POLICY PAPER 121

Self-sufficiency in Edible Oil Production

NATIONAL ACADEMY OF AGRICULTURAL SCIENCES, NEW DELHI
December 2022

Self-sufficiency in Edible Oil Production

NATIONAL ACADEMY OF AGRICULTURAL SCIENCES, NEW DELHI

December 2022

CONVENER : Dr Sanjeev Gupta, ADG (Oilseed and Pulses), ICAR, New Delhi

REVIEWER : Dr Anjani Kumar, Senior Research Fellow, IFPRI, New Delhi

EDITORS : Dr Pratap Singh Birthal
Dr Malavika Dadlani

CITATION : NAAS 2022. Self-sufficiency in Edible Oil Production. Policy Paper No. 121, National Academy of Agricultural Sciences, New Delhi: 16 p.

Published by Dr Sanjeev Saxena, Executive Director on behalf of
NATIONAL ACADEMY OF AGRICULTURAL SCIENCES
NASC, Dev Prakash Shastry Marg, New Delhi - 110 012
Tel: (011) 25846051-52; Fax: (011) 25846054
Email: naas-mail@naas.org.in; Web site: http://naas.org.in

Preface

The per capita edible oil consumption has increased dramatically to more than 18.7 kg/year during the last two decades, making the country dependent on large oil imports to meet the domestic demand as well as industrial needs. Approximately 55-60% of the edible oil needs are met through imports at present. In the year 2020-21 in spite of more than three times increase in the production of oilseed in the last three and half decades, India imported about 13.35 million tonnes of cooking oil at over Rs. 1,17,00 crore, making the edible oil the largest import item after crude oil and gold.

To discuss the challenges in achieving self-sufficiency in edible oil and examine the plausible institutional and policy solutions, the National Academy of Agricultural Sciences (NAAS) organized an Experts' Meet on "Self-sufficiency in Edible Oil Production" on March 28, 2022. This meeting was attended by the representatives of DAC&FW, scientists, oilseed industry and associations, policymakers and academicians.

On behalf of the Academy, I appreciate the efforts of Dr Sanjeev Gupta for convening the Experts' Meet and bringing out its recommendations in the form of this policy paper, which I hope will lead to prepare implementable strategies in achieving self-sufficiency in oilseeds in the country. I would like to express my gratitude to Dr Mangala Rai, Former Secretary, DARE and Director General, ICAR for co-chairing the meet, and to Dr Deepak Pental, Former Vice Chancellor, Delhi University, Ms Shubha Thakur, Joint Secretary (Crops), DAC &FW and Mr Ashwani Kumar, Joint Secretary (Seeds), and other resource persons and eminent participants for their valuable inputs. My thanks are due to the distinguished reviewers for their critical comments and valuable suggestions and to Drs P.S. Birthal and Malavika Dadlani for their editorial support.

December, 2022
New Delhi

(Trilochan Mohapatra)
President, NAAS

Self-sufficiency in Edible Oil Production

1. INTRODUCTION

India imports 55-60 percent of its edible oil requirements. Till recently, it used to import nearly 14.5 million tonnes of edible oil annually, while the domestic production used to be around 10.4 million tonnes. In 2020-21, India imported 13.35 million tonnes of edible oil costing Rs. 1,17,000 crores. Over the past five decades, the share of imports has increased considerably, from 3 percent in 1970-71 to 58 percent at present. To reduce dependence on imports, a rationalised and comprehensive approach is needed to boost domestic production of oilseeds through technological and policy interventions. Although India was nearer to self-sufficiency in the early 1990s because of successful implementation of Technology Mission on Oilseeds, the imports increased considerably since 2000. However, there is a possibility to increase production of oilseeds by improving productivity of annual oilseeds, bringing additional area under them in non-traditional areas, including rice fallows, and increasing intercropping of annual oilseeds with other crops. Varietal improvement with newer breeding methods and breeding pipelines can significantly enhance yields of oilseed crops. Through technological means such as refining, bleaching and deodorisation, cotton seed, sunflower, oil palm and rice bran can also contribute significantly towards achieving self-sufficiency. Alongside, a strong policy support in terms of availability of quality seeds of improved varieties, credit, insurance, marketing, processing and price support also assumes importance in catalysing these efforts.

2. PRODUCTION AND CONSUMPTION

Oilseeds account for 14.3 percent of the gross cropped area in India. India is the 4th largest vegetable oil economy next to USA, China and Brazil. The country ranks first in production of castor, safflower, sesame and niger, second in groundnut, third in rapeseed-mustard, fourth in linseed, and fifth in soybean. Oilseeds contribute 12-13 percent to the dietary energy and account for about 8 percent of the agricultural exports. Together, soybean (36 percent), groundnut (32 percent), and rapeseed-mustard (29 percent) account for 97 percent of the total edible oilseeds production. The rest is accounted for by sesame, sunflower, safflower and niger. However, the major contribution to domestic edible oil production comes from rapeseed-mustard (3.2 million tonnes: 45 percent), groundnut (1.8 million tonnes: 25 percent) and soybean (1.8 million tonnes: 25 percent). The minor edible oilseeds (sesame, sunflower,

safflower and niger) contribute about 5 percent of the total domestic production of 7.03 million tons. Around 3.50 million tonnes of edible oils come from secondary sources such as cotton seed, oil palm, corn, rice bran, coconut and other TBOs.

However, total domestic production of edible oils is far below the annual requirement of over 25 million tonnes, at a consumption rate of 18-19 kg per capita. The deficit is met through imports of 13-14 million tonnes. It is worth noting that owing to rapid urbanization, sustained rise in per capita income and changing lifestyles, the per capita consumption of edible oil has increased dramatically from 6.2 kg/annum in 1986-87 to 18.2 kg/annum at present (Table 1). The growth in demand for edible oil increased at a rate of 4.3 percent, while production of oilseeds grew at the rate 2.2 percent, necessitating import of edible oil. In 2020-21, the oilseeds were cultivated in 28.7 million hectares producing 36.1 million tonnes of oilseeds with an average yield of 1254 kg/ha.

