)	773.1	22.4	1329.0	3.0	1749.5	0.8	2126.9	-3.4	2746.0	0.0	3686.2	-2.3	2041.0	4.8
	(52.2)		(26.6)		(39.5)		(42.9)		(38.1)		(32.5)		(60.0)	
Yield (kg/ha)	500.1	13.9	602.1	5.3	765.1	-1.1	819.0	-3.8	948.7	0.5	1287.7	-1.7	853.6	3.2
	(33.6)		(28.6)		(36.7)		(39.7)		(37.5)		(30.7)		(43.4)	
Total Agriculture Crops														
Area (000 hectares)	8494.5	1.7	9121.9	0.4	9267.4	0.1	9140.1	-1.0	9122.7	-1.5	9072.2	1.0	9035.8	0.3
	(4.8)		(1.9)		(5.1)		(9.7)		(5.8)		(7.4)		(6.6)	
Production ('000 tonnes)	3882.0	11.8	6192.0	5.4	8307.7	0.7	9920.1	-1.3	12497.8	-1.6	17747.9	5.1	9622.5	4.1
	(27.0)		(19.8)		(22.9)		(25.9)		(25.4)		(25.8)		(53.1)	
Yield (kg/ha)	457.0	9.9	678.8	5.0	896.4	0.6	1085.3	-0.3	1370.0	-0.1	1956.3	4.0	1064.9	3.8
	(23.9)		(18.0)		(20.3)		(21.2)		(21.7)		(20.0)		(50.4)	

Notes: (1) Figures in parentheses are the CV in per cent. (2) CAGR implies compound annual growth rate. (3) A, P and Y stands for area, production and yield respectively.

Source: GoG (2011).

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 (Table 6). The share of some of these districts has declined marginally during TE 2009-10. The share of Rajkot, Amreli and Bhavnagar has decreased to 14.5 per cent, 9.4 per cent and 5.0 per cent of total area under oilseeds during TE 2009-10 respectively. 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%).

Table 6: Changing shares of area and production of oilseeds in major oilsees producing districts in the state: TE 1993-94 and TE 2009-10

(Area in 000' hectare and Production in 000' tonne)

Districts	TE 1993-94				TE 2009-10			
	Area		Production		Area		Production	
Rajkot	488.9	(16.6)	172.7	(8.0)	407.1	(14.5)	463.2	(11.9)
Junagadh	434.8	(14.8)	300.9	(13.9)	417.0	(14.9)	643.0	(16.6)
Jamnagar	404.9	(13.8)	125.9	(5.8)	407.5	(14.5)	684.6	(17.6)
Amreli	351.9	(12.0)	186.3	(8.6)	262.9	(9.4)	207.8	(5.4)
Bhavnagar	272.3	(9.3)	227.9	(10.5)	141.1	(5.0)	149.3	(3.8)
Banaskantha	246.5	(8.4)	311.2	(14.4)	274.7	(9.8)	441.1	(11.4)
Mehsana	236.0	(8.0)	302.9	(14.0)	110.9	(4.0)	177.8	(4.6)
Kutch	55.1	(1.9)	149.2	(6.9)	119.6	(6.3)	247.4	(6.4)
Sabarkantha	96.2	(3.3)	139.8	(6.5)	127.2	(4.5)	166.7	(4.3)
Surendarnagar	84.3	(2.9)	42.6	(2.0)	121.7	(4.3)	129.5	(3.3)
Patan	0.0	(0.0)	0.0	(0.0)	95.2	(3.4)	132.1	(3.4)
Porbandar	0.0	(0.0)	0.0	(0.0)	89.5	(3.2)	176.9	(4.6)
Gujarat State	2936.9	(100.0)	2165.6	(100.0)	2803.9	(100.0)	3880.4	(100.0)

Note: Figures in parentheses show the district's percentage share in state total area under oilseeds and state total production.

Sources: GoG (2003), various earlier issues; GoG (2011).

As far as the oilseeds production in the state is concerned, 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 (Table 6).

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 Kutch in total *Kharif* 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%), 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, Kutch and Patan 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. However, only 22.2 per cent of total oilseeds area was irrigated in 2002-03 (GOG 2008). Banaskantha, Mehsana, Kutch, Patan, Sabarkantha and Gandhinagar were the major districts where more irrigated oilseeds were grown during both *Kharif* and *Rabi* 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. It is highly desirable that irrigation facilities be expanded for further growth in oilseeds acreage and production in the state.

