International Journal of Agriculture Innovations and Research
Volume 5, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received: 11/01/2017 | Accepted on: 20/01/2017 | Published: 25/01/2017

Attaining Self-Sufficiency in Edible Oils in India
Intensifying Research & Development Efforts

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Abstract – **With 21 % of world's area and 15% of world's production, India is the fourth largest oilseed producing country in the world. Oilseeds in India account for the second largest agricultural commodities after cereals sharing 13% of the country's gross cropped area, nearly 5% of gross national product and 10% of the value of all agricultural products. Oilseeds crops have added advantage because of their nutritional quality, varying industrial and pharmaceutical/ medicinal uses. Although, India is a major producer of oilseeds, per capita annual oil consumption in India is only 10.7 kg which is quite low compared to 12.5 kg in China, 20.8 kg in Japan, 21.3 kg in Brazil and 48.0 kg in USA. Increasing population accompanied by rapid process of urbanization and changes in people's dietary habits has impacted on the increased pattern of consumption of oils in recent past. With the implementation of several thrust programs and provision of minimum support prices, in recent years there has been significant increase in the output as well as yield per hectare of oilseeds. However, import of vegetable oils on an average per annum was 8.278 million tons amounting to Rs.377.74 billion in last six years, besides import of oilseeds worth Rs.3.57 billion on an average per year in last three years. This article briefly examines the importance, area, production, productivity, and import in light of Government's initiatives and suggests strategic action plan intensify R& D efforts to attain self-sufficiency in edible oils.**

Keywords – **Edible Oils, Oil Seed Crops, Agricultural Commodities, Oil Consumption, Production.**

I. INTRODUCTION

A wide range of oilseed crops including high value premium crops along with tree origin oilseeds are grown in India's diverse agro-climatic regions. These include annual edible oilseeds [groundnut, rapeseed & mustard, soybean, sunflower, sesame, safflower and niger], non-edible oilseeds [castor and linseed] and tree-borne oilseeds (TBOs), viz. sal, mahua, simarouba, kokum, olive, karanja, jatropha, neem, jojoba, cheura, wild apricot, walnut, tung etc. which grow wild or are cultivated under different agro-climatic conditions. TBOs are, also, good source of vegetable oils [Kalkoti *et al* 2012].

With 21 % of world's area and 15% of world's production India is the fourth largest oilseed producing country in the world, next to USA, China and Brazil. Oilseeds in India account for the second largest agricultural commodities after cereals sharing 13% of the country's gross cropped area, nearly 5% of gross national product and 10% of the value of all agricultural products. Oilseeds crops have added advantage because of their nutritional quality, varying industrial and pharmaceutical/ medicinal uses. The consumers' oil basket comprises many varieties. For example, major domestic oils are groundnut, mustard/rapeseed, cottonseed, soybean and sunflower; minor domestic oils are rice-bran, mahua (Madhucalongifolia), sesame, safflower; and coconut palm, soybean and sunflower.

India occupies the place of pride as the world's largest producer of groundnut, castor, safflower, sesame, linseed and niger. India meets about 80% of global castor oil requirement and earns significant amount of foreign exchange through export [GOI,2015]. Although, India is a major producer of oilseeds, per capita annual oil consumption in India is only 10.7 kg which is quite low compared to 12.5 kg in China, 20.8 kg in Japan, 21.3 kg in Brazil and 48.0 kg in USA. Increasing population accompanied by rapid pace of urbanization and changes in people's dietary habits has impacted on the increased pattern of consumption of oils in recent past. India's domestic consumption of edible oils has significantly increased over the years & has touched 20.14 million tons [MT] in November 2014-October 2015 & is likely to increase further as against domestic availability of 10.06 MT [GOI,2015].

