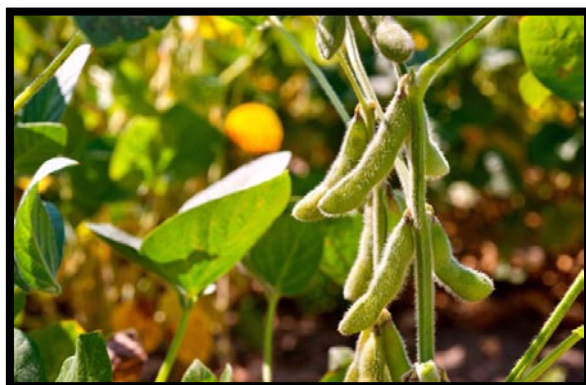


SOYBEAN

Scientific name: *Glycine max-Linn*



- **Soil and seed bed preparation:** - Soybean can be grown under wide range of soils with better performance under Vertisols rich in organic carbon. Deep ploughing once in 03 year is recommended for moisture conservation and insect-pest management.
- **Sowing time:** - Optimum sowing time is from mid of June to end of June subject to availability of moisture/rainfall.
- **Varieties:-** Selection of varieties may be made on the basis of time of rainfall. Multiple varieties may be adopted instead of single variety.
- **Seed treatment:-** Application of Rhizobium (400 gm per 65-75 Kg seed), Phosphorus Solubilizing Bacteria (PSB) and Fungicide (Thiram + Carbendazim) or Trichoderma viridi @ 8-10 g/kg of seed.
- **Seed rate:** - Optimum seed rate of 55-65 kg/ha with a spacing of 30-45 cm, which could be reduced with the use of broad-bed-furrow/ridge-furrow.
- **Inter cropping:-** Inter-cropping of arhar with soybean for risk management
- **Nutrient Management:** - Recommended dose of 25: 60: 40:30 N: P: K: S Kg / ha in north plains zones, application of 5kg Zn/ha through zinc sulphate is recommended.
- **Weed Management:-** Application of pre emergence weedicides (Pendamethalin / Metolachlor/ Diclosulum) followed by inter-culture operations.
- **Water Management:-** Adoption of Broad-Bed-Furrow/Ridge-Furrow System for effective water management. Life saving irrigation at pod initiation and grain filling . Spray of anti-transparent like KNO_3 @1% or $MgCO_3$ or Glycerol is also recommended during long dry spell.
- **Pest and Disease Management:-** In addition to deep summer ploughing and seed treatment, use of resistant varieties like JS 335, PK 262, NRC 12, MACS 124 against **stem-fly**, NRC 7, NRC 37, JS 80-21, Pusa 16, Pusa 20, Pusa 24, PS 564, PK 472 against **defoliators**, JS 71-05 against **girdle beetle**, JS 80-21, PK 1029, PK 1024, Indira Soya 9 against **soybean rust**, PK 262, PK 416, PK 472, PK 1042, NRC 37 against **collar-rot**, PK 416, PK 472, PS 564 against **bacterial pustule**, and PS 564, PK 1024, PK 1029, PS 1042, PS 1092, SL 295 against **yellow mosaic virus are also recommended**.
- **Harvesting:-** Timely harvesting of the crop, when pods turn pale yellow, is recommended to avoid shattering.
- **Yield:-** Rainfed condition – 1600-2000 kg/ha
Irrigated condition – 2000-2500 kg/ha