4.3 Growth Trends in Area, Production and Yield of Major Oilseed (Groundnut) vis-à-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 area in the state was about 66.4 per cent in the corresponding period. As presented in Table 7, the growth in area under groundnut was considerably high during 1950s (10.3%). However, it has exhibited negative trend thereafter (except 1970s). The annual growth in area under groundnut was -2.7 per cent during 1960s that has marginally increased to 1.0 per cent during 1970s and thereafter continued to exhibit negative trend. 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 7).

Table 7: 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		1961-62 to 1970-71		1971-72 to 1980-81		1981-82 to 1990-91		1991-92 to 2000-01		2001-02 to 2009-10		1951-52 to 2009-10	
	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR	Mean	CAGR
Groundnut (main oilseed crop)														
Area (000 hectares)	1245.9	10.3	1987.4	-2.7	2252.8	1.0	1928.8	-1.9	1879.2	-1.4	1920.8	-0.4	1868.3	1.4
	(38.0)		(10.9)		(44.4)		(12.8)		(4.4)		(3.8)		(29.5)	
Production ('000 tonnes)	703.4	25.3	1259.9	2.6	1515.9	-0.9	1435.7	-8.4	1559.1	-0.4	2550.7	-5.0	1486.4	4.2
	(57.0)		(26.8)		(40.9)		(55.0)		(55.2)		(41.0)		(58.5)	
Yield (kg/ha)	564.6	13.6	633.9	5.4	672.9	-1.8	744.4	-6.6	829.7	1.0	1327.9	-4.6	795.6	2.8
	(33.5)		(29.3)		(49.0)		(54.0)		(56.3)		(39.8)		(53.5)	
Cotton (main competing crop)														
Area (000 hectares)	1561.0	4.3	1733.2	0.3	1887.8	-3.7	1257.6	-4.1	1443.8	3.7	2061.6	4.4	1650.6	1.2
	(18.2)		(3.0)		(10.4)		(18.5)		(13.9)		(16.8)		(21.2)	
Production ('000 tonnes)	1000.0	14.7	1590.4	3.8	1929.7	-5.5	1597.5	-3.1	2348.8	-0.4	5599.6	20.2	2289.2	5.0
	(33.4)		(10.5)		(19.2)		(32.9)		(38.5)		(45.6)		(79.2)	
Yield (kg/ha)	640.6	10.0	917.6	3.5	1022.2	-1.8	1270.3	1.0	1626.8	-3.9	2716.1	15.1	1386.8	3.8
	(24.1)		(10.3)		(14.4)		(26.6)		(30.8)		(35.4)		(54.7)	

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

Sources: GoG (2009) and earlier issues; GoG (2011).

Figure 2: Growth in Area ('000 ha), Yield (Kg/ha) and Production ('000 tonnes) of Groundnut in Gujarat (1951-52 to 2009-10)

