



Technology for Maximising Production of Sesame

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Introduction

Sesame (*Sesamum indicum L.*) is the oldest indigenous oilseed crop, with longest history of cultivation in India. Sesame or gingelli is commonly known as til (Hindi, Punjabi, Assamese, Bengali, Marathi), tal (Gujarati), nuvvulu, manchi nuvvulu (Telugu), ellu (Tamil, Malayalam, Kannada), tila/pitratarpa (Sanskrit) and rasi (Odia) in different parts of India. Sesame seed (contain 50% oil, 25% protein and 15% carbohydrate) is used in baking, candy making and other food industries. It is an integral part of rituals, religion and culture. The oil is used in cooking, salad oils and margarine (contains about 40% oleic and 40% linoleic acid). Sesame oil and foods fried in sesame oil have a long shelf life because the oil contains an antioxidant called sesamol. The oil can be used in the manufacture of soaps, paints, perfumes, pharmaceuticals and insecticides. Sesame meal is an excellent high quality protein (40%) feed for poultry and livestock. Sesame seeds are store house of energy and very rich in vitamins E, A, B Complex and minerals viz., calcium, phosphorus, iron, copper, magnesium, zinc and potassium. It is a best substitute for mother's milk especially in case of milk allergies. Sesame seed contains extraordinary quantities of methionine, tryptophan, amino acids with innumerable benefits. The oil is used as the base for Ayurvedic preparations and known as the Queen of oils. Sesame seeds are called as the seed of immortality. Studies showed that lignans found in sesame seed have remarkable antioxidant effect on human body. Til se dil or Til – dil are the ancient Hindi proverbs in India signifying the importance of sesame for heart. Sesame oil is considered as anticholesterol and highly beneficial for heart ailments. Sesame is energy rich crop, ironically however, grown on energy starved condition.

India ranks first in world with 16.73 Lakh ha area and 6.5 Lakh tonnes production. The average yield of sesame (391 kg/ha) in India is low as compared with other countries in the world. The main reasons for low productivity of sesame are its rainfed cultivation in marginal and submarginal lands under poor management and input starved conditions. However, improved varieties and agro production

technologies capable of increasing the productivity levels of sesame are now developed for different agro ecological situations in the country. A well-managed crop of sesame can yield 1200-1500 kg/ha under irrigated and 800-1000 kg/ha under rain fed conditions. The crop is grown in almost all parts of the country. The area, production and the productivity of the important states growing sesame during 2022-23 is given below:

Table 1. Area, Production and Productivity of Sesame in major states of India.

State	Area (‘000 ha)	Production (‘000 tonnes)	Productivity (kg/ha)	State	Area (‘000 ha)	Production (‘000 tonnes)	Productivity (kg/ha)
Andhra Pradesh	67.0	22.0	328	Madhya Pradesh	314.5	157.1	500
Assam	12.0	7.0	583	Maharashtra	31.0	9.0	290
Bihar	2.5	2.2	873	Odisha	23.1	4.4	191
Chhatisgarh	18.8	5.5	293	Punjab	5.1	1.7	133
Gujarat	133.0	34.0	256	Rajasthan	415.2	122.1	294
Haryana	2.8	1.0	357	Tamil Nadu	47.6	20.9	439
Himachal Pradesh	3.0	1.1	357	Uttar Pradesh	345.0	64.0	186
Jammu and Kashmir	4.8	2.1	437	Uttarakhand	2.0	1.0	500
Jharkhand	8.0	2.9	356	West Bengal	187.5	176.5	941
Karnataka	40.0	13.0	325	Others	9.9	6.1	616
				All India	1673.0	653.6	391

ANALYSIS OF SESAME SCENARIO:

In India sesame is grown practically in all states. However, Rajasthan, Gujarat, West Bengal, Maharashtra, Uttar Pradesh, Madhya Pradesh and Andhra Pradesh are the major sesame growing states. The productivity of sesame is low in India, because the crop is mainly grown in kharif. It is significant to note that since 1965-66, the productivity of sesame increased by 128 % and the production increased by



54 % despite a reduction of 32% in area. In 2022-23 maximum area was covered by Rajasthan (415 thousand hectare). The maximum production (176 thousand tonnes) and yield (941 kg/ha) was in West Bengal. Since 1965-66, the production of sesame increased by 192 % in Madhya Pradesh and 4204 % in West Bengal, area increased by 19 % in Gujarat and 2186 % in West Bengal respectively and highest yield increase in Rajasthan in 2022-23.

