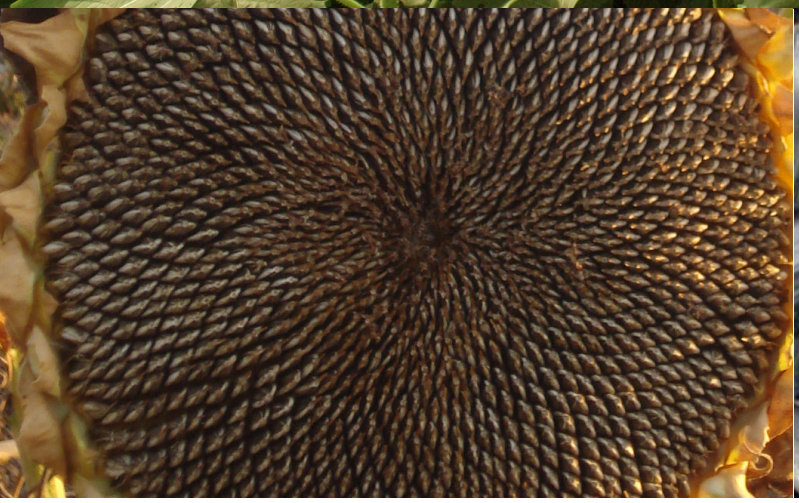


Irrigation Solution

Sunflower

With Jain Technology™

Jain Irrigation Systems Ltd.

Small Ideas. Big Revolutions.®

Sunflower is one of the important crops in India's oil seed production that has contributed to rapid growth in oilseed production during the last two decades. Sunflower is the oil of preference among the consumers' world over due to its health appeal and in India too, sunflower oil is the largest selling oil in the branded oil segment. Sunflower is also a crop of choice for farmers due to its wider adaptability, high yield potential, shorter duration and profitability. The crop, is cultivated in about 3.5 M ha.

Varieties

Table 1- *Varietal recommendation*

Varieties/ Hybrids	States for which recommen-ded	Duration (days)	Plant height (cm)	Head dia. (cm)	Seed yield (kg/ha) under rainfed conditions*	Oil content (%)
Varieties						
Morden	All Sunflower growing states	85 to 90	90- 120	15-Dec	1000	42-45
EC 68414	All states	100-110	150-200	15-20	800-1000	40-42
TNAU SUF-7	All India	90-95	135-165	16-20	800-1200	38-42
Hybrids						
BSH-1	All states	130- 150	130-150	15-Dec	1000-1500	41-43
KBSH-1	All states	130-150	150-180	15-20	1200-1500	42-44
APSH-11	All states	90-95	120-150	15-20	1000-1500	40- 42
MSFH-1	All states	90-95	120-150	15-20	1000-1500	41-43
MSFH-8	All states	90-95	120-150	15-20	1000-1500	38-42
MSFH-17	All states	80-85	120-150	15-20	1000-1500	40- 42

- Under conditions of high inputs, favourable moisture and management, go in for cultivation of hybrids and long duration populations for higher returns.
- choose early maturing varieties / hybrids whenever chances of receiving post planting rains are less and application of protective irrigations are either remote or irrigation water is available only for limited period / no. of irrigations.

Soil

- Soils with an appreciable sand content are prefered.
- Good drainage is essential.
- Sunflower grows well on neutral to moderately alkaline soils, with a range of pH 6.5 – 8.0, but dislikes acid conditions.

Agro-Climatic Conditions

- Sunflower is grown from 40oS to 55 oN, but greatest production is between latitudes 20 and 50 oN and 20 – 40 oS. it will grow from sea level to 2500m, but generally gives highest yield of oil per ha below 1,500m.

Land preparation

- Generally sunflower is grown as a rainfed crop in kharif, hence to make use of rain water,
- It is necessary to plough the land once by a mould board plough followed by harrowing soon after the onset of the rains.
- F.Y.M or Compost @ 20-25 cartloads per hectare, should be applied at the time of the land preparation.

Planting

- As a field guide to final stand, most modern cultivars have 80-85 percent emergence 2-5 days after first seedlings appear.
- Seed should be dressed with a fungicide; Captan, Carboxin, Quintozene and Thiram are suitable, and preferably an insecticide, or a combination may be used, i.e. a standard groundnut or maize seed dressing.
- Seed should normally be planted 3-8 cm deep, depending mainly on the variety and moisture in the seed-bed.
- When using standard planters with 75 cm row-width, seed rates will vary from 3 to 8 kg/ha depending on seed size, to achieve a final spacing of approximately 30 cm between plants.
- Population in the range of 30,000 - 40,000 plants/ha at harvest is acceptable for the tall varieties and 35,000 - 60,000 for hybrids in areas where annual rainfall of 500 mm or above is normal; 14000 - 15000 plant/ha in very low rainfall areas.