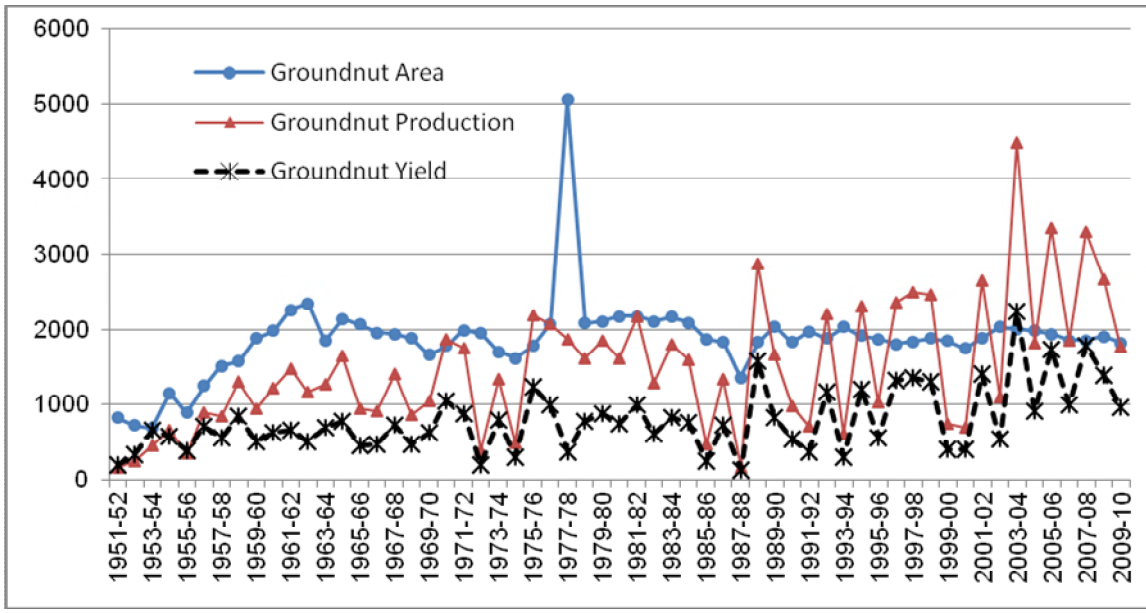
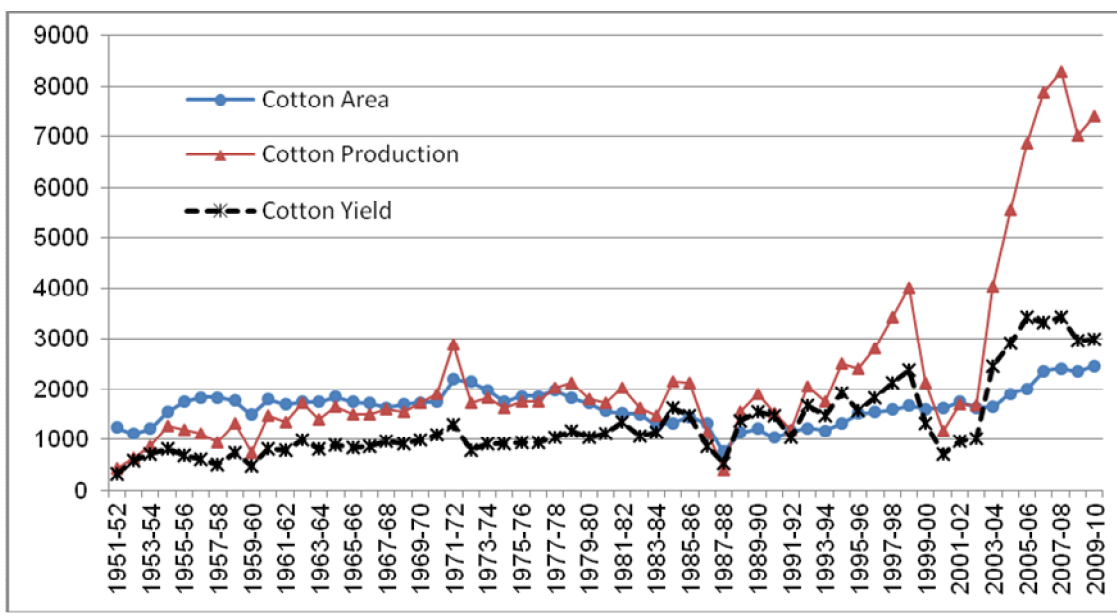


Figure 3. Growth in Area (000 ha), Yield (Kg/ha) and Production (000 tonnes) of Cotton in Gujarat (1951-52 to 2009-10)



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 (Figures 2 and 3). 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 dominated 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 Kutch 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 Oilseeds Production in the State

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 with the help of decomposition analysis. 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 all reference periods and overall period of TE 1983-84 to TE 2009-10. The same was also found true 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 whereas the yield effects played major role during Period II and overall period in the district. The yield effects also played a dominant role for the main oilseed (groundnut) throughout the reference periods in the state (Table 8). About 110.8 per cent of growth in total oilseeds in Gujarat was due to yield effect during Period II (TE 1993-94 to TE 2009-10). As far as the main oilseed (groundnut) of the state is concerned, the yield effect accounted for 110.0 per cent to total output growth during the corresponding period. However, the area effect was dominant during the Period I (703.3%) and interaction effect played a dominant role during the Period II (35.9%) for the main competing crop (cotton) in the state.

Table 8: Decomposition of output growth of main oilseed crop (groundnut) and main competing crop (cotton) in the selected districts of Gujarat

State/ Districts	Crops	Effects	Period I (TE 1983-84 to TE1993-94)	Period II (TE 1993-94 to TE2009-2010)	Period III (TE 1983-84 to TE2009-2010)
Gujarat	Total oilseeds	Area	-83.93	-5.79	4.12
		Yield	171.19	110.81	93.47
		Interaction	12.74	-5.02	2.41
	Groundnut (main oilseed)	Area	25.97	-4.31	-28.80
		Yield	81.07	109.99	148.73
		Interaction	-7.03	-5.68	-19.93
	Cotton (main competing crop)	Area	703.27	29.15	19.89
		Yield	-728.40	34.94	47.69
		Interaction	125.13	35.92	32.41
Junagadh	Total oilseeds	Area	19.46	-3.59	-28.49
		Yield	86.53	108.00	143.93
		Interaction	-5.99	-4.41	-15.44
	Groundnut (main oilseed)	Area	28.15	0.24	-13.23
		Yield	78.25	99.47	122.95
		Interaction	-6.40	0.30	-9.72
	Cotton (main competing crop)	Area	29.28	24.86	20.16
		Yield	61.84	44.49	41.34
		Interaction	8.88	30.64	38.50
Rajkot	Total oilseeds	Area	100.34	-9.94	-2.06
		Yield	-0.29	132.03	106.63
		Interaction	-0.04	-22.09	-4.57
	Groundnut (main oilseed)	Area	-26.51	-7.13	-6.77
		Yield	117.96	124.75	115.94
		Interaction	8.55	-17.62	-9.16
	Cotton (main competing crop)	Area	-248.68	34.68	17.87
		Yield	480.40	22.44	38.87
		Interaction	-131.72	42.89	43.27