GROUNDNUT

Scientific name: *Arachis hypogaea*



- **Soil:-** The crop can be grown with a minimum rainfall of 500 mm and maximum of 1250 mm. Sandy-loam soils rich in organic matter is considered as best.
- **Sowing time:** Kharif-groundnut- June to July subject to onset of monsoon, *Rabi* groundnut-November and *Summer* groundnut-February-March.
- **Method of sowing:** Line / criss-cross sowing on flat beds, sowing on BBF/RF
- **Seed treatment:-** Thiram/Mancozeb (3g/kg of kernel) or Carbendazim (2g/kg)
- **Seed rate:-** 100-110 kg seed/ha with 30x10 and a plant population of 3.33 lakh per ha for bunch type groundnut varieties and 95-100 kg seed per ha for spreading and semi-spreading varieties with a spacing of 45 x 10 cms and a plant population of 2.22 lakh per ha.
- **Inter cropping:-** Inter-cropping of arhar with groundnut for risk management under drought prone areas
- **Nutrient Management:-** For every one tonne of pod yield and two tonne of haulm yield, groundnut crop removes 60 kg Nitrogen, 11 kg Phosphorous, 46 kg Potassium, 27 kg Calcium and 14 kg Magnesium from the soil. Use of NPK and micro-nutrients as per Soil-Health Card.
- **Weed Management:-** Two hand weeding, first around 20 days after sowing and second at about 35 days after sowing. Use of herbicides Pendimethalin, Oxyfluorfen, Quinalofop ethyl and Imazethapyr as per recommended doses
- **Water Management:-** Rainfall/protective irrigation is necessary at flowering (20-40 DAS), pod formation (40-70 DAS) and pod filling (70-100 DAS), Sprinkler irrigation is ideal for the crop grown under sandy soils. Use of Broad-Bed-Furrow / Ridge and Furrow system for effective water / moisture management. Drip irrigation is becoming popular among groundnut growers as it increases crop yield by 25-40% besides improving seed quality and saves up to 40-50% irrigation water compared to flood irrigation.
- **Pest and Disease Management:-**
 - ✓ White grub, aphids, thrips, caterpillars, tikka leaf spot, collar rot and bud necrosis are the major insect pest and diseases in groundnut.
 - ✓ Growing of resistant varieties like, BR 2, ICGV 87160, ICGV 86031, ICGV 86699 against leaf mine; ICGV 86590 against *Spodoptera*; BG 2, Girnar 1 against aphids; Girnar 1, Co-1, Dh-3-30, ICGS 11, MH 1, POL 2, S 206 against leafhoppers and Girnar 1 against thrips.
 - ✓ Spray neem oil @5ml/ltr water alongwith suitable surfactant like soap powder @ 1g/ltr or NSKE 5% as it acts as oviposition deterrent.

- ✓ Release of *Trichogramma chilonis* @ 50000/ha, two times at 7-10 days interval followed by release of *Bracon hebetor* @ 5000/ha two times at 7-10 days against Leaf Miner and Defoliators.
 - ✓ Install pheromone traps @ 10 traps/ha for *Spodoptera* and *Helicoverpa* and 25 traps/ha for leaf miner.
 - ✓ Erect bird perches @ 10-12/ha.
 - ✓ Soil application of neem cake or castor cake @ 500kg/ha or neem seed kernel powder @ 3-5%.
 - ✓ Seed treatment with commercial formulation of *Trichoderma harzianum* or *T. viride* or *Pseudomonas fluorescens* @ 10g/kg seed or Thiram or Carbendazim or Captan or Mancozeb @ 3-4g/kg seed or Tebuconazole (Raxil 2 % DS) @ 1.25g/kg.
 - ✓ Foliar application of Carbendazim (0.025%) + Mancozeb (0.2%) at 2-3 weeks interval, 2 or 3 alternate spray of Mancozeb (0.2 %), Carbendazim (0.02 %) and Mancozeb (0.2 %) or three sprays of Chlorothalonil (0.2 %) or Hexaconazole (0.005 %) or Difenoconazole 25% EC @ 2ml/L at 30, 50 and 70 DAS effectively reduces the early leaf spot and late leaf spot severity.
 - ✓ Spray Mancozeb (0.2 %) or Copper Oxychloride (0.2 %) and destroy the collateral weeds and self-sown plants.
- **Harvesting:-** Pods with prominent veins, dark coloured inside of the shells and the kernels are the indicatives maturity of crop.
 - **Yield**
 - ✓ Rainfed- 1000-1250 Kg/ha
 - ✓ Irrigated (Rabi/Summer) – 2000 -3500 Kg/ha