With the implementation of several thrust programs and provision of minimum support prices, in recent years there has been significant increase in the output as well as yield per hectare of oilseeds, viz. area under oilseeds was on an average per annum at 26.85 million hectares [MHA] during 2004-15 with an average annual output of 27.86 million tons [MT]. Average annual yield per hectare also increased to 1140 kg in last five years. However, import of vegetable oils on an average per annum was 8.278 million tons amounting to Rs.377.74 billion in last six years, besides import of oilseeds worth Rs.3.57 billion on an average per year in last three years. This article briefly examines the importance, area, production, productivity, and import in light of Government's initiatives and suggests strategic action plan to attain self-sufficiency in edible oils.

II. IMPORTANCE

Oilseeds crops have their own significance in Indian farming system and in the country's economy, viz. [i] vegetable oils are important in daily human diet as sources of energy, essential fatty acids & amino acids [ii] occupy almost 70% area under rain-fed farming and provide the livelihood of a large number of small and marginal farmers in arid and semi-arid regions of the country in particular[iii] can be grown on all kinds of soils. [iv] are raised after millets and pulses as crop-rotations [v] bring ready cash to the farmers [v] are a source of foreign exchange [vi] provide raw materials for many industries e.g. paints, varnishes, soaps, lubricating oils, pharmaceuticals etc. [vii] provide vegetable oils and fats to Indian diet [viii] provide concentrates for the cattle as edible oil-cakes [ix] are used

as organic manures in the form of non-edible oil cakes and some oil cakes like castor cake control termites due to their vermicide properties.

Area, Production & Productivity

Table 1. Area, Production and Productivity of Oilseeds Crops [1950-51 to 2014-15]

Year	Area	Production	Yield	Year	Area	Production	Yield
1950-51	10.73	5.16	481	2004-05	27.52	20.70	752
1960-61	13.73	6.98	507	2005-06	27.86	27.98	1004
1970-71	16.64	7.73	579	2006-07	26.05	24.29	917
1980-81	17.80	9.37	532	2009-10	26.10	24.90	958
1990-91	24.15	18.61	771	2010-11	27.20	32.50	1193
1995-96	25.96	22.11	851	2011-12	26.31	29.80	1133
2000-01	22.27	18.44	810	2012-13	26.48	30.94	1169
2001-02	22.64	20.66	913	2013-14	28.38	33.00	1166
2002-03	21.49	14.84	691	2014-15	25.73	26.68	1037
2003-04	23.66	25.19	1064	2015-16*	18.65	19.89	1067

Source: Agricultural Statistics at a Glance, Ministry of Agriculture,
Area in Million hectares, Production in Million tons and Yield in Kg/ha * indicates Kharif season only, Data for 2007-08 & 2008-09 not available. Source: Statistics at a glance, Ministry of Agriculture

Depending on the season of cultivation, the oilseeds are grown as *'Kharif* Crop' and *'Rabi* Crop'. The *Kharif* Crop is grown during the monsoon season and is harvested around October-November each year, whereas the *Rabi* Crop is raised in winter season and harvested around March-April each year. At present, oilseeds crops are raised on around 26.85 MHA of land. Area under oilseeds has progressively increased since 1950-51. It significantly increased from 10.73 MHA in 1950-51 to 25.96 million hectares in 1995-96 and further increased during 2004-05 to 2014-15 with annual average of 26.85 MHA. Average annual area in Kharif season during 2011-12 to 2014-15 accounted for as high as 69.96% of the total whereas output constituted 68.00% reflecting 97.17% yield per hectare in kharif as against 106.46% in rabi season. This suggests the impact of monsoon on the productivity of oilseeds.

