TWO DECADES OF SUNFLOWER RESEARCH IN INDIA

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ABSTRACT:

Sunflower is annually grown over an area of 2.7 million hectares with a production of 1.6 mt in India. It is estimated that during 1995-96 the area would have touched 3.0 m.ha mark. Because of its wide adaptability it is grown in several states of the country in rainy, post-rainy as well as Summer/Spring seasons. The crop has come a long way in augmenting edible oil production in the country.

Crop production and protection technology is generated in the All India Co-ordinated Research Project at six Research centres. Eight open pollinated varieties and six hybrids have been released for commercial cultivation. The hybrids are grown under input-intensive conditions whereas the open pollinated populations are cultivated in marginal lands under limited soil moisture conditions. A plant population level of 55,555 per ha for medium duration (95-100 days) hybrids and 74,000 per ha for short duration cultivars (80-85 days) have been found to be optimum. Directed spray of 0.2% Borax to the Capitulum at ray floret opening stage has been found to enhance the yield by 15%.

Leaf rust and Alternaria leaf spot are the major diseases whereas Capitulum borer (Helicoverpa armigera), leaf hoppers and defoliators are the important insect pests for which integrated disease and pest management strategies have been worked out.

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Sunflower was introduced for commercial cultivation in India during 1972. With a modest area of 5,000 hectares during 1972-73, the acreage under sunflower has witnessed a phenomenal increase in the last two decades. The crop is now grown over an area of 2.7 million hectares. The crop which was hitherto grown mostly in Southern parts of the country is now becoming popular in the Northern States during Spring season (February-May). The crop in the Southern States is cultivated in all the three cropping

seasons - Rainy, post-rainy and summer seasons. The area, production and productivity of the crop is presented in Fig.1.

The appreciable increase in area and production of sunflower crop is due to several merits of the crop -

- Wide adaptability to wide ranging agro-climatic conditions and soil types
- Short duration (90-100 days)
- Photo insensitivity which enables its cultivation in rainy, post-rainy and Spring/summer seasons.
- Good quality oil with high PUFA content
- Availability of promising hybrids and varieties having high yield potential.
- Ideal crop for contingency cropping plan.
- High seed multiplication ratio of more than 1:80
- Remunerative market price

Although area under Sunflower is increasing, the productivity in some States is below 500 Kg/ha. However, it is gratifying to note that the Northern States such as Punjab and Haryana have State average around 1.7 t./ha. The low yield in some of the States is due to the crop being grown in marginal and sub-marginal lands. Nevertheless, the importance of Sunflower as an oilseed crop is increasing year by year due to several merits of the crop mentioned earlier.

HIGHLIGHTS OF RESEARCH:

The research work is being carried out under the All India Co-ordinated Research Project on Oilseeds financed by Indian Co-ordinated Agricultural Research, New Delhi. Multi-disciplinary teams of Scientists are working at six centres to generate production technology for increased yields in Sunflower. A brief account of research accomplishments is presented here.

BREEDING:

A number of high yielding open pollinated varieties and hybrids of diverse duration have been evolved at various research centres (Table-1). Over the years, the area under the hybrids has increased and it is estimated that hybrids may be covering about 70% of the total area of Sunflower. Among the open pollinated varieties, the cultivar Morden is occupying sizeable acreage due to short duration which enables its cultivation in multiple and inter-cropping systems.

The breeding strategies to improve the productivity of the hybrids would include improvement in self-fertility, oil content, resistant to diseases and improvement in seed yield components.

CROP PRODUCTION PRACTICES:

Location-specific agronomic requirements for the crop have been worked out. General agronomic management practices recommended for sunflower cultivation are presented in Table-2. Suitable sowing date would be the onset of monsoon which coincide with the months June-July in many production areas in the southern parts of the country. In the post-rainy season, the suitable planting dates would be September-October, whereas for Summer and Spring seasons, the crop is planted in January-February. Optimum population levels have been worked out to be 55,555 (60 cms X 30 cms) or 74,074 (45 cms X 30 cms) for long duration varieties/irrigated conditions and for short duration varieties/rainfed situation respectively. In rainfed situations, the Sunflower crop has been found to be ideal for many inter-cropping systems. The most favourable companion crops are Pigeonpea and Groundnut. The optimum fertilizer dose around 60:90:60 NPK Kg/ha depending on the initil soil fertility status. Recent studies have revealed that application of Borax either in the form of Dust or Spray (0.2%) at the time of ray floret opening increases yield to the tune of 15 to 20% (Table-3). This has been found to be a Cost effective technology. Groundnut has been found to be the ideal crop for crop rotation with sunflower.