RAPESEED-MUSTARD

Scientific name: *Brassicas sp.*



- **Soil:-** The crop require longer cool temperature. Mustard could be successfully grown under wide range of soils including saline/alkaline, low irrigated and paddy fallows in Eastern India.
- **Sowing time:-** An average day and night temperature of 25⁰ C is considered optimum for sowing. From August end to first half of September is best for sowing of toria, 25th September to 15th October for sarson, 30th September to 15th October for mustard.
- **Seed treatment:-** Seed treatment with Apron SD 35 @ 6 g/kg of seed is advised for White Rust and Downy Mildew endemic areas. For other seedling diseases, seed treatment with Carbendazim, Thiram or Captan @ 2 g/kg of seed is recommended.
- **Seed rate:-** 4-5 kg/ha.
- **Method of sowing:-** Line sowing with row-to-row distance of 30 cm and plant-to-plant distance of 10-15 cm. Use of ridge-furrow technique is beneficial in saline areas. Thinning is necessary after three weeks of sowing for maintaining optimum plant population.
- **Nutrient Management:-** Integrated nutrient management with 40 kg N per ha for rainfed situations and 40-80 kg of N per ha under irrigated situations is recommended.
- **Weed Management:-** Clean cultivation with regular weeding.
- **Water Management:-**
 - ✓ Two irrigation for mustard one at 20-30 days after sowing (DAS) and another at siliqua formation stage (50-60 DAS)
 - ✓ Use of ridge & furrow technique is beneficial in saline area and for moisture conservation.
- **Pest and Diseases Management:-**
 - ✓ Aphid, painted bug, alternaria, white rust and powdery mildew are the major insect/ pest of rapeseed-mustard crop.
 - ✓ Seed treatment with Carbedazim 0.1% or Thiophanate Methyl against seedling diseases and imidacloprid @ 5g/kg of seeds.
 - ✓ Use of ridomil MZ 72 WP @ 3g/l for control of white rust and spray of Mancozeb 50 WP @ 2g/l needs to be taken up at 50 and 70 days after sowing for control of alternaria.
 - ✓ Dusting of Sulphur @ 1.5 kg/ha or spraying of Sulfex 2 g/l for powderymildew
 - ✓ Spray of systemic insecticides viz. Monocrotophos, Oxydemeton Methyl etc., for control of aphid.
- **Harvesting:-** Harvesting as soon as the crop begins to turn yellow, threshing mechanically and storing at the moisture content of less than 8% is suggested.
- **Yield:-** Rainfed condition – 800-1500 kg/ha
 - ✓ Irrigated condition – 2000-2500 kg/ha

SESAME

Scientific name: *Sesamum indicum*



- **Climate and soil:-** The crop is grown in the plains and also at elevation up to 1200 m. It is grown in sandy-loam to heavy black soils.
- **Sowing time:-** Sesame is considered as a contingency crop and could be sown upto mid of August under delayed rainfalls during Kharif season. Rabi crops could be sown from Sep-Nov and *Summer* crop, which has largest area in WB is sown in Feb/March.
- **Seed treatment:-** For the prevention of seed borne diseases, seed may be treated with Bavistin @ 2 g/kg seed. Seed may be soaked for 30 minutes in 0.025% solution of Agrimycin-100 prior to seeding in the area of bacterial leaf sport disease.
- **Seed rate:-** A seed rate of 5 kg/ha is adequate to achieve the required plant population. In order to facilitate easy seeding and even distribution increase the bulk by mixing the seed with either sand or dry soil or well sieved farm yard manure in 1:20 ratio.
- **Spacing:-** 22.5 to 45 cm between rows and 10 to 22.5 cm between plants in the row
- **Method of sowing:-** Seed drills may be used for sowing in rows.
- **Nutrient Management:-** may be used as per soil health card. In areas deficient in sulphur, application of 15-30 kg S/ha is recommended at the time of sowing.
- **Weed Management:-** The crop is most sensitive to weed competition during the first 20-25 days. Two weeding, one after 15-20 days and 30-35 days after sowing are suggested
- **Water Management:-** Irrigation at flower initiation and capsule formation is essential.
- **Pest and Diseases Management:-** Use of resistant varieties is the most economic method of reducing the losses by pest and disease attack.
- **Harvesting:-** Crop should be harvested when leaves turn yellow and start dropping while the capsules are still greenish-yellow.
- **Yield:-**
 - ✓ Kharif – 375-500 kg/ha
 - ✓ Rabi – 500-750 kg/ha
 - ✓ Rainfed condition – 500-600 kg/ha
 - ✓ Irrigated (Rabi/summer) – 900-1000 kg/ha

