STATUS PAPER

OILSEED CROPS OF PAKISTAN

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Foreword

Oilseeds are important commodity crops for human diet after cereal and sugar crops in the country and is source of vegetable oil which provides 2.5 times more energy than protein and carbohydrates. It has some essential fatty acids and vitamins D and E needed for human body. Vegetable oil is considered better for health than ghee from animal source having zero cholesterol and higher percentage of mono & poly unsaturated fats.

Pakistan with the population of more than 180 million needs about 3 million tones vegetable oil for human consumption and 2.32 million tones vegetable oil of Rupees 207 billion was imported and 0.646 million tones was locally produced to meet the local requirements during 2012-13. There is great need to increase the local production of oilseed crops to meet country demand and to save foreign exchange and it will also generate the employment in the country.

The present situation of vegetable oilseed production, import, total consumption and per capita consumption is documented in this manuscript **"Status of Oilseed Crops in Pakistan"** It also includes the country situation of different oilseed crops viz rapeseed-mustard, canola, sunflower, groundnut, sesame, soybean, safflower and castor bean. The author also described the way forward to increase the local production and improve the present situation utilizing the indigenous resources. I hope this manuscript will be a good source of information regarding oilseed situation in Pakistan.

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OILSEED CROPS OF PAKISTAN

1. INTRODUCTION

In Pakistan, area under major crops is situated in Indus basin. There are some established cropping systems based on farm major crops i.e. wheat, rice, cotton and sugarcane. Among these wheat is a rabi crop and rice, cotton and sugarcane are kharif crops. Harvesting of kharif crops generally delay wheat planting resulting in low yield. Oilseed crops like rapeseed-mustard (rabi crops) and sunflower (spring crop or late rabi crop) fit in to these cropping system. Safflower is a drought tolerent rabi crop. The groundnut crop is a special kharif crop planted earlier (March-April) and harvested in October-November. Whereas sesame and soybean are kharif crops planted in July and harvested in October. Based on these facts oilseed crops have found some specific areas for cultivation. There is less established cropping system for oilseed crops in the country. However, some pockets for sunflower such as rice-sunflower-rice and cotton-sunflower-cotton are emerging. Currently, 591,500 ha of the total cropped area under oilseed crops.

Importance of Oilseed Crops

Edible oil is one of the important commodities of every day use. Pakistan has been constantly and chronically deficient in its production. About 70% of the domestic requirements are met through imports. Since early 1970s its import increased at the rate of 12.5% annually and the trend will further not only continue but will also get worsen with increase in population. However, efforts have been made to increase its local production. The area under oilseed crops during 1990-1991 was 514.300 ha with the production of 400360 tones, which was 596046 ha producing 576,670 tones in 2012-13. The area under cotton during 1990-91 was 2662200 ha with the production of 3274000 tones which was 2891900 ha producing 3393000 tones in 2012-13. Sunflower, Rapeseed-mustard and Canola with high oil yield per unit area have emerged as major oilseed crops and with the potential to narrow down the gap between production and consumption of edible oil.

Table 1. Share of domestic production and import in total availability of edible oil in Pakistan.

Year	Domestic production (000' t)	Import (000' t)	Total availability (000' t)	Import as % of total availability	Value (Rs Billion)
2000-01	642	1144	1786	64	19.04
2001-02	497	1197	1694	65	24.03
2002-03	475	1293	1756	66	34.29
2003-04	494	1361	1855	67	37.91
2004-05	583	1605	2093	66	44.98
2005-06	510	1696	2205	69	44.21
2006-07	565	1787	2289	78	59.51
2007-08	588	2700	3288	82	136.8
2008-09	565	2347	2912	81	138.4
2009-10	560	1878	3319	83	154.7
2010-11	696	2176	2490	81	187.15
2011-12	636	2283	2103	70	225.69
2012-13	646	2322	2968	78	207.66

Source: Agricultural Statistics of Pakistan, 20012-13

Domestic production of edible oil during 2000-01 was 0.642 million tons which was decreased to 0.475 million tons, gradually increasing and now reached to 0.646 million tons during 2012-13 due to canola and sunflower plantation on a considerable area.

Share of Major Oilseed Crops

In Pakistan mainly two types of oilseed crops are grown i.e., traditional (rapeseed-mustard, groundnut, sesame and linseed) and non-traditional (sunflower, safflower, soybean). The area under these crops remained almost stagnant with minor fluctuations except sunflower, rapeseed and mustard (especially canola) and sesame which showed a considerable increase in area, production and yield per unit area during the last 12 years. During 2012-13, traditional and non-traditional oilseed crops were grown on 58% and 42% respectively of the total oilseed area (Table-2).

In domestic production, major share comes from cottonseed contributing 63% of local production. Sunflower contributes 16%, rapeseed-mustard (13%) and canola contributes 2%. Sunflower, rapeseed-mustard and canola are the potential crops, which can fulfill some requirements of edible oil in the country (Table-3).

Table 2. Area, production and yield of different oilseed crops during 2012-13

Crop	Area (000 ha)	Production (000 tons)	Yield (kg/ha)
Sunflower	196.1	243.1	1239
Rapeseeds-mustard	238.9	220.3	922
Groundnut	81.7	81.3	995
Sesame	70.9	29.1	418
Linseed	3.69	2.62	710
Soybean	0.10	0.10	1000
Safflower	0.10	0.10	1000
Castor seed	3.39	3.38	996

Source: Agricultural Statistics of Pakistan, 2012-13.

Table 3. Share of major oilseed crops in local edible oil production

	2012-13			
	Area	Production		
Crop	(000 ha)	Seed (000 tons)	Oil (000 tons)	% Share
Cotton seed	2891.9	3393	407	63
Sunflower	196.1	243.1	97.24	16
Rapeseed/Mustard	238.9	220.3	77.10	13
Canola	12	18	11	2
Total	**3338.9**	**3874.4**	**592.34**	**100**

Source: Agricultural Statistics of Pakistan, 2012-13

Yield Potential of Oilseed Crops

Big gaps exist between potential yield and national average yield of various oilseed crops. About 69% of the yield potential has not yet been achieved in sunflower, 74% in rapeseed-mustard, 75% in groundnut, 65% in sesame and 72% in linseed (Table 4). However, the progressive farmers are already achieving more than 70% of the yield potential indicating that there is a large scope for vertical increase in oilseed production through the use of proper crop management practices.

Table 4. Yield potential and yield gap of different oilseed crops.

Crop	Yield potential (kg/ha)	*Average yield (kg/ha)	Yield gap (kg/ha)	Unachieved potential (%)
Sunflower	4000	1239	2761	69
Rapeseed-mustard	3500	922	2578	74
Groundnut	4000	995	3005	75
Sesame	1200	418	782	65
Linseed	2500	710	1790	72

Source: *Agricultural Statistics of Pakistan, 2012-13.

2. TRENDS IN AREA, PRODUCTION AND YIELD OF OILSEED CROPS

In Pakistan area, production and yield of various oilseed crops is presented in Tables 5-12. Total area under oilseed crops is stagnant with minor fluctuations during the last thirteen years. A number of factors are involved in these fluctuations. The most important has been the marketing and support price to the farmers. Being minor crops, the oilseed crops do not get policy support, ensured support prices and effective marketing in the country. The result is that the total area under oilseed crops is stagnant for the last three decades. In fact the area of some crops have decreased while some of them have almost been non-existent.

i. Rapeseed and Mustard

Rapeseed and mustard are important species grown as oilseed crops in Pakistan. These species are rich source of oil and contains 40-46% good quality oil. In addition, its meal has 38-40% protein which has a complete profile of amino acids including lysine, methionine and cystine. The oil from canola quality rapeseed varieties is superior for human consumption and meal is an excellent feed for animals and birds especially poultry. Thus the development of canola quality rapeseed will enhance the use of rapeseed oil for edible purpose and meal for animal and poultry feeding. Among oilseed crops, canola has considerably contributed in the local production of edible oil due to its high varietal potential and increase in area. However, there is a great potential to increase the area under the canola

crop in river belts, Silaba and Khushkaba areas and planting as intercropping with sugarcane. Moreover, adjustment of this crop in different cropping patterns will also help increasing areas and oilseed productivity. During 2012-13, rapeseed and mustard were grown on an area of 238,861 hectares, production of 220,318 tones with average yield of 922 kg/ha. Its has shown 10.8% and 23% increase in area and production as compared to last year and 11% average increase in yield.

Constraints to increased production are:

- Use of marginal lands.
- Use of low quality seed.
- Use of unbalance fertilize
- Damage by aphids
- Competition with other winter crops such as wheat, chickpea, lentil and winter forages.
- High level of erucic acid and glucosinolates
- Lack of specific seed drill and harvesting machines.

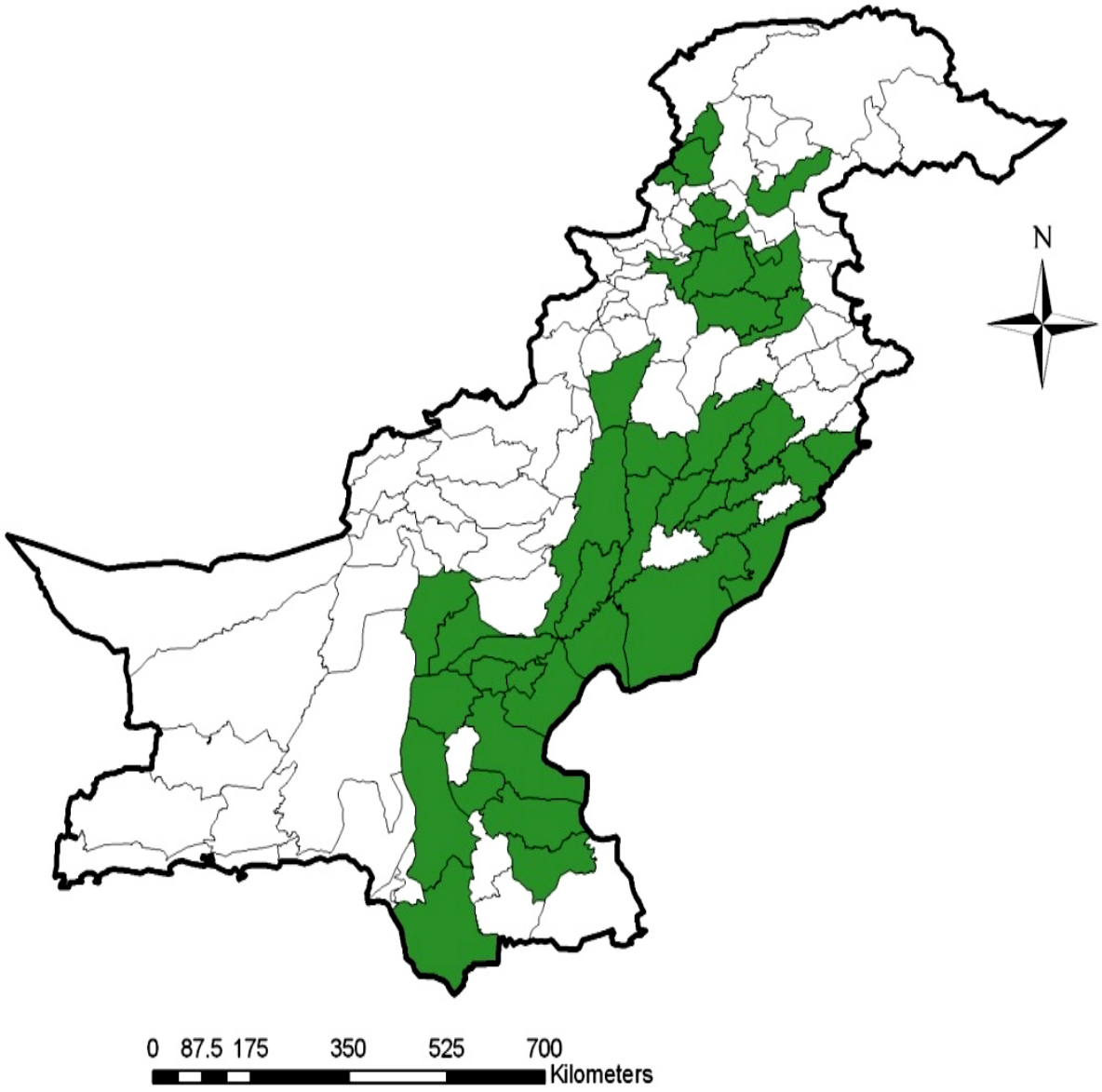
Table 5. Area, production and yield of rapeseed and mustard in Pakistan.