SOWING

- The seed should be planted at 4 cm .deep in the plough for getting highest percentage of germination.

Seed dormancy and Viability

- Sunflower seeds (achenes) remain dormant upto 40-45 days of harvesting however, the dehusked seeds may germinate from 10th day after harvest.
- Exogenous application of ethrel, benzyl adenine and Gibberellic acid promotes germination of achenes.
- Pre-soaking of dormant seeds with ethrel solution (25 ppm) equivalent to 40% by volume of seeds has been found to be optimum.

Seed treatment

- The seed should be treated with Captan or Thiram Or Mancozeb 75 W.P @ 3 gm. per kg . of seed before sowing. For getting good result.
- After fungicide treatment, the seed can be treated with Azospirillum which helps in N-fixation (or) apply one kg or Azospirillum to soil after mixing with powdered FYM.

Seed rate

Straight varieties - Rainfed 8-10 Kg/ha/ ID 6-8 Kg/ha

Hybrids - Rainfed 6-7 Kg/ha/ ID 5-6 Kg/ha

Spacing

- The seed should be sown in lines 60 cm. apart (row to row) and in rows with a plant spacing of 30 cm.
- For a good crop ,row to row spacing of 80 cm, and plant to plant spacing of 20 cm. must be kept .

Table 2- Plant Spacing for different soil types

Soils	Spacing (cm)	Optimum population / ha
Light	45 x 20	1,11,000
Medium	45 x 30	74,000
Heavy	60 x 30	55,000

- Usually for long duration varieties or hybrids adopt a spacing or 60 x 30cm.
- In regions where the amount and distribution of rainfall is good adopt a spacing of 45 x 30cm.
- For short duration straight varieties like Morden adopt a spacing of 45 x 20 cm.

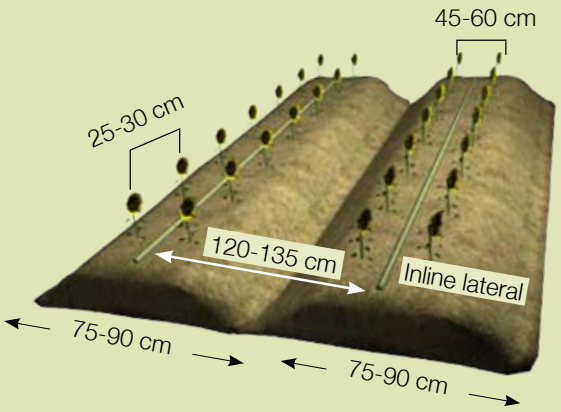
Recommended sowing dates

- Rainfed (and with life saving irrigation)
  Kharif July 15th to August 15th
  Kharif(Late) August 16th to August 31st
  Rabi September 15th to September 30th
  Rabi (Late) October 1st to October 15th
- Irrigated
  Rabi October
  Summer January

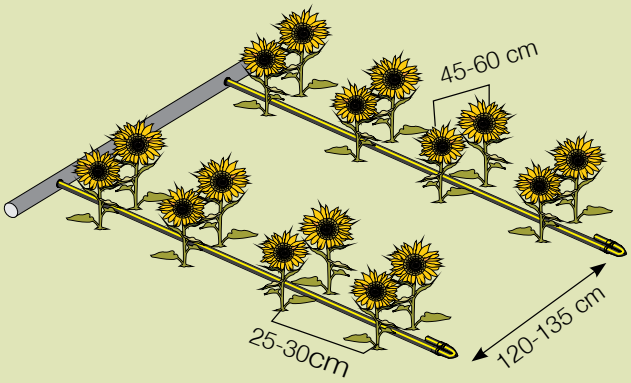
Thinning

The sunflower seed is planted at the rate of 2-3 seeds per hill. Thinning is done to keep one healthy plant per hill as excess plant population adversely affects the growth and yield of the crop. Thinning should be done with 15-20 days of germination seeds

Drip layout on bed rised system



Drip layout on plain land



Cropping System

- Sunflower is not season bound crop.
- Its short growing period of 90-125 days makes it an ideal catch crop.
- It can follow potato, sugarcane or even early wheat.
- Sunflower also fit well in most multiple cropping program. It can also serve as a companion crop to a long duration crop like sugarcane.
- Sunflower is grown in rotation with several crops as follows:

  Sunflower + Redgram (2:1), Paddy-Sunflower, Maize-Potato-Sunflower, Maize-Sunflower, Maize-Mustard Sunflower and Red gram-Sunflower

Intercrop

- Sunflower based ntercropping system sanp recommended.
- Hybrid Sorghum + Sunflower at 4:2 ratio.
- Kharif sunflower is mostly grown as rainfed crop in which few crops like groundnut (2 : 6); Ragi (2 : 5); Cowpea or Blackgram (2 : 3) may also be intercropped.

