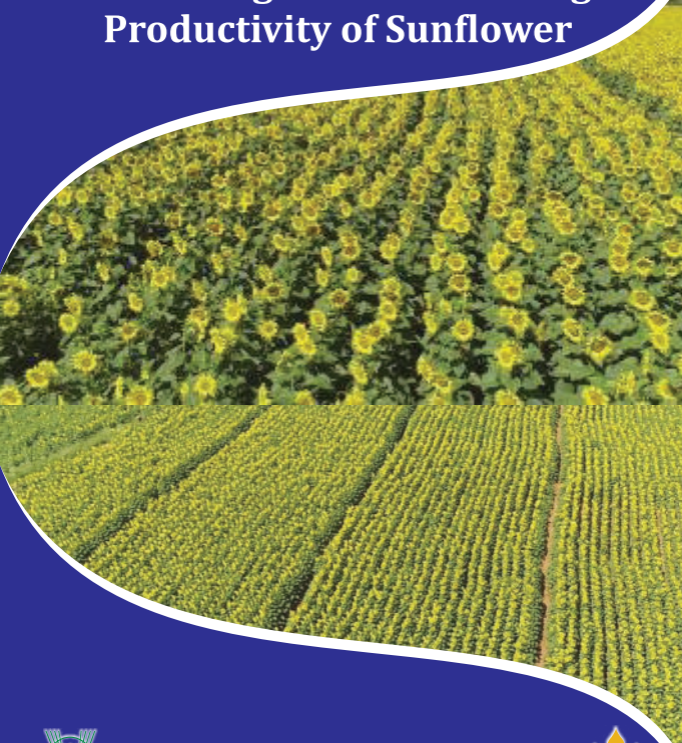


Pocket Book

Technologies for Enhancing Productivity of Sunflower



ICAR- INDIAN INSTITUTE OF OILSEEDS RESEARCH

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Pocket Book **Technologies for** **Enhancing Productivity** **of Sunflower**



ICAR-Indian Institute of Oilseeds Research
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Sunflower

Sunflower (*Helianthus annuus* L.) is an important, edible oilseed crop with wider adaptability for varied soil and climatic conditions. The crop has high yield potential and oil quality. Sunflower is cultivated in Karnataka, Andhra Pradesh, Maharashtra, Telangana and Tamil Nadu, which contribute to more than 90% area and 80% production of the country. The crop has proven high potential in non-traditional areas of Punjab, Haryana, Bihar, West Bengal, Uttar Pradesh, Orissa and Chhattisgarh in spring and *rabi* seasons. It is grown over an area of 2.54 lakh ha with a productivity of 956 kg/ha. Major area (66%) of sunflower cultivation is in *rabi*/summer and spring seasons and nearly 44% of sunflower cultivation is in *kharif*.



Sunflower crop during *rabi* season in Siddipet, Telangana



Performance of DRSH-1 in FLDs



Sunflower grown with optimum spacing and nutrition



Demonstration of best management practices

Climate: Ideal conditions for best sunflower production is that during the growing period a temperature of 15-20°C and during the seed filling a temperature of 20-25°C is optimum. For germination optimum temperature is 20-26°C and during flowering period, temperature above 38-40°C is not desirable. The rainfall requirement is about 500 mm but, a moderate crop can be grown even with 300 mm of rainfall, with reduction in yield.

Crop rotation: Follow a minimum of 2 or 3 year rotation with non-sunflower crops preferably legumes. Continuous cultivation of sunflower season after season not only depletes soil fertility but also leads to build up of diseases and decline in seed yield.

Soils: Prefer well drained and fertile soils for sunflower cultivation. Low lying and marginal fertility soils are not suitable for sunflower cultivation.

Tillage and seed bed preparation: For better germination, establishment and growth, well prepared seed bed is required. In light soils, 1 or 2 ploughings followed by planking and harrowing are necessary. In medium to heavy soils, 1 or 2 harrowing's should be done immediately after rains or when soil moisture is favourable. Final seed bed should have fine tilth.