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area'000'hectares)					
2000-01	128.9	74.2	24.3	44.7	272.1
2001-02	134.9	76.1	19.3	38.6	268.9
2002-03	150.8	71.7	19.9	38.2	280.6
2003-04	157.2	67.4	20.7	34.5	279.8
2004-05	158.3	53.1	21.6	24.2	257.2
2005-06	127.6	49.9	18.9	30.9	227.3
2006-07	135.6	70.4	19.6	40.2	265.8
2007-08	127.4	49.1	16.4	35.0	227.9
2008-09	142.8	47.6	17.7	36.8	244.9
2009-10	111.5	40.7	15.3	22.8	190.3
2010-11	135.6	47.3	17.1	16.5	216.5
2011-12	132.6	45.9	16.7	20.2	215.4
2012-13	152.8	49.1	18.8	18.1	238.8
(Production '000' tonnes)					
2000-01	127.6	59.4	15.4	28.2	230.6
2001-02	130.5	58.8	8.5	23.5	221.3
2002-03	146.1	57.6	8.9	22.4	235.0
2003-04	151.3	57.3	9.0	20.6	238.2
2004-05	142.5	47.6	10.2	15.5	215.8
2005-06	108.6	44.7	8.6	18.9	180.8
2006-07	120.2	70.1	9.4	21.3	221.0
2007-08	103.6	50.3	7.6	18.5	180.0
2008-09	120.5	51.1	7.4	19.9	198.9
2009-10	96.3	46.5	7.3	12.1	162.2
2010-11	124.5	50.2	7.9	12.4	191.9
2011-12	109.8	49.3	7.3	12.5	178.9
2012-13	148.2	52.6	8.5	11.0	220.3
Note:- Figures in parenthesis are of canola					
(Yield in Kgs per hectare)					
2000-01	990	799	579	599	836
2001-02	967	773	435	609	823
2002-03	969	803	447	586	837
2003-04	962	850	435	597	851
2004-05	900	896	472	640	839
2005-06	851	896	455	612	795
2006-07	886	996	480	530	831
2007-08	817	1031	463	540	793
2008-09	844	1073	418	541	812
2009-10	864	1151	477	531	852
2010-11	918	1061	450	812	886
2011-12	828	1074	437	619	830
2012-13	969	1071	451	606	922

Source: Agricultural Statistics of Pakistan 2012-13

RAPESEED & MUSTARD CULTIVATION AREAS IN PAKISTAN

Punjab	Attock, Rawalpindi , Islamabad, Jhelum, Chakwal, Faisalabad , T.T.Singh , Jhang, Kasur, Okara, Sahiwal, Multan, Khanewal, Vehari, Muzfargarh, Layya, D.G. Khan, Rajanpur, Bahawalpur, Rahimyar. Khan, Bahawalnagar
Sindh	Khairpur, Ghotki, Sukkur, NaushehroFeroze, Nawabshah, Jacobabad, Kashmor, Shikarpur, Larkana, KamberShahdadKot, Sanghar, Mirpurkhas, Umerkot, Dadu, Jamshoro, Thatta.
KPK	Nowshera, Mardan, Swabi, Mansehra, Dir, Swat, Bajour, D.I.Khan, Kohat
Balochistan	Nasirabad, Jaferabad, DeraMuradJamali, JhalMagsi



PRODUCTION TECHNOLOGY OF RAPESEED AND MUSTARD

Soil: All soil types suitable except water logged and acidic soils

Seedbed Preparation: 2 – 3 ploughings with planking

Planting time:

North Punjab	=	1st October to 31st October
South Punjab	=	15th October to 15th November
KPK	=	Mid September to Mid October
Sindh	=	Mid October to Mid November
Balochistan	=	Mid October to Mid November

Seed Rate:

Line sowing	=	4-5 kg/ha
Broadcast	=	5-6 kg/ha

Method of Planting:

Row to row distance	=	30-45 cm
Plant to plant distance	=	4-5 cm
Seed depth	=	2-3 cm

Fertilizer:

Nitrogen	=	90 kg/ha
Phosphorus (P_2O_5)	=	60 kg/ha
Potash	=	50 kg/ha

Irrigations: 3-4 irrigations (depending upon rains)
1st irrigation 30-45 days after germination
2nd irrigation at bud formation stage
3rd at the flowering stage
4th at pod/seed development stage

Weeding: One hoeing manually or by tractor

Aphid Control:

Spray Tallstar	@ 1000 ml/ha
Prymore	@ 750 ml /ha

Harvesting: Matures in 160-190 days, harvest when 30-40% seeds matures and turn brown /yellow

Threshing: Sundry for 8-10 days and then thresh

Drying & Storage: Dry seed upto 8-10% moisture level and store at dry places

Potential Areas:

Punjab	=	Attock, Rawalpindi, Jhelum, Sargodha, Faisalabad, Kasur,Sahiwal Sialkot, Muzaffar Garh, Bahawalpur, Bahawalnagar,R.Y.Khan
Sindh	=	Khairpur, Sukhar, Larkana, Jacobabad, Nawab Shah, Sanghar,
KPK	=	Mardan, Dir Swat, D.I. Khan and Bajor Agency.
Balochistan	=	Nasirabad, Jafarabad, Jhal Magsi, Dera Murad Jamal

Table 5 A. Area, production and yield of canola in Pakistan.

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area'000'hectares)					
2005-06	2.4	3.6	1.1	3.6	10.7
2006-07	2.8	2.7	1.0	3.4	9.90
2007-08	3.6	2.3	1.1	3.3	10.3
2008-09	5.5	2.2	1.0	3.0	11.7
2009-10	5.7	1.9	1.0	4.0	12.6
2010-11	9.6	3.8	0.3	3.5	17.2
2011-12	8.7	2.1	0.5	3.4	14.7
(Production '000' tonnes)					
2005-06	2.3	3.8	0.7	2.4	9.2
2006-07	2.9	3.1	0.5	2.2	8.7
2007-08	3.4	2.7	0.5	2.2	8.8
2008-09	6.1	2.6	0.5	2.0	11.2
2009-10	6.4	2.4	0.4	2.4	11.6
2010-11	11.9	4.2	0.2	2.3	18.6
2011-12	11.9	2.6	0.2	2.3	17.0
Note:- Figures in parenthesis are of canola					
(Yield in Kgs per hectare)					
2005-06	958	1056	636	667	859
2006-07	1035	1148	500	647	878
2007-08	944	1173	454	667	854
2008-09	1109	1181	500	667	957
2009-10	1122	1263	400	600	920
2010-11	1239	1105	667	657	1081
2011-12	1367	1238	400	676	1156

Source: Agricultural Statistics of Pakistan 2011-12
Note: Canola Crop Estimates were Included in Rapeseed and Mustard Crop Estimates before 2005-6

ii. Sunflower

Sunflower (*Helliantus annuus* L.) is a potential oilseed crop in the country. But during its history of four decades, the area and production remained almost stagnant during the first decade and started increasing with a lot of fluctuations during 2nd and 3rd decades of its cultivation. However, due to its potential for contributing towards edible oil, the area had been increasing continuously since 2000-01 to 2007-08 (397 thousand ha.). However after that there was declining trend in area and production in the coming years. (table-6). Similarly its average yield has also increased considerably with fluctuations due to use of sub-optimal inputs, poor quality seed, cultivation on marginal lands, unfavorable climatic conditions, etc. Presently sunflower has become the most important oil crop. Its contribution reached to 16 % in domestic edible oil production. About 7.14 million acres are under cotton cultivation. About 20% of this area can be utilized for sunflower cultivation after the late cotton picking. This will not only give high return to the farmers but also allow timely sowing of cotton in the next season. For this propose, Multan, DG Khan, Vehari, Mailsi, Lodhran and Bahawalpur will be main areas of focus in Punjab. However, in Sindh, limited areas in Hyderabad division and Mipurkhas shall also be utilized for this purpose.

Rice-sunflower-rice rotation is another way to expand area under sunflower. After rice harvesting about 5.50 million acres are available and about 20% of this area can be utilized for sunflower cultivation. Area in Sialkot, Gujranwala, Naroewal, Sheikupura, Qasoor and Okra will be focal point for this intervention. Similarly limited area in Larkana and Hyderabad division in Sindh will also be utilized for this purpose.

Potato growing areas have also good potential for sunflower. Potato is harvested in December and January. About 271,000 acres area is available after potato for sunflower cultivation. However, in Punjab more than 150,000 acres can be utilized fully for sunflower cultivation. Among oilseed crops, sunflower has considerably contributed in the local production of edible oil due to its high varietal potential and increase in area. However, there is a great potential to increase the area under the sunflower crop in river belts, Silaba and Khushkaba areas and planting as intercropping with sugarcane. Moreover, adjustment of this crop in different cropping patterns will also help increasing areas and oilseed productivity.

Research and development constraints to increased production are:

- Non-availability of quality seed to small farmers.
- High cost of imported seed.
- Lack of awareness about the crop and its production technology.
- Defective and inefficient marketing/procurement system.
- Non availability farm machinery to small farmers.

Table 6. Area, production and yield of sunflower in Pakistan

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area in 000 hectares)					
2000-01	18.267	37.371	2.814	0.546	58.998
2001-02	21.439	38.530	0.613	2.663	63.245
2002-03	37.290	63.909	0.364	6.154	107.717
2003-04	84.108	171.305	0.089	0.177	255.679
2004-05	56.905	206.386	0.178	0.536	264.005
2005-06	75.054	248.979	0.472	0.577	325.082
2006-07	90.454	231.660	0.349	0.604	323.067
2007-08	152.089	243.973	0.524	0.720	397.306
2008-09	64.813	253.713	0.527	0.690	319.743
2009-10	34.112	220.963	0.559	0.487	256.121
2010-11	32.539	266.964	0.503	0.608	300.614
2011-12	46.238	188.663	0.494	0.606	236.001
2012-13	51.700	143.600	0.265	0.506	196.102
(Production in 000 tonnes)					
2000-01	24.920	39.737	3.394	0.595	68.646
2001-02	28.877	40.827	1.335	2.923	73.962
2002-03	54.885	66.272	0.666	6.708	128.531
2003-04	122.490	235.683	0.171	0.188	358.532
2004-05	86.356	240.516	0.241	0.537	327.650
2005-06	122.840	224.198	0.654	0.583	348.275
2006-07	156.258	249.775	0.579	0.612	407.224
2007-08	324.973	277.326	0.794	0.801	603.894
2008-09	130.510	288.393	0.812	7.072	420.487
2009-10	65.050	259.200	0.899	0.329	325.478
2010-11	61.253	341.641	0.803	0.694	404.391
2011-12	94.052	187.379	0.775	0.717	282.923
2012-13	92.24	150.14	0.377	0.624	243.81
(Yield in kgs per hectare)					
2000-01	1364	1063	1206	1090	1164
2001-02	1347	1060	2178	1098	1169
2002-03	1472	1037	1830	1090	1193
2003-04	1456	1376	1921	1062	1402
2004-05	1518	1165	1354	1002	1241
2005-06	1637	900	1386	1010	1071
2006-07	1727	1078	1659	1013	1260
2007-08	2137	1137	1515	1113	1520
2008-09	2014	1137	1541	1119	1315
2009-10	1907	1173	1608	676	1271
2010-11	1882	1280	1596	1141	1345
2011-12	2034	993	1568	1183	1198
2012-13	560	956	67	822	1239

Source: Agricultural Statistics of Pakistan, 2012-13

iii. Groundnut

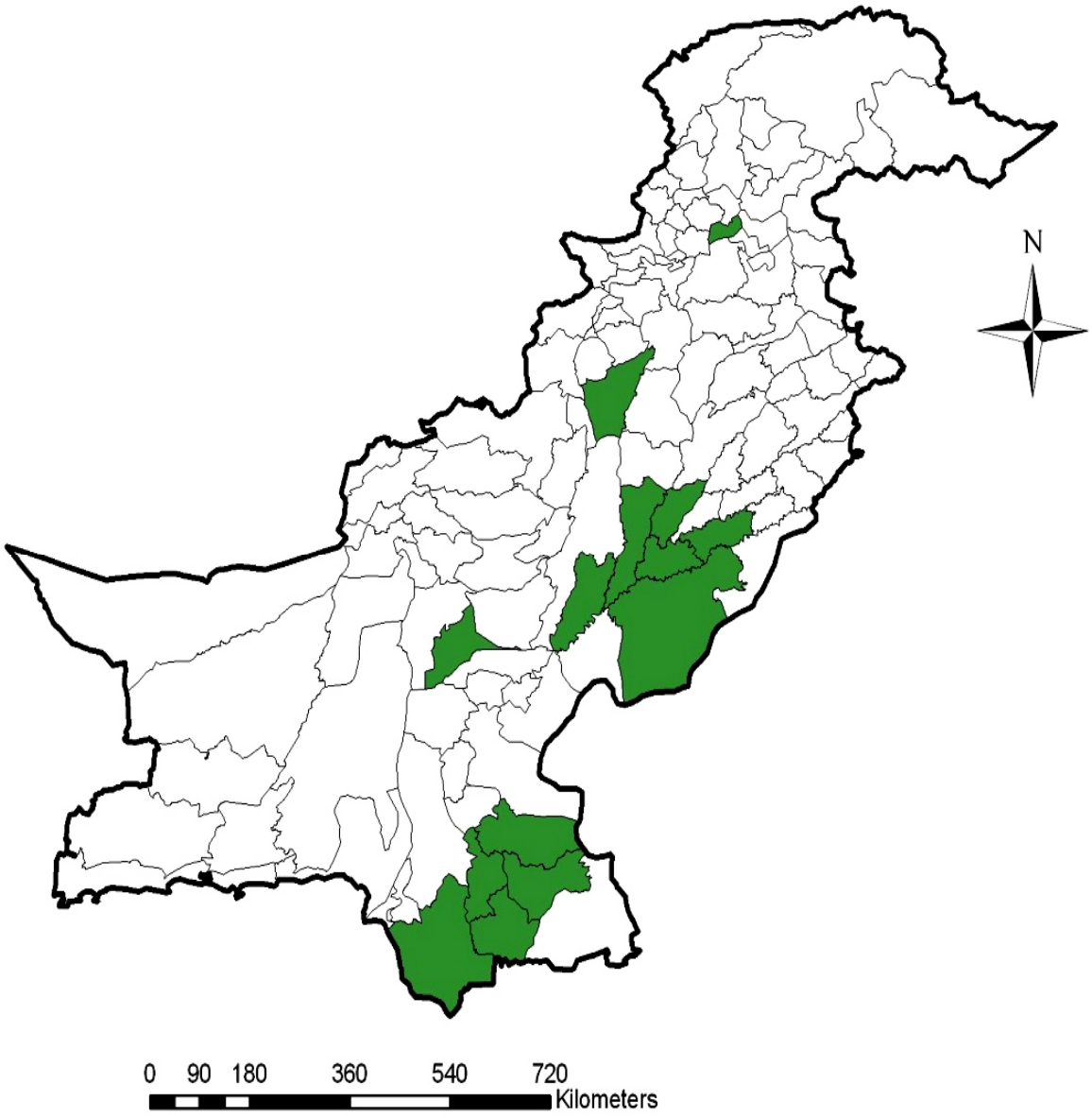
Groundnut (*Arachis hypogaea* L) is one of the world's fifteen leading food crops and cultivated throughout the world. It is a cash crop and has an importance in our existing agricultural cropping pattern of rainfed areas. It is a drought tolerant and good for crop rotation in rainfed areas. Because of leguminous crop it fixes atmospheric nitrogen and maintains soil productiveness. It was grown on an area of 81.7 thousands hectares with annual production of 81.3 thousands tones and average per hectare dry pods yield 995 kg/ha during the year 2012-13.It showed 8% increase in average yield/ha as compared last year. Groundnut is energy rich crop and it contains 25 to 30% protein, 5 to 15% carbohydrate and 50 to 55% oil. With high yielding varieties and improved agronomic practices, the production can be increased easily which can cover the gap between demand and supply.

Constrains for increased production are:

- Non-availability of high yielding and short duration varieties.
- Non-availability of quality seed of approved varieties and Use of low seed rate by farmers.
- Use of low seed rate by farmers, Damage by mammalian pests and High harvesting cost.