Table 2. Area, Production & Yield of Oilseeds during Kharif & Rabi Seasons
[Area in Million hectares, Production in Million tons, Yield in Kg/ha]

	Kharif Season		Rabi Season		Total/Average	
Year	Area	Production	Area	Production	Area	Production
2011-12	18.42	20.69[1123]	7.89	09.11[1155]	26.31	29.80[1133]
2012-13	18.32	20.99[1135]	8.16	10.15[1244]	26.48	31.14[1169]
2013-14	19.65	22.02[1121]	8.63	11.00[1270]	28.28	33.02[1166]
2014-15	18.34	18.33[999]	7.39	8.35 [1130]	25.73	26.68[1037]
2015-16	18.65	19.89 [1067]				
Average	18.68	20.51 [1098]	8.02	9.65 [1203]	26.70	30.16[1130]
$	69.96%	68.00%[97.17%]	30.04%	32.00%[106.46%]		

Source: Agricultural Statistics at a Glance, Ministry of Agriculture,
Figures in parentheses indicate yield in kg/ha and $ indicates percentage of area, production& yield in kharif and rabi in the total of four years.
Source: Statistics at a glance, Ministry of Agriculture

III. PRODUCTION

With the progressive increase in the area the production of oilseeds too recorded increase since 1950-51. It significantly increased from 5.16 million tons [MT] in 1950-51 to 25.19 in 2003-04. Further, with the implementation of Integrated Scheme of Oilseeds while area increased to 25.73 MHA, the production rose to 26,68 MT in 2014-15 with an average annual production of 27.86 MT between 2004-05 and 2014-15 The year 1995-96 witnessed the highest area [25.96 MHA] and output [22.11 MT] and thereafter both area and output decelerated till 2003-04/2004-05 but again both area and output increased. Net availability of edible oils, therefore, increased from 12.7 kg in 2012 to 15.8 kg in 2013. Growth analysis of individual crops during 2000-01 to 2011-2012 suggests that while there has been increase in the area under soybean, rapeseed & mustard and sesame, there was stagnation in area under groundnut, niger, sunflower and linseed. Castor, however, demonstrated substantial increase in the output despite insignificant increase in the area.

Between 2009-10 and 2013-14, annual average area of 5.4 MHA of groundnut supported production of 6.9 MT reflecting yield of 1235 kg/ha whereas 6.3 million hectares under rapeseed & mustard produced 7.4 million tons exhibiting 1192 kg/ha.

International Journal of Agriculture Innovations and Research
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Table 3. Area, Production and Yield of Groundnut and Rapeseed & Mustard Crops [2009-10 to 2013-14]

	Groundnut			Rapeseed & Mustard		
Year	Area	Production	Yield	Area	Production	Yield
2009-10	5.5	5.0	991	5.6	6.6	1183
2010-11	5.9	8.3	1141	6.9	8.2	1185
2011-12	5.3	6.9	1323	5.9	6.6	1121
2012-13	4.7	4.9	995	6.4	8.0	1262
2013-14	5.5	9.5	1723	6.5	7.8	1208
Average	5.4	6.9	1235	6.3	7.4	1192

Source: Agricultural Statistics at a Glance, Ministry of Agriculture,
Area in Million hectares, Production in Million tons and Yield in Kg/ha

Groundnut and rapeseed & mustard together occupied 43% area and contributed to 48% of total production of oilseeds between 2009-10 and 2013-14, whereas soybean alone accounted for 41% of total output during the same period. Thus, soybean, groundnut and rapeseed & mustard had a share of 89% in the total output during the period.

Three States of Madhya Pradesh [20.54%], Rajasthan [20.21%] and Gujarat [18.81%] together accounted for 59.57% of total oilseeds production in the country. Similarly, Gujarat [52.08%] along with Tamil Nadu [12.79%] and Andhra Pradesh [10.83%] contributed as high as 75.70% of total groundnut output whereas Rajasthan [46.81%] with Madhya Pradesh [11.95%] and Haryana [11.25%] accounted for70.01% of rapeseed & mustard output, Madhya Pradesh [44.10%] with Maharashtra [39.15%] and Rajasthan [9.53%] had a share of 92.78% in soybean output and Karnataka [44.67%] with Madhya Pradesh [18.72%] and Maharashtra [10.27%] shared 73.66% of sunflower output.

