

## A DECADE OF SUNFLOWER RESEARCH IN INDIA

S.S. Sindagi and K. Virupakshappa  
 Project Co-ordinating Unit for Sunflower, University of  
 Agricultural Sciences, GKVK, Bangalore-560065, India

## Abstract

Sunflower was introduced in India during 1969 and the research on this crop began in 1972-73. Hand pollination in commercial plots was found to increase the seed yield by 25%. Self fertile lines developed are in S-7 generation. A number of experimental hybrids superior to Bangalore Sunflower hybrid-1, now in commercial cultivation, are in advance trials. Early maturing varieties (65-70 days) have been developed to fit into multiple cropping systems. It is found that higher yields are obtained when the crop is sown in July with a fertilizer dose of 60:60:45 NPK Kg/ha with Nitrogen applied in two splits- 40 Kg at sowing and 20 Kg on 25 days after sowing. Keeping the plots weed free till the crop is 45 days old was found to be essential to obtain higher yields. Pre-emergence application of alachlor (Lasso) 1.5 Kg a.i/ha controlled the weeds effectively. Moisture stress studies revealed that at bud initiation, flowering and seed filling are the critical stages of the crop. Among the various inter-crops tried, groundnut and sunflower grown in 6:2 proportions gave higher returns. Based on all these findings, a Package of Practices has been developed. Varietal renovation based on the method of population breeding developed by Academician Pustovoit in "Armovirskii", "Peredovick" and "Morden" has resulted in stabilization of yield. Oil content is raised by 4% in "Armovirskii". So far, 400 tons of renovated foundation seeds have been supplied to State Departments of Agriculture in the country for further multiplication and supply to the farmers. This has resulted in raising the productivity and production of sunflower crop in India.

## Introduction

Sunflower (*Helianthus annuus* L) as an oilseed crop was introduced in India in the year 1969 and research on this crop was initiated in the year 1972 at three centres viz., Akola, Bangalore and Coimbatore. During the year 1977, the Seed production work was started at five centres, viz., Akola, Bangalore, Bhavanisagar, Hyderabad and Kanpur to produce Breeder and Foundation seeds. These research and Seed Production centres come under the perview of the All India Co-ordinated Research Project on Sunflower with the Coordinating Unit at Bangalore. Sunflower research is also conducted in a number of Agricultural Universities in the country. In this paper, however, the salient features of work carried out in the Coordinated Project only is presented.

## Breeding

About 500 germplasm collections are maintained at the

sunflower germplasm management unit attached to the Project Co-ordinator at Bangalore. These collections include populations, inbred lines, CMS and restorer lines, wild species and local ornamental types. These collections are being evaluated and catalogued for yield, oil content, height, maturity and resistance to leaf spot (Alternaria-helianthi) and rust (Puccinia helianthi) which are the major diseases in India at present.

Heterosis breeding has resulted in developing and releasing a hybrid, Bangalore Sunflower Hybrid-1 (BSH-1) which gives 30% more yield than the open pollinated cultivars Peredovik, Armavirskii and Morden (Seetharam et al , 1977).

A number of experimental hybrids - both single and three way crosses - superior to BSH - 1 are in advance trials. These hybrids have been constituted using CMS and restorer lines introduced from other countries as well as the ones developed in India.

Among the hybrids, KBSH-1 & KBSH-2 from Bangalore centre and APSH-11 from Hyderabad are performing well across the locations. Some of the self fertile lines developed at Coimbatore centre give as high as 95% seed set upon selfing.

Table-1. Characteristics of the Sunflower varieties grown in India.

Sl. No.	Variety/ hybrid	Duration (days)	Plant height (Cm)	Seed yield Kg/ha	Oil%
1.	Peredovik	100-110	180-200	800-1000	42-46
2.	Armavirskii	100-110	180-200	800-1000	42-45
3.	Morden	80-90	90-120	600-800	38-42
4.	Surya	90-100	135-155	800-1000	38-40
5.	CO-1	60-65	65-70	500-700	36-37
6.	BSH-1 (Hybrid)	90-95	130-150	1000-1500	42-45

Apart from developing hybrids, the work on evolving high yielding open pollinated varieties is also taken up. As a result, "Surya" and CO-1 have been released for cultivation in Maharashtra and Tamilnadu states respectively. "Surya" was evolved by recurrent selection from "Lathur" local bulk while CO-1 is a selection from Cernianka-66. Characteristics of the important varieties currently under cultivation in India are given in Table-1.

## Crop Production

Sunflower can be grown round the year in India. Higher yields, however are obtained in Kharif (July-November) and summer seasons (January-April) rather than in rabi (September-January). Sowing date is to be adjusted in such a way that flowering period does not coincide with heavy rains as this affects pollination and seed set.

Spacing, Seed rate and planting :

Plant population studies conducted at Bangalore have shown that the seed yield per plant increased with decrease in plant population. Yield/hectare, however, increased only upto a population level of 67,000 per hectare (Table-2)

Table-2 Effect of plant density on seed yield,  
(Average of two years)

Plant population per ha (in thousands)	Seed yield	
	Per plant (g)	Kg per ha
98	13.87	1357
81	16.63	1345
67	21.99	1479
56	24.04	1341
46	26.83	1239
38	28.75	1108
32	28.61	915
26	34.76	915
22	43.19	903
18	49.83	895

A spacing of 60 cm between rows and 22.5 cm between plants for tall varieties and 45 X 30 cm for dwarf varieties like Morden were found to be optimum. Generally, a seed rate of 10 to 12.5 Kg/ha has been recommended. The seeds are sown either by seed drills or by dibbling in rows opened by ploughs.