DISEASES, INSECT PESTS AND THEIR INTEGRATED MANAGEMENT PRACTICES:

The list of important diseases and insect pests is presented in Table 4 and 5 respetively.

Among the diseases, Alternaria leaf spot has been found to be most especially during rainy season (July-October).

Recently, Downy mildew has been causing concern due to its appearance in some parts of the country, especially in Marathwada region of Maharashtra where it is in endemic form. The race of Downy mildew has been identified to be the Race-1. Fortunately, some of the hybrids grown are resistant to Downy mildew disease. Seed treatment with APRON 35 SD (6 gms./Kg of seeds) has been recommended to control the disease. The disease scenario is different in the Northern part of the State. Head rot and Sclerotinia are more important than the Alternaria leaf spot. The integrated disease management practices include seed treatment, growing disease resistant cultivars, crop rotation, application of fungicides, etc. The most prevalent insect pest has been found to be the Capitulum borer (Helicoverpa armigera). Since the crop is grown in rotation with Cotton in many areas, the incidence leaf hoppers, Helicoverpa and jassids is increasing. Need based chemical control measures have been worked out for each of the insect pests. Biological control measures like application of NPV, Bacillus thuringensis, release of Chryzoperla carnea have been tested and found to be promising as components in Integrated pest management (IPM).

PHYSIOLOGY:

Fresh-seed dormancy period of 45 to 60 days has been observed in Sunflower. The treatment of seeds with Ethrel 25 ppm has been found to be effective in releasing the fresh seed dormancy. Sunflower germplasm accessions with high biomass and tolerant to moisture stress have been identified. The parameters of drought tolerance include less reduction in leaf area duration under imposed stress conditions. Some of these germplasm accessions have been utilised in the breeding programme for improving the productivity in Sunflower.

FIG.1 Area, Production and Yield of sunflower in India

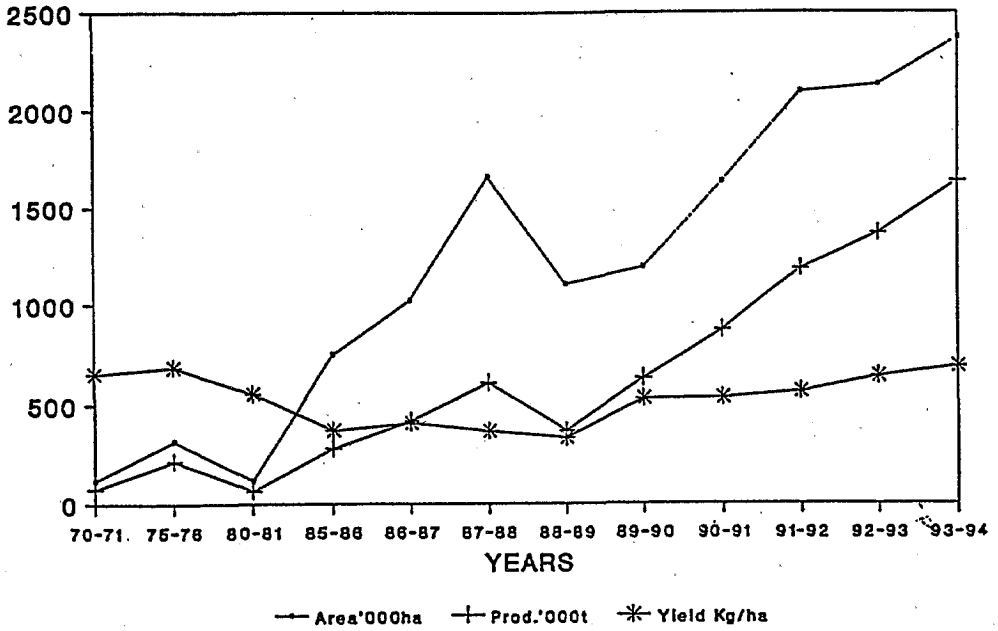

Table 1: CHARECTERISTIC FEATURES OF RELEASED VARIETIES/HYBRIDS OF SUNFLOWER.