Table 1. Changes in India's oil sector

	Edible oil available for consumption (million tonnes)	Domestic production (million tonnes)	Imports (million tonnes)	Value of imports (Rs. in crore)	Dependence on imports (percent)	Per capita consumption (kg/annum)
1986-87	5.34	3.87	1.47	700	28.0	6.2
1994-95	7.54	7.19	0.35	300	5.0	7.3
2014-15	21.36	8.83	12.73	64,894	59.6	18.3
2019-20	25.06	10.60	14.46	68,576	57.7	18.7
2020-21	25.82	12.47	13.35	1,17,000	54.9	18.2

Source: Department of Sugar & Vegetable Oils; DG, CI&S, Department of Commerce, Kolkata

The diverse agro-ecological conditions of India favour growing nine annual oilseed crops, which include seven edible oilseeds (groundnut, rapeseed-mustard, soybean, sunflower, sesame, safflower and niger, and two non-edible oilseeds (castor and linseed). There have been technological breakthroughs in edible oilseeds in terms of improved varieties/hybrids with higher yield, earliness in maturity (for entering into different cropping systems), photo-thermo insensitivity (enabling cultivation in more than one season), amenability to mechanization, value added specialty varieties of superior quality, tolerance/resistance to abiotic (drought, heat, salinity, sodicity, etc) and biotic (pests & diseases) stresses. During the past five decades, the average yield of annual oilseeds has almost tripled, from 428 kg/ha in 1970-71 to 1254 kg/ha in 2020-21 and is estimated to reach 1336 kg/ha by 2025-26.

During this period, a total of 846 high-yielding climate-resilient varieties/hybrids of different oilseeds have been notified for commercial cultivation, and about one-fourth of them are in seed multiplication chain. In the last five years since 2015-162, a total of 170 varieties/hybrids of the oilseeds have been notified. In 2020-21, 24 high-yielding climate-resilient varieties/hybrids of different oilseeds have been notified. High genetic potential of the newly developed varieties of groundnut (3500-4000 kg/ha), mustard (3000-3500 kg/ha), castor (3000-3500 kg/ha), soybean (2200-2800) and sunflower (2000-2500 kg/ha) can be realized through adoption of the best management practices. ICAR has also made state-wise recommendations for identification of potential oilseeds, their varieties and package of practices for area expansion through intercropping and introduction of oilseeds in rice fallows, potato-fallows, rabi/spring/summer season and non-traditional areas.

Seed is the most critical input and the National Agricultural Research System is mandated to provide breeders seed of high-yielding varieties for the seed chain, as per the indents from the DA&FW. During the last five years (2015-16 to 2019-20), total indent for breeder seed of nine annual oilseed crops was 173664 quintals as against the production of 150779 quintals. Soybean (63 percent) and groundnut (35.3 percent), the two high seed volume crops with low seed multiplication ratio together accounted for 98.3 percent of the total indent. The deficit in breeder seed is mainly for soybean, which is a *kharif* season crop and its production is often affected by weather aberrations. However, a contingency plan (off-season production) has been made for meeting the breeder seed requirement of soybean. As per the indent for breeder seed from the DA&FW, the seed chain of oilseeds will be maintained with 287 varieties/hybrids in 2022-23, comprising of 62 varieties of groundnut, 54 of soybean, 75 of rapeseed-mustard, 32 of sesame, 27 of linseed, 11 of niger, 10 of sunflower, 14 of safflower and two of castor. In 2015-16, there were only 216 varieties/hybrids of oilseeds in the seed chain.

Besides the breeder seed production, the ICAR Seed Network Project also produced 34287 quintals of foundation seed, 82087 quintals of certified seed and 51160 quintals of truthfully-labelled seed of high-yielding varieties/hybrids of annual oilseeds to augment their availability to farmers during the last five years (2015-16 to 2019-20). To enhance the availability of quality certified seed of latest high- yielding varieties of oilseed crops, the ICAR, in collaboration with the DA&FW, is also implementing a project on “Seed Hubs on Oilseeds” in 14 states (Assam, Bihar, Chhattisgarh, Haryana, Karnataka, Maharashtra, Odisha, Rajasthan, Telangana, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Uttar Pradesh and West Bengal) since 2018-19. About 30,000 quintals of quality certified seed of

latest varieties was produced by “Seed Hubs on Oilseeds” in 2019-20. With the provision of self- sustaining operational funding (revolving fund), these seed hubs may further increase their targets of quality certified seed production. More “Seed Hubs on Oilseeds” particularly for high seed volume oilseed crops like soybean and groundnut may be established for further enhancing the availability of quality certified seeds to farmers. There has been a surge in the requirement for certified quality seeds of oilseeds in the last decade, from 48.14 lakh quintals in 2008-09 to 63.60 lakh quintals in 2019-20.

The ICAR and SAUs have been implementing frontline demonstrations (FLDs) on annual oilseeds since 1989 to create awareness about the newly developed varieties and technologies, to collect feedback over them, to assess the yield gap and also to create demand for them. Based on an analysis of over 23000 FLDs conducted over a decade by ICAR’s AICRP network, the yield gap (between improved technology and farmers’ practices) ranged from 20 percent in groundnut to 66 percent in niger, with an average of 39 percent for all oilseeds. By bridging the yield gap, production of nine annual oilseeds can increase by 12 million tonnes.