SUNFLOWER CULTIVATION AREAS IN PAKISTAN

Punjab	Multan, Vehari, Lodhran, Bahawalpur, MuzaffarGarh, Rajanpur, D.G.Khan.
Sindh	Badin, Thatha, Umarkot, MirpurKhas, Tando Muhammad Khan, Sanghar.
KPK	D.I. Khan, Swabi, Mardan.
Balochistan	Sibi,Nasirabad.



PRODUCTION TECHNOLOGY OF SUNFLOWER

Soil : Sandy clay soil (pH 6.5 to 7.5)

Seedbed preparation: One deep ploughing with mould board plough followed by cultivator and plank

Planting Time:

Punjab

Southern Punjab**:**	1st Feb-15th Feb
Central & Northern Punjab:	15th Feb-28th Feb

Sindh

Southern Sindh:	1st Dec-20th Feb
Northern Sindh:	15th Dec-20 Feb
Dobari Crop:	1st Nov-28th Feb

Baluchistan

Plain Areas (Naseer Abad Division)	15th Dec – 10th Feb
Hilly Areas (Quetta, Khuzdar, Noshki)	15th Mar – 20th June

Kyber Pakhtunkhwa

Plain Areas	15th Jan – 28th Feb
Hilly Areas	1st Mar-15th April

Seed Rate: 5-6 kg/ha

Method of planting: Row to row spacing = 75 cm
Plant to plant spacing = 25 cm.

Fertilizer:

Nitrogen	=	150 kg/ha (1/2 at planting + 1/2 at first irrigation)
Phosphorus	=	60 kg/ha
Potassium	=	60 kg/ha

Irrigations: 4-5 **Spring crop**
1st 25 days after germination
2nd 15 to 20 days after 1st irrigation
3rd At the time of head initiation
4th At the time of seed development
5th 10-15 days before harvest

Weed Control: Successful weed control should include a combination of cultural and chemical methods.

Harvesting: Harvest when the back of heads turn yellow and bracts brownish

Threshing: Dry for 4-5 days and thresh with thresher

Drying and Storage: For storage 9.5 % moisture is considered suitable.

Proposed crop rotations for sunflower:

Spring Crop (Irrigated areas)
Cotton-Sunflower-Cotton-Wheat
Rice-Sunflower-Rice-Wheat
Potato-Sunflower-Potato-Potato

Potential Areas:

Punjab	=	Multan, Sialkot, Rahim Yar Khan, Bahawalpur, Sahwal, Sheikhupura, Gujranwala, Kasur, Vehari, Sarghodha, Gujarat, D.G. Khan
Sindh	=	Thatta, Badin, Hyderabad, Dadu, Khairpur, Larkana
NWFP	=	Peshawar, Mardan, D.I. Khan
Balochistan	=	Sibi, Quetta, Qallat, Nasirabad, Lasbela

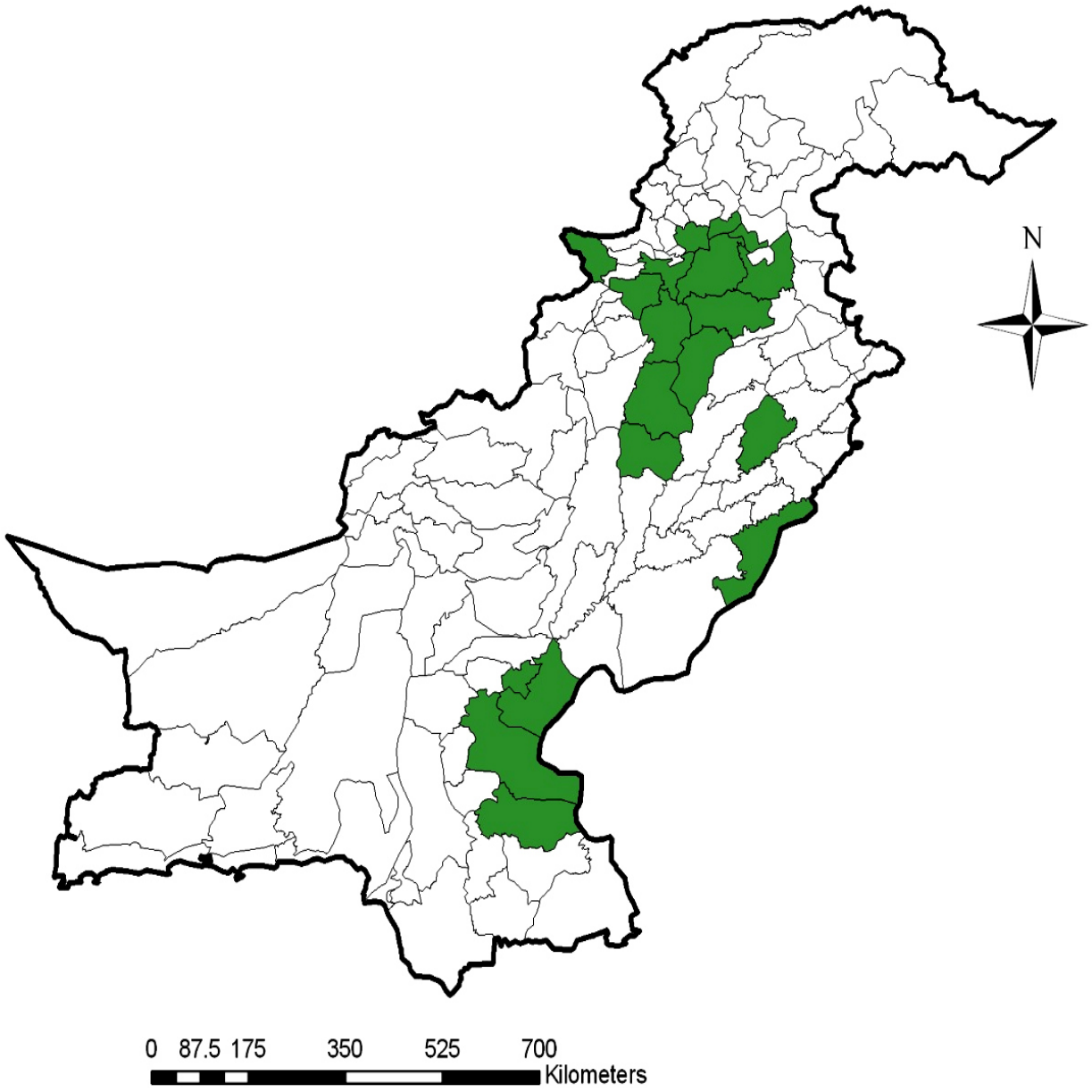
Table 7. Area, production and yield of groundnut in Pakistan

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area'000'hectares)					
2000-01	66.4	2.2	12.9	-	81.5
2001-02	86.1	1.9	11.4	-	99.4
2002-03	74.3	1.8	10.3	-	86.4
2003-04	89.7	3.6	9.1	-	102.4
2004-05	94.7	1.6	9.5	-	105.8
2005-06	81.8	2.2	9.7	-	93.7
2006-07	83.2	1.5	8.8	-	93.5
2007-08	85.2	2.1	7.6	-	94.9
2008-09	82.8	2.2	7.8	-	92.8
2009-10	78.1	2.2	7.1	-	87.4
2010-11	72.8	2.3	7.8	-	82.9
2011-12	87.8	0.1	7.7	-	95.6
2012-13					81.7
(Production '000' tonnes)					
2000-01	67.4	4.1	19.8	-	91.3
2001-02	80.0	3.7	17.3	-	101.0
2002-03	71.1	3.4	15.6	-	90.1
2003-04	94.3	6.5	13.9	-	114.7
2004-05	58.5	3.2	14.7	-	76.4
2005-06	49.9	4.6	14.6	-	69.1
2006-07	57.6	3.0	13.3	-	73.9
2007-08	67.4	4.5	11.5	-	83.4
2008-09	69.0	4.7	11.8	-	85.5
2009-10	38.6	4.8	9.8	-	53.2
2010-11	51.6	5.0	11.2	-	67.8
2011-12	77.4	0.1	10.4	-	87.9
2012-13					81.3
(Yield in Kgs per hectare)					
2000-01	1017	1864	1535	-	1121
2001-02	930	1955	1520	-	1017
2002-03	956	1907	1521	-	1042
2003-04	1051	1827	1525	-	1121
2004-05	618	2000	1547	-	722
2005-06	610	2091	1505	-	737
2006-07	692	2000	1511	-	790
2007-08	791	2143	1513	-	879
2008-09	833	2136	1513	-	921
2009-10	494	2182	1380	-	609
2010-11	709	2174	1436	-	818
2011-12	882	1000	1351	-	919
2012-13					995

Source: Agricultural Statistics of Pakistan, 2012-13

GROUNDNUT CULTIVATION AREAS IN PAKISTAN

Punjab Attock, Chakwal, Rawalpindi, Kushab, Mianwali, Bhakkar, Faisalabad, Layyah,Bawalnagar, Bahawalpur, Jhelum, Islamabad
KPK Noshera, Swabi, Kohat, Karak, Haripur, Kuram Agency
Sindh Khairpur, Ghotki, Sukkur, Sanghar



PRODUCTION TECHNOLOGY OF GROUNDNUT

Soil: Sandy clay loam soil.

Seedbed Preparation: 2 – 3 ploughings with planking

Planting Time:

Punjab (Irrigated)	=	1st March to 15th March
Punjab (Barani)	=	15th March to 15th April
Sindh	=	1th March to 15th March
KPK	=	15th March to 15st April
Balochistan	=	1st April to 30st April

Seed Rate:

Bunch type	=	100 kg/ha kernels
Spreading type	=	75 kg/ha kernels

Method of Planting:

Row x plant spacing	=	45 x 10 cm (Bunch types)
	=	60 x 10 cm (Spreading type)

Fertilizers:

Nitrogen	=	20 kg/ha
Phosphorus (P_2O_5)	=	80 kg/ha
Potassium (K)	=	100 kg/ha (in sandy soils)
Gypsum	=	500 kg/ha (apply at peg formation)

Weed Control:

Grasses and small	=	Stomp @ 2-3 l/ha
Seeded weeds	=	(pre-emergence)

Harvesting: When 75% of pods are mature, harvest the crop.
Delay in harvest will cause pod losses

Use of Machinery: Use available groundnut machines for planting, digging and threshing to decrease cost of production.

Storage: Dry the groundnut upto 10% moisture
Grading of pods for good market price
Put in clean jute bags and store in dry storage room

Potential Areas:

Punjab	=	Attock, Rawalpindi, Jhelum, Chakwal, Khushab, Mianwali
Sindh	=	Sanghar and Larkana
KPK	=	Mardan, Swabi, Kohat, Karak and Malakand Agency

iv. Sesame

Sesame (*Sesamum indicum* L.) is one of the important oilseed crops in Pakistan. It is mostly grown in both irrigated as well as rainfed areas. Due to variation in rainfall pattern, the yield is not stabilized and the farmers can not get sustained income. However, it is prized for its high quality oil besides high content of protein (22.0%). Its oil content ranges from 50-58%. Sesame oil is of drying type as oil of sunflower and maize. Iodine number varies from 100-120 that shows its better oil quality and shelf life. Sesame is grown in 65 districts of the country as rainfed as well as irrigated crop. Its total area and production during 2012-13 was 70.900 ha and 29.100 tonnes respectively with yield of 410 kg/ha. There is great scope for this crop in the farmers' community. During the year 2004-05, its international marketing was very encouraging because seed worth Rs. 1.5 billions was exported to Iran, Jordan, Turkey, Korea and Thailand. Sesame cultivation, if done on large areas using high yielding varieties, it can help to bridge the gap

between domestic production and consumption of edible oil in the country as well as to increase the export magnitude.

In Pakistan, however, there are some areas which are considered potential areas for sesame cultivation and these include Gujrat, Sialkot, Gujranwala, Attcok, Bhakkar, Faisalabad in Punjab; Tharparkat/, Daldu and Hyberabad in Sindh; Kohat and DI Khan in Khyber Pakhtoonkhwa and Naseerabad and Lesbela in Balochistan.

Factors responsible for low production are:
- Shattering losses.
- Lack of improved high yielding varieties.
- Cultivation on marginal lands.
- Low level of fertilizer use.
- Phyllody disease.
- Poor crop management