Sl. No.	Variety	States for which recommended	Duration (days)	Plant height (cm)	Head diameter (cm)	Seed yield (Kg/ha)under rainfed conditions*	Oil content (%)
A. VARIETIES							
1.	MORDEN	All sunflower growing states	75-80	80-100	12-15	600-800	30-38
2.	EC 68414	All states	100-110	150-200	15-20	800-1000	40-42
3.	EC 68415	Karnataka	100-110	150-200	15-20	800-1000	40-42
4.	SURYA	Maharashtra	90-95	150-200	15-20	800-1000	32-35
5.	CO 1	Tamil nadu	65-70	60-80	8-10	500-700	38-39
6.	CO 2	Tamil nadu	85-90	130-160	15-20	800-1000	38-40
7.	TNAU SUF 7	All India	90-95	135-165	16-20	800-1200	38-42
8.	GAU SUF 7	Gujarat	90-95	140-170	16-20	800-1200	38-42
B. HYBRIDS							
9.	BSH 1	All states	85-90	130-150	12-15	1000-1500	40-42
10.	KBSH 1	All states	90-95	150-180	15-20	1200-1500	42-44
11.	APSH 11	All states	90-95	120-150	15-20	1000-1500	42-44
12.	MSFH 1	All states	90-95	120-150	15-20	1000-1500	38-42
13.	MSFH 8	All states	90-95	120-150	15-20	1000-1500	38-42
14.	MSFH 17	All states	90-95	120-150	15-20	1000-1500	35-37
15.	LSH 1	Maharashtra	85-90	100-110	12-15	900-1200	37-39
16.	LSH 3	Maharashtra	95-100	150-170	15-20	1000-1500	38-40
17.	PSFH 67	Punjab	90-95	120-140	15-20	1000-1500	38-42

* Under irrigated condition more than two times yield could be expected.

TABLE 2: PRODUCTION TECHNOLOGY OF SUNFLOWER

1. Sowing seasons	(a) Kharif (Monsoon)	June-July		
	(b) Rabi (Winter)	September-October		
	(c) Summer	January-February		
2. Seed rate (Kg/ha)		10		
3. Plant population/ha		74,074		
Planting geometry	(a) Row to row (cm)	45		
	(b) Plant to Plant (cm)	30		
4. Manures and Fertilizers	Farm yard manure or compost (t/ha)	6-8		
	Hybrids/long duration varieties	N	P_2O_5	K_2O (Kg/ha)
	(a) Rainfed	40	50	40
	(b) Irrigated	60	80	60
	Short duration varieties			
	(a)Rainfed/Irrigated	30	40	30
5. Herbicide	Alachlor (Lasso) at 1.5 kg a.i/ha as pre-emergence spray			
6. Hand pollination	In morning hours for about 8-10 days on alternate days during flowering period			
7. Rotation	Sunflower-Cereal-Pulse			
8. Intercropping (Rainfed)	Finger millet/Peanut with Sunflower in 6:2 row proportion Sunflower hybrid (BSH-1) with Pigeon pea (TTB-7) in 1:1 row proportion			

TABLE 3: RESPONSE OF SUNFLOWER TO BORAX NUTRITION

	Seed yield (Kg/ha)						
	Akola	B.lore	Raichur	Kanpur	R.Nagar	Mean	% Increase
Control	660	788	1173	855	1328	961	-
HP	810	1119	1275	1090	1430	1145	19
B(Soil)	796	1135	1407	1050	1454	1168	22
BS	829	1226	1417	1175	1598	1249	30
BD	732	1141	1301	1383	1557	1222	27

Control = Only recommended fertilizer
HP = Hand pollination
B(Soil) = 10 Kg Borax per hectare
BS = 0.2 % directed spray of Borax to capitulum at flowering stage
BD = 2 Kg Borax per hectare as dusting to capitulum at flowering stage

TABLE 4: SUNFLOWER DISEASES

Leaf spot	Alternaria helianthi
Leaf rust	Puccinia helianthi
Downy mildew	Plasmopara halstedii
Head rot	Rhizopus sp.
Root and collar rot	Sclerotium rolfsii Rhizoctonia solani
Leaf blight	Phoma sp. Curvularia sp.
Leaf spot	Cladosporium cladosporioides

TABLE 5: PESTS OF SUNFLOWER IN INDIA

I. MAJOR PESTS

Head borer — Heliothis armigera

DEFOLIATORS

Tobacco caterpillar — Spodoptera litura

Bihar hairy caterpillar — Spilosoma obliqua

Green semi looper — Plusia orichalcea

SUCKING PEST

Jassid — Amarasca biguttella biguttella

II. MINOR PESTS

Grass hoppers, weevils

Thirps, white fly, aphid, plant bugs