3. STRATEGIES FOR ENHANCING PRODUCTION

India’s population is expected to reach 1410 million by 2025, and with a per capita annual consumption of 18.7 kg (in 2016-17), the total vegetable oil requirement for direct consumption would be 26.4 million tonnes, and the indirect requirement (for other uses) is projected to be around 5.0 million tonnes, amounting to a total of 31.4 million tonnes. If the vegetable oil from secondary sources is assumed 5.5 million tonnes then the vegetable oil requirement from nine annual oilseeds would be 25.9 million tonnes. To achieve that quantity from the annual oilseeds, their total production must reach 103.6 million tonnes. The additional production would be possible by enhancing both area and yield of oilseeds. Soybean, rapeseed-mustard and groundnut are the three major annual oilseeds, which will have the most important role in enhancing the overall production of oilseeds and making the country self –sufficient in edible oils by 2025. Following strategies are important for achieving self-sufficiency in edible oils:

(i) Increasing productivity by harnessing frontier science

Oilseeds are chiefly confined (72 percent acreage) to rainfed agro-ecosystem that have low resource base, and faces several operational challenges including degradation of natural resources. As a result, adoption of improved varieties and package of practices is low, and consequently, the yield is also low. There exists

tremendous potential for enhancing yield of oilseeds by adopting already available technologies. The average yield of oilseeds is 1.25 tonne/ha but the yield varies across crops (Table 2): groundnut (1.7 t/ha), soybean (1.0 t/ha), rapeseed-mustard (1.7 t/ha) and sunflower (~1.0 t/ha). The proposed target yield by 2027 is 3.2t/ha for groundnut, 1.7 t/ha for soybean, 2.1 t/ha for rapeseed-mustard and 1.1 t/ha for sunflower.

The research strategies for achieving self-sufficiency in vegetable oil emphasize development of improved cultivars with high yield potential and resilience to climate change through (i) pre-breeding for introgression of QTLs for higher yield and tolerance to biotic and abiotic stresses in groundnut, rapeseed-mustard and sunflower; (ii) development of climate-resilient short-duration, high- yielding varieties of groundnut, soybean and safflower; (iii) harnessing heterosis to increase yield of rapeseed-mustard, sunflower, castor, safflower and sesame; (iv) directed breeding using MAS to develop high-yielding varieties of groundnut, soybean, rapeseed- mustard, castor and sunflower with better oil quality and tolerance to moisture, heat and photoperiod stresses; (v) development of transgenics for biotic and abiotic stresses in groundnut, rapeseed- mustard, castor and sunflower; (vi) integrated crop management practices for enhancing yield and reducing cost of cultivation; (vi) application of PGPR for sustainable yield improvements, and (vii) promotion of integrated pest management (IPM).

New breeding techniques (fast track breeding, genomic selections, genome editing and gene introgression) need to be resorted aggressively with increasing

Table 2: Yield (kg/ha) of oilseed crops in India *vis-a-vis* world

Crop	India*	World	Country with highest productivity**	Genetic potential of newly bred Indian varieties
Groundnut	1720	1699	4426 (USA)	3500-4000
Rapeseed-Mustard	1719	2039	3303 (Germany)	3000-3500
Soybean	1040	2784	3378 (USA)	2200-2800
Sunflower	927	1802	4378 (China)	2000-2500
Safflower	694	799	1721 (Mexico)	1000-1200
Linseed	706	951	1432 (Canada)	1200-1600
Sesame	454	487	1618 (China)	1000-1500
Oilpalm fruit	12380	14561	18534 (Malaysia)	-

research investment for such techniques. Recent advances in the development of a genome editing technique using CRISPR/Cas9 provide a ray of hope for developing new varieties of crops rapidly. High linoleic acid content in cotton seed oil could be reduced by knocking out one of the *fad 2* gene. The Government of India in its recent notification in 2022 provided the exemption to genome edited plants falling in the categories of SDN 1 and SDN 2, which are free of exogenous introduced DNA.

The conventional breeding supported by marker technologies are also at a fast pace to achieve well-defined crop specific objectives of breeding high yielding and disease resistant varieties. These efforts need to be accelerated further.

Crop specific research priorities are as follows:

Soybean: development of varieties tolerant to herbicides and drought, resistant to diseases, photo-thermal insensitive with wider adaptability across planting times and latitudes, and possessing specialty traits in terms of quality, and conservation agriculture practices.

Mustard: development of varieties tolerant to drought and resistant to Sclerotinia stem rot disease, broadening of genetic base, development of hybrids, and suitability to conservation agriculture practices.

Groundnut: development of varieties tolerant to moisture (drought), heat and photoperiod stresses and resistance to diseases, and suitability to conservation agriculture practices.

Other oilseeds (linseed, sesame, sunflower, safflower, castor, and niger): improvement in fatty acid profile of linseed for shifting to edible category; development of sesame varieties with tolerance to drought and Phyllody disease, and development of sesame hybrid; breeding hybrids/varieties of castor, safflower and sunflower for higher seed and oil yield, and having tolerance to biotic and abiotic stresses; development of specialty type varieties such as high oleic sunflower and safflower, white and large seeded sesame, dual purpose safflower with high petal yield.

(ii) Consensus on GM oilseeds

The ISAAA, 2019 Report indicated that GM oilseed crops account for more than 50 percent area of GM crops. Globally, 78 percent of soybean and 29 percent of canola production comes from GM varieties/hybrids. All Canadian mustard is GM that occupies more than 10 million hectares. Australia has recently released

herbicide tolerant GM Indian mustard to meet the increasing global demand of edible oil. The GM technology for hybrid seed production developed by the University of Delhi may play an important role in reducing the edible oil imports and moving towards self-sufficiency in edible oils.

(iii) Exploring newer niches for oilseed production

In their traditional areas, oilseed crops are likely to regain some of their lost areas or may find newer areas for cultivation. About 2.85 million hectare of additional area can be brought under oilseed cultivation. The additional area in non-traditional oilseeds regions will come from groundnut in rice- and potato-fallows in West Bengal; potato-fallows in Deesa-Gujarat and Western UP; rice fallows in Odisha and Jharkhand; north-eastern region; intercropping in sugarcane in UP, Odisha and Karnataka); rapeseed-mustard in north-eastern hill (NEH) region, parts of Telangana, Andhra Pradesh, and Karnataka under conserved moisture and assured irrigated conditions; soybean in Andhra Pradesh, Arunachal Pradesh, HP, Jharkhand, UP, Uttarakhand, West Bengal, Punjab, Haryana and Odisha; sunflower in parts of Punjab, Haryana, Bihar, West Bengal, NEH region, Telangana, UP, and Madhya Pradesh; sesame in parts of Bihar, Haryana, Punjab, Assam and NEH region, and safflower in parts of Gujarat, Madhya Pradesh and Chhattisgarh as sole or intercrop (Table 3).