Critical crop growth stages

The most critical periods for irrigation in sunflower are bud (button) stage, flowering and grain formation stages.

Table 3 : Critical growth stages for irrigation

Stage (Days after planting)	Short duration varieties (Days after planting)	Long duration varieties
Bud initiation	30-35	35-40
Flower opening	45-50	55-65
Seed filling	55-80	65-90

Water Requirement

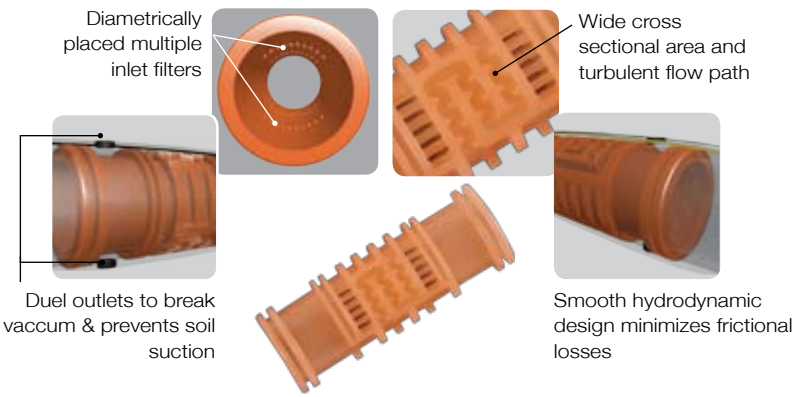
Sunflower will produce good yields with only 300-500mm of added water. The most obvious field symptom is an increase in the number of unfilled or aborted seeds in the centre of the plant heads, although inadequate pollination or soil nitrogen may also be partially responsible.

Jain® Drip
More Crop Per Drop®

s as per crop requirement!

Jain Turbo Line

- Available discharge rates - 2.4, 4 lph at 1 kg/cm² Pressure.
- Cylindrical shape permits wide flow path cross section along with multiple inlet filter improves clog resistante.
- Available in 12,16 & 20 mm nominal diameter.
- Suitable for surface as well as subsurface installation.



Benefits of drip fertigation

- Yield increase up to 120 %
- Suitable for all growth stages
- Water use is less compared to sprinkler.
- Irrigation can be performed duiring anthesis and pollen transfer stage.
- Flowering and Seed formation (grain filling) stages are most critical for irrigation requirement. Drip irrigation suits this situation.
- Effective fertigation, especially of N and K is possible with drip irrigation and providing K during the grain fill stage will increase weight of head and thus results in High yield.

Drip irrigation

Drip lines are placed at every 120 cm (skip row) for sun flower planted at 60 cm row to row spacing. Based on soil type one may choose dripper spacing of 40 cm (sandy loam) or 60 cm (clayey soil)

*Table 4: Water requirement of Sun flower for the pan E** shown.*

season	E mm	ET0 mm	kc	kp	Lit/ acre
Sept	4.5	3.2	0.35	0.5	2475
Oct	5	3.5	1	0.9	14140
Nov	4.5	3.2	1.15	1	16261
Dec	4	2.8	0.35	0.8	3519
1.Adjust for rainfall.					
2.**As Pan E chnages from location to location WR also will change					

Fertilizer Management

- It responds to fertilisers in soils of pH 6.5-8.5. With balanced fertilisation, seed yields of upto 3000 kg/ha can be obtained.
- Higher rates of P and K are recommended for hybrid seed production than for a regular crop.
- Add 3 M. T. FYM/acre to be applied at final ploughing

Table 5 : Recommendations of Fertilizers(kg/ha)

	Nitrogen	Phosphorus	Potassium
Rainfed			
a)Scanty rainfall areas	50-60	30	0
b)Assured rainfall areas	60	60	30
Irrigated			
a)Hybrids	60	90	40
b)Varieties (Non-Hybrid)	30	60	40

Fertigtaion Schedule for drip irrigated Sunflower

1. Apply all P at basal at planting; 90 P per ha for hybrids/ or 60 P /ha for varieties.

Fertigation for hybrids.