SUNFLOWER

Scientific name: *Helianthus annuus*



- **Climate and soil:-** Sunflower can be cultivated in all the seasons but perform better during *Rabi* or spring/early summer. It performs well in deep, neutral and well-drained light as well as heavy soils.
- **Sowing time:-** Sowing time should be so planned that the flowering and seed filling stages of the crop do not coincide with continuous rainy period or high temperatures above 38°C.
- **Seed treatment:-** Seed should be treated with Thiram or Captan @ 2-3 g/kg of seed to protect from seed-borne diseases. Seed treatment with Metalaxyl @ 6 g/kg can protect the crop against downy mildew disease. Treat the seed with imidacloprid @ 5 g/kg before sowing against insect vectors for the necrosis management.
- **Seed rate:-** A seed rate of 5 kg/ha is adequate to achieve required plant population of 55,000/ha under heavy soil and 74,000/ha under light soils. Maintenance of optimum population by judicious thinning at 10-15 days after germination to retain single healthy plant per hill is essential for obtaining optimum yields.
- **Spacing:-** The optimum spacing is 60 cm between rows and 30 cm between plants which can accommodate 55555 plants/ha. For short duration and dwarf varieties, 45 cm x 30 cm spacing may be followed.
- **Nutrient Management:-**
 - ✓ Sunflower is an exhaustive crop and for every tonne crop removes as much as 63.3 kg nitrogen, 19.1 kg phosphorous, 126.2 kg potassium, 11.7 kg sulphur, 68.3 kg calcium, 26.7 kg magnesium, 47g zinc and 1075 g iron. Application of nutrient may be decided as per soil health card.
 - ✓ Boron is the most important for sunflower. Providing directly spray of borax (0.2% i.e. 2 g/l of water) to capitulum at ray floret opening stage increases seed filling, yield and oil content.
 - ✓ Sulphur is emerging as fourth major nutrients especially for oilseeds due to its involvement in oil synthesis. Sunflower has been found responsive to direct and residual sulphur fertilisation.
 - ✓ Seed treatment with *Azospirillum* and/or *Azotobacter* can save 50% recommended nitrogen fertilizers. Similarly, use of PSB in sunflower – sorghum cropping system can meet 50% of phosphorous requirement of sorghum (30kg P₂O₅/ha).
- **Weed Management:-** Two hoeings followed by one hand weeding at an interval of 15 days commencing from 15-20 DAS. Use of alachlor or pendimethalin or fluchloralin at

the rate of 1.0 kg a.i./ha in 600 litres of water as pre-emergence spray followed by one hand weeding and inter-culture at 35 DAS provide effective control of weeds.