High-yielding short-duration varieties (90-100 days) with a yield target of >4000 kg/ha for groundnut with fresh seed dormancy; >2000 kg/ha for rapeseed-mustard; >2500 kg/ha for soybean; >1500 kg/ha for sunflower; >1000 kg/ha for sesame and other oilseeds resistant to biotic and abiotic stresses will be required for non-traditional areas. Significant area expansion of about is possible through promoting in intercropping, cultivation in rice and other fallows and non-traditional areas, replacing some areas of cereals with annual oilseeds, and cultivating some of them in spring/summer season. Reduction in maturity duration by 10-20 days of oilseeds and enhancement of photo-thermo insensitivity is essential for diversification of the existing cropping systems in favour of oilseeds in traditional as well as new regions.

(iv) Revival of sunflower

Area under sunflower has drastically reduced from 2.34 million ha in 2005-06 to 0.22 million ha in 2020-21. India is largely dependent on imports of sunflower oil as the domestic production is only 0.7 million tonnes. Import of sunflower oil has been increasing, from 1.08 million tonnes in 2013-14 to 2.43 million

Table 3. New potential areas for oilseed cultivation

Crop	Area (million ha)			States/ Regions
	2024-25	2029-30	2034-35	
Groundnut	0.28	0.30	0.10	Rice- and potato- fallows in West Bengal; Potato-fallows in Gujarat and Western UP; rice fallows in Odisha and Jharkhand; intercrops with sugarcane in UP, Odisha and Karnataka, etc.
Rapeseed-Mustard	0.11	0.08	0.10	NEH region, part of Telangana, Andhra Pradesh, and Karnataka under conserved moisture and assured irrigated conditions
Soybean	0.64	0.58	0.53	Andhra Pradesh, Arunachal Pradesh, HP, Jharkhand, UP, Uttarakhand, West Bengal, Punjab, Haryana and Odisha
Sesame	0.065	0.02	0.01	Parts of Bihar, Haryana, Punjab, Assam, and NEH region
Sunflower	0.30	0.10	0.20	Parts of Punjab, Haryana, Bihar, West Bengal, NEH region, Telangana, UP, and Madhya Pradesh
Safflower	0.012	0.012	0.02	Parts of Bihar, Haryana, Punjab, Assam, and NEH region
Total	**1.207**	**1.072**	**0.96**	

tonnes in 2019-20. India imports sunflower oil mainly from Ukraine, Russia and Argentina.

There is an urgent need for a separate Mission for revival of sunflower. The Mission should include establishment of production and processing hubs in Karnataka, Maharashtra and Andhra Pradesh. Hybrid seed production programme in public-private partnership may be promoted. Sunflower suffers from necrosis disease, which need to be controlled. For higher yields, there is a need to promote apiary for promoting pollinators.

(v) Closing yield gaps

The existing yield gaps in oilseeds varies from 22 to 160 per cent with an average of around 60 per cent. The highest gap is in sunflower (160percent). In other crops, it ranges from 22 percent (sesame) to 81 percent (safflower). The yield gap in major oilseed crops viz., groundnut, soybean and rapeseed-mustard is between 27 to 50 percent. However, with the use of recommended agronomic

and plant protection practices the yield gaps can be bridged substantially. If the gap is reduced from an average of 60 per cent in seven oilseed crops at present (Table 4) to 20 per cent in the next 10 years, an additional 13-14 million tonnes of oilseed production can be achieved. In other words, the production of edible oils can be enhanced by 3-4 million tonnes.

Table 4. Yield gaps in oilseed crops

Crop	Existing yield gap (per cent)	Target for minimizing yield gap by 2025-26
Soybean	50	20
Rapeseed- Mustard	27	15
Groundnut	40	15
Sesame	22	10
Sunflower	160	20
Safflower	81	45
Niger	40	15
Average	60	20

(vi) Enhance participation of cooperatives and private seed entrepreneurs in seed production

The seed replacement rates (SRR) of most of the edible oilseeds, barring mustard (90 per cent) and soybean (68 per cent), are low. At present it is 30 per cent for groundnut, 29 per cent for sesame, 36 per cent for sunflower, 27 per cent for safflower and 36 per cent for niger. Production of quality seeds of recently released improved varieties in the entire chain of nucleus-breeder-foundation-certified seed is to be ensured to improve seed replacement rate. Overall improvement in SRR to the extent of about 40 per cent is to be targeted by 2034-35. Thirty-three 'Seed Hubs on Oilseeds' have already been established and 136 new hubs are proposed to augment supply of quality certified seeds for use by the farmers or for use in different extension programmes such as frontline demonstrations, cluster frontline demonstrations, mini kit seed distribution, etc. The cooperatives and private seed entrepreneurs may be encouraged in seed production of oilseed crops.

(vii) Mainstreaming secondary sources of oil

Besides the nine oilseed crops, a number of oil-yielding species of plant origin are cultivated in India as perennials (Oil palm and Coconut) and minor oil

bearing tree species (Mahua, Simarouba, Cheura, Wild Apricot, Karanja, Jatropha, Neem, Jojoba, Sal, Kokum, Olive, Walnut, Tung etc.). These supplementary sources may contribute significantly towards improving supply of edible oils. At present, the secondary sources like rice bran (1.07 million tonnes), cotton seeds (1.3 million tonnes), coconut (0.6 million tonnes), palm oil (0.28 million tonnes) and tree-borne oilseeds (0.15 million tonnes) contribute about 30 percent to the total domestic production of edible oils (Table 5, Fig. 1). These sources need to be explored further, and mainstreamed in the edible oil sector. Most secondary oils are less stable, and the efforts are needed to address their quality. High linoleic content in cotton could be reduced by knocking out one of the fad 2 genes. Efforts are also required for technological upgradation for refining, bleaching and deodorization of secondary oil sources.