Table 8. Area, production and yield of sesame in Pakistan

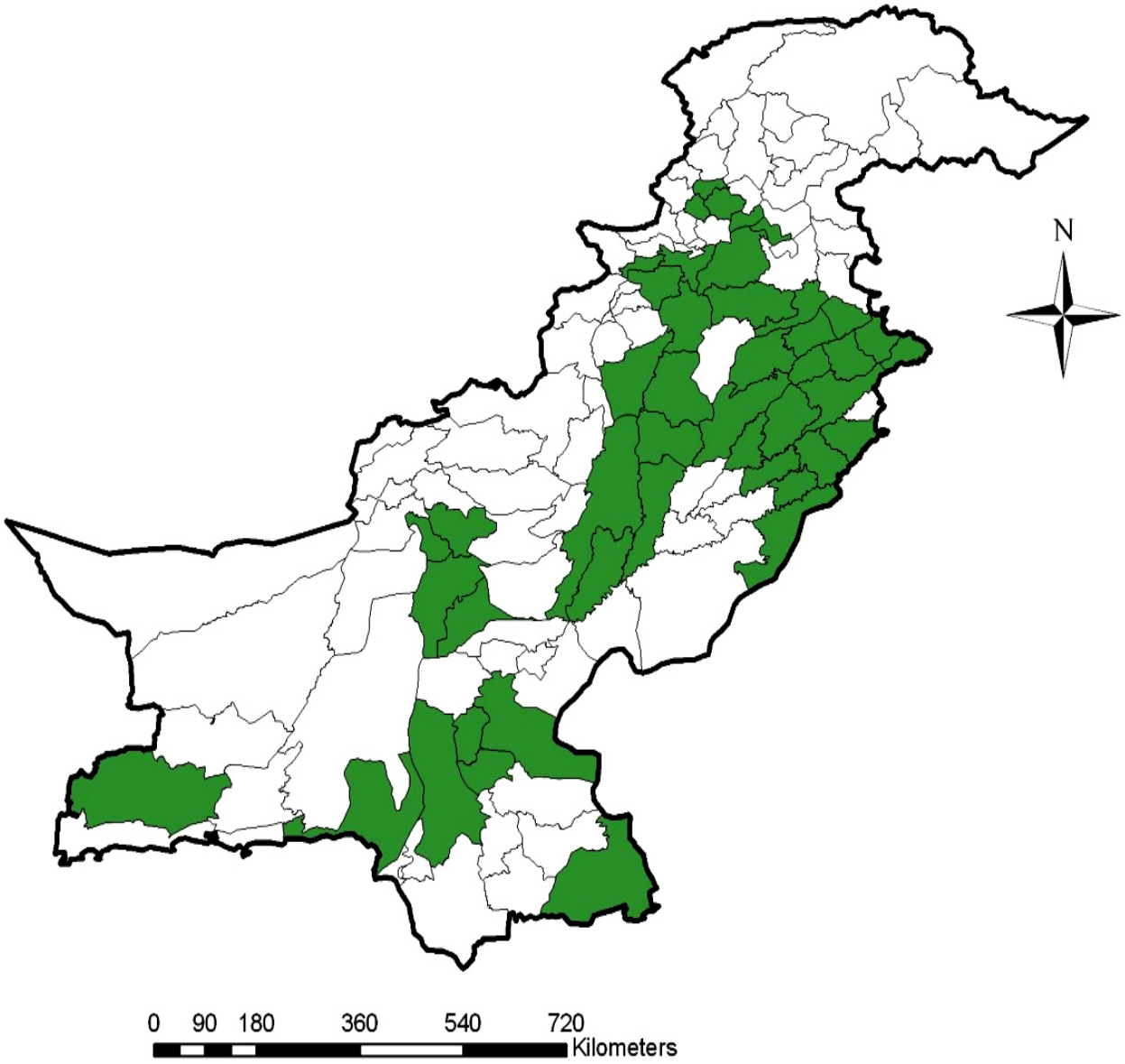
Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area'000'hectares)					
2000-01	98.0	1.5	0.6	0.9	101.0
2001-02	131.7	2.5	0.5	0.9	135.6
2002-03	83.9	2.5	0.3	1.2	87.9
2003-04	53.6	4.6	0.3	1.2	59.7
2004-05	63.5	1.7	0.2	1.1	66.5
2005-06	75.1	3.4	0.1	3.4	82.0
2006-07	64.9	2.8	0.2	3.5	71.4
2007-08	65.5	7.3	0.3	3.3	76.4
2008-09	75.8	7.7	0.2	7.0	90.7
2009-10	64.1	8.8	0.1	6.8	79.8
2010-11	63.6	6.4	0.1	7.5	77.6
2011-12	62.7	5.7	0.1	7.2	75.7
2012-13	57.1	7.2	0.1	6.5	70.9
(Production '000' tonnes)					
2000-01	49.5	0.4	0.3	0.5	50.7
2001-02	68.1	0.7	0.2	0.6	69.6
2002-03	17.4	0.9	0.2	0.7	19.2
2003-04	22.1	1.6	0.2	0.8	24.7
2004-05	28.3	0.6	0.1	0.8	29.8
2005-06	31.6	1.4	0.1	2.0	35.1
2006-07	26.9	1.3	0.1	2.1	30.4
2007-08	27.5	3.2	0.2	1.9	32.8
2008-09	33.0	3.5	0.1	4.4	41.0
2009-10	25.2	3.8	0.1	4.3	33.4
2010-11	23.8	2.9	0.1	4.3	31.1
2011-12	23.5	2.3	0.1	4.4	30.3
2012-13	21.8	3.3	0.1	3.9	29.2
(Yield in Kgs per hectare)					
2000-01	505	267	500	556	502
2001-02	517	274	492	630	513
2002-03	208	340	605	625	219
2003-04	412	358	610	635	413
2004-05	446	353	500	727	448
2005-06	421	412	1000	588	428
2006-07	414	464	500	600	426
2007-08	420	438	667	576	429
2008-09	435	455	500	629	452
2009-10	393	432	1000	632	419s
2010-11	374	453	1000	573	401
2011-12	375	404	1000	611	400
2012-13	381	458	1000	600	411

Source: Agricultural Statistics of Pakistan, 2012-13

SESAME CULTIVATION AREAS IN PAKISTAN

Punjab Attock, Bhakkar,Bahawal Nagar, Chakwal,D.G. Khan, Faisalabad,Hafizabad, Jhang,Kasur, Layyah, Jhelum, Gujrat,Gujranwala,Muzfargarh, Mianwali,MandiBahaudin,Nankana Sahib, Rajanpur, Narowal,Okara,Pakpattan, Sheikhupura, Sahiwal, Sargodha, Sialkot, Toba Tek Singh

Sindh Khairpur, NausheroFeroze, Nawabshah, Tharparkar, Dadu
KPK Charsadda, D.I. Khan Mardan, MalakandSwabi, Kohat, Karak, Hangu, Haripur,
Balochistan Bolan,JhalMagsi,Lesbella,Jaffarabad,Nasirabad, Sibi, Turbat



PRODUCTION TECHNOLOGY SESAME

Soil:		Light sandy and clay loam soil	
Seedbed Preparation:		2-3 ploughings with planking	
Planting Time:		Punjab	1st July to 31st July
		Sindh	15th June to 15th July
		KPK	15th June to 31st July
		Balochistan	1st July to 31st July
Seed Rate:	a)	Line sowing	5 kg/ha
	b)	Broadcasting	8 kg/ha
Method of Planting		Row to row distance	45 cm
		Plant to plant distance	10 cm
		Seed depth	2 to 2.5 cm.
Fertilizer:		Nitrogen	50 kg/ha
		Phosphorus	60 kg/ha

Irrigations: 3-4 irrigations (depending upon the rain fall)
1st Irrigation 15-20 days after sowing(DAS).
2nd Irrigation 30-40 DAS.
3rd Irrigation at the time of flowering
4th Irrigation at the time of seed development

Thinning and Hoeing After 10-15 days single out the weak and diseases plants by keeping 10 cm spacing between plants
Two hoeings: 15-20 days and 30 days after germination.

Harvesting: Sesame crop matures in about 100-=120 days.
Harvest when 75 % capsules mature and turn yellow
Stack the bundles keeping the pods upward

Threshing: Dry for one week and then collect the seed just by inverting the plants

Potential Areas:

Punjab	=	Gujrat, Sialkot, Gujranwala, Attock, Bhakkar, Faisalabad & Southern Punjab
Sindh	=	Tharparkar, Dadu, Hyderabad
KPK	=	Kohat, D.I. Khan
Balochistan	=	Nasirabad, Lasbela

v. Soybean

Soybean (*Glycine max* L. Merrill) is one of the most important protein as well as oil seed crop. It supplies approximately 65% world protein meal and 20% of the world edible oil. It is reported that more than 400 different products are prepared from it. Soybean seed contain about 37-42% good quality protein, 6% ash, 29% carbohydrate and 17-24% oil comprising 85%poly-un saturated fatty acid with two essential fatty acids (Linoleic and linolenic acid), not synthesized by the human body.

Soybean crop is mainly produced annually. Few countries including Pakistan have opportunity of harvesting two crop (spring and autumn) crops in a year. Soybean is commonly rotated with other crops such as wheat, maize, rice, cotton sorghum and sugarcane. Soybean has great potential as spring and autumn crop. Cotton and Rice are grown as cash crops and 30 percent area remains fallow after these two crops which can be brought under soybean plantation.

In Indo-Pak subcontinent preliminary work on the crop was started during 1930s by initiating the plantation in the rainfed areas. A yield of 790 to 988 kg/ha was reported. Later on, in 1960 a research scheme on soybean cultivation was initiated in Tandojam, Sindh with the objectives to introduce and select the exotic varieties for cultivation in the country. The varieties recommended for general cultivation were S.B., LK-30, I.F., 60.1 and

Pelican. However, 1978-79 attempts was made to introduce it as a commercial crop in all the provinces and a number of varieties including Williams, Bragg, Pelican and Davis were tried. Satisfactory results were obtained in Swat. In 1984-85, Agriculture Development Bank tried to push it on large scale in Multan region. The GCP continued its efforts in the northern region and succeed in pushing the area beyond 6000 ha in 1986-87. As a result of INTSOY testing program it was reported that a tropical altitude of Pakistan, varieties of late maturity groups perform better than medium or early maturing varieties. Varieties such as Cob, Bossier, Bragg and Hampton were top yielder in Sindh and selected for cultivation. It was also reported that soybean is a photo and thermo sensitive plant, there is need to breed, select and introduce area specific varieties for obtaining better yields.

Soybean has a number of advantages over other oilseed crops:

- It is nitrogen fixing crop, hence need less chemical fertilizer
- It is soil building crop and adds to the soil organic matter
- It requires less water as compared to other crops

As soybean is a soil building crop, it is recommended to plant on soils which have come under intensive cultivation and has exhausted its capacity and need to be replenished. Such areas are located in sugarcane, rice and cotton cropping systems in fruit orchards or newly reclaimed soils. The large scale cultivation of soybean on one hand will alleviate the dependence on import of soya meal and on the other hand will produce some edible oil.

Potential Areas

Punjab:	Multan, Khanewal, Vehari, Lodhran, Bahawalpur Gujrat, Gujranwala, Sialkot Rawalpindi, Attock, Jhelum, Kasur, Sargodha
Sind:	Nawabshah, Hyderabad, Thatta and Badin
Kyber Pakhtunkhwa:	Mardan, Swabi, Charsada, Peshawar, Noshehra, Mansehra, Malakand, Swat, Dir
Balochistan:	Kallat, Khuzdar, Quetta

Proposed cropping System

Land Description	**Potential Crop**
Cotton-Fallow-	Soybean (Spring crop)
Rainfed	Soybean (Autumn crop)
Riverine	Soybean (Spring/Autumn crop)
Inter-cropping (with sugarcane)	Soybean (Spring crop)
Orchards	Soybean (Spring/Autumn crop)

Production constraints:

- Non-availability of high yielding varieties and their quality seed.
- Lack of awareness about soybean crop.
- Improper marketing.
- Loss of seed viability during summer in ordinary storage condition

1) SOYBEAN PRODUCTS

i) **Soya milk** -The milk is recommended for infants where mother milk cannot be fed at the time of birth and also for persons allergic to cow/buffalo milk. However soybean milk is not covered under the definition of milk as per PFA rules. Soybean milk can be used in the same way as dairy milk.

ii) **Tofu -**Tofu is made by coagulating the hot soya milk. Tofu is a versatile (Soybean Curd) food and can be converted into a variety of value added products.

iii) **Soya nuggets-**These products have >50% protein which makes it one of the granules - richer source of protein.

iv) **Bakery products**- In different bakery products soya can be fortified with wheat flour both for functional and nutritional reasons.

v) **Noodles** - Noodles and vermicelli.

vi) **Soya flour** -Full fat soya flour obtained by grounding whole soybeans and heat processed or toasted to minimize enzyme action or defatted flour produced after complete removal of oil from soybeans. Used for fortifying wheat flour and in preparation of bakery products.

vii) **Soya protein** -The de-fatted soya flakes (after oil extraction) are the bases for different soybean products like soya flour, soya concentrate and soya protein (Textured/isolates/concentrates) highly digestible source of amino acids, necessary for human growth.

viii) **Substitute for pulses**- This is very important area on which Food Processors should lay more and more emphasis as it would help in reducing the dependence on pulses. Roasted whole soybeans, oil roasted and dry roasted, whole or crumbled and flavored with a confectionary or seasoning coating are consumed in US and other soybean producing countries.

Table 9. Area, production and yield of soybean in Pakistan

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area in hectares)					
2000-01	-	86	1175	-	1261
2001-02	-	92	1009	-	1101
2002-03	-	44	253	-	297
2003-04	-	53	245	-	298
2004-05	-	35	185	-	220
2005-06	-	85	288	-	373
2006-07	-	55	0	-	55
2007-08	-	49	0		49
2008-09	-	51	2	-	53
2009-10	-	89	-	-	89
2010-11	-	128	-	-	128
2011-12	-	90	8	-	98
2012-13	-	85	15	-	100
(Production in tonnes)					
2000-01	-	86	1318	-	1404
2001-02	-	95	1171	-	1266
2002-03	-	45	306	-	351
2003-04	-	61	310	-	371
2004-05	-	34	230	-	264
2005-06	-	62	359	-	421
2006-07	-	32	0	-	32
2007-08	-	29	0	-	29
2008-09	-	31	1	-	32
2009-10	-	51	-	-	51
2010-11	-	89	-	-	89
2011-12	-	90	8	-	98
2012-13	-	84	16	-	100
(Yield kg per hectare)					
2000-01	-	1000	1122	-	1113
2001-02	-	1033	1161	-	1150
2002-03	-	1023	1209	-	1182
2003-04	-	1151	1265	-	1245
2004-05	-	971	1243	-	1200
2005-06	-	729	1247	-	1129
2006-07	-	582	-	-	582
2007-08	-	592	-	-	592
2008-09	-	607	500	-	604
2009-10	-	573	-	-	573
2010-11	-	695	-	-	695
2011-12	-	1000	1000		1000
2012-13	-	988	1060	-	1000

Source: Agricultural Statistics of Pakistan, 2012-13

PRODUCTION TECHNOLOGY OF SOYBEAN

Soil: Clay loam soil with good drainage

Seed bed preparation: 2-3 ploughings with two planking.

Planting Time:

	Autumn crop	Spring crop
Punjab	Ist-July to 15th July	Last week Jan.to1st week Feb
Sind	Mid-June to Mid-July	Mid-Jan to 1st week of Feb
KPK	Mid May to Mid June	1st and 2nd week of March

Seed rate: 80-100 kg ha^{-1}

Method of Planting: Planting with seed drill.
Rows Spacing (spring= 30 cm, Autumn= 45 cm)
Plants Spacing 3-5 cm

Fertilizer:

Phosphorus	60 kg/ha at the time of planting.
Nitrogen	25 kg/ha at the time of planting.
Potassium	50 kg/ha at the time of planting

Irrigations: 4-5 irrigations (Spring) 3-4 (Autumn depending upon the rain fall)
1st Irrigation 21-30 days after germination
2nd Irrigation at flower initiation stage
3rd Irrigation at the flowering stage
4th Irrigation at the time of seed development

Weed control: Two weddings after irrigations

Harvesting and Threshing: Harvest when 90-95% pods turn yellow
Dry for 5-6 days before threshing

Storage: Store at about 8 to 10 percent moisture and 15°C temperature otherwise seed will lose its viability at room temperature.