Sowing time: Though sunflower can be grown in all seasons, sowing time should be decided to avoid continuous drizzle, cloudy weather or temperature more than 38°C during flowering period. In traditional areas during *kharif*, sunflower can be sown from 2nd fortnight of June to middle of July in light soils and up to 2nd fortnight of August in heavy soils. During *rabi*, sunflower can be sown from September to end of November. In non- traditional areas, it can be sown from January to February end in spring season.

Seed treatment: Treat seed with thiram or captan @ 3 g/kg to protect from seed borne diseases. In areas of known downy mildew incidence, treat seed with metalaxyl @ 6 g/kg.

Seed rate and spacing: Use 5-7.5 kg/ha seed for rainfed crop and 3.7-5 kg/ha for irrigated crop. Sow by

dibbling the seed with a spacing of 60 cm x 30 cm in heavy soils and 45 cm x 30 cm in light soils. Follow ridge and furrow system.



Optimum spacing in sunflower



Sunflower under zero tillage conditions

Thinning: Thinning of excess seedlings to retain one seedling per hill is essential and can be done at 10-15 days after germination for realizing higher yield, easy intercultural operations and management of insect pests and diseases.



Soil test based fertilizer application in sunflower

Fertilizer management: For adequate and balanced fertilization, incorporate 5 t/ha of well decomposed FYM/compost, 2-3 weeks prior to sowing. It is desirable to apply fertilizer based on soil test values. In general, 60:60:30 NPK/ha is recommended for rainfed crop and 60:90:30 NPK/ha for irrigated crop. Apply 50% N + 100% P and K as basal and remaining N in two equal splits at 30 and 55 days after sowing (DAS) for irrigated crop. Prefer Single Super phosphate (SSP) as source of P that also meets Ca and S requirement.

Apply sulphur @ 25 kg/ha in the form of gypsum or soil application of elemental S @ 2 g/ha in deficit soils. Boron is an essential micronutrient for sunflower, which increases seed filling and yield. Apply borax @ 2 g/l as directed spray to capitulum at star bud stage. First dissolve borax in small quantity of hot water and make up the volume to 250 litres/ha.

Weed management: First 4-6 weeks after emergence are the most critical for weed competition. Perform two hoeing's and one hand weeding at an interval of 15 days starting from 15- 20 DAS. In areas of labour shortage, pre-emergence application of Alachlor or Fluchloralin @ 3-5 ml/l followed by one hand weeding and hoeing at 35 days is recommended for effective weed control.

For effective control of grasses post – emergence application of Quizalofop ethyl (5%) 750 ml/ha or Fenoxyprop ethyl (9%) 625 ml/ha mixed in 500 ltrs of water is recommended.

Irrigation management: Provide irrigations at 8-10 days interval in light soils and 15-25 days in heavy soils. Do not miss irrigation at critical crop growth stages i.e. bud initiation (35- 40 DAS), flower opening (55-65 DAS) and seed filling (65-80 DAS) for realizing maximum yield. Moisture stress at these stages causes significant yield reduction.



Sunflower + pigeon pea intercropping system

Intercropping systems (ICS): Pigeonpea + sunflower (2:1/1:1/1:2), groundnut + sunflower (5:1/3:1) and soybean + sunflower (2:1) are remunerative ICS.

Management of diseases: The major diseases are *Alternaria* leaf spot, Necrosis, Downy mildew and Powdery mildew.

***Alternariaster* leaf spot/blight:** Seed treatment with combination of Carbendazim (12%) + Mancozeb (63%) @ 3 g/kg seed, followed by two sprays of Propiconazole @1 ml/l at 45 and 60 DAS for control of *Alternaria* leaf spot.