Table 6: Fertigation schedule for hybrid sunflower$$

Fertigation schedule for Hybrid sunflower			
Fertilizer recommen-dation for hybrids.			24: 36:16 per acre.
Time	N	P	K
Basal	5	36	0
15 DAS	3		0
22 DAS	5		0
30 DAS	6		2
45 DAS	4		4
60DAS			6
70 DAS			4
$$Fertigation units are given as N,P, K units.			
Use Urea as N source			
Use Potash as K source.			
Use SSP as P source. The S in SSP will be useful for Sunflower			

Secondary Nutients - Sulphur

- Sulphur increases seed yield and also the oil content.
- Apply Sulphur S-deficient soils at 13 kg/ha

Micro nutrients

- Among micro nutrients, iron, boron, manganese, copper and molybdenum are the important nutrients which show impact on Sunflower growth.
- Two to three sprays of (2g/l) copper sulphate solution at weekly intervals is recommended.
- Manganese sulphate should be applied to the soil at 50 kg per hectare.
- Foliar spray of (2-3g/l) manganese sulphate solution 2-3 times at weekly intervals is also recommended.
- Give directed spray of Borax (2 g/l) to capitulum at ray floret opening stage for increasing seed filling, yield and oil content.
- A spray mixture of 500 l/ha is required.
- Dissolve required quantity of Borax (2 g/l) in small quantity of hot water and make up the required volume.

Plant Protection

IPM practices

1. The cultural practices, starting from selecting the disease-free and robust planting material.
3. Deep tilling to weeding out unwanted vegetation and soil-borne pests and pathogens
4. Crop hygiene, keeping clean field and practicing hygiene by workers will contribute significantly in controlling crop pests.
5. The pest surveillance and monitoring exercises based on frequent visits to the fields and sweeping with insect nets,
6. Observing the movement of the pests using pheromone traps, light traps and sticky traps, and deciding on a spraying schedule with botanical insecticides (neem- based products).
7. The need-based application of safe botanical insecticides not only cuts the costs, but also helps in reducing the pollutant load in the environment.
8. The use of biological agents to manage the pests is another important aspect of IPM. Spiders and preying mantises can be effectively used in managing pests.
9. By growing `antenna" crops such as corn (maize) and sorghum (jowar or `cholam') have also helped in attracting the birds to crop fields as bio-control agents.
10. By raising companion crops along the main crops the pest could be managed well. While, the trap crops help in trapping the pests in them, other plants with strong aroma, such as fennel and garlic, help in repelling the pests.
11. The pests can be managed well by judiciously following the mixed-cropping groundnut (marigold or sorghum) , alley cropping (marigold, softwood trees like sesbanea) and border cropping (marigold, Castor) with suitable crop varieties.
12. The light traps are mostly used for monitoring the pest movements in the fields.

Table 7 : Insect pests of Sunflower and their control

Name	Part and stage of crop	Control Mesaure
Jassids *Amrasca biguttula bigguttula*	Undersurface of leaves	Spray Dimethoate (2m/l)
White Fly *Bemisia tabaci*	Undersurface of leaves	Spray monocrotophos (1.6 ml/l) or Acephate (0.5g/l)
Leaf Eating Caterpillar *Spodoptera litura*	Feed on leaves	Early infection, spray Endosulfan (2 ml/ l) (1ml/l); Late infection Quinalphops (1ml/l)
Gram Caterpillar *Helicoverpa armigera*	Feed on leaves, later on the florets and seeds	Ha NPV (500l.E./ha) Avoid spraying at Pollination stage to protect Honey bees

Table 8 : Diseases of Sunflower and their control

Name	Part and sage affected	Control Measures
Alternaria blight *A. helianthi*	Occurs in winter season petiols, leaves and flowers	use tolerant varieies BSH 1, seed treatment with captan 3g/kg seed Spray Mancozeb (2g/l) at 10 days interval
Rust *Puccinia helianthi*	leaves	use tolerant variety pracice crop rotation-Spray Mancozeb (2g/l)
Head Rot *Rhizopus sp.*	When rain falls on head Wind transmission of fungus	Spray fenthion 1ml/l pluswettable sulphur 2g/l at head initiation
Charcol rot *Macrophomina phase-olina*	Wilting at flowering Soil infection	Seed treatment with Trichoderma viride 4g/kg seed.
Downy Mildew *Plasmopara halstedii*	leaves, all stages	Seed treatment with Metalaxyl 6g/kg seed Foliar spray Ridomil 2g/l
Collar wilt *Sclerotium rolfsii*	40 days after sowingBase of stem	Seed treatment with Captan 3g/kg Soil drenching cheshnut copmpound 3g/l
Powdery mildew *Erysiphe cichoracerum*	in dry conditions on leaves	wettable sulphur 3g/l at or Calyxin 1ml/l
Mosaic Virus	Irregular yellow patches on leaves, all stages	Rouging infected plants. Spray triazophos 1ml/l or monocrotophos 1.5 ml/l

Crop yields on depend on Climate, Soil and Management and therefore can't be guaranteed by the company

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