Fertilizer requirements :

Sunflower responded upto 80-90 Kg N/ha. However, the doses upto 40-60 Kg N/ha only were found to be economical. Application of 60:60:45 NPK Kg/ha for long duration varieties and 30:30:30 NPK Kg/ha for short duration varieties like "Morden" have been recommended. Band placement of fertilizers 5 cm away on both the sides of seed line gave highest net returns.

In the studies on split application of nitrogen using BSH-1, it was observed that applying 40 Kg N at sowing and 20 Kg N as top dressing on 25th day after sowing gave highest yield of 1704 Kg/ha (Table-3).

Table-3 Seed yield of BSH-1 hybrid as influenced by time of nitrogen application.

Treatment	Seed yield Kg/ha		
	1979	1980	Average
1. Control (no fertilizer)	1300	868	1084
2. 60 Kg N at sowing	1664	1000	1332
3. 30 Kg N at sowing + 30 Kg N at 25th day	1770	1409	1589
4. 40 Kg N at sowing + 20 Kg N at 25th day	1925	1483	1704
5. 20 Kg N at sowing + 20 Kg each at 25th and 45th day	1983	1235	1609
CD at 5%	193	307	--

Studies on the application of Sulphur, magnesium and Boron either alone or in combination (in addition to NPK) revealed that there was an increase in seed yield by 4.12 and 8.82% with the application of Sulphur and Boron respectively (Krishne Gowda 1984). However the yield differences were not significant. Hence minor elements may be applied only when there is a deficiency of these elements in the soil.

#### Weed control :

Keeping the crop weed free upto 45 days after sowing is essential to obtain higher yields. Two hand weeding and two intercultivation with hoe - one at 20-25 days and another at 30-35 days after sowing - were quite effective in increasing the yield.

Pre-emergence application of 1.5 to 2.0 Kg a.i/ha of TOK-E-25 or 0.75 to 1.0 Kg a.i/ha of prometryne controlled the weeds effectively. However, alachlor (Lasso) at the rate of 1.5 Kg a.i/ha was found to be more economical (Table-4).

#### Intercropping studies :

Among many crops tried, groundnut grown with sunflower in 6:2 proportions has been found to be highly profitable. Other profitable combinations are Sunflower-finger millet

(*Eleusine coracana*) and Sunflower-Cowpea (*Vigna unguiculata*) or Blackgram (*Vigna munge*). In the crop sequence studies it was concluded that sunflower can be taken up successfully after fieldbean (*Dolichos lablab*), groundnut and finger millet. Returns in Soyabean-sunflower, Cowpea-Sunflower and Sorghum-sunflower sequences were lower.

Table-4 Seed yield of sunflower as influenced by Weed control measures.

Treatments	Seed yield Kg/ha	
	Bangalore (Average of 3 years)	Kota (Av. of 2 years)
Weed free upto 15 days	604	892
Weed free upto 30 days	847	1056
Weed free upto 35 days	1046	1184
Weed free upto 60 days	1029	1898
Lasso at 1.5 Kg a.i/ha	969	1055
Lasso at 2 Kg a.i/ha	942	1167
TOK-E-25 at 1.5 Kg a.i/ha	944	1118
TOK-E-25 at 2 Kg a.i/ha	929	1260
Two hoeings on 20th & 35th day	919	1101
Unweeded control	570	832

#### Hand pollination for increased yields :

Hand pollination has been shown to increase the yield to the extent of 18 to 25 percent. Sunflower heads are gently rubbed with palm during flowering period in the morning hours on alternate days for two weeks. This practice is now being followed by farmers in commercial plots.

#### Diseases, Pests and their control

The diseases observed on the crop in India are listed in Table-5.

Table-5 Important Sunflower diseases observed in India

Sl.No. Diseases	Causal organism
1. Leaf spots	<u>Alternaria helianthi</u> <u>Cladosporium cladosporoides</u>
2. Rust	<u>Puccinia helianthi</u>
3. Root rot and "damping off"	<u>Sclerotium rolfsii</u> <u>Rhizoctonia bataticola</u>
4. Stem rot	<u>Sclerotinia sclerotiorum</u>
5. Head rot	<u>Rhizopus spp</u>
6. Powdery mildew	<u>Erysiphe cichoracearum</u>

Among these diseases, leaf spot incited by Alternaria helianthi and rust are important and often cause substantial yield loss especially during Kharif season (June-October). Resistant types for rust have been identified in the germ-plasm collections. For Alternaria, however, only tolerant types are available. Spraying the crop with Dithane-M-45 (0.4%) checks the diseases effectively.

Jassids (Amrasca biguttula), Diacrisia obliqua, Spodoptere litura and Plusia orichalcea are the important pests among foliar pests. Heliothis armigera is the most serious pest observed in recent years. Caterpillars feed on developing seeds by making tunnels in the head. The pest can be controlled by spraying with Endosulfan (0.1%). A spray schedule to control the sunflower diseases and pests has been developed and supplied to farmers.

The germplasm lines SFM1, SFM 2 and SFM 3 which are reported to be resistant to Sunflower moth (Rogers et al, 1984) are being tested for resistance to Heliothis.

#### Seed Production

A total quantity of 400 tons of Foundation seeds of Poredovik, Armavirskii and Morden has been produced by Seed Production centres and supplied to various agencies for Stage-1 seed production. This has contributed significantly in popularising and establishing sunflower as potential edible oilseed crop in the country.

#### Conclusions

Due to intensive research and development programmes, sunflower crop has now assumed importance as an oilseed crop in Indian Agriculture. Rapid expansion of acreage under sunflower and wide interest shown by farmers suggest that sunflower may become one of the major oilseed crops in India. At present the crop is being cultivated in 8 lakh hectares either as entire, mixed or inter-crop.

#### References

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