Alternaria leaf blight on leaves

Necrosis: Seed treatment with Imidacloprid 70 WS @ 5 g/kg and two sprays of Imidacloprid 0.3 ml / l or Thiomethaxam 0.25 g/l at 30 and 45 DAS. Raising 2-3 rows of barrier crops with sorghum/ bajra reduces



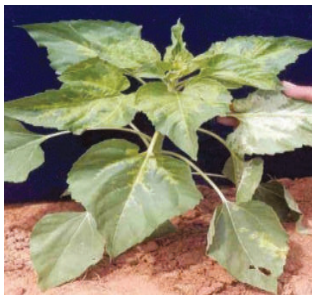
Seedling stage



Maturity stage 1

the incidence of Necrosis. Remove infected plants and destroy them.

Downy mildew: Crop rotation of three years with groundnut/ castor/ sorghum/ maize; grow resistant



Downy mildew

hybrids and seed treatment with Metalaxyl 35 SD @ 6 g/kg seed and under severe conditions spraying of Ridomil MZ 2.5 ml / litre twice at 30 and 45 days after sowing manages the disease.

Powdery mildew: Spraying wettable sulphur @ 3 g/l or Calixin 1 ml/l is effective in reducing the disease.

Under severe conditions, spraying of Propiconazole / Difenoconazole 1 ml/l at 45 and 60 days after sowing effectively manages the disease.



Powdery Mildew

Head rot: Head rot generally affects the crop when there is intermittent rain or drizzling during heading stage.



Head Rot

Spraying of Fenthion 1 ml / l or Wettable sulphur 3 g/l or Copper oxychloride 3 g/l or Mancozeb 2.5 g/l at 10 days interval can reduce the disease.

Management of insect pests: The major insect pests are sucking pests (leaf hoppers, thrips and white flies), leaf eating caterpillars (tobacco caterpillar, Bihar hairy caterpillar and green semilooper) and capitulum borer.

Head borer:

- Erect bird perches @ 25 / ha.
- Spray BtK (1.5 kg/ha) or HaNPV @ 250 LE/ha or Profenofos 50 EC (500 ml/ha) or Chlorantraniliprole @ 150 ml/ha



Defoliators



Defoliation



Skeletonisation
of leaves

Tobacco caterpillar:

- Remove egg masses, gregarious early instar larvae
- Monitor the population by installing pheromone traps @ 10/ ha.
- Foliar sprays of Flubendiamide 39.35 SC @ 150 ml/ha or Profenofos 50 EC @ 1000 ml/ ha



Hairy caterpillars:

- Spray NSKE 5% or Cypermethrin 10 EC (650-760 ml/ha) for hairy caterpillars



Spilosoma obliqua



Euproctis fraterna

Green semilooper:

- Larvae feed on leaves and defoliate the plant
- Spray Emamectin benzoate 1.9 EC @ 425 ml/ha or



Chlorantraniliprole @ 150 ml/ha or Profenofos 50 EC @ 1000 ml/ha

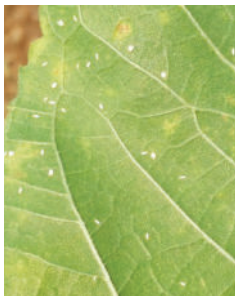
Leafhopper:

- Seed treatment with Imidacloprid 70 WS @ 7 g/kg seed or Thiamethoxam 30 FS @ 10 g/kg seed and foliar spray Imidacloprid 17.8 SL (100 ml/ha)



Whitefly:

- Primarily acts as a vector for Sunflower Leaf Curl virus
- Seed treatment with Imidacloprid 70 WS @ 7 g/kg seed and foliar spray Imidacloprid 17.8 SL @ 100 ml/ha or Diafenthiuron 50 WP @ 500 g/ha.



Pollination: Maintaining 5 bee hives/ha provides optimum pollination for higher seed yield, besides yielding valuable honey. Avoid

insecticidal spray during flowering period as it affects the visit of honey bees.