- **Water Management:-** Protective Irrigation is essential at three critical stages of bud initiation, flower opening and seed filling.
 - **Pest and diseases Management:-**
 - ✓ Cut worm – sow the seeds on ridges
 - ✓ Capitulum borer – Spray Decamethrin (0.002%) or Cypermethrin (0.005%)
 - ✓ Foliage pests – Spray Dichlorvos (0.05%) or Fenitrothion (0.05%)
 - ✓ Sucking pests:- Spray Phosphamidon (0.03%)
 - **Harvesting:-**Sunflower can be harvested at physiological maturity when the back of the head turns to lemon yellow colour and the bottom leaves start drying and withering.
 - **Yield**
 - ✓ Rainfed condition – 1000-1500 kg/ha
 - ✓ Irrigated condition – 2000-2500 kg/ha
- ❖ Honey bees play a very important role in increasing seed set in sunflower. Maintaining 5 hives/ha provides optimum requirement, besides yielding valuable honey. Avoid spray of insecticide at the blooming period as it affects the visit of pollinators (bees).

SAFFLOWER

Scientific name: *Carthamus tinctorius* L



- **Climate and soil:-** Safflower comes up better in relatively drier areas. It requires fairly deep, moisture retentive and well drained soils. The crop is fairly tolerant to saline condition and grows well under residual moisture in paddy fallows.
- **Sowing time:-** Depending upon the availability of conserved/ residual moisture/late Kharif rains crop could be sown from late September to mid of November
- **Seed treatment:-** Seeds should be treated with Thiram, Captan or Carbendizim @ 3 g/kg seed before sowing.
- **Seed rate:-** Seed Rate of 7.5 kg to 20 kg / ha is used depending upon soil conditions
- **Spacing:-** 30cm x 15 cm or 45cm x 20 cm
- **Method of sowing:-** Follow line sowing using improved seed drills or fertilizer-cum-seed drills
- **Nutrient Management:-** Application of fertilizers may be made as per soil health card.
- **Weed Management:-** Normally, weeds do not pose any serious problem in safflower except when frequent rains are received during initial phase of crop growth or when land preparation and tillage are not proper. Timely weeding and interculture during rosette stage is crucial for arresting weeding and obtain full benefits.
- **Water Management:-** Yield can be boosted by 40 to 60% by providing just one life saving irrigation at critical stages of crop growth (early stem elongation or flowering).
- **Pest and diseases Management:-**
 - ✓ Safflower is affected by a number of insect pests and diseases. However, aphid is a major problem under late sown conditions.
 - ✓ Spray Dimethoate (0.05%) or Methyl Parathion (0.05%) or Monocrotophos (0.05%) or Chlorpyrifos or Endosulfan (0.05%) or alternatively dust Quinalphos (1.5%) or Methyl parathion (2.5%) or Malathion (5%) or Endosulfan (4%) at 40 and 60 DAS.
 - ✓ Use 500 litres of spray mixture and 20 kg dust formulation/ha.
 - ✓ Spray Mancozeb (0.25%) immediately after disease is noticed and repeat the spray 15 days later depending on the intensity of Alternaria leaf spot.
- **Harvesting:-** The crop is ready for harvest when the leaves and most of the bracteoles become dry and brown. Hand gloves may be used to protect legs and hands against spines. Effect of spines could also be minimized by harvesting of crop before rising of sun. Multi-crop threshers and combine harvester could be used for harvesting and threshing.
- **Yield:-**
 - ✓ Scanty moisture condition – 800 – 1200 kg/ha
 - ✓ Favourable moisture condition - 1500 – 2000 kg/ha
 - ✓ Minimal irrigation – 2000 – 2800 kg/ha