IV. Minimum Support Prices

Minimum Support Prices of oilseeds crops between 2009-10 and 2013-14 significantly rose showing rise by 90.5% for groundnut, followed by soybean-black/yellow [85.2%/84.2%], safflower [78.6%], sunflower [67.0%], rapeseed & mustard [66.7%] and sesame [57.9%].

Table 4. Minimum Support Prices of Major Oilseeds Crops; [Rs./Quintal]

Year	G.nut shell	Sunflower	Soybean [Black]	Soybean [Yellow]	Sesame	Niger seeds	R&M	Safflower
2009-10	2100	2215	1350	1390	2850	2405	1830	1680
2012-13	3700	3700	2260	2240	4200	3500	3000	2800
2013-14	4000 [90.5%]	3700 [67.0%]	2500 [85.2%]	2560 [84.2%]	4500 [57.9%]	3500 [45.5&]	3050 [66.7%]	3000 [78.6%]

Source: Agricultural Statistics at a Glance, Ministry of Agriculture,
Figures in parentheses indicate percentage change in 2013-14 over 2009-10

V. Productivity

The yield per hectare progressively increased from 481 kg in 1950-51 to 913 kg in 2001-02. It significantly increased to 1064 kg in 2003-04 and further to 1193 kg in 2010-11. It was on an average 1140 kg between 2010-11 and 2014-15. The productivity is still low as compared to other oilseed producing countries in the world as is evident in case of chickpea, pigeon pea, groundnut and rapeseed & mustard in particular from the following table

Table 5. Average Yield of selected oilseeds in India Vis-à-vis Average in the World and the Country with the Highest Yield in the World

Crops	India TE 2012	World TE 2011-12	TE 2012
Chick pea [gram]	912	917	1663 [Ethiopia]
Pigeon pea	681	786	1320 [Myanmar]
Groundnut	1212	1626	4069 [USA]
Rapeseed & Mustard	1163	1855	3588 [UK]

Source: Agricultural Statistics at a Glance, Ministry of Agriculture,

Between triennium ended 1980-81 and 1989-90 annual growth rate in area [1.51%] and yield [2.43%] of oilseeds was modest/significant which resulted in the highest growth rate in output [5.20%] whereas between triennium ended 1990-91 and 1999-2000 annual growth rate in the area [0.86%] and yield [1.15%] was unsatisfactory resulting in the lowest output growth rate [1.63%]. This, however, significantly improved to 2.35% in respect of area and 2.31% in yield that produced 4.71% growth rate in output during TE 2000-01 to 2013-14.

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Table 6. Growth rate of Area, Production and Yield of Oilseeds in percentage per annum

TE 1980-81 to 1989-90			TE 1990-91 to 1999-2000			TE 2000-01 to 2013-14		
Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.51	5.20	2.43	0.86	1.63	1.15	2.35	4.71	2.31

Source: Agricultural Statistics at a Glance, Ministry of Agriculture,
Nine major oilseeds crops include groundnut, castor seeds, sesamum, R &M, Linseed, niger seed, safflower, sunflower and soybean.

VI. Import & Export

Average per capita consumption of edible oils increased to 6.3 kg/annum from 1985-86 to 1999-00 and the post-2000 period that witnessed large-scale urbanization, the rise in the income of middle class and the change in peoples' dietary habits did impact on the consumption pattern of oils for 2001-02 to 2011-12 escalating to 29.4 gram/day [10.7 kg/annum from edible oils and 1.2 kg/annum from vanaspati]. India witnessed steep rise in per capita consumption growth rate [5.25%] between 2001 and 2012.