Bird control: When sunflower is raised in isolated areas, birds particularly parrots pose serious problem. It is desirable to take up sunflower cultivation in large contiguous blocks. Crop should be protected from bird damage during seed filling to harvest stage through effective bird scaring particularly in the morning and evening hours. Tying of bright reflector ribbons above the crop will supplement bird scaring.

Harvesting: The right time of harvesting is when the back of the head turns to lemon yellow colour and the bottom leaves start drying and withering. The crop can be harvested at maturity when all leaves dry. After separation of heads, they should be dried for 2-3 days to facilitate easy separation of seed. The harvested heads



can be threshed by beating with sticks manually or using power operated threshers. Dry the seeds before storage to bring the moisture content below 10%. Sunflower thalamus serves as good animal feed to enhance the milk yield from milch animals.

Storage: The seed moisture content should be $< 9.5\%$. For safe storage of sunflower seeds, polythene bags are used normally, while mud pot and metal bins are considered to be safe for storage.

Yield potential:

Rainfed: 1000-1500 kg/ha

Irrigated: 2500-3000 kg/ha

Sunflower in paddy fallows under zero tillage: Sunflower responds well under zero tillage conditions in paddy fallows.



Sunflower under zero tillage conditions in Nizamabad

Bee keeping for additional income in sunflower:

Low population of pollinators will adversely affect the sunflower yields. In order to increase the sunflower yield and realize additional income to farmers and develop complete value chain through co-cultivation of honey bees, apiary can be encouraged wherever sizeable area of sunflower crop is grown. Apiary is a win-win situation for sunflower farmers and the village level entrepreneurs, whereby farmers perceive that the yield of sunflower increases by 20% due to honey bee



Bee keeping in sunflower

activity and provides a sustainable livelihood to the local entrepreneur with additional valuable honey.



Performance of improved technologies in FLDs

Improved Technologies	FLDs	Mean Yield (kg/ha)		% Increase in yield
		IT	FP	
Whole Package	1866	1652	1372	20.5
Improved Cultivar	278	1825	1571	16.1
Zero Tillage	25	2100	1800	16.7
Optimum Spacing	100	2424	1933	25.4
Thinning	12	1775	1555	14.1
Soil Test Based Fertilizer Management	15	2136	1695	26.1
Application of sulphur	80	2475	2057	20.3
Foliar spray of Boron	114	2178	1758	23.9
Pest Management	52	2262	1928	17.3
Integrated Pest Management	5	1701	1494	13.9
Paddy fallow	15	1313	1122	17

The results of FLDs conducted in real farm situations with improved technologies of sunflower indicated an increase in seed yield ranging from 14 to 26%.

Recently released sunflower hybrid for various states

Hybrid	Year	Suitable areas	Salient Features
PSH 996	2015	Punjab (PUN)	Recommended for irrigated areas, average yield 1951 kg/ha, duration 96 days, oil content 39% and moderately resistant to downy mildew & charcoal root rot.
PSH 1962	2016	Punjab	Recommended for irrigated areas, average yield 2054 kg/ha, duration 99 days, oil content 41%.
RSFH 1887	2016	Karnataka (KTK)	Suitable for irrigated condition and rainfed cultivation, Yield range 1800 – 2500 kg/ha (I), 1200-1600 kg/ha (R), duration 95-100 days, oil content 38-40% and tolerant to viral necrosis and <i>Alternaria</i> leaf spot. Quality traits: Black seeds with high oil content, high yield per hectare and low hull content.
Prabhat (NDSH 1012)	2017	Andhra Pradesh (AP)	Suitable for irrigated condition and rainfed cultivation, Yield range 2000 – 2500 kg/ha (I), 1500-2000 kg/ha (R) duration 90-95 days, oil content 40% and tolerant to downy mildew.
PDKV-SH-952	2017	Maharashtra (MAH)	Average yield 1700 kg/ha, duration 90 days, oil content 38% and moderately resistant to powdery mildew