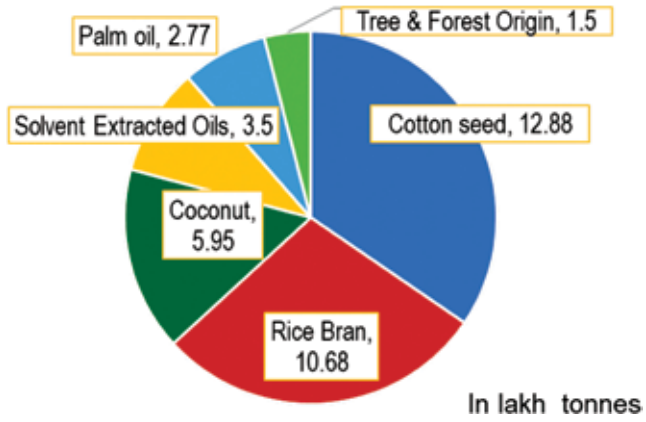

Fig. 1. Secondary sources of vegetable oil

Table 5: Oil production (in million tonnes) from secondary sources

Year	Oilseed Production	Oil from Primary Sources	Oil from Secondary Sources	Total Edible oil
2014-15	27.51	6.55	3.25	9.80
2015-16	25.25	6.05	3.12	9.17
2016-17	31.27	7.31	3.40	10.71
2017-18	31.45	7.36	3.65	11.01
2018-19	32.25	6.96	3.48	10.44
2020-21	35.94	8.80	3.67	12.47

(viii) Mechanization for production and processing

Designing and development of efficient farm machines for planting, harvesting, inter-cultivation, threshing and zero-till drill need to be promoted for cultivation of oilseed crops. All required machines can be developed in PPP mode to ensure availability

at affordable prices. Tax holiday should be declared for small implements, and tractors of more than 30 HP. Popularization of broad-bed and furrow machine for sowing of soybean and groundnut is urgently needed to overcome the challenges water-logging and intermittent droughts. Besides, micro-irrigation is also important for rainfed oilseed crops. Drones for chemical spray and monitoring may also be applied. Custom-hiring centres need to be established in oilseed production hubs. India has the largest oil processing industry, which needs to be modernized for improving oil recovery.

(ix) Value addition and quality improvement

Oilseed crops provide immense scope for diversified uses with high-value specialty products and derivatives. Oil meal receives premium price in poultry and livestock production. Efforts have been made to develop null Kunitz trypsin inhibitor and low oxygenase in soybean adding value to the use of soybean as food. Similar efforts are required to develop groundnut varieties for confectionary. High oleic acid in oilseed crops enhances shelf life of oil. High oleate varieties of groundnut, soybean and sunflower have been developed. Development canola quality of rapeseed-mustard oil is also paving way to develop high quality mustard varieties.

(x) Addressing exporters' needs

India exports oilseeds, oils and oilseed meals or cakes. There is an export avenue for sesame, groundnut and castor worth Rs. 18,000 to 19,000 crores. India also earns foreign exchange of Rs. 7,000 to 8,000 crore annually from exports of oil meals. Indian Oilseeds and Produce Export Promotion Council organizes exporters of groundnut and sesame. There is need to address problems of aflatoxin (2 ppb B1; 4ppb B+G), sucrose content, fatty acid and peroxide in groundnut and oxalic acid, lignin and oil content in sesame.

(xi) Minimum support price and procurement

Seven edible oilseed crops are provided minimum support price (MSP), and the prices of all these have been increased steadily over the years, ranging from 31.5 per cent for groundnut to 48.5 per cent for sunflower. However, the increase in MSP is ineffective in the absence of sufficient procurement, which is only about 5 per cent of their production. Therefore, there is need for a dedicated agency such as NDDB to procure oilseeds as was done during the period of Technology Mission on Oilseeds.

(xii) Innovative marketing models

Agricultural marketing system has several structural weaknesses, which need to be addressed by evolving innovative marketing models involving the private sector. The NDDB played a significant role in 'yellow revolution' by providing forward and backword linkages. Its edible oil brand 'Dhara' became popular among consumers. Such a model may serve as a base for evolving new institutional mechanisms for improving marketing efficiency.

(xiii) Awareness campaign for reducing consumption

On one hand, the overall requirement of edible oil continues to increase with the rise in population, whereas on the other, the annual per capita consumption of edible oils has increased from 15.8 kg in 2012-13 to 18.76 kg in 2019-20, and is expected to cross 19 kg soon. If this trend were to continue, the annual per capita consumption is likely to increase to 21.20 kg by 2024-25, 23.96 kg by 2029-30 and 27.08 kg by 2034-35. Reducing their consumption needs an aggressive campaign to create awareness among consumers of the health benefits of reduced consumption.

(xiv) Edible Oil Development Fund

There is need to create an Edible Oil Development Fund by levying cess, say 0.5 percent on imports of edible oils. This fund should be utilized for research and development in oilseeds and for incentivizing farmers for greater allocation of area to oilseeds and adoption of improved technologies and agronomic practices. Alteration in the import duty can make an impact on area and production of edible oilseeds. The Government of India had adopted low import duty regime during 1994-2000, and high import duty during 2000-2008, but again resorted to low import duty during 2008-14. Low import duty reduces prices of domestically produced oilseeds, which act as a disincentive to oilseed farmers. Linking support price to import duty favours farmers, processors and consumers, while higher difference in the import duty between crude and refined oil favours processing industries. A rational import duty regime is likely to help a healthy growth in oilseed production.

4. RECOMMENDATIONS

- A nationwide aggressive campaign needs to be launched in print, electronic and other media platforms for creating health awareness among the consumers on reducing the consumption of edible oil.

  (Action: Department of Consumer Affairs, MoCAFPD and Department of Health & Family Welfare, MoHFW, GoI)

- Productivity of oilseed crops has to be increased with the use of frontier science (eg., fast track breeding, genomic selections, gene silencing, genome editing etc.). Genome editing approach needs to be pursued for improving both the yield and quality of oil.