Despite India is one of the largest producers of oilseeds in the world its domestic requirements of vegetable oils and oilseeds are being met through significant amount of imports in terms of quantity and value since several years. It was a time when 50 per cent of its domestic requirements were met through imports, out of which crude palm oil and RBD palmolein constituted about 77% and soybean oil constituted about 12%. With the implementation of various programs aimed at increasing the production and commitment to reduce the import, dependence on import declined to mere three per cent during 1992-93. The situation could not much change thereafter too as is evident from the fact that despite the production of oilseeds rose to 26.68 MT in 2014-15 with an average annual production of 27.86 MT between2004-05 and 2014-15 it has not kept pace with the demand for edible oils in India. The domestic availability of edible oils recorded 5% growth rate during the period ended 2011-12 whereas the growth rate of import of edible oilseeds and per capita consumption of oils was 6.99% and 5.65% respectively. The domestic consumption of edible oils has touched the level of 20.14 MT in 2014-15. With per capita consumption of vegetable oils at the rate of 16 kg/year/person for a projected population of 1276 million, the total vegetable oils demand is likely to touch 20.4 MT by 2017.

Import of vegetable oils in terms of quantity and value significantly rose from 6.719MT amounting to Rs.158.3746 billion in 2008-09 to 9.5 MT amounting to Rs.516.99 billion in 2013-14. Similarly, import of oilseeds in terms of value also increased from Rs.1.18 billion in 2010-11 to Rs.8.1 billion in 2013-14. As against this, quantity and value of export of oil meals fluctuated with the maximum being 7.4 MT and value amounting to Rs.158.22 billion. Thus, during past six years, average quantity and value of import of vegetable oils was 8.278 MT and Rs.377.7363 billion and that of oilseeds Rs.3.5725 billion. As compared to this, average quantity and value of export of oil meals was 6.302 MT tons and Rs.121.89 billion.

Table 7. Import of vegetable oils & Oilseeds and Export of oilcakes, Quantity in million tons

Commodity	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14*
Vegetable oils	671.9 [158.3746]	8.034 [264.8330]	6.918 [298.60]	8.4 [462.42]	10.1 [565.20]	9.5 [516.99]
Oilseeds			[1.18]	[0.99]	[3.22]	[8.10]
Export of Oil meals	674.3 [112.6924]	4.671 [78.3179]	6.8 [108.46]	7.4 [117.62]	6.3 [158.22]	5.9 [156.03]

Source: Ministry of Agriculture,
*Figures in parentheses indicate value in Rs. billion; * indicates up to February 2014*

According to Solvent Extractors' Association of India, India imported more edible oils in last four years due to stagnant oilseeds production and rising demand. Import dependence on edible oils rose by 45.99%. During November 2016 to October 2017 import of edible oils is likely to rise by 200,000 tons touching to 15 million tons because of increase in import of soybean and sunflower oils. Oilseeds production is likely to rise by one million tons with consumption of 18 Kg per capita. More importantly, import of soybean oils will increase by 252.18% from 1.079million tons in 2011-12 to estimated 3.8 million tons in 2016-17. Import of soft oils [soybean, sunflower & rapeseed oils] shot up by 165.85% in 2015-16 over 2011-12 being the highest in last five years as against 10.58% increase of palm oils. Particularly, import of soybean oils has been increasing from year to year. It increased to 4.235 million tons in 2015-16 from 1.079 million tons in 2011-12 due to stagnant domestic production.

Table 7.1. Import of Edible Oils [October-November] during 2011-12 to 2015-16 in '000 tons

Edible Oils	2011-12	2012-13	2013-14	2014-15	2015-16
RBD Palmolein	1577	2223	1576	1659	2623 [66.32%]
Crude Palmoil	5993	5889	6253	7724	5749 [-4.07%]
Crude almolein	01	01	00	00	00
CPKO	98	180	129	154	71 [-27.55%]
Soybean oil	1079	1091	1951	2986	4235 [292.49%]
Sunseed oil	1135	973	1509	1542	1516 [33.57%]

Edible Oils	2011-12	2012-13	2013-14	2014-15	2015-16
Rapeseed oil	91	13	200	356	377 [314.28%]
Coconut oil	02	04	00	00	00
Safflower oil	05	11	00	00	00
Total	9981	10385	11618	14421	14571 [45.99%]