Crop rotations: Irrigated Areas: Rice-Soybean-Rice Cotton-Soybean-Cotton
Rainfed Areas: Wheat -Soybean-Wheat

Potential Areas

Punjab:	Multan, Khanewal, Vehari, Lodhran, Bahawalpur Gujrat, Gujranwala, Sialkot Rawalpindi, Attock, Jhelum, Kasur, Sargodha
Sind:	Nawabshah, Hyderabad, Thatta and Badin
KPK:	Mardan, Swabi, Charsada, Peshawar, Noshehra, Mansehra, Malakand, Swat, Dir
Balochistan:	Kallat, Khuzdar, Quetta

vi. Linseed

Linseed (*Linum usitatissimum* L.) is a long day plant and cultivated in 34 countries of the world. It is one of the major agro-industrial oilseed crops. Its seed contains 33-43% oil of drying type and 24% protein. Its oil has high percentages of unsaturated fatty acids; it is mainly used in paint and varnish industries. Moreover, its oil contains 75% linolineic acid and 17% linoleic acid. In Pakistan, linseed is grown on marginal and sub-marginal lands under irrigated as well as rainfed conditions of Punjab and Sindh provinces with 762 and 2929 ha (2012-13) respectively. In Punjab, it is cultivated mainly in districts of Faisalabad, Toba Take Singh, Gujarat, Mandi Bah-ud-Din, Sargodha, Narowal, Sahiwal, Layyah, Bahawalpur and Bahawalnagar. Whereas in Sindh, it is grown in Jacobabad, Shikarpur, Larkana and Dadu districts. Its national average yield during 2012-13 was 710 kg/ha.

Production constraints are:

- Non-availability of high yielding varieties and their seed.
- Lack of awareness about production technology.
- Improper marketing.

Table 10. Area, production and yield of linseed in Pakistan

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area in hectares)					
2000-01	1897	2832	-	-	4729
2001-02	1800	4353	-	-	6153
2002-03	1675	4271	-	-	5946
2003-04	1613	4559	-	-	6172
2004-05	1411	4037	-	-	5448
2005-06	1397	4419	-	-	5816
2006-07	1299	3942	-	-	5241
2007-08	1261	3386	-	-	4647
2008-09	1340	4092	-	-	5432
2009-10	1137	3070	-	-	4207
2010-11	1018	3000	-	-	4018
2011-12	800	3000	-	-	3800
2012-13	762	2929	-	-	3691
(Production in tonnes)					
2000-01	1550	1160	-	-	2710
2001-02	1417	1604	-	-	3021
2002-03	1335	1631	-	-	2966
2003-04	1243	1848	-	-	3091
2004-05	1105	1453	-	-	2558
2005-06	1077	1704	-	-	2781
2006-07	1020	2611	-	-	3631
2007-08	953	2152	-	-	3105
2008-09	1013	2643	-	-	3656
2009-10	803	1911	-	-	2714
2010-11	779	2000	-	-	2779
2011-12	610	2000	-	-	2610
2012-13	578	2044			2622
(Yield in kg per hectare)					
2000-01	817	410	-	-	573
2001-02	787	368	-	-	491
2002-03	797	382	-	-	499
2003-04	771	705	-	-	501
2004-05	783	360	-	-	470
2005-06	771	386	-	-	478
2006-07	785	662	-	-	693
2007-08	756	636	-	-	668
2008-09	756	646	-	-	673
2009-10	706	622	-	-	645
2010-11	765	667	-	-	692
2011-12	763	667	-	-	787
2012-13	758	697	-	-	710

Source: Agricultural Statistics of Pakistan, 2012-13

PRODUCTION TECHNOLOGY OF LINSEED

Soil: Light sandy and clay soil

Seed bed preparation: 2-3 ploughings with planking.

Planting Time:

Irrigated area: 15 October to 15 November
Rainfed area: 1st October to 15 November

Seed rate (drill planting):

Irrigated area: 6 kg /acre (15 kg/ha)
Barani area: 8 kg /acre (20 kg/ha)

Method of Planting:

Rows Spacing 30 or 45 cm
Plants Spacing 10 cm

Thinning: 10 - 15 days after germination

Fertilizers:

Nitrogen = 80 kg/ha
Phosphorus (P_2O_5) = 60 kg/ha

Irrigations: 3-4 irrigations (depending upon the rain fall)
1st Irrigation 15-20 days after germination
2nd Irrigation at flowring stage
3rd Irrigation at the time of seed development

Weed control: Weeding with tarphali or rotary hoe after first irrigation
Harvesting and Threshing: Mid April to Mid May
Storage: Store at about 8 to 10 percent moisture level in dry place

Potential Areas:

Punjab	=	Irrigated and Barani area
Sindh	=	Northren and Southren areas
KPK	=	D.I.Khan, Kohat,and Karak district.
Balochistan	=	Nasirabad, Jafarabad, Jhal Magsi, Dera Murad Jamal

vii. Castor Seed

Castor plant (*Ricinus communis* L.) belongs to the family Euphorbiaceae. It is an oil yielding crop and may be grown in tropical, subtropical or temperate climates. In tropical and subtropical areas, the plant grows as perennial, while in temperate climate it grows as an annual crop. Its plant is monoecious (2n=20) with about 50-60% male flowers at the base of the inflorescence and remaining as pistialte flowers in the upper portion. Early and high yielding varieties of castor with high oil content are desirable to fit in the prevailing cropping system. Castor is sown in Punjab, Sindh and Balochistan. The total area under the crop was 3390 hectares with production of 3375 tons and yield was 995 kg/ha in 2011-12. The major districts where castor seed is cultivated on large scale are Tharparkar and Karachi in Sindh, Lasbela in Balochistan and Bhakar, Jhang, Bahawalpur and Bahawalnagar in Punjab.

Table 11. Area, production and yield of castor seed in Pakistan

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area in hectares)					
2000-01	39	2018	-	65	2122
2001-02	95	2489	-	65	2649
2002-03	104	1645	-	200	1949
2003-04	171	3271	-	492	3934
2004-05	90	2308	-	1000	3398
2005-06	49	2485	-	670	3204
2006-07	46	4290	-	730	5066
2007-08	70	2247	-	1250	3567
2008-09	73	2143	-	6030	8216
2009-10	36	493	-	826	1355
2010-11	29	635	-	2730	3394
2011-12	25	635	-	3410	3390
2012-13					
(Production in tonnes)					
2000-01	60	1023	-	50	1133
2001-02	144	1459	-	50	1653
2002-03	159	852	-	80	1091
2003-04	233	2070	-	197	2500
2004-05	111	1574	-	400	2085
2005-06	77	1744	-	268	2089
2006-07	63	2511	-	292	2866

2007-08	98	1621	-	500	2219
2008-09	65	1546	-	2412	4023
2009-10	52	421	-	330	803
2010-11	41	282	-	3057	3380
2011-12	36	282		3818	3375
2012-13					

(Yield in kgs per hectare)					
2000-01	1538	507	-	969	534
2001-02	1516	586	-	769	624
2002-03	1529	518	-	400	560
2003-04	1363	633	-	400	635
2004-05	1233	682	-	400	614
2005-06	1571	702	-	400	652
2006-07	1370	585	-	400	566
2007-08	1400	721	-	400	622
2008-09	1512	721	-	400	490
2009-10	1444	854	-	400	593
2010-11	1414	444	-	1120	996
2011-12	1440	444	-	1120	995

Source: Agricultural Statistics of Pakistan, 2011-12

viii. Safflower

Safflower is xerophytic in nature and is bestowed with unique features of salt and drought tolerance. In Pakistan it is grown only in Sindh. In 2012-13, its national average yield was 1000 kg/ha. Safflower seed contains 25-37% oil. Its oil is drying type with Iodine number up to 149 and contains little linolenic acid and high percentage of oleic acid and linoleic acid. Safflower oil is human health friendly and can be blended with other edible oil or can also be used directly for edible purpose. As an oil crop it proved successful in rotation with rice in the northern areas of Sindh and Balochistan. Performance of the crop in Dobari and Kacha areas of Sindh and Balochistan has been extremely good.

The crop can be planted after wheat in areas which are left fallow due to high salinity. About 600,000 acres are left fallow in rice and Kacha areas during winter. Other areas which hold promise for safflower production are areas of Punjab and Khyber Pakhtoonkhwa and Barani areas of northern Punjab. Safflower can be ideal crop in areas where canal water during rabi is not available for wheat sowing. In situation where sunflower and canola face severe competition from established crop, safflower can be grown in these areas producing about 90,000 tonnes of edible oil annually. Keeping in view the importance of this crop, the following experiments were conducted for the genetic improvement and breeding high yielding spineless varieties.

Major constraints for low production are;

- Spiny nature of the crop.
- Lack of high yielding varieties.
- Competition with other winter crops.
- Long duration crop maturity.
- Lack of seed dormancy due to which the mature seeds gets germinated in heads before harvesting.

Table 12. Area, production and yield of safflower in Pakistan

Year	Punjab	Sindh	KPK	Balochistan	Pakistan
(Area in hectares)					
2000-01	-	49	-	12	61
2001-02	-	45	-	11	56
2002-03	-	51	-	10	61
2003-04	-	61	-	9	70
2004-05	-	48	-	-	48
2005-06	-	47	-	-	47
2006-07	-	58	-	-	58
2007-08	-	66	-	-	66
2008-09	-	73	-	-	73
2009-10	-	52	-	-	52

2010-11	-	39	-	-	39
2011-12	-	40	33	-	73
2012-13	-				100

(Production in tonnes)					
2000-01	-	36	-	8	44
2001-02	-	34	-	7	41
2002-03	-	41	-	6	47
2003-04	-	43	-	6	49
2004-05	-	35	-	-	35
2005-06	-	38	-	-	38
2006-07	-	49	-	-	49
2007-08	-	60	-	-	60
2008-09	-	65	-	-	65
2009-10	-	45	-	-	45
2010-11	-	34	-	-	34
2011-12	-	35	35	-	70
2012-13					100
(Yield kgs per hectare)					
2000-01	-	735	-	667	721
2001-02	-	756	-	636	732
2002-03	-	804	-	600	770
2003-04	-	705	-	667	700
2004-05	-	729	-	-	729
2005-06	-	809	-	-	809
2006-07	-	845	-	-	845
2007-08	-	909	-	-	909
2008-09	-	890	-	-	890
2009-10	-	865	-	-	865
2010-11	-	871	-	-	871
2011-12		875	942	-	958
2012-13					1000

Source: Agricultural Statistics of Pakistan, 2012-13

PRODUCTION TECHNOLOGY OF SAFFLOWER

Soil: Light and heavy clay soil

Seed bed preparation: 2-3 ploughings with planking.

Planting Time: 15 October to 15 November

Seed rate: 20 kg/ha

Method of Planting: Lines sowing with drill or broadcasting

Rows Spacing: = 45 cm

Plants Spacing: = 10-15 cm

Fertilizers: Nitrogen = 80 kg/ha

Phosphorus (P_2O_5) = 60 kg/ha

Irrigations: 2-3 irrigations (depending upon the rain fall)

1st Irrigation 45 days after germination

2nd Irrigation at flowering stage

3rd Irrigation at the time of seed development

Weed control: Weeding with tarphali or rotary hoe after first irrigation

Harvesting and Threshing: When 80-90% capsules mature and leaves color becomes brownish harvest the crop.

Storage: Store at about 8 to 10 percent moisture contents

3. SOURCES OF EDIBLE OIL

Pakistan is lucky enough to have over a dozen oilseed crops, of which it can afford to grow one or the other in all seasons of the year. However, despite their importance in our national economy and trade, the oil crops, in general are termed as "Minor Crops". This status and approach has indirectly resulted in a constant neglect of oilseed crops and the sector as a whole. Some of the major crops which are grown in the country along with the area and production have been discussed in the earlier paragraphs. Here we just present a comparison of some major oil crops which contribute edible to the system. Detailed comparison is given Table 13.

Table 13. Comparative yields estimates of oil in oilseed crops and trees.

Crop/Tree	Total Days	Average Seed Yield (kg/ha)	OC%	Oil Yield (kg/ha)	Oil Yield (kg/ha/day)
*Oil Palm	365	***14320-20500	20	****2864-4100	7.84-11.23
Palm Kernel	365	8500	64-70	5440-5950	14.90-16.30
*Coconut	365	5000-7000	64	3200-4480	8.76-12.27
*Olive	365	1661-3000	18	300-540	6.82-1.20
**Rapeseed	180	992-2500	38	350-950	1.94-5.28
**Canola	180	1156-3500	38	439-1330	2.43-7.39
**Groundnut	200	995-4000	42	418-1680	2.1-8.4
**Sesame	120	410-1000	50	205-500	1.71-4.17
**Sunflower	120	1239-3500	40	495-1400	4.12-11.67
**Safflower	180	1000-1500	28	280-420	1.56-2.33
**Linseed	180	710-1000	35	248-350	1.38-1.94
**Soybean	120	1000-2500	18	180-450	1.50-3.75

*World Average Yield FAO STAT 2012 , **National Average Yield Agri.Stat 2012-13, ***Fruit yield of palm oil tress ****Palm oil yield

COMPARISON OF DIETARY FATS

SATURATED FAT

POLYUNSATURATED FAT
Linoleic Acid 18.2
Alpha-Linolenic Acid
18.3 (An Omega -3 Fatty Acid)

MONOUNSATURATED FAT
Oleic Acid 18.1

Palmitic 16.0
Stearic 18.0

DIETARY FAT	CHOLESTEROL mg/Tbsp	Fatty acid content normalized to 100 percent
NEW Sunflower oil	0	5% 5% 90%
Canola oil	0	6% 26% 10% 58%
Safflower oil	0	9% 78% Trace→ 13%
Sunflower oil	0	11% 69% 20%
Corn oil	0	13% 61% ← 1% 25%
Olive oil	0	14% 8% ← 1% 77%
Soybean oil	0	15% 54% 7% 24%
Peanut oil	0	18% 34% 48%
Cottonseed oil	0	27% 54% 19%
Lard	12	41% 11% ← 1% 47%
Palm oil	0	51% 10% 39%
Beef tallow	14	52% 3%→ ← 1% 44%
Coconut oil	0	92% 2% → 6%

References: - Agricultural Handbook No. 8-4 and Human Nutrition Information Service, United States Department of Agriculture, Washington, D.C., 1979.

Table 14. Fatty acid composition of selected oilseeds.