  (Action: ICAR, DARE, MoA&FW, GoI)

- Policy decision is needed on fast-tracking the release of indigenously developed GM oilseeds.

  (Action: MoEF&CC)

- Oil palm needs to be declared as a "plantation crop" by the state governments and be exempted from land ceiling.

  (Action: MoEF&CC)

- The secondary sources of oil like cotton seed, rice bran, TBOs etc. are assuming importance and need mainstreaming in the edible oil sector. Innovations in refining, bleaching and deodorization of oils from cotton seed, sunflower, palm oil and rice bran could contribute to achieving self-sufficiency in edible oil.

  (Action: Department for Promotion of Industry & Internal Trade, MoC&I)

- Efforts are required for restricted use of edible oils for industrial purposes.

  (Action: Department for promotion of Industry & Internal Trade, MoC&I)

- An **Oilseed Development Fund** may be created by imposing 0.5 percent cess over imports. This fund could be utilized for R&D projects and price incentives to farmers.

  (Action: Department for Promotion of Industry & Internal Trade, MoC&I, DARE, GoI).

- Adopting higher import duty regime will protect domestic production, whereas higher duty difference between crude and refined oil favors processing industries. Linking support price to import duty structure will favor farmers, processors and consumers.

  (Action: Department for promotion of Industry & Internal Trade, MoC&I)

- The average yield gap in various edible oilseed crops is about 60 percent, which needs to be reduced by addressing secondary and micro-nutrient deficiencies, provision of life-saving irrigation, use of customized fertilizers and ICT interventions.

(Action: DAC&FW, MoA&FW and ICAR)

- Mapping of states/regions/areas with respect to productivity levels of oilseed crops as high, medium or low is needed, so that the resources could be utilized more efficiently for higher production levels. Areas may be further identified based on availability of one/two/three irrigations, and accordingly, the respective crops could be promoted in Mission Mode approach in the potential areas.

(Action: NMEO, DAC&FW, MoA&FW and ICAR)

- Timely availability of quality seeds to the farmers is to be ensured for each crop and efforts to be made for establishment of more number of seed hubs, seed villages, and seed banks.

(Action: DAC&FW, MoA&FW and ICAR)

- Newer options of oilseed production in high productivity zones viz., rice fallows, *kharif* fallows and potato fallows and in intercropping are to be explored.

(Action: DAC&FW, MoA&FW and ICAR)

- Subsidy needs to be extended to all types of machinery for micro-irrigation. These could be developed in PPP mode to ensure availability at an affordable price. Tax holiday may be considered for small implements, tractors of more than 30 HP, etc.

(Action: DAC&FW, MoA&FW)

- Export avenues for sesame, groundnut and castor oil should be created by addressing quality concerns. The organic cultivation of sesame and groundnut may also be encouraged.

(Action: Indian Oilseeds Produce Export Promotion Council and ICAR)

- Improving indigenous production of crops that constitute greater proportion of imports like sunflower, palm and soybean oil is essential.

(Action: DAC&FW, MoA&FW, ICAR, DARE, MoA&FW)

- A single value chain from production to processing, and marketing needs to be encouraged under the umbrella of 'Make in India' by inviting cooperatives and corporates for establishing production and processing hubs. Innovative institutional

models of processing and marketing like Amul, Parag, and Dhara need to be established and promoted.

(Action: Department of Consumer Affairs, MoCAF&PD, GoI, Ministry of Cooperation, GoI)

- High MSP and remunerative prices encourage farmers to take up more oilseed crops. However, only 5 percent of oilseed is procured by government agencies. A separate procurement agency may be established/identified for effective implementation of MSP.

(Action: Department of Consumer Affairs, MoCAF&PD, GoI)

- To ensure the success of NMEO program, a high level official at the centre could be identified for effective coordination among various agencies/ ministries.

(Action: DA&FW, MoA&FW, GoI)

List of Participants

1. Dr Trilochan Mohapatra, Secretary (DARE) & DG (ICAR), New Delhi
2. Dr Mangala Rai, Former Secretary (DARE) & DG (ICAR), New Delhi
3. Dr TR Sharma, DDG (Crop Science), ICAR, New Delhi
4. Dr Deepak Pental, Former VC, Delhi University
5. Mrs Shubha Thakur, Jt Secretary (Oilseeds), DA&FW, New Delhi
6. Mr Ashwani Kumar, Jt Secretary (Seed), DA&FW, New Delhi
7. Dr Suresh Pal, Director. ICAR-National Institute of Agricultural Economics & Policy Planning
8. Dr Arvind Kumar, Vice Chancellor, RLBCAU, Jhansi
9. Dr A.K.Singh, DDG (Extension), ICAR
10. Dr S.N.Jha, DDG (Agricultural Engineering), ICAR, New Delhi
11. Dr Sanjeev Gupta, ADG (O&P), ICAR, New Delhi
12. Dr DK Yadava, ADG (Seed), ICAR, New Delhi
13. Dr JS Chauhan, Former ADG (Seed), ICAR, New Delhi
14. Dr. Malavika Dadlani, Editor, NAAS, New Delhi
15. Dr. Sudhakar Rao Desai, President, Indian Vegetable Oil Producers Association
16. Mr D.N. Pathak, Executive Director, Soybean Processors Association of India, Indore
17. Dr Mrs P Janila, Sr Scientist, Groundnut, ICRISAT, Hyderabad
18. Dr Radhakrishnan, Former Director, ICAR-DGR, Junagadh
19. Dr PK Rai, Director, ICAR-DRMR, Bharatpur
20. Dr R.K. Mathur, Director, ICAR-IIOPR, West Godavari
21. Dr Sujatha, M, Director, ICAR-IIOR, Hyderabad
22. Dr Nita Khandekar, Director, ICAR-IISR, Indore
23. Dr Rajni Bisen, PC (Sesame & Niger), JNKVV, Jabalpur
24. Dr KH Singh, Principal Scientist, ICAR-DRMR, Bharatpur
25. Dr Sanjay Gupta, Principal Scientist, ICAR-IISR, Indore
26. Dr Amrendra Reddy, Principal Scientist, ICAR-CRIDA, Hyderabad
27. Dr. Girish Jha, Principal Scientist, ICAR-IARI, New Delhi
28. Dr.S.K.Jha, Principal Scientist, ICAR, New Delhi

Note: The designations and affiliations of the participants are as on the date of BSS.