Note: District level data on Porbandar for TE 1983-84 and TE 1993-94 was not available.
Sources: GoG (2009) and earlier issues; GoG (2011).

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 satisfactory in the state whereas the growth in irrigated area under total oilseeds was not satisfactory since the annual growth in irrigated oilseeds area 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 during the corresponding period.

The growth in annual prices of major oilseeds has been impressive in Gujarat. The per quintal 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 per quintal price of major *Rabi* oilseed (rapeseed-mustard) has increased from Rs 1226 in TE 1998-99 to Rs 2222 in TE 2009-10. It was good to find that the FHP of all major oilseeds was much more than their MSPs in the state. However, the extent of variability in price of groundnut was somewhat lower than that of cotton both spatially and temporally.

4.5 Socio-Economic Charecteristics of Sample Households

The primary level data analysis was conducted on 250 sample households. 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 per cent 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 for the sample farmers 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.

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 31.3 per cent HHs, it was fixed rent in cash.

It was good to see that the area under protective irrigation was 81.9 per cent of total operated area. 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 per cent in the case of our sample farmers.

4.6 Croping Pattern and Yield of Major Crops Grown by Sample Farmers

As regard the cropping pattern followed by the farmers, the per-HH area under *Kharif* crops and Rabi crops 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 adopted by sample farmers. 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 sample 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 ha and 3.4 quintals per ha, respectively; whereas the average yield of *Kharif* crops and Rabi crops under irrigated conditions was 21.5 quintals per ha and 41.8 quintals per ha, respectively. The average yield of *Kharif* oilseeds under rainfed and irrigated conditions was 7.1 quintals per ha and 18.1 quintals per ha, 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 ha and 11.1 quintals per ha, respectively.

4.7 Pattern of Production, Retention and Marketed Surplus 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 62% of selected farmers (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 (Table 9). About 1.8 quintals of groundnut (4.5%) was retained per household for household consumption and for use as seed.

Table 9: Total Oilseeds Production, Retention and Sale Pattern

(Quintals)

	Kharif Oilseed I (Groundnut)					*Kharif Oilseed 2 (Castor)*				
	Production	Retention	Sold	Price (Rs/q)	No. of farmers	Production	Retention	Sold	Price (Rs/q)	No. of farmers
Marginal	12.7	0.5	12.2	3290	15	0.0	0.0	0.0	0	0
Small	18.3	0.9	17.4	3559	66	28.0	0.0	28.0	2875	2
Medium	35.0	1.9	33.1	3522	87	31.7	0.0	31.7	3083	3
Large	67.5	2.5	65.1	3524	82	40.1	0.0	40.1	3082	7
All farms	39.9	1.8	38.2	3518	250	36.0	0.0	36.0	3048	12
	Kharif Oilseed 3 (Sesamum)					*Major competitive crop (Cotton)*				
	Production	Retention	Sold	Price (Rs/q)	No. of farmers	Production	Retention	Sold	Price (Rs/q)	No. of farmers
Marginal	0.0	0.0	0.0	0	0	10.2	0.0	10.2	3775	2
Small	20.0	0.0	20.0	6000	1	16.7	0.0	16.7	4037	25
Medium	10.0	0.0	10.0	6000	1	30.9	0.0	30.9	4091	47
Large	7.0	0.0	7.0	6000	1	73.9	0.0	73.9	4131	50
All farms	12.3	0.0	12.3	6000	3	45.0	0.0	45.0	4091	124

Source: Field survey

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 large farmer (Rs 4131 per quintal), followed by the medium farmer (Rs 4091 per quintal). The lowest price was realized by marginal farmer (Rs 3775 per quintal). The output of some oilseeds like castor and sesamum and competing crop cotton was entirely sold by the farmers. All these farmers relied on certified seeds purchased from the markets for growing the same crops in next season.