CLIMATIC REQUIREMENT:

Sesame is grown in almost all the states in large or small areas. It can be cultivated up to the latitude of 1600m (India 1200 m). Sesame plant needs fairly high temperature during its life cycle. Normally the optimum temperature required during its life cycle is between 25-35 degree C. If the temperature is more than 40 degree C with hot winds the oil content reduces. If the temperature goes beyond 45 degree C or less than 15 degree C there is a severe reduction in yield. The pollen becomes sterile at aberrant temperatures. The crop is very sensitive to excessive water in the field. Stagnation of water for long period in the standing crop will completely affect the crop. The well distributed rain during *kharif* season results in the good crop. During the last decade drastic changes in the climate have been experienced in the country. Aberrations in weather conditions, irregular and unevenly distributed rainfall have adverse effect on sesame yield. The abiotic stresses consequently will result in the biotic stresses which are difficult to manage. In order to tackle these problems one should evolve appropriate varieties to tolerate abrasive weather conditions. Photo and thermo insensitive varieties, responsive to fertilizer application depending on moisture and resistant varieties to insect pests and diseases are the need of the hour

VARIETAL REQUIREMENT:

Research on sesame is limited for it being considered as a minor crop. Efforts should be intensified to enhance germplasm resources with detailed investigations on wild species. There is a wide range of variability in the germplasm reservoir of sesame. Wild species are rich 6 sources for resistance to stresses. The wild species possess desirable genes *viz.*, resistance to Antigastra, powdery mildew, wilt, drought, tolerance to heavy rainfall and more seeds per capsule. High oil, protein, high sesamin, sesmolin, large seed size, colour, rough and easily removable seed coat with reduced anti nutritional factors are the important characters for breeding. The leaves should be medium to broad at base, narrow lanceolate towards apex with short petiole and high photosynthetic efficiency. Capsules with full seed set, short internodes, determinate growth habit with a uniform, short ripening period and non-shattering type suitable for machine harvest can lead to higher yield. An improved harvest index should be stressed,



thus reducing unproductive biomass. In sesame, harvest index varies from 15 to 20% and possibilities exist to double with improved plant types. The genotypes with the potential to respond to added inputs should be developed.

Most of the sesame varieties are sensitive to photo and thermo periods, which limits cultivation across seasons and regions. Therefore, breeding for wider adaptation is important. Cultivars having white, bold, high lignans, low free fatty acid, oxalic acid and phytic acid are important for export market. Breeding efforts having a combination of improved and conventional breeding is required for sesame improvement.

IMPROVED VARIETIES:

Sesame is highly sensitive to seasonal variation in terms of day length and temperature. Therefore, varieties recommended for commercial cultivation are location and season specific. Farmers generally prefer particular varieties in different regions/states for their popularity on the basis of the desirable traits viz., seed colour, resistance to biotic and abiotic stresses and higher market prices.

EXPORT AND IMPORT:

International demand for sesame is increasing continuously every year due to its increasing applications. India is the largest exporter of Sesame seed in the World accounting for a share of 23%. The total global exports of Sesame seed were at a level of 1.31 million tonnes during 2012- 13(**Source: Oil World 2013**). China is the largest importer of sesame seed followed by Japan. Most of the importers who supply ingredient distributors and oil processors only want to purchase scientifically treated, properly cleaned, washed, dried, color sorted size graded and impurity free seeds packed according to international standards. Usually, only seed meeting there criteria may be exported from a producing country. India earned the foreign exchange of Rs. 2880 crores by export of sesame seed. The export demand is in increasing trend promising a bright future for export potential. The pesticide residue free, white seeded sesame is preferred in foreign countries market. Sesame export has witnessed a constant increase from 218.97 thousand tonnes (2001-02) to 299.52 thousand tonnes (2012-13).

Table 2: Year-wise Export status of Sesame (India)

Year	Sesame seed	
	Quantity ('000 tonnes)	Value (Rs. in crores)
2001-02	218.97	562.23



2002-03	118.31	372.89
2003-04	189.11	708.90
2004-05	168.28	708.95
2005-06	199.81	746.60
2006-07	233.34	939.58
2007-08	317.01	1642.29
2008-09	196.98	1494.26
2009-10	215.73	1494.10
2010-11	398.44	2307.52
2011-12	389.15	2641.66
2012-13	299.52	2881.54

Source: Director General of Commercial Intelligence and Statistics, Ministry of Commerce, Kolkata

SWOT Analysis:

Sesame with high export potential (40 % of world natural; 60 % of hulled), Irreversible increase in demand and growth of international trade is the strength; Poor transfer of 25 recommended technology, energy rich crop grown in energy starved conditions are the weaknesses; Very low seed rate, very high seed multiplication ratio, short duration crop, fits well into various cropping systems and best contingent crop to manage drought situations are opportunities; High pesticide residue, high FFA, low lignans, high anti nutritional factors and shifting of better areas with irrigation to low risky crops like soybean and upland rice are the threats. Sudan, China, Korea and Thailand are international competitors

DIVERSIFIED USES:

Sesame seeds are the oldest condiment and because of nutty flavour used in cooking recipes. They are the main ingredient in tahini (Tahini is one of the main ingredients in famous middle eastern dip, hummus). Natural sesame seeds are largely served in bakery products such as bread, bread sticks, cookies, candies, pasta, vegetables and curry dishes. Sesame flour, an edible, creamy and light brown powder obtained from seed has high protein, high levels of methionine and tryptophan and 10% to 12% oil. Sesame meal is excellent feed for poultry and livestock. Among edible oils, sesame has the highest antioxidant content. According to Hindu legends and beliefs, til oil represent a symbol of immortality and is considered the most auspicious oil next to ghee. Tamil medicine holds that gargling with sesame oil after brushing one's teeth will reduce gum disease and mouth ulcers while eliminating plaque. Sesame oil



is used as a solvent, oleaginous vehicle for drugs, skin softener and used in the manufacture of margarine and soap. Sesame seeds are rich in quality vitamins and minerals. They are very good sources of B-complex vitamins such as niacin, folic acid, thiamin (vitamin B1), pyridoxine (vitamin B6) and riboflavin and also contain dietary fiber and monounsaturated fats. The mono unsaturated fatty acid oleic acid, which comprises 40-50% fatty acids, helps to lower LDL or bad cholesterol and increases HDL or good cholesterol in the blood. Calcium, iron, manganese, zinc, magnesium, selenium, and copper are specially concentrated in sesame seed. Many of these minerals have a vital role in bone mineralization, red blood cell production, enzyme synthesis, hormone production, as well as regulation of cardiac and skeletal muscle activities. Sesame seed contain three times more calcium than a comparable measure of milk. In addition to these, sesame seeds also contain health benefiting compounds such as sesamol and sesaminol. Sesame is used to prepare perfumes. Several pharmaceutical uses have been identified from sesame. Myristic acid is used as an ingredient in cosmetics. Sesame flower extract possesses tumor inhibiting effect. Chlorosesamone obtained from roots of sesame has antifungal activity. Its oil and seed are sources for some phytonutrients such as omega-6 fatty acids, flavonoid phenolic antioxidants, vitamins and dietary fiber with anticancer as well as health promoting properties.

EXPLOITABLE YIELD RESERVOIR:

The impact of improved sesame production technologies under real farm situations indicated that there is a huge gap between actual and attainable yield, which be harnessed through adoption of improved technologies. An attempt has been made to estimate the extent of yield reservoir through adoption of technologies. For this purpose, the whole package demonstrations of 26 three years (2010-11, 2011-12 and 2012-13) conducted in Maharashtra (35), Tamilnadu (44), Uttar Pradesh (91), Karnataka (25), Rajasthan (53) and India (248) were considered (Table 14). The yield Gap-I (between IT and FP) was ranging from 23.5% in Rajasthan to 72.1 % in Uttar Pradesh. The national sesame production could be increased to 1145.4 thousand tonnes from 785.6 thousand tonnes, if the yield gap was bridged. Similarly, the yield gap-II (between IT and state average productivity) was ranging from 5.9 % in Karnataka to 775.1 % in Uttar Pradesh. The national sesame production could be increased to 2097.6 thousand tonnes from 1145.4 thousand tonnes by bridging the yield gap-II. This situation warrants a need to effectively transfer the improved sesame production technologies among the sesame growers, so that the huge exploitable yield reservoir be harnessed.

Table 3: Exploitable Yield Reservoir in sesame

State	No of Demons.	FLD's Average Yield (kg/ha)		Yield gap p-1 (%)	Average yield (kg/ha)	Yield Gap-II(%)	Average Production ('000 tonnes)	Expected production ('000 tonnes)	
		IT	FP					EP-I	EP-II
Maharashtra	35	1199.7	927.3	29.4	324.3	269.9	14.7	19.0	54.3
Tamil Nadu	44	1385.3	891.3	55.4	526.0	163.4	24.2	37.7	63.8
Uttar Pradesh	91	1747.3	1015.3	72.1	199.7	775.1	68.3	117.6	598.0
Karnataka	25	498.0	390.7	27.5	470.3	5.9	31.7	40.4	33.5
Rajasthan	53	714.3	578.3	23.5	342.0	108.9	170.5	210.6	356.2
All India	248	1108.9	760.6	45.8	415.3	167.0	785.6	1145.4	2097.6

Note: IT-Improved Technology, FP- Farmer's Practices

TIPS TO OBTAIN HIGHER YIELD:

- Use good quality seed of recommended variety.
- Sow at appropriate time with proper spacing and maintain population by thinning
- Select well levelled field and provide good drainage. Prepare a fine seed bed free from clods.
- Apply recommended dose of fertilizers at appropriate time and foliar spray of 2 % urea, DAP at flowering and capsule development stage.
- Keep the field weed free, particularly up to 40 days after sowing.
- Apply irrigation at critical stages for *rabi*-summer crop and provide protective irrigation wherever possible during *kharif*.
- Treat the seed with fungicide/bactericide as recommended.
- Adopt need based plant protection measures against insect pests and diseases.



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