NAAS DOCUMENTS ON POLICY ISSUES

Policy Papers

65.	Climate Resilient Agriculture in India	2013
66.	Role of Millets in Nutritional Security of India	2013
67.	Urban and Peri-Urban Agriculture	2013
68.	Efficient Utilization of Phosphorus	2014
69.	Carbon Economy in Indian Agriculture	2014
70.	MOOC for Capacity Building in Indian Agriculture: Opportunities and Challenges	2014
71.	Role of Root Endophytes in Agricultural Productivity	2014
72.	Bioinformatics in Agriculture: Way Forward	2014
73.	Monitoring and Evaluation of Agricultural Research, Education and Extension for Development [AREE4D]	2014
74.	Biodrainage: An Eco-friendly Tool for Combating Waterlogging	2015
75.	Linking Farmers with Markets for Inclusive Growth in Indian Agriculture	2015
76.	Bio-fuels to Power Indian Agriculture	2015
77.	Aquaculture Certification in India: Criteria and Implementation Plan	2015
78.	Reservoir Fisheries Development in India:Management and Policy Options	2016
79.	Integration of Medicinal and Aromatic CropCultivation and Value Chain Management for Small Farmers	2016
80.	Augmenting Forage Resources in Rural India:Policy Issues and Strategies	2016
81.	Climate Resilient Livestock Production	2016
82.	Breeding Policy for Cattle and Buffalo in India	2016
83.	Issues and Challenges in Shifting Cultivation and its Relevance in the Present Context	2016
84.	Practical and Affordable Approaches for Precision in Farm Equipment and Machinery	2016
85.	Hydroponic Fodder Production in India	2017
86.	Mismatch between Policies and Development Priorities in Agriculture	2017
87.	Abiotic Stress Management with Focus on Drought, Flood and Hailstorm	2017
88.	Mitigating Land Degradation due to Water Erosion	2017
89.	Vertical Farming	2019
90.	Zero Budget Natural Farming - A Myth or Reality?	2019
91.	Loan Waiving versus Income Support Schemes: Challenges and Way Forward	2019
92.	Tropical Wilt Race-4 Affecting Banana Cultivation	2019
93.	Enhancing Science Culture in Agricultural Research Institutions	2020
94.	Payment of Ecosystem Services	2020
95.	Food-borne Zoonotic Diseases	2020
96.	Livestock Improvement through Artificial Insemination	2020
97.	Potential of Non-Bovine Milk	2021
98.	Agriculture and Food Policy for the Five Trillion Dollar Economy	2021
99.	New Agricultural Education Policy for Reshaping India	2021
100.	Strategies for Enhancing Soil Organic Carbon for Food Security and Climate Action	2021
101.	Big Data Analytics in Agriculture	2021
102.	WTO and Indian Agriculture: Issues, Concerns, and Possible Solutions	2022
103.	Antimicrobial Resistance	2022
104.	One World One Health	2022
105.	Sugarcane-based Ethanol Production for Sustainable Fuel Ethanol Blending Programme	2022
106.	Utilization of Wastewaters in Urban and Peri-urban Agriculture	2022
107.	Certification of Quality Planting Material of Clonally Propagated Fruit Crops For Promoting Agricultural Diversification	2022
108.	Agri-Startups in India: Opportunities, Challenges and Way Forward	2022
109.	Emergency Preparedness for Prevention of Transboundary Infectious Diseases in Indian Livestock and Poultry	2022
110.	Strategies and Approaches for Promotion of Sustainable Bivoltine Sericulture in India	2022
111.	Food Fortification : Issues and Way Forward	2022
112.	Gender and Nutrition based Extension in Agriculture	2022
113.	Contract Farming for Transforming Indian Agriculture	2022
114.	Promoting Millet Production, Value Addition and Consumption	2022
115.	Waste to Wealth – Use of Food Waste as Animal Feed and Beyond	2022
116.	Sustaining the Pulses Revolution in India: Technological and Policy Measures	2022
117.	Road Map for Rehabilitation of 26 Mha Degraded Lands in India	2022
118.	Entrepreneurship for Quality Fodder Production	2022
119.	Secondary Agriculture - Challenges, Opportunities and Way Forward	2022
120.	Scaling up Innovative Agricultural Extension Models	2022

Status / Strategy Papers

1.	Role of Social Scientists in National Agricultural Research System (NARS)	2015
2.	Towards Self-sufficiency of Pulses in India	2016
3.	Strategy for Transformation of Indian Agriculture for Improving Farmers Welfare	2016
4.	Sustaining Soybean Productivity and Production in India	2017
5.	Strengthening Agricultural Extension Research and Education - The Way Forward	2017
6.	Strategy on Utilization of Glauconite Mineral as Source of Potassium	2017
7.	Vegetable Oil Economy and Production Problems in India	2017
8.	Conservation Policies for Hilsa and Mahseer	2018
9.	Accelerating Seed Delivery Systems for Priming Indian Farm Productivity Enhancement: A Strategic View Point	2018
10.	Renewable Energy: A New Paradigm for Growth in Agriculture	2018
11.	Rumen Microbiome and Amelioration of Methane Production	2019
12.	Harnessing Full Potential of A1 and A2 Milk in India: An Update	2019
13.	Development and Adoption of Novel Fertilizer Materials	2019
14.	Innovations in potato seed production	2021
15.	Potential of Transgenic Poultry for Biopharming	2022
16.	Need for Breeding Tomatoes Suitable for Processing	2022
17.	Biofortification to Address Malnutrition in India: Present Status and Way Forward	2022
18.	Drudgery Reduction in Agriculture through Improved Farm Machinery	2022