4.8 Comparative Economics of Cultivation of Major Oilseed vis-à-vis Competing Crop

It was observed that the cultivation of the major oilseed crop (groundnut) was less profitable over the major competing crop (cotton) in the study areas. The per hectare gross value of main product and by-product of groundnut for sample farmers was estimated to be Rs 54533 and Rs 6242, respectively. The total variable cost of cultivation of the crop including material cost and labour cost was Rs 37932.6 per ha. Thus, the net income derived from cultivation of groundnut was Rs 22842 per ha (see Table 10). On the other hand, the net income derived from the cultivation of cotton was Rs 54455 per ha which was more than double of net income generated from cultivation of main oilseed groundnut (Rs 22842). That is why, the share of cotton in the GCA is gradually increasing and that of groundnut is declining.

Furthermore, the cost of production per ha of cotton was much lower (Rs 1766) compared to that of groundnut (Rs 2447). 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 competing crop (cotton) 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 seed cost for cultivation of cotton was 4.6 per cent and 10.0 per cent of total operational cost, respectively.

Table 10: Cost of Cultivation &Profitability of Major Oilseeds and Competing Crops

(Rs/ha)

Cost Items	Main Oilseed (Groundnut)				
	Marginal	Small	Medium	Large	All
Seed	10938	9613	9715	9318	9631
Fertilizer & manure	3760	4478	4241	4051	4213
Insecticides & pesticides	2351	1892	1864	1568	1804
Total human labour	18705	14741	13192	11003	13214
(a) Family	6224	5022	3960	2369	3854
(b) Hired	12481	9719	9231	8634	9359
Machine labour	2834	2272	2195	2950	2501
Bullock labour	1342	1349	1216	982	1182
Irrigation	872	1080	1063	859	989
Harvesting & threshing (machine charges)	2840	1908	2221	1734	2016
Interest on working capital	2841	2515	2392	2185	2383
1. Total operational costs (TC)	46483	39848	38098	34651	37933
Yield (quintals)	16.2	14.8	15.4	15.7	15.5
Price(Rs/quintal)	3290	3559	3522	3524	3518
2. Value of main-product (Rs)	53298	52675	54233	55297	54533
3. Value of by-product (Rs)	5657	5983	6776	6002	6242
Net Income (2+3) – (1)	12472	18809	22911	26649	22842
Cost of production (TC/q)	2869	2692	2474	2208	2447
Total cost of cultivation (TC/ha)	46483	39848	38098	34651	37933
Cost Items	Major Competing Crop (Cotton)				
Seed	3606	4755	4191	3733	4128
Fertilizer & manure	9461	9563	8709	7574	8384
Insecticides & pesticides	1813	1548	1575	1234	1444
Total human labour	31161	27555	20699	15175	20080
(a) Family	6995	7711	4607	2591	4481
(b) Hired	24167	19844	16091	12584	15599
Machine labour	2500	2245	2005	2060	2092
Bullock labour	781	1116	809	486	741
Irrigation	2031	1886	2228	1601	1909
Harvesting & threshing (machine charges)	0	0	0	0	0
Interest on working capital	3382	3369	2728	2141	2636
1. Total operational costs (TC)	54735	52037	42943	34003	41414
Yield (quintals)	25.5	25.7	23.0	23.7	23.4
Price (Rs/quintal)	3775	4037	4091	4131	4088
2. Value of main-product	96263	103751	94092	97893	95838
3. Value of by-product	0	50	0	51	31
Net income (2+3) – (1)	41527	51764	51149	63941	54455
Cost of production (TC/q)	2146	2025	1867	1435	1766
Total cost of cultivation (TC/ha)	54735	52037	42943	34003	41414

Source: Field survey

4.9 Yield Risks and Price 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 11). The variability in price 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, more acreage variability of cotton is quite understandable.

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 difference was higher for groundnut (11 quintal) than that of cotton (10 quintal). However, the average price gap per quintal of production was higher for cotton (Rs 1188) than that of groundnut (Rs 768). This was mainly because of higher price expectation by the prospective cotton growers in the state in the corresponding year.

Table 11: Profitability vis-à-vis Risks in Oilseeds Production

(Coefficient of Variation in per cent)

Indicators	Marginal	Small	Medium	Large	All Farms
Main 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

4.10 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 ha and the average experimental yield of the main crop was 29.7 quintal per ha (Table 12). However, the average actual yield of the crop was found to be only 15.5 quintal per ha. 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, i.e., 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 the largest. Thus the prevailing level of yield gap is considerably high in the study regions.

Table 12: 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} x 100

Source: Field survey

Surprisingly, the feasibility of technology was 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 presented in Table 13 reveals that, there was huge gap found in fertilizer dose applied, weeding, disease management, control of pesticides and insecticides. Less gaps were found in terms of crop variety used, seed rate and harvesting methods.