Source: Solvent Extractors' Association of India,
Figures in Parentheses indicate Percentage increase or decrease in 2015-16 over 2011-12

VII. Government's Initiatives

Recognising the meteoric jump in the import bills of oilseeds from Rs.0.142 billion in 1975-76 to Rs.9.21 billion by 1984-85, the Government launched the TMO during 1986. This resulted into doubling the oilseeds production to 17.45 million tons in a decade ended 1995-96 and imports got reduced to Rs 0.71 billion by the TE 1993-94. Government further strengthened its research and development efforts. As a part of this, the centrally Sponsored Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize [ISOPOM] has been under implementation in the country for increasing area, production and yield of these crops since 2004-05. The Technology Mission on Oilseeds and Oil Palm (TMO & OP), introduced in the Twelfth Plan, aims to increase domestic production of edible oilseeds/oil, which is 50 per cent short of the domestic demand, through several focused and integrated interventions.

VIII. National Mission on Oilseeds & Oil Palm

Oil palm is a comparatively new crop in India and is the highest vegetable oil yielding perennial crop. With quality planting materials, irrigation and proper management, it has the potential to yield 20-30 metric tons/ha fresh fruit bunches after attaining age of 5 years. Therefore, to arrest the declining productivity on one hand and on the other to further enhance productivity of oilseeds, Government from 2011-12 is implementing Oil Palm Area Expansion (OPAE) Programme in 8 identified states. Under the scheme, financial assistance is extended for planting material, meet partly cultivation cost, installation of drip irrigation system, diesel pump sets, development of wasteland & technology transfer through demonstration, training and publicity. Based on the experience of implementing ISOPOM, OPAE and Integrated Development of Tree Borne Oilseeds (TBO) the scheme is now re-structured and implemented from 2014-15 as National Mission on Oilseeds and Oil Palm (NMOOP).

The NMOOP consists of three Mini Missions, viz. [i] Mini Mission-I on Oilseed; [ii] Mini Mission-II on Oil Palm; and [iii] Mini Mission-III on TBOs aimed at enhancing vegetable oilseeds production. Differential strategies focusing on yield improvement in districts with low yield high spread and to explore the possibilities of area expansion in districts with low spread high yield include [i] Cluster demonstrations on improved production technologies of oilseeds including use of micro-nutrients, gypsum [ii] Augmenting production and availability of certified/quality seeds with emphasis on seed treatment [iii] Enhancing irrigation through Sprinklers/Rain-guns/water carrying pipes and pump-sets [iv] Encouraging cultivation of oilseeds in areas of low wheat productivity, rice fallows and intercropping with coarse cereals, pulses [v] Promotion of Sunflower cultivation in Zaid season [vi] Capacity building through demonstrations in Pest & Disease Management]vii] Procurement tie-up through NAFED.

Mini Mission-I on Oilseeds aims at achieving production of 35.51 MT and productivity of 1,328 kg/ha of oilseeds from the present average production & productivity of 28.93 MT and 1,081 kg/ha respectively. It covers States viz. Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Assam, Jammu & Kashmir, Jharkhand, Nagaland and Tripura.

Mini Mission-II on Oil Palm aims at bringing additional 1.25 lakh hectare area under oil palm cultivation through area expansion approach including utilization of wastelands with increase in productivity of fresh fruit bunches from 4927 kg/ha. to 15000 kg/ha.

States covered are Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Maharashtra, Mizoram, Karnataka, Kerala, Odisha, Tamil Nadu, Arunachal Pradesh, Assam, Bihar, Manipur Meghalaya, Nagaland, Sikkim, Tripura and West Bengal.

Mini Mission-III on Tree Borne Oilseeds aims at enhancing the seed collection of TBOs from 0.9 MT to 1.4 MT and augmenting elite planting materials for area expansion under waste land. It covers all states of the country.