Policy Briefs

1.	To Accelerate Utilization of GE Technology for Food & Nutrition Security and Improving Farmers' Income	2016
2.	Innovative Viable Solution to Rice Residue Burning in Rice-Wheat Cropping System through Concurrent Use of Super Straw Management System-fitted Combines and Turbo Happy Seeder	2017
3.	Soil Health: New Policy Initiatives for Farmers Welfare	2018
4.	Uniform Policy for Fish Disease Diagnosis and Quarantine	2019
5.	Saving the Harvest: Reducing the Food Loss and Waste	2019
6.	Better Management of Pesticides in India: Policy Perspectives	2019
7.	Regulatory Framework for Genome Edited Plants: Accelerating the Pace and Precision of Plant Breeding	2020
8.	Covid-19 Pandemic: Impact and New Normal in Agriculture	2020
9.	Direct Benefit Transfer of Fertilizer Subsidy: Policy Perspectives	2020
10.	Harmonization of seed regulations for sustainable food security in India	2020
11.	Towards Revision of Biological Diversity Act 2002	2021
12.	Limitations of Global Hunger Index and Way Forward	2022
13.	Regulation for Genetically Modified (GM) Foods and Detection of Unauthorized GM Food Events	2022

NAAS DOCUMENTS ON POLICY ISSUES*

Policy Papers

1.	Agricultural Scientist's Perceptions on National Water Policy	1995
2.	Fertilizer Policy Issues (2000-2025)	1997
3.	Harnessing and Management of Water Resources for Enhancing Agricultural Production in the Eastern Region	1998
4.	Conservation, Management and use of Agro-biodiversity	1998
5.	Sustainable Agricultural Export	1999
6.	Reorienting Land Grant System of Agricultural Education in India	1999
7.	Diversification of Agriculture for Human Nutrition	2001
8.	Sustainable Fisheries and Aquaculture for Nutritional Security	2001
9.	Strategies for Agricultural Research in the North-East	2001
10.	Globalization of Agriculture: R & D in India	2001
11.	Empowerment of Women in Agriculture	2001
12.	Sanitary and Phytosanitary Agreement of the World Trade Organization Advantage India	2001
13.	Hi-Tech Horticulture in India	2001
14.	Conservation and Management of Genetic Resources of Livestock	2001
15.	Prioritization of Agricultural Research	2001
16.	Agriculture-Industry Interface: Value Added Farm Products	2002
17.	Scientists' Views on Good Governance of An Agricultural Research Organization	2002
18.	Agricultural Policy: Redesigning R & D to Achieve It's Objectives	2002
19.	Intellectual Property Rights in Agriculture	2003
20.	Dichotomy Between Grain Surplus and Widespread Endemic Hunger	2003
21.	Priorities of Research and Human Resource Development in Fisheries Biotechnology	2003
22.	Seaweed Cultivation and Utilization	2003
23.	Export Potential of Dairy Products	2003
24.	Biosafety of Transgenic Rice	2003
25.	Stakeholders' Perceptions On Employment Oriented Agricultural Education	2004
26.	Peri-Urban Vegetable Cultivation in the NCR Delhi	2004
27.	Disaster Management in Agriculture	2004
28.	Impact of Inter River Basin Linkages on Fisheries	2004
29.	Transgenic Crops and Biosafety Issues Related to Their Commercialization in India	2004
30.	Organic Farming: Approaches and Possibilities in the Context of Indian Agriculture	2005
31.	Redefining Agricultural Education and Extension System in Changed Scenario	2005
32.	Emerging Issues in Water Management The Question of Ownership	2005
33.	Policy Options for Efficient Nitrogen Use	2005
34.	Guidelines for Improving the Quality of Indian Journals & Professional Societies in Agriculture and Allied Sciences	2006
35.	Low and Declining Crop Response to Fertilizers	2006
36.	Belowground Biodiversity in Relation to Cropping Systems	2006
37.	Employment Opportunities in Farm and Non-Farm Sectors Through Technological Interventions with Emphasis on Primary Value Addition	2006
38.	WTO and Indian Agriculture: Implications for Policy and R&D	2006
39.	Innovations in Rural Institutions: Driver for Agricultural Prosperity	2007
40.	High Value Agriculture in India: Prospects and Policies	2008
41.	Sustainable Energy for Rural India	2008
42.	Crop Response and Nutrient Ratio	2009
43.	Antibiotics in Manure and Soil A Grave Threat to Human and Animal Health	2010
44.	Plant Quarantine including Internal Quarantine Strategies in View of Onslaught of Diseases and Insect Pests	2010
45.	Agrochemicals Management: Issues and Strategies	2010
46.	Veterinary Vaccines and Diagnostics	2010
47.	Protected Agriculture in North-West Himalayas	2010
48.	Exploring Untapped Potential of Acid Soils of India	2010
49.	Agricultural Waste Management	2010
50.	Drought Preparedness and Mitigation	2011
51.	Carrying Capacity of Indian Agriculture	2011
52.	Biosafety Assurance for GM food Crops in India	2011
53.	Ecolabelling and Certification in Capture Fisheries and Aquaculture	2012
54.	Integration of Millets in Fortified Foods	2012
55.	Fighting Child Malnutrition	2012
56.	Sustaining Agricultural Productivity through Integrated Soil Management	2012
57.	Value Added Fertilizers and Site Specific Nutrient Management (SSNM)	2012
58.	Management of Crop Residues in the Context of Conservation Agriculture	2012
59.	Livestock Infertility and its Management	2013
60.	Water Use Potential of Flood-affected and Drought-prone Areas of Eastern India	2013
61.	Mastitis Management in Dairy Animals	2013
62.	Biopesticides – Quality Assurance	2013
63.	Nanotechnology in Agriculture: Scope and Current Relevance	2013
64.	Improving Productivity of Rice Fallows	2013

Continued on inside cover

***For details visit web site: http://naas.org.in**