Oil	Fatty acid (%)										
	12:0+	14:0	16:0	18:0	18:1	18:2	18:3	20:0	20:1	22:1	Other
Sunflower			7	4	17	72					
Coconut	44	18	11	6	7	2					12
Corn			12	2	29	56	1				
Cottonseed		1	29	4	24	40					2
Olive			14	2	64	16	2				2
Palm		1	48	4	38	9					
Palm kernel	50	17	-	2	16	1					6
Peanut			6	5	61	22		2			4
Rapeseed			4	2	17	13	9		15	41	
Rapeseed*			5	2	63	19	9		1		1
Safflower			7	2	13	78					
Safflower**			5	1	78	16					
Soybean			11	4	25	51	9				

* Low erucic acid rapeseed.

** High oleic oil of safflower.

+12:0= Lauric, 14:0= Myristic, 16:0= Palmitic, 18:0= Stearic, 18:1= Oleic

18:2 = Linoleic, 18:3:= Linolenic, 20:0= Arachidic, 20:1- Eicosenoic, 22:1 = Erucic.

Source: Jack F. Carter (ed). 1978. Sunflower Science and Technology. ASA, Madison, USA.

4. RESEARCH ACHIEVEMENTS UNDER NATIONAL AGRICULTURAL RESEARCH SYSTEM

A. Development of Varieties/Hybrids

The Oilseed Research Program, NARC has made efforts for the development of improved varieties of the majority of oilseed crops. These varieties are potentially high yielding and suitable for agro-climatic conditions of the country. Details are given in Table 14.

Table 15. Hybrids/Varieties developed by Oilseed Program, NARC

SUNFLOWER	SOYBEAN	MUSTARD	CANOLA	GROUNDNUT
PARC-92E	NARC-I	BARD-I	CON-I	BARD-479
PARSUN-I	NARC-II		CON-II	BARD-669
PARSUN-III	NARC-III		CON-III	BARD-92
	Ajmeri		Shiralee	
	Rawal-I(Vegetable)		Westar	
			Pakola	
			Canola Raya	

i. Development of local sunflower and canola hybrids

Sunflower breeding was initiated during 1985-86. Canola type hybrids were introduced in the country during 1995. Keeping in view the importance of the hybrids and its advantages over the conventional varieties, the Oilseed Program at NARC, has initiated the hybrid development program. In this regard breeding work has been initiated and some A, B and R lines have been developed. After the evaluation of hybrid combination in different trials. Three sunflower hybrids have been approved by VEC (Table-14). Similarly, different canola hybrid combination were tested in National Uniform Yield Trials and some were fond promising and they are in processes for approve from VEC.

ii. Development of local canola type mustard

Recent avenue of research at the Oilseed Research Program is the development of local canola type mustard, because mustard is more resistant to stresses and certain diseases. In this connection canola quality character has been incorporated into the locally adopted mustard varieties successfully and is under advance testing stages. These lines are early in maturity and tolerant to white rust and black leg diseases and less attractive to aphid which is injurious insect of brassica species. With the release of canola type mustard varieties, it will be easy to replace the existing local varieties on 65% of area under brassica hence contributing to increased quantities of quality oil.

iii. Development of Production Technology

Since most of the oilseed crops were new in the production system of some areas of the country and the farmers were not aware of their production technology. Therefore, it was felt necessary to develop appropriate production technology for

Increasing production per unit area. In this connection experiments on the following aspects were conducted and recommendations were formulated.

- Planting time
- Seed Rate
- Method of sowing
- Fertilizer Requirements
- Harvesting
- Row spacing
- Plant spacing
- Seed depth
- Plant protection measures
- Drying & Storage

Another way of dissemination of the production technology is publication of production brochures. Various brochures of mandated oilseed crops such as sunflower, canola, rapeseed-mustard, linseed, soybean and groundnut have been published and distributed among the farmers.

iv. Development of Farm Machinery

Development of farm machinery for planting, crop management, harvesting and threshing of oilseed crops was initiated by BARD project with the collaboration of private sector. Moreover, the efforts were also made in NODP. As a result the following machinery was developed.

- Planting drills
- Soybean thresher
- Groundnut digger
- BARD Precision Planter
- Digger/Shaker/Invertor
- PTO Thresher
- Hand Sheller
- Sunflower thresher
- Weeding machine
- Rapeseed-mustard thresher
- Inter-row Cultivator
- Batch Thresher
- Electric Sheller

B. Variety/Hybrid Developed by Provincial Research Institute / Private Seed Sector

Following varieties/hybrids of oilseed crops have been developed by the Provincial Research Institutes and Seed Private Companies. These varieties/hybrids were recommended by PARC through multi-location system of NUYT.

Table 16. Varieties of oilseed crops developed by provincial research institutes and seed companies.

Rapeseed-Mustard	Variety/ Hybrid	Year of release	Institute/Company
Raya Anmol	Variety	1988	Oilseeds Research Institute, Faisalabad
Pak-Cheen	Variety	1989	Agricultural Research Institute, Tarnab, Peshawar
Sarhen-95	Variety	1995	Agriculture Research Institute, Tandojam
Hola 401	Canola Hybrid	1995	ICI, Pvt. Ltd.
Abasin-95	Variety	1996	Nuclear Institute for Food Agriculture, Peshawar
Chakwal Raya	Variety	1996	Banani Agricultural Research Institute, Chakwal
Hola 438	Canola Hybrid	1998	ICI, Pvt. Ltd.
Khanpur Raya	Variety	2000	Oilseeds Research Institute, Faisalabad
Tandojam-Raya	Variety	2000	Agriculture Research Institute, Tandojam
Bahawalpur Raya	Variety	2002	RARI, Bahawalpur
Chakwal Sarsoon	Variety	2002	Banani Agricultural Research Institute, Chakwal
NIFA Raya	Canola Variety	2003	Nuclear Institute for Food Agriculture, Peshawar
Durr-e-NIFA	Canola Variety	2005	Nuclear Institute for Food Agriculture, Peshawar
Punjab Sarsoon	Canola Variety	2009	Oilseeds Research Institute, Faisalabad
45 J21	Mustard Hybrid	2010	Pioneer Seed, Pvt. Ltd.
Faisal Canola	Canola Variety	2011	Oilseeds Research Institute, Faisalabad
NIFA Gold	Canola Variety	2012	Nuclear Institute for Food Agriculture, Peshawar
NIA Surhan	Variety	2012	Nuclear Institute for Agriculture, Tundojam
Coral-432	Mustard Hybrid	2012	ICI, Pvt. Ltd.
PAC-438	Mustard Hybrid	2012	ICI, Pvt. Ltd.
45S42	Mustard Hybrid	2013	Pioneer Seed, Pvt. Ltd.

Sunflower			
NK-265	Hybrid	1991	Sandoz/Syngenta
SF-187	Hybrid	1991	Cargill/Monsanto
PI-6480	Hybrid	1991	Pioneer Seeds
Hysun-33	Hybrid	1993	ICI Pakistan Seeds
SF-177	Hybrid	1995	Cargill Pvt. Lahore
NK-S-278	Hybrid	2002	Syngenta Seeds
PI-64 A 93	Hybrid	2004	Pioneer Seeds
Hysun-38	Hybrid	2004	ICI Pakistan Seeds
LG 56-60	Hybrid	2006	Bari Seeds
NK-Melody	Hybrid	2008	Syngenta Seeds
NK-Armony	Hybrid	2008	Syngenta Seeds
FH-331	Hybrid	2009	Oilseeds Research Institute, Faisalabad
FSS-64	Hybrid	2010	Farm Services Syndicate
Soybean			
Faisalabad-83	Variety	1983	Oilseeds Research Institute, Faisalabad
SWAT-84	Variety	1984	Agricultural Research Station, Swat
FS-84	Variety	1984	Oilseeds Research Institute, Faisalabad
Malakand-96	Variety	1996	Agricultural Research Station, Swat
Faisal Soybean	Variety	1996	Oilseeds Research Institute, Faisalabad
Groundnut			
BARI-89	Variety	1991	Banani Agricultural Research Institute, Chakwal
Chakori	Variety	1994	Banani Agricultural Research Institute, Chakwal
Swatphali	Variety	1995	Agricultural Research Station, Swat
BARI-2000	Variety	2000	Banani Agricultural Research Institute, Chakwal
Golden	Variety	2002	Banani Agricultural Research Institute, Chakwal
BARI-2011	Variety	2011	Banani Agricultural Research Institute, Chakwal
Sesame			
Til-89	Variety	1990	Oilseeds Research Institute, Faisalabad
TS-3	Variety	2000	Oilseeds Research Institute, Faisalabad
TH-6	Variety	2009	Oilseeds Research Institute, Faisalabad
TS-5	Variety	2011	Oilseeds Research Institute, Faisalabad
Safflower			
Thori-78	Variety	1978	Agriculture Research Institute, Tandojam
Agaiti Pawari	Variety	1995	Agriculture Research Institute, Tandojam

Table 17. Summary of Varieties/Hybrids of Oilseed Crops Developed in the Country and Recommended through PARC NUYT System

Institution	Sunflower	Soybean	Rapeseed	Mustard	Groundnut	Sesame	Safflower	Total
NARC, Islamabad	3	5	7	1	3	-	-	19
ORI, Faisalabad	1	3	4	2	-	4	-	14
BARI, Chakwal	-	-	1	1	5	-	-	7
ARS, Mingora	-	2	-	-	1	-	-	3
ARI, Tandojam	-	-	-	2	-	-	2	4
NIA, Tundojam				1				1
NIFA, Peshawar	-	-	3	1	-	-	-	4
ARI, Tarnab	-	-	1	-	-	-	-	1
Private Sector	11	-	2	4	-	-	-	17
Total	**15**	**10**	**18**	**12**	**9**	**4**	**2**	**70**

5. CONSTRAINTS TO OILSEEDS PRODUCTION

There are both major and minor constraints that affect the oilseed production in the country. The constraints that directly discourage and deter the farmers from the adoption of oilseed crops, are ineffective marketing, low economic returns and inadequate support of essential production elements including credit, quality seed, production technology and appropriate farm machinery.

a. General Constraints

i Marketing Constraints

In-efficient and inadequate marketing of oilseed crops has been identified as the most important factor hampering promotional and developmental efforts. The farmers are most disheartened when they face problems in the sale of their produce. According to a survey conducted in Sindh and Punjab by PARC concluded that the most burning issue in the promotion of oilseed crops was marketing.

ii Policy Constraints

The government has been dealing with the oilseed crops as **MINOR CROPS** while the import bill touching always and every year the **MENACING LEVEL** in the country. Therefore, the government should treat the oilseed as **PRIORITY CROPS** and pay due attention towards its promotion. Therefore, lack of sound and favorable government policies has been of the most important factors in the slow development of and promotion of oilseed crops. A number of policies were given GOP during the last about three decades. Most important has the Government's liberal policy which is based on imported oil. This ensures sufficient supply of edible oil at reasonably low rates. This has resulted in rapid increase in domestic consumption and has surpassed local production. It also encouraged un-official export to neighboring countries where prices of edible are relatively high.

iii. Technological

Research on oilseed crops is the key to increase in productivity. This is possible through the development of high yielding and disease resistant hybrids/varieties. Presently, sufficient funds are not provided for conducting extensive research to exploit the potential of particularly minor oilseed crops. like soybean, sesame, safflower and groundnut.

iv. Non-availability of quality seed

The entire sunflower, canola and mustard hybrid seed is import in the country. This takes almost months to reach the country, resulting in loss of seed viability and hence poor germination. Moreover, cost of imported hybrid seed is very high and is beyond the buying power of common farmers. Therefore there is a need to produce hybrid seed locally. This will not only guarantee the availability of quality seed in time but will also reduce its cost.

v. Machinery

Most of the oilseed crops pose tremendous post harvest losses. This is due to the fact that proper machinery is not available and if available is beyond the purchase power of the small farmer. Therefore, proper, planting, harvesting and threshing machinery needs to be ensured.

vi. Low support prices

Compared to other crop commodities, the cost of production of sunflower is comparatively high while the sale price of produce is low. This deters the farmers from adopting this crop. The farmer is always the best economist. He will plant that pay him back easily and more, which is not the case in oilseed crops. ***Therefore, attractive support price of the crop with ensured marketing need to be arranged at the government level.***

vii. Low demand of produce

The government lax policy of import of oilseed produce had bad effect on the local prices of oilseed produce and hence the farmers. Therefore, there is a strong need to make such measures to create local demand for oilseed crops.

viiii. Lack of credit facilities

No credit facilities are available to the oilseed growers in the country specially at a time when all the inputs for sunflower in particular and other oilseed in general are going out of reach of the farmers. The present hikes in the rates of inputs have made it imperative to provide easy credit to the oilseed growers.

6. FUTURE VISION

Large yield gaps are present between the potential yield and the national yield in all the oilseed crops. These gaps vary from 50 to 70 percent unachieved potential (Table 04). Yield gap in rapeseed-mustard and groundnut is the largest compared to sesame. Other oilseed crops also have very wide yield gaps between the potential yields and the national average yields. To bridge these gaps, priorities must be fixed according to the needs.

Suggested measures to exploit the unachieved potentials in oilseed crops are as under:

a. Research Priorities

- Collection, evaluation and maintenance of germplasm of oilseed crops.
- Development of improved varieties of oilseed crops.
- Development of Hybrids of Sunflower and Rapeseed-mustard.
- Development of Canola type mustard varieties.
- Production of Hybrid Seed in the country.
- Conducting of National Uniform Yield Trials (NUYT) of sunflower, groundnut, rapeseed-mustard and sesame.
- Standardization of package of production technology for oilseed crops.

b. Dissemination of production Technology

A package of improved production technology have already been developed for all oilseed crops, but the same has not been disseminated properly at farmers fields. To enhance the per hectare yield it is imperative to educate the farmers about the improved production technology through demonstration plots, field days, brochures and electronic media.

c. Machinery

Presently, almost all the machinery for the oilseeds is imported which is very expensive and beyond the approach of the small farmers. Therefore, local production of the machinery such as planters, harvesters and threshers not only be encouraged but also funded to provide affordable and efficient machinery to the farmers.

d. Credit facilities

Majority of the farmers have small holdings and are already facing severe resource problems. The Banks' asset-based approach of credit evaluation also limits his access to credit availability. Scarcity of resources lower down the level of inputs application and use of farm machinery and equipment thus inhibiting increase in area and yields. Farmers' motivation, profit margin, procurement arrangement and the financial position are of prime consideration in supply of credit. Therefore, specific efforts at government level are needed for strengthening the banking infra-structure to extend adequate credit facilities to the oilseed growers. Chargeable interest rates may be brought down through suitable financial and banking reforms.

e. Marketing

Marketing has been the most serious problem hampering the promotion of oilseed crops in the country. Therefore, prompt procurement of farmers' produce at support price or the market price whichever is higher and quick payments are the most important measures to increase oilseed production. Support price itself should not be unattractive. It must not only cover the cost of production but should also provide a reasonable margin of profit.