NIGER

Scientific name: *Guizotia abyssinica*



- **Soil:-** Niger could be raised in wide range of soils from clay loam to sandy loam, sandy and gravel soil. It can withstand slight alkalinity and salinity also.
- **Sowing time:-** Primarily, Niger is a Kharif crop, but mostly sown in late July/ August.
- **Seed treatment:-** Seed should be treated with Thiram or Captan 3.0 g/kg seed before sowing. Seed treatment with Phosphorus solubilising bacteria (PSB) 10 g/kg seed gives higher yield.
- **Seed rate:-** Generally 5 kg/ha seed is required for the sole crop. Line sowing has been found beneficial with spacing of 30cm x 10cm.
- **Method of sowing:-** The crop is largely sown by broadcasting. Seeds are mixed with sand/ powdered FYM/ ash to increase the bulk, 20 times to ensure even distribution of seed.
- **Nutrient Management:-** The crop is mostly grown on marginal and sub-marginal land without manure or fertilizer application. However, application of recommended N through urea + seed treatment with PSB 10 g/kg seed enhances yield significantly. Application of sulphur (20-30 kg/ha) increases seed yield and oil content in niger.
- **Weed Management:-**
 - ✓ First weeding is needed 15-20 days after sowing. In Orissa, *Cuscuta* (*Cuscuta hyalina*/ *C. chinensis*) infestation has become a major problem. Seed should be obtained from *Cuscuta* free areas. *Cuscuta* seeds could be separated with a 1 mm sieve.
 - ✓ Pre sowing soil application of Fluchloralin (1 kg a.i./ha). or Pre emergence application of Pendimethalin (1.5 kg a.i./ha).
- **Water Management:-** It is invariably grown in the rainy season and it is seldom irrigated. There are indications that niger yields can be doubled under irrigation, if the crop suffers from moisture stress. Irrigation may be given at the seedling stage.
- **Pest and diseases Management:-** Niger is generally not menaced by any major insects or diseases.
- **Harvesting:-** Niger usually matures in 95-105 days after sowing. The crop should be harvested when the leaves dry up and the capitula turn brownish / blackish in colour.
- **Yield:-**
 - ✓ Pure crop – 400-500 kg/ha
 - ✓ Intercrop – 150-300 kg/ha

CASTOR

Scientific name: *Ricinus communis*



- **Climate and soil:-** Castor is tolerant to drought and grows well in relatively dry and warm regions. The crop comes up well on almost all types of well drained soil, but generally grown on red sandy loams in peninsular India and light alluvial soils in northern states.
- **Sowing time:-** Normally, rainfed crop is sown subject to receipt of monsoon and irrigated crop which is largely hybrid is sown late upto end of August. Purchase of hybrid seeds every year and renewal of seed stock of improved varieties once in 4-5 years.
- **Seed treatment:-**Seeds treatment with Thiram or Captan @ 3g/kg seed or Carbendazim 2 g/kg to protect plants from seed borne diseases like *Alternaria* Leaf Blight, Seedling Blight and Wilt. Treat the seed with *Trichoderma viride* @ 10 g/kg seed and soil application of 2.5 kg incubated in 125 kg FYM/ha for managing wilt.
- **Seed rate:-**Plant population of 18,500/ha and 14,000/ha was found to be optimum for rainfed and irrigated areas respectively with 5 kg seeds/ha.
- **Spacing:-** Square planting at 75 cm x 75 cm for rainfed areas and 90 cm x 90 cm for irrigated area.
- **Method of sowing:-** Castor is generally sown behind the country plough in Andhra Pradesh. Seed-cum-fertilizer drill can also be used.
- **Nutrient Management:-** Castor crop with an yield of 10 qtl./ha removes 40 kg N, 9 kg P₂O₅ and 16 kg K₂O/ha under rainfed conditions, whereas, an irrigated crop with an yield of 22.8 q/ha removes 84 kg N, 26 kg P₂O₅ and 31 kg K₂O/ha. Application of fertilizer may be decided as per soil health card.
- **Weed Management:-** Two or three weedings at intervals of 15-20 days in order to keep weeds under check. Alternatively preplant application of herbicides such as Fluchloralin or Trifluralin @ 1.0 kg a.i./ha or pre-emergence application of Alachlor @ 1.25 kg a.i./ha is equally effective under irrigation.
- **Water Management:-** For realizing the full productivity potential, the first irrigation should be applied at around 55-75 days or around full flowering of primary spike. All hybrids/varieties require 5-7 irrigations in sandy loam soils of Gujarat and Rajasthan for realizing the full productivity potentials. Drip irrigation in hybrid castor saves 24% water and offers 36% higher yield.
- **Pest and diseases Management:-** Semilooper is a major problem in castor. Hand picking of older larvae during early stages of crop growth. Manipulate parasitic activity by avoiding chemical spray, when 1-2 larval parasites are observed on castor plant. Spray of Monocrotophos (0.05%), Endosulfan (0.07%), if 4-5 semiloopers/ plant are observed with more than 25% defoliation.