IX. Factors Responsible for Low Productivity

The low, uncertainties and fluctuating productivity and profitability is primarily attributed to factors viz.[i] most of the crops are raised under rain-fed farming system and on nutrient-starved soils by most resource-poor farmers. On an average of four years [2011-12 to 2014-15] area under rain-fed oilseeds accounted for as high as 69.96% of the total whereas output of kharif oilseeds crops accounted for 68.00% & yield 97.1% of the total [ii] significant amount of weather aberrations during all stages of crop growth [iii] inadequate use of quality seeds of high yielding varieties accompanied by low level of adoption of scientific techniques including pests & disease control measures [iv] a large number of small, marginal and tenant farmers, share croppers and oral lessees consider raising oilseeds riskier than food grains [v] vulnerability to market forces, low output prices under the Government's MSP as compared to rice and wheat and inadequate processing facilities [vi] unawareness about crop-insurance scheme among farmers as also ineffectiveness of the scheme to serve the intended

purpose [vii] most farmers face difficulties in accessing timely and adequate credit.

X. Strategic Action Plan

During the last few years, the domestic consumption of edible oils has increased substantially and has touched the level of 20.14 MT in 2014-15as against projected 20.40 MT by 2017. With per capita consumption of 16 Kg/year would substantially increase further against the domestic availability of 10.06 MT. One estimate indicates that India would need to raise 40.89 MT of oilseeds production to meet the growing demand of edible oils in 2050 based on ICMR's calorie requirements, changes in food consumption pattern in relation to population growth, per capita income &expenditure pattern and relative prices of food items. This necessitates formulating and implementing strategic action plan incorporating following actions.

- India's national/central research institutes and State Agricultural Universities have already evolved region and crop-specific high yielding varieties, profitable cropping systems, agronomic/cultural practices, nutrient management practices for maximizing productivity. The new technology tested at the farmers' fields under the project Frontline Demonstrations in Oilseed Crops confirmed significant economic benefits of improved varieties and technologies as compared to farmers' traditional practices. The incremental benefit: cost ratio established that the technologies are cost-effective. A nation-wide campaign should be launched right from this season to disseminate use of these proven high-yielding varieties and scientific techniques. The campaign should focus sharply increasing [i] Seed Replacement Ratio (SRR) with focus on Varietal Replacement [ii] irrigation coverage under oilseeds from 28% to 35% [iii] awareness and adoption of the techniques of integrated pests and nutrient management [iv] availability of adequate and timely supply of good quality seeds of high-yielding varieties and oil-palm planting material [iv] procurement of oilseeds and collection [v] diversification of area from low yielding cereals to oil seeds crops and inter-cropping of oilseeds with cereals/ pulses/sugarcane [vi] Use of fallow land after paddy/potato cultivation [vii] expansion of cultivation of Oil Palm and tree borne oil seeds in watersheds and wastelands [viii] processing of tree borne oilseeds [ix] Inter-cropping during gestation period of oil palm and tree borne oilseeds to help growers obtain economic return when there is no production. Where necessary State Governments in order to make farmers' see benefits of improved production technologies must organize field demonstrations using seeds and Integrated Pest and nutrient management techniques..
- Green revolution in 1970s demonstrated that the newer genotypes can express their full genetic potential only under optimum agronomic/cultural practices and judicious use of inputs. Oilseeds production program should, therefore, strengthen availability and augmenting the supply side in respect of critical production inputs viz. assistance for purchase of breeder seed, production of foundation seed, production and distribution of certified seed, distribution of seed mini-kits, distribution of plant protection chemicals, plant protection equipment, weedicides, supply of rhizobium culture/phosphate solubilising bacteria, supply of improved farm implements, supply of micronutrients, distribution of gypsum/pyrite/liming/dolomite, distribution of sprinkler sets and water carrying pipes, among others.
- Only around 28% area under oilseeds is irrigated specifically for rabi/summer groundnut, mustard and castor in Gujarat and Rajasthan. Almost entire safflower and castor in Andhra Pradesh and kharif sunflower in peninsular India are grown under rain-fed conditions. A time-bound program is necessary to bring at least 35% area under irrigated oilseeds and provision of protective irrigation during kharif season when necessary. Use of water-saving devices and water use efficiency technology must be popularized..
- Since frequently visited droughts in one or the other parts of the country reduce yields and quality of crops significantly there is need to invest more in research and development efforts in order to evolve drought-resistant varieties as also develop drought-proofing technology. Organic manure, which has a unique role in rain-fed conditions as it adds nutrients in the soil and help maintain the fertility/productivity level, is fast disappearing leading to higher risks of drought. All out efforts are required to ensure that most farmers are encouraged to produce organic manure [particularly through bio-gas technology & green-manuring techniques, among others] and invariably use it along with need-based chemical fertilizers. Often inadequate and imbalance in the use of major and micro-nutrients has directly affected on the yield and cost of cultivation. This needs to be corrected through use of organic manure and chemical fertilizers based on soil analysis.
- Government in a PPP mode can create enabling environment that can facilitate country's research institutes and State Agricultural Universities to harness the power of science to increase productivity per unit of resources deployed, enhance input use efficiency, reduce cost of cultivation and post-harvest losses to make it competitive, minimize risks and improve quality of oilseeds and their products.
- Biotechnology is the most important tool to evolve varieties which possess one or more than one beneficial characteristic viz. short duration, high-yielding with high percentage of oil content, drought-resistant/escape, insect-pests resistant that can be raised under different agro-ecological conditions. Some countries have developed genetically engineered oilseeds crops having one or more such characteristics.
- It is time now to intensify R&D efforts to design farm equipment that suit to small farmers and help mechanize and commercialise the oilseeds-production sector by encouraging small farmers to avail contractual services of agro-service centres, agri-clinics, contract farming and value-chain system.