Hybrid	Year	Suitable areas	Salient Features
LSFH-171	2018	Maharashtra	Suitable for irrigated condition and rainfed cultivation, average yield 1866, kg/ha Yield range 1800-2000 kg/ha, duration 95-100 days, oil content 35% and highly Susceptible to downy mildew disease. Quality traits: High poly unsaturated fatty acid content.
DSFH-3	2018	Karnataka (<i>Rabi</i>)	Average yield 1900 kg/ha, Yield range 1800-2000 kg/ha, duration 95-98 days, oil content 38.5%. Quality traits: Early and high seed yield and oil content.
COH-3	2018	Tamil Nadu (TN)	Average yield 1613 kg/ha (<i>kharif</i>), 1822 kg/ha (<i>Rabi</i>), duration 90-95 days, oil content 42%. Moderately resistant to leaf spot, necrosis and powdery mildew.
KBSH-78	2020	Zone V Karnataka	Suitable for irrigated condition and rainfed cultivation, Yield range 1700 – 2300 kg/ha (I), 1000-1200 kg/ha (R), duration 82-85 days, oil content 40%. Quality traits: Short duration and medium height hybrid
PSH-2080	2021	Punjab	Average yield 2636 kg/ha, duration 95-97 days, oil content 43.7%. Quality traits: High yield and oil content
TilhanTec SUNH-1	2021	Uttarakhand (UK), J&K, Gujarat (GUJ), MAH, KTK, AP, TN and Telangana (TG)	Suitable for irrigated condition and rainfed cultivation, Yield range 2000 - 2657 kg/ha (I), 1500-2000 kg/ha (R), duration 90-100 days, oil content 37-41%. Resistant to downy mildew but susceptible to <i>Alternariaster</i> leaf blight.

Hybrid	Year	Suitable areas	Salient Features
KBSH-85	2022	GUJ, MAH, KTK, AP, TN and TG	Suitable for irrigated condition and rainfed cultivation, average yield 1829 kg/ha, duration 90-100 days, oil content 35%. Resistant to downy mildew but moderately tolerant to <i>Alternariaster</i> leaf spot. Quality traits: seed with high oil content.
RSFH-700 (Karnataka state variety)	2023	Zones I, II and III of Karnataka	Suitable for irrigated condition and rainfed cultivation, yield range 2000-2200 kg/ha (I), 1200-1400 kg/ha (R), duration 90-95 days, oil content 39%. Tolerant to viral sunflower necrosis disease, <i>Alternaria blight</i> and Powdery mildew diseases. Quality traits: seed with high oil content.
COH-4 (CSFH 15020)	2023	Tamil Nadu	Average yield 2182 kg/ha (<i>Kharif</i>) and 1898 kg/ha (<i>Rabi</i>) duration 90-95 days, oil content 41%, moderately resistant to powdery mildew and <i>Alternaria</i> , moderately resistant to sucking pest and leaf feeders. Quality traits: High volume weight (46 g/100ml), High oil content.
KBSH-88	2024	GUJ, MAH, KTK, AP, TN and TG	Suitable for irrigated condition and rainfed cultivation, average yield 1557 kg/ha, yield range 1850-2500 kg/ha (I), 1450-1850 kg/ha (R), duration 86-89 days, oil content 35.3% and moderately resistant to leafhoppers, thrips, whitefly, head borer and resistant to downy mildew.
Tilhan Tec-SUNH-2	2024	UK, J&K, GUJ, MAH, KTK AP, TN, TG and all India	Average yield 1570 kg/ha, duration 89-95 days, oil content 38.1%, moderately resistant to powdery mildew and <i>Alternaria</i> , Moderately resistant o leafhopper, resistant to downy mildew. Quality traits: Responsive to higher doses of fertilizer, suitable for both early and late sowing. Resistance to lodging and shatterin.





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