Table 13: Technology Gap (TG) in Groundnut Cultivation Prevailing at Farmers' Level

Sr. No.	Parameter	Farmers' practices	Recommended technology	Gap analysis
1	Varieties	GG-20, GG-37, GG-13, Deshi	GG-2, GG-10, GG-11, GG-20, GG-37, GG-13	Variety gap is almost nil
2	Land preparation	2-3 ploughing before days of sowing	1 and 2 ploughing, followed by 2 or 3 harrowing	Gap is about 20 per cent.
3	Seed rate	131 kg/ha	110-125 kg/ha	Gap is low
4	Fertilizers dose	1. 115 kg/ha DAP; 2. FYM: 1.1 tonnes per ha; 3. Liquid S: 1 litre/bigha in 225 litre water; 4. Ammonium sulphate: 10 kg/bigha;	N: 12.5-25, P2O5: 40-50, K2O:0 kg/ha; DAP: 56 kg/ha	Over dose of fertelizer
5	Weeding	Hand picking or khurpi for removal of weed	Application of herbicide along with one or two interculture operation	High level of gap exists.
6	Disease Management	Used chemical fungicide for root rot, collar rot, tikka disease	Deep poughing (8-10 inches) seed treatment with carbendazin 0.1 @ 2g/kg seed, formulations of Trichderma harzianum or T. viridi @ 4-10 g/kg seed before sowing, application of neem or casor cake @ 250-500 kg/ha at the time of sowing	50 per cent gap with reference to recommended technology
7	Insect-pest	Thrips, jassids, aphid manage by chemicla insecticides	Cowpea as trap crop reduces aphid and jassids infestation, application of malathion 0.05 or dimethoate (0.03%) or phosphamidon (0.03%) or methyl-odemeton (0.03%) or quinalphos (0.05%) or monocrotophos (0.04%). Use of predator	50 per cent gap with reference to recommended technology
8	Harvesting	10 September -10 October	10 September -10 October	No gap
9	Yield	1590 kg/ha; widely varied from as low as 590 kg/ha in Rajkot to as high as 2358 kg/ha in Junagadh	Research station yield =2970 kg/ha, Potential yield = 3170 kg/ha	Wide gaps are observed.

Source:Jha, et al. (2012); Field survey (2012)

4.11 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 was observed that about 96.8 per cent of the sample farmers with 90.1 per cent of total area under oilseeds had used HYV seeds for getting better yield (Table 14). The major source of seeds was market. Only 15.6 per cent of sample farmers used own seed while 96.8 per cent farmers, had purchased the seeds from the nearby markets.

Table 14: Access to Improved Technology and Markets

(% households agreed)

	Marginal	Small	Medium	Large	All Farms
Use of HYV					
Yes	100.0	90.9	98.9	98.8	96.8
No	0.0	9.1	1.1	1.2	3.2
Area under HYV (% to total area under oilseeds)	96.7	87.2	91.2	89.9	90.1
Source of seed					
Own	0.0	13.6	13.8	22.0	15.6
Market purchased	100.0	90.9	98.9	98.8	96.8
Use of recommended doses of fertilizers					
Yes	100.0	86.4	75.9	53.7	72.8
No	0.0	0.0	11.5	30.5	14.0
Don't know	0.0	13.6	12.6	15.9	13.2
Awareness about MSP					
Yes	100.0	86.4	86.2	78.0	84.4
No	0.0	13.6	13.8	22.0	15.6
MSP for 2011-12 (Rs/q)	2700	2700	2700	2700	2700
Price realization					
≥MSP	93.3	98.5	93.1	98.8	96.4
<MSP	6.7	1.5	6.9	1.2	3.6
Marketing problems					
Yes	73.3	48.5	56.3	51.2	52.8
No	26.7	51.5	43.7	48.8	47.2

Source: Field survey.

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 the sample farmers have received the price of groundnut which was higher than the prevailing MSP. It was found that the majority of farmers (72.8%) used more than recommended doses of fertilizers and pesticides. About 52.8 per cent of sample farmers stated that they faced marketing problems for selling groundnut.

4.12 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 yard (*mandi*) (Table 15). Since the distance from APMC market ward was considerably high and 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. The average price received by the sample farmers from the commission agent was the lowest of Rs 3175 per quintal. The average price of groundnut 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.