- In the context of significant awareness of most people preferring organic farm products more research is required in organic farming of oilseeds.
- Profitability of oilseeds can be enhanced by exploring and exploiting their potential for diversified uses with high value speciality products and derivatives including plant bio-mass.
- Union and State Governments and corporate sector need to commit to make available need-based resources including human capital such that central research institutes and SAUs are enabled to organize basic and strategic research to increase productivity, improve quality and value addition; establish a repository of information and genetic/genomic resources and strengthen linkages and partnerships with different stakeholders.
- As unbranded segment accounts for 80%to 90%.of total consumption in the country, it is necessary to formulate policies and strategic action plan such that corporate sector can make available within five years branded products that can have better value addition and minimize health hazards by preventing adulteration.
- Over the past decade, world class edible oil refineries have been set up in India where superior quality refined oil is produced at a competitive processing cost. However, the capacity utilisation of Indian refineries is still as low as 35% of installed capacity which if improved over a period of five years to 80% can yield rich dividends to the farmers and industry.
- Share of raw oil, refined and vanaspati in total oil market is 35%, 55% and 10% respectively. Thus, oilseeds offer substantial scope for the growth and development of country's agri-business in terms of production, processing, storage, pricing and marketing in and outside India which India can prioritize.
- With fragmented supply chain farmers realise as low as 30% to 35% of the final price paid by the consumers as against 60-65% realised by farmers in other countries. This factor along with asymmetry in information, poor bargaining power, and forced sales act as a substantial deterrent for farmers to invest in oilseeds-farming. This calls for revisiting the agricultural marketing system and introducing necessary reforms that can help farmers market and export their produce and products profitably.
- The credit and insurance infrastructure for agriculture needs to be expanded and lending and insurance policies must be farmer-friendly.

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- Since 1996 working as international consultant on "Rural Credit & Micro-finance" in countries of India, Azerbaijan, Tajikistan, Kazakhstan, Bangladesh and Uganda, with projects funded by World Bank, Asian Development Bank, & International Fund for Agricultural Development.
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