7. ALTERNATIVE OPTIONS FOR EDIBLE OIL PRODUCTION

At the moment Pakistan is growing three types of oil yielding crops, i.e., true oilseed crops, crops which yield oil only as a by-product and crops which yield oil both for edible and industrial purposes. The true edible oilseed crops include rapeseed-mustard, groundnut, sesame, sunflower, soybean and safflower. In the second category, fall cottonseed, maize and rice bran, while in the third category are included linseed, jojoba, castor, salicornia and salvadora. Other natural resources such as mango and apricot stones can also provide edible oil, if a system is devised for their collection.

In the first category, there is an ample scope for substitution of the existing varieties with better strains to increase domestic production and improve the trade balance. As far as increasing productivity per unit area is concerned, the contribution of improved production technology is as important as high yielding varieties.

In the second category falls cotton. From cottonseed, the oil recovery is normally about 11 percent. It can definitely be improved by using the solvent extraction methods. The oil content of cottonseed can also be improved through

use of breeding varieties having oil content as high as 24-30 percent. The provision of appropriate storage facilities at extraction plants and ginneries can also improve oil recovery.

Rice bran is another source, which has not yet been exploited and utilized properly. It has about 14-17 percent good quality edible oil with high linoleic acid content. The lipids have 3 to 9 percent wax. Bran also contains about 12 percent protein, 45 to 50 percent soluble carbohydrates, and 5 to 8 percent fibre.

Rice bran is the oil-and protein rich seed skin under the seed coat of rice, which is removed during milling. Paddy contains about 6-8 percent of this product. The rice bran oil is soon decomposed by active enzymes in the bran if the latter are not destroyed through process known as "stabilization". Since bran is an abrasive material, its oil can only be extracted through solvent extraction process.

The process of "stabilization" referred to above is necessary as it is used to keep the free fatty acid levels low in the resultant oil. This is necessary for human consumption. Several processes involving steam and electrical energy have been evaluated by CFTRI and other organizations. An entirely new technology has been developed by CFTRI. This process involves chemical stabilizations by use of hydrochloric acid. Its advantages lie low equipment cost, low energy consumption, less processing time and cost, little post-processing operation and resistance to infestation. This technology need to be introduced in Pakistan on pilot scale and demonstrated to the local industry so that it can be adopted and used for extracting edible oil from rice bran on large scale. Till the "stabilization" technology is introduced and popularized, rice bran should be processed as such in solvent industry to obtain oil for industrial uses.

About 3.9 million tons of rice paddy is produced in Pakistan out of which approximately 240 thousand tons rice brains obtained, which can yield about 33 thousand tons of edible oil worth rupees one billion. It is a huge import substitution commodity. Therefore, it must be utilized as an alternative source of edible oil. In Japan, considerable quantities of edible oil are contributed by this source. Similarly, Thailand, India, Korea and Nepal also get edible oil from rice bran in considerable quantities.

Maize is another potential source of good quality edible oil in the developed countries. Corn oil is used extensively in domestic food preparations and fetches a premium price. In Pakistan, corn is grown on about 900 thousand hectares, producing about 1.2 million tons of corn seed. The seed has 4-5 percent oil and therefore, potentially can produce about 46 thousand tons of oil**.** This source of oil has not yet been fully exploited. There is a need for installation of corn food and by-products industry. This can only be done with appropriate government support and incentives.

Under the third category fall linseed and castor. Castor has almost become extinct. The area under linseed has diminished significantly. Castor has excellent chances for increase. It can withstand drought and flourish very well even on poor soils. Pakistan has some seasonal and perennial varieties. The only need is to push up this crop with vigorous efforts. Sufficient area is also available in the arid zones of Punjab, Sindh and Balochistan. Many industrial needs can be met through its use. It can thus help reduce burden on our edible oil resources and consequently reduce imports. Since castor oil is one of the most expensive oils in international market (Table 25.1), it has also very good scope for export thus help us earn foreign.

Likewise linseed cultivation can also be promoted. Its high yielding varieties will be needed to attract farmers for its cultivation. The introduction and propagation of fibre flax will have additional advantages. Its fibre is useful and provides an opportunity to start linin cloth industry, which at present is almost non-existent. It will also enable the country to meet the Defense requirements of tents. The pith of this plant is used for manufacturing superior quality paper, including bank note paper, which can save a considerable amount of foreign exchange being spent on this account.

Large quantities of cottonseed and rapeseed cake are produced annually. This contains 7-8 percent oil. According to 2010-11 estimates, 2.9 million tons of cotton cake was produced, which can yield 203 thousand tons of oil (worth Rs. 40.6 billion) if all of it is processed through solvent industry. It offers another large potential alternative source of edible oil. Efforts should be made to set a system through which it can be easily channelized to solvent extraction industry for extraction of the residual oil. This programme cannot be made successful unless it is coupled with meal promotion and utilization efforts.

Cultivation of selicornia and jojoba on large scale also offers excellent alternative sources of vegetable oil. For this, a vast land is available in Pakistan. Efforts are therefore, needed to run production projects and set up research infrastructure for large-scale promotional programme. Jojoba produces expensive industrial oil, which has numerous

uses, especially in the cosmetics industry. Both these crops can play an appreciable role after 10-15 year in vegetable oil production; therefore, these should get a place in long-term strategy action plans.

Other sources such as mango and apricot stones can also contribute considerable quantities of edible oil. Such resources are utilized in India effectively for obtaining vegetable oil. Devising a cost effective collection system, would be imperative for exploiting this potential source, which is presently going a sheer waste.

Rural self-sufficiency program is an option for meeting the need of the rural household of edible oil. It is based on the fact that a rural family of 6 persons would need about 50 kg of edible oil per year as per capita consumption in rural area is 8.4 kg. This much oil can be produced by planting canola crop on 0.12 hectares of land. It will not only provide oil for catering the needs of a family for the whole year but also allow a saving of Rs 10,000/- which otherwise would be spent on purchasing "Vanaspati Ghee" from open market not with good quality. The program will aim at:

- Involvement of rural development department under the leadership of district management.
- Technical supervision from agriculture extension and agriculture research departments.
- Seed production by the farmers to cater the requirements of the village
- Oil expelling by the power operated efficient expellers at village level.
- Implementation of the programme in the regions where large acreage is already being grown with oilseed crops. Later, it would be extended to other areas as well.

8. OTHER OPTIONS FOR INCREASED OILSEED PRODUCTION

If the production of the edible oil is running with the present production level, then the country will be importing 3.0 million tons of edible oil in the year 2013-2014, incurring huge foreign exchange. However, production can be increased by (i) vertical (ii) horizontal increase and (iii) improving the extraction efficiency. These three factors can contribute very much in narrowing the gap between production and consumption. If these factors are coupled and 15 % increase in productivity is ensured, the self-reliance could be achieved easily.

a. Substitute Crops

Pakistan cannot afford horizontal expansion in the oilseed crops beyond certain limits. Therefore, efforts should be made in the utilization of marginal lands. The present edible oilseed crops cannot be grown on the marginal or stressed lands. This demands that future emphasis should be on the import-substitute crops which can be easily and economically adopted by the farmers. These include:

* Promotion of Castor in dry areas
* Promotion of Safflower in Southern Punjab, Sindh and Balochistan
* Introduction and promotion of Jojoba in the sandy soils of Cholistan
* Cultivation of Oil Palm in the coastal areas of Sindh and Balochistan
* Introduction of Salicornia in coastal areas of Sindh and Balochistan
* Introduction of Olive in the Northern mountainous parts of the country.

b. Approaches to Enhance Oilseed Production

i. Horizontal increase

- Replacement of existing 700,000 acres of traditional sarson with canola.
- Canola inter-cropping with sugarcane and in orchards.
- Sunflower cultivation after cotton and rice crops in Punjab and Sindh and in tobacco fallow lands of Peshawar, Mardan and Swabi districts.
- Crop maximization programme for oilseed crops.
- Exploring virgin lands, river belts, sailaba and Khuskhaba for oilseed planting.

ii. Vertical increase

- Development of short duration canola hybrids and high yielding varieties.
- Development of local sunflower hybrids and their indigenous seed production.
- Improvement and proper dissemination of production technology.
- There is a need of some organizations responsible for quality seed production of oilseed crops.
- Encouragement of private sector in quality oilseed production.

iii. Incentives to growers

- Provision of proper extension services to the farmers.
- Attractive support price.
- Ensure adequate procurement management.

- Adequate and timely input supply.
- Availability of adequate credit facility.
- Provision of farm machinery at proper time.

iv. Cultivation of alternate oilseed crops

- Promotion of safflower in southern Punjab, northern Sindh and Balochistan
- Promotion of soybean in northern areas
- Cultivation of oil palm in the coastal areas of Sindh and Balochistan
- Cultivation of olive in the northern parts of the country

9. STRATEGY FOR OILSEED PRODUCTION

i. <u>Short-term Strategy</u>

- Production of quality seed of oilseed crops.
- Dissemination of appropriate production technology through brochures, print media, electronic media etc.
- Crop maximization by PODB in potential areas in collaboration with PARC and provincial research institutes.
- Demonstration of improved production technology at farmers fields.
- Intervention by public sector in the procurement of oilseed produce.

ii. <u>Long Term Strategy</u>

- Development of high yielding varieties/hybrids of these oilseed crops.
- Development of short duration varieties suitable for intensive cropping and intercropping.
- Development of area specific production technology package for each crop.
- Crop maximization projects to bring new areas like riverine, sailaba and khushkaba etc. under oilseed crops.
- Promotion of safflower in southern Punjab, Sindh and Balochistan.
- Promotion of castor in dry areas.
- Cultivation of oil palm in coastal areas of Sindh and Balochistan.
- Cultivation of soybean in northern mountainous areas of the country.
- Appropriate policy measures to phase out oilseed imports.

10. NATIONAL AND INTERNATION COORDINATION

I. NATIONAL COORDINATION

In Pakistan, the National Agricultural Research System (NARS) is the single largest Agricultural Research System spread over Federal Research Institutes of Federal Ministry of Food Security and Research and PAEC, Provincial Departments, Agricultural Universities/Agriculture Colleges. The PARC administers the largest portion of the Federal part of Agricultural Research. One of the main functions of PARC as an apex National Agricultural Research Organization is to conduct, promote and Coordinate Research and Development activities in NARS.

PARC is entrusted to introduce the National Coordinated Research Programmes (NCRPs) as a mechanism for conducting joint research in the country. It started with implementation of National Coordinated Research Programs on major commodities/disciplines in collaboration with all concerned provincial and federal institutions as participating units. The NCRPs provide most effective mechanism for joint planning of research with a view to eliminate wasteful duplication/repetition of research efforts and to improve the utilization of research resources in terms of man, money and materials. PARC re-prioritized its research plan/activities and short listed some of the programmes of national importance. At present there are five Coordinated Programmes operationalized by the Plant Sciences Division of PARC including Oilseed Crops. Now National Coordinator of oilseed program is based at PARC headquarter, whereas the Coordinating Units in the provinces are headed by the provincial directors/senior scientists.

The primary objectives of Oilseed Research Coordinated Programme are:

i. Introduction and /or development of improved varieties of established oilseed crops.
ii. Introduction and evaluation of new oilseed crops.
iii. Development of production practices, including better control of pests (disease insects, weeds).
iv. Out reach programme to popularize the improve production technology for different oilseed crops.
v. Develop procedures to increase yield, maintain purity, and to distribute seed of improved varieties.
vi. Integration of oilseed research in Pakistan involving different disciplines, institutions and extensions.

vii. Development of farm equipments for all phases of oilseed production from seedbed preparation through harvest in collaboration with Agricultural Machinery Institute and similar organizations in the country.

To achieve the above objectives the core activities assigned to National Coordinator are:

i. Coordinate research and development activities of oilseed crops with international, federal and provincial research, education institutions and other stakeholders.
ii. Indentify research gaps at national level.
iii. Germplasm acquisition, evaluation and distribution.
iv. National uniform yield trials (NUYT).
v. Annual planning meeting, variety evaluation committee (VEC) meeting,
vi. Travelling seminar, symposium and workshops.
vii. Training for capacity building of researchers and other stakeholders.

Provincial Oilseed Cooperating Units:
Pakistan Agriculture Research Council has revitalized the provincial cooperative units. Major functions of the units are:

1) To conduct NUYT on oilseed crops.
2) Germplasm evaluation for variety development.
3) Development of area specific production technology.
4) Specific studies assigned time to time and in the annual planning meeting.