Table 15 : Sale Pattern of Major Oilseeds (Groundnut)

Particulars	Marginal	Small	Medium	Large	All Farms
Agency to whom sold (% share)					
Local village trader	80.0	65.2	65.5	62.2	65.2
Processing mill	0.0	16.7	20.7	18.3	16.0
Government agency	13.3	4.5	1.1	7.3	4.8
Commission agent	13.3	9.0	13.8	11.0	11.2
Private company (contract arrangement)	0.0	1.5	2.3	1.2	1.6
Others	0.0	1.5	0.0	0.0	0.4
Price received (Rs/q)					
Local village trader	3404	3616	3544	3569	3560
Processing mill	0	3809	3886	3637	3771
Government agency (NAFED)	3250	3250	3250	3250	3250
Commission agent	3000	3125	3252	3123	3175
Private company (contract arrangement)	0	4250	3875	3750	3938
Others	0	4750	0	0	4750
Average distance to sale point (km)	2.0	4.6	5.5	7.0	5.6

Source: Field survey

The sale of main competing crop (cotton) of sample farmers exhibited slightly different pattern. Here the local village traders purchased slightly less output from the sample farmers whereas 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 (Table 16). 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.

Table 16: Sale Pattern of Cotton (Main Competing Crop)

Particulars	*Marginal*	*Small*	*Medium*	*Large*	*All Farms*
No. of cotton cultivators	*2*	*25*	*47*	*50*	*124*
Agency to whom sold (% share)					
Local village trader	100.0	60.0	36.2	34.0	41.1
Processing mill	0.0	8.0	29.8	34.0	26.6
Government agency	0.0	12.0	14.9	12.0	12.9
Commission agent	0.0	16.0	17.0	20.0	17.7
Private company (contract arrangement)	0.0	8.0	0.0	0.0	1.6
Others	0.0	4.0	0.0	0.0	0.8
Price Received (Rs/q)					
Local village trader	3775	3985	4029	4204	4065
Processing mill	0	4200	4014	4025	4031
Government agency (CCI)	0	4000	4214	4375	4234
Commission agent	0	4188	4072	4038	4150
Private company (contract arrangement)	0	0	3975	0	3975
Others	0	4000	0	0	4000
Average distance to sale point (km)	0.0	4.0	11.0	11.0	9.4

Source: Field survey

The average distance travelled by the farmers to sell their produce was 5.6 km for groundnut and 9.4 km for cotton. The average distance travelled was lowest for the marginal farmers (2.0 km for groundnut sale) since most of them had sold their output to the local village traders.

4.13 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 a 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.

4.14 Determinants of Oilseed Production and Acreage Allocation

The relative contribution and significance of the major factors (such as area under the crop, seed cost, fertilizer cost, pesticide/insecticide cost, human labour cost, bullock labour cost, machine charges and irrigation charges) to change in yield of major oilseed and competing crop grown by the sample farmers was analyzed with the help of a log-linear regression model. Only the area under groundnut,size of land holding, irrigation charges and fertiliser and manure cost were found to significantly affect the groundnut yield (Table 17).

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. Among various inputs, only the seed cost is found to significantly but negatively

influence the cotton productivity. The farmers have applied more seeds than the recommended doses of seeds in order to generate more output. However. It has resulted in decrease in cotton productivity.

Table 17: Description and Results of Estimation of Production Functions (Groundnut and Cotton)

Variables	Description	Main oilseed (groundnut)				Main competing crop (cotton)			
		Coefficient		t-value	p-value	Coefficient		t-value	p-value
AR	Area under crop (Ha)	-0.405	***	-5.058	0.000	0.091		1.297	0.197
LS	Size of land holdings (Ha)	0.478	***	-2.870	0.004	-0.057		-0.738	0.462
SC	Seed cost (Rs)	0.125		3.348	0.001	-0.150	***	-2.711	0.008
FC	Fertiliser and manure cost (Rs)	0.299	**	0.668	0.505	0.008		0.249	0.804
PC	Insecticides/pesticides cost (Rs)	0.063		2.134	0.034	0.008		0.590	0.556
HL	Total human labour cost (Rs)	0.791	***	1.361	0.175	0.087		0.874	0.384
ML	Total machine labour cost (Rs)	0.022		5.354	0.000	0.005		0.247	0.805
BL	Total bullock labour cost (Rs)	0.018		0.714	0.476	-0.005		-0.528	0.599
IC	Irrigation charges (Rs/Ha)	0.072	**	0.812	0.418	0.028	*	2.685	0.008
A (Constant)		-9.955	***	3.561	0.000	3.182	***	0.954	3.334
Dependant Variable (Y)		Groundnut yield				Cotton yield			
R^2		0.427				0.141			
F observed		16.143				2.074			
No. of observations 'N'		250				124			

Note: * 10% level of significance, **5% level of significance, ***1% level of significance

Source: Computed from field survey data

As far as the acreage allocation between the main oilseed crop (groundnut) and competing crop (cotton) 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 (Table 18). 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 oilseed.

Table 18: Description and Results of Estimation of Short-Run Area Response Function for Groundnut

Variables	Description	Main oilseed (Groundnut)			
		Coefficient		t-value	p-value
LSt	Size of land holdings (Ha)	0.2059	***	3.907	0.000
At-1	Lagged area of groundnut (Ha)	0.8115	***	18.936	0.000
Yt-1	Lagged yield of groundnut (Qtl/Ha)	-0.03		-1.223	0.222
Pt-1	Lagged price of groundnut (Rs/Qtl.)	0.0193		0.213	0.831
ACt-1	Lagged area of cotton (Ha)	0.0031		0.097	0.923
YCt-1	Lagged yield of cotton (Qtl/Ha)	-0.059	*	-1.664	0.097
PCt-1	Lagged price of cotton (Rs/Qtl.)	0.0055		0.398	0.691
A (Constant)		-0.185		-1.583	0.115
Dependant Variable (Y)		Current area under groundnut (At)			
R^2		0.9328			
F observed		479.67			
No. of observations 'N'		250			

Note: * 10% level of significance, **5% level of significance, ***1% level of significance
Source: Computed from field survey data

4.15 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 constraints faced by the sample farmers (Table 19). These factors have affected all farmers irrespective of their categories or land holding sizes. The incidence of diseases and pests and weed infestation have 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 19: Major Constraints in Cultivation of Oilseed Crops

(Composite index value*)

Major Constraints	Marginal	Small	Medium	Large	All Farms
Technological factors					
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 factors					
High-input cost (diesel, fertilizers, agrochemicals)	3.29	3.43	3.24	3.35	3.33
Shortage of human labor	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

Table 19 Continued…..

Major Constraints	Marginal	Small	Medium	Large	All Farms
Institutional factors					
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 has been 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

4.16 Farmers' Suggestions for Improving Production and Productivity of Oilseeds

The larger proportion of the sample farmers suggested 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 oilseeds 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.

5. Conclusions and Policy Implications

Oilseeds production contributes significantly to agricultural prosperity in the state. Though the growth in area under major oilseeds has been more or less stagnated, the growth in production and yield of major oilseeds has been quite impressive. The yield effect was found to play a dominant role in increasing oilseeds production in the state. However, there are number of challenges facing the oilseed sector in the state. The constraints faced and suggestions made by the sample oilseeds farmers have been highlighted in the preceding section that specifically covered the issues related to the required provisions and facilities to be created by the government to lessen the difficulties of the

oilseeds growers and to encourage them 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 in area under oilseeds and to increase the production and productivity of oilseeds in the state.

5.1 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 observed that the yield effect contributed 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 satisfactorily in the state so far because of enormous pressure on land use for other agricultural and industrial activities. Though the scope of expansion of area under oilseeds in recent years looks gloomy, emphasizing irrigation expansion, more efficient use of irrigation water, checking input prices at reasonable level and offering better marketing facilities would help in further increase in area under the oilseeds in the state.

The district level analysis reveals that 7 out of 26 districts (Junagadh, Jamnagar, Rajkot, Amreli, Bhavanagar, Porbandar and Kutch) accounted for about 91.3 per cent of total oilseeds area of the state. So, there is possibility of increasing the area under oilseeds in other districts with very thin area under these crops. The oilseeds area can also be increased in the districts with low area but high productivity. 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 1607 kg/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.

5.2 Scope for Enhancing Oilseeds Productivity in the State

Major avenue for increase in oilseed production in the State is expected to come through increase in yield levels of these crops. The possibility in productivity enhancement in oilseed crops is probably highest among any other group of crops in the state. The study found that there is a considerable yield gap in cultivation of selected oilseeds in the state. In the case of the 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 a 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 was 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 yield 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.

5.3 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 increase in yield level should be emphasized in some targeted regions of the state. As far as the area expansion in oilseed 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 by effective technology transfers. 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 further expansion of canal command area and to promote efficiency in water use through protective irrigation such as drip and sprinkler and other micro irrigation techniques

- Ensuring the timely availability of quality/certified seeds of improved varieties
- Providing incentives to promote balanced crop nutrition
- Popularizing the effective crop management techniques
- Encouraging farmers to adopt integrated pest and nutrient management
- Promoting farm mechanization in oilseed cultivation
- Supporting 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, expansion of irrigation from canal wherever possible with a focus on raising water use efficieny by promoting micro irrigation techniques, 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.

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