List of Oilseed Cooperative Units:

1. Oilseed Research Program, NARC, Park Road Islamabad
2. Oilseed Research Institute AARI, Faisalabad
3. Nuclear Institute for Agriculture Biology, (NIAB) Jhang Road, Faisalabad
4. Barani Agriculture Research Institute, (BARI) Talagang Road, Chakwal
5. Regional Agriculture Research Institute (RARI), Bahawalpur
6. Arid Zone Research Institute, G.T. Road, Bahawalpur
7. Agriculture Research Station, (ARS) Khanpur.
8. Oilseed Research Program, ARI, Tarnab G.T. Road, Peshawar
9. Arid Zone Agricultural Research Institute, Ratta Kulachi, Dera Ismail Khan (D.I.Khan)
10. Agriculture Research Station, Ahmad Wala Karak
11. Agricultural Research Institute, Mingora Swat
12. Nuclear Institute for Food & Agriculture, (NIFA) G.T. Road, Tarnab Peshawar
13. Agricultural Research Institute, Tandojam, Sindh
14. Nuclear Institute for Agriculture, (NIA) Tandojam Sindh
15. Oilseed Research Institute, (ARI) Soriab Road, Quetta
16. FCRS Goner Farm, Chillas (District Diamer) Gilgit-Baltistan

II. RESEARCH COLLABORATION/LINKAGES WITH INTERNATIONAL AND NATIONAL ORGANIZATION

International

- United States Department of Agriculture (USDA)
- INTSOY, USA
- International Centre for Agricultural Research in Dry Areas (ICARDA), Syria
- International Centre ICRISAT, India
- IDRC, Canada
- United Nations Development Program, UNDP
- Food and Agriculture Organization, FAO

Federal

- Pakistan Oilseed Development Board
- Federal Seed Certification and Registration Department
- Agricultural Policy Institute
- Pakistan Science Foundation
- Higher Education Commission

- Quaid-i-Azam University
- NIBGE, Faisalabad
- National Rural Support Programme (NRSP)

Agriculture Universities:

- Pir Mahr Ali Shah ARID University, Rawalpindi
- University of Agriculture, Peshawar
- University of Agriculture, Faisalabad

Extension Departments

- Directorate of Agriculture Extension, Rawalpindi
- Directorate of Agriculture Extension, Lahore
- Directorate of Agriculture Extension, Quetta
- Directorate of Agriculture Extension, Peshawar
- Directorate of Agriculture Extension, Tandojam

Solvent Extraction Industries

- Kohinoor Oil Mills Lahore
- Wali Oil Mills, Lahore
- Alvi Oil Mills, Rawalpindi

Private Seed Companies

- ICI-Pakistan (Pvt) Ltd, 63-Mazang Road, Lahore (0300-8731805)
- Pioneer Pakistan Seed Ltd, 6km Sahiwal Lahore Road, SAHIWAL (0302-8476693)
- Syngenta Pakistan Ltd. 90 Industrial Estate, Kot Lakhpat Lahore (0301-8449692)
- Ali Akbar Group, Lahore
- Four Brother Group, 177, B-1 First Floor, Main Buleward, Gulberg, Lahore (0321-4017567)
- Bari Seeds, Flat No. 21, Sharaf Mansion, Gangaram Hospital Chowk, Fatima Jinnah Road, Lahore
- Auriga Seed Co., Sunder Adda, 33-km Multan road, Lahore (03008631770)
- Kanzo Quality Seeds, 286-H-2, Johar Town, Lahore (042-35302036)
- Jullundar Seed Corporation (Pvt). Ltd 1Km Bhalwalnagar Road, Arifwala (0345-8441298)
- Farms Seed Services, 33-A, Industrial State, Multan (0321-6301917)
- Sitara Seeds (Aziz Group) Agri Farm Services (Pvt) Ltd.
  SeedDivision 77- Industrial Estate, Multan (0321-6329118)
- Kashif Seed Company, Sarghoda (0300-6044824)

<u>Progressive Farmers</u>

Punjab:

- Mr. Muhammad Mumtaz, Progressive Grower, Tiba Sultan, Vehari (0300-873166)
- Malik Muhammad Asif, Progressive Grower, Village Baloot,Post office Bhatar via Hassan Abdal Tehsil Fateh Jhang District Attock (0300-5561848)
- Muhammad Ijaz Ahmed, Progressive Grower, Village Dhoke Gujra, District Rawalpindi (0333-5118794)
- Syed Mushtaq Ali Shah, Progressive Grower, Chakri, District, Rawalpindi (0300-9553641)
- Malik Atta Muhammad, Progressive Grower, Fateh Jhang, District Attock (03005095544)
- Mr. Imtiaz Ahmed Progressive Grower, Fateh Jhang, District Attock (0300-5518001)
- Mr. Umar Farooq, Progressive Grower, District Talagang (051-2013248)
- Mr. Abdul Khaliq, Progressive Grower, District Chakwal (0334-8734375)
- Rao Sultan Ahmed Progressive Grower,House No.62 St.16, F-11/2 Islamabad (0342-5304228)
- Captain Abdul Khaliq, Progressive Grower, Village Khanpur District Chakwal (03325002916)
- Raja Bashir Ahmed, Progressive Grower, Village & Post Office Dhoda, Tehsil &District Chakwal (03465769240)
- M. Jhangir Ch. Progressive Grower Doltana, Chakwal (03335130065)
- Raja Naeem, Progressive Grower Doltana, Chakwal (03465769240)
- Muhammad Iqbal Cheema, Progressive Grower, Tameer-e-Millat Fateh Jhang (0345-6868762)

- Abdul Khurram Waheed, Progressive Grower Baba Fareed Chowk, Pakpatan (0321-6901196)
- Muhammad Bakhsh, Progressive Grower, Milsi District Vehari (0347-5329991)
- Abdul Sattar , Progressive Grower 405/TDA, Tehsil Chobara District Layyah (0302-6031332)
- Ahsan Mohyo-ud-Din, Progressive Grower 387/J.B, Tehsil & District Toba, Tek Singh (0300-6634583)
- Muhammad Shafique,Progressive Grower48/J.B Tehsil Sumandri District, Faisalabad, (0322-7022941)
- Saeed Ahmad, Progressive Grower 52/G.B Tehsil Jaranwala District, Faisalabad (0345-4088040)
- Irfan Ali, Progressive Grower 91/G.B Tehsil & District, Faisalabad, (0301-7042050)
- Ghulam Mustafa, Progressive Grower 333/J.B Tehsil Gojra District, Toba Tek Singh, (0341-7745243)
- Abdullah, Progressive Grower Hawaili Lakha Tehsil Depalpur District Okara, (0321-7980644)
- Ghulam Abbas, Progressive Grower 90/G.B Tehsil & District Faisalabad (0347-4612267)
- Muhammad Azam, Progressive Grower 342/J.B Tehsil Gojra District Toba Tek Singh (0333-6512373)
- Rashid Hamid, Progressive Grower 90/G.B Tehsil & District Faisalabad (0302-7071210)
- Irfan Ali, Progressive Grower 71/G.B Tehsil & District Faisalabad (0305-7993361)
- Abdul Waheed, Progressive Grower 108/G.B Tehsil Jaranwala District Faisalabad (0300-6682387)
- Mukhtar Ahmad, Progressive Grower 84/G.B Tehsil & District Faisalabad. (0301-3131584)
- Usman Safdar, Progressive Grower Ghaoon Hammla Tehsil Renala Khurd District Okara (0300-4920941)
- Qamar Zaman, Progressive Grower 84/G.B Tehsil & District Faisalabad 0301-7025604
- Muhammad Arshad, Progressive Grower 317/J.B Tehsil & District Toba Tek Singh (0345-7869717)
- Abad Ali Khan, Progressive Grower 130/G.B Tehsil & District Faisalabad. (0343-7770103)
- Sajid Mahmood, Progressive Grower 535/G.B Tehsil & District Faisalabad (0300-7688535)
- M. Farkh Gill, Progressive Grower 264/R.B Tehsil & District Faisalabad (0300-6631251)
- Shafqat Ali, Progressive Grower 294/J.B Tehsil & District Toba Tek Singh 0321-6564794
- Ghazanfar Ali, Progressive Grower 154/R.B Tehsil Jhumra District Faisalabad (0347-7400077)
- Hasnat Mahboob, Progressive Grower Peer Mahal Tehsil & District Toba Tek Singh (0333-6874321)
- M. Akram, Progressive Grower 485/G.B Tehsil Sumundri District Faisalabad (0346-7726691)
- Ghulam Abbas, Progressive Grower Malaikhi Tehsil & District Dera Ismail Khan (0321-7161679)
- Shakeel Ahmad, Progressive Grower 234/G.B Tehsil Jaranwala District Faisalabad (0300-7652506)
- Abdul Sattar, Progressive Grower Jhang Road, Tehsil & District Faisalabad (0300-76336628)
- Umair Afzal, Progressive Grower Dera Ismail Khan (0346-7855533)
- Khadum Hussain Anjum, Progressive Grower 428/G.B, Tehsil Gojra District T.T.Singh (0300-5653308)
- Faisal Aqeel, Progressive Grower 44/M.B, Khushab (0300-9780793)

Sindh

- Mr. Allah Dad Nizamani, Progressive Grower, Tehsil & District Tando Muhammad Khan (0344-3579412)
- Mr. Noor Ahmed Nizamani, Progressive Grower, Farm Near Tando Qaisar at TandoJam District Hyderabad (0312-4066777)
- Syed Qudurat Ali Shah, Progressive Grower, Shah Farm near Mirpurkhas Tahsil & Districtr Mirpurkhas (0305-3343732)
- Mr. Sirai Akhtur Hussain Bhatti, Progressive Grower, Bhatti Farm near Manjhand City Tahsil and District Jamshoro (0346-3968703)
- Mr. Sohail Mustafa, Progressive Grower, Shaikh Harvest Seed Corporation Shaikh Farms Larkana District Larkana (0301-3507897)
- Major (Retd.) M. Umar Farooq, Progressive Grower, Kadhan Road near Khoski Sugar Mills Tehsil Khoski District Badin (0302-3000369)
- Mr. Taj Muhammad Burriro, Progressive Grower,Near Ghari Yasin Tehsil and District Shikarpur (0300-0215438)
- Mir Yar Muhammad Talpur, Progressive Grower, Mir Abadullah Farm near Sultanabad Tehsil & District Tando Allahyar (0333-1380922)
- Mr. Makhdoom Ghulam Rasool, Progressive Grower, Near Golarchi Tehsil Shaheed Fazul Rahu, District Badin (0324-3502926)
- Mr Abdul Majeed Nazamani, Progressive Grower, Tando Allah yar, Sindh.
- Mr. Nawaz Ali Samajo, Progressive Grower Talhar City Near Mukhtiar Kar Office (029-7830167)
- Mr. Muhammad Yousif Thebo, Progressive Grower Village Suleman Thebo Taluka Talhar (029-7846105)
- Mir Muhammad Hussain, Progressive Grower Tando Ghulam Ali Taluka Matli (029-7851013)
- Rais Abdul Majeed, Progressive Grower Village Bagar Khan Taluka Matli (029-7813267)

- Rais Ali Muhammad Nizamani, Progressive Grower Village Nizamani Taluka Matli (029-7840088)
- Rais Muhammad Umer Shahani, Progressive Grower Vill: M. Umar Shahani Taluka S.F Rahoo (029-7853098)
- Haji Hafeezullah, Progressive Grower City Shaheed Fazul Rahoo (029-7853042)
- Mr. Bashir Ahmed Kharal, Progressive Grower City Shaheed Fazul Rahoo (029-7853088)
- Mr. Nawaz Ali Samajo, Progressive Grower Tlhar City Near Mukhtiar Kar Office (029-7830167)
- Haji Nawaz Memon, Progressive Grower Badin City Taluka Badin (029-7861149)
- Haji Qadir Bux, Progressive Grower PO Thatta (0298-510078)
- Haji Shoukat Ali Malkani, Progressive Grower PO Ch: Jamali Chhachh Jehan Khan (0298-779260)
- Haji Muhammad Rahim Jat, Progressive Grower PO Chohar Jamali (0298-773110)
- Qazi Faizullah, Progressive Grower Tando Jan Muhammad, Taluka Digri (0233-868001)
- Mir Zafarullah Khan Talpur, Progressive Grower Tando Jan Muhammad, Taluka Digri (0233-868001)
- Seth Liaquat, Progressive Grower Tando Jan Muhammad, Taluka Digri, (0233-500833)
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- Mr. Mukhtiar Ahmed, Progressive Grower SLD Farm Mirpurkhas (0233-875086)
- Mr. Muhammad Umar Bughio, Progressive Grower Mirpurkhas (0233-862387)
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- Nawab Nadeem, Progressive Grower Kot Ghulam Muhammad (0233-551077)
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Bolochistan:

- Maqsood Ahmed, Progressive Grower, Mehar gar, Balochistan (03023476830)
- Abdul Karim, Progressive Grower, Uthal, Balochistan (03336871776)
- Ameer Muhammad, Progressive Grower, Dotani Loralai, Balochistan (03222225105)
- Abdul wahid, Progressive Grower, Dhadhar, Balochistan
- Sakhi dad, Progressive Grower, Uthal, Balochistan
- Master Fazlullah, Progressive Grower, Uthal, Balochistan
- Haji Sultan Muhammad, Progressive Grower, Loralai (chamaza), Balochistan
- Ubaidullah loni, Progressive Grower, Sibi, Balochistan
- Niaz Muhammad, Progressive Grower, Mastung (Khad kocha, Balochistan
- M . Azeem Baloch, Progressive Grower, Khuzdar (Nal), Balochistan
- Mr. Mohsan Bhurgri, Progressive Grower Kot Ghulam Muhammad (0233-551077)
- Mr. Fazalullah Memon, Progressive Grower Misri Agri. Farm, Mirpurkhas (0233-861463)

Kyber Pakhtoonkhwa:

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- Muneer Khan, Progressive Grower, Speena Wari, Charsadda (03449121447)
- Shoaib Khan, Progressive Grower, Mardan (03455858866)
- AbdurRab, Progressive Grower, Dargai (03449042074)
- Faheem, Progressive Grower, Gujar Gari, Mardan (03139692311)
- InzarGul, Progressive Grower, Manai Swabi (03025680544)
- Ayub Khan, Progressive Grower, AkoraKhattak (03339002027)
- Fazl e Kareem, Progressive Grower, Mingora Swat (03249312438)
- Israeel, Progressive Grower, Chargulai Mardan (03409752925)
- Israr, Progressive Grower, Dargai Malakand (03013024450)
- FakeerRab Nawaz, Progressive Grower, Sarae Naurang Bannu (03139151157)
- HaroonGul, Progressive Grower, Doaaba, Hangu Kohat (03018021799)
- Imran, Progressive Grower, Mardan (03038563532)
- Dr. Noor Ali Shah, Progressive Grower, Umerko (0238-571253)
- Mr. Hameer Singh, Progressive Grower, Umerkot (0238-571460)
- Haji M. Ilyas Rajar, Progressive Grower, Umerkot (0238-571087)
- Haji Ali Murad Rajar, Progressive Grower, Umerko (0238-571261)
- Mir Ghulam Mustafa Talpur, Progressive Grower, Kunri (0238-558645)
- Mian Saleem, Progressive Grower, Kunri (0238-558449)
- Haji Muhammad Zahir, Progressive Grower, Kunri (0238-558258)
- Pir Nazir Jan Sirhindi, Progressive Grower Samaro (0238-51244)
- Vadero Zulfiqar Khan, Progressive Grower, Samaro (0238-551177)
- Vadero M. Maruf Mangrio, Progressive Grower, Pithoro (0238-72553)
- Dr. Qazi Hamayoon, Progressive Grower Pithoro (0238-541531)