- **Harvesting:-** Physiological maturity in castor is attained when some of the capsules in a spike turn brown in colour.
- **Yield:-**
 - ✓ Rainfed condition – 800-1000 kg/ha
 - ✓ Irrigated condition – 1500-2500 kg/ha

LINSEED

Scientific name: *Linum usitatissimum*



- **Climate and soil:-** Linseed is a cool season crop and requires moderate to cool temperature. It is grown best in well drained, fertile, medium and heavy soils especially silty loam, clay loam and silty clays. This crop is under cultivation in three ecosystems namely *utera*, rainfed and irrigated. Growing linseed in *utera* system is the predominant practice in Eastern States under paddy fallows.
- **Sowing time:-** The crop could be sown during October to first fortnight of November depending upon the soil moisture and irrigation facilities.
- **Seed rate:-** High seed rate ranging between 25 to 30 kg/ha is used under different situation.
- **Spacing:-** A row spacing of 20-30 cm with a plant to plant spacing of 7-10 cm is ideal.
- **Method of sowing:-** Drilling in prepared seed bed or by broadcasting in the standard rice crop as *utera*.
- **Nutrient Management:-** Application of fertilizer @ 40 kg N + 20kg P₂O₅ and 20kg/ha K₂O has been found quite beneficial in increasing yield of this crop in rainfed eco-system at various locations. Higher doses of fertilizers are used for dual purpose (seed + fibre).
- **Weed Management:-** To ensure clean cultivation, *cuscuta* seeds should be separated before sowing. Other weeds could be managed by post emergence application of weedicides isoproturon @1.00kg/ha at 30-35 DAS. However, 2,4-D (Na) @0.5kg/ha may also be mixed in the tank with Isoproturon if broad leaf weeds are also problem.
- **Water Management:-** Yields can be doubled with 1 or 2 irrigations given at 35 and 75 DAS. On light soils, 3-4 irrigations may be needed. Branching, flowering and grain filling are critical stages for irrigation.
- **Pest and diseases Management:-**
 - ✓ Two fortnightly sprays of spinosad 45 SC (0.015%) reduces upto 78% bud fly infestation, which enhances upto 63% seed yield.
 - ✓ Two application of neem based commercial formulation containing Azadirachtin 300 ppm reduces upto 63% bud infestation and thereby enhancement upto 40% in seed yield.
- **Harvesting:-**Crop should be harvested by sickle when the leaves are dry, the capsules have turned brown and seeds become shiny
- **Yield:-**
 - ✓ Rainfed condition – 800-1000 kg/ha
 - ✓ Irrigated condition – 1600-2000 kg/ha
 - ✓ Protective irrigated condition – 1200-1500 kg/ha

OILPALM

Scientific name: *Elaeis guineensis*



Climatic requirements: Oil palm is a humid crop. Requires evenly distributed rainfall of 150mm/ month or 2500-4000mm/annum. Rainfall distribution in India is not even and adequate. Hence grow oil palm under assured irrigation conditions by adopting recommended practices. Crop comes up well between 29-33oC max. and 22-24oC min. temperatures and with bright sunlight for at least 5 hrs. per day. Humidity of more than 80% is required to come up well.

Soils: Best-suited soils are moist, well-drained, deep, loamy alluvial soils, rich in organic matter with good water permeability. At least one-meter depth of soil is required. Avoid highly alkaline, highly saline, waterlogged and coastal sandy soils.

Cultivated variety: Tenera is the ruling hybrid and it is a cross between thick-shelled Dura and shell less Pisifera. Tenera has a thin shell, medium to high mesocarp content and high oil content.

Planting: Best season for planting is June-December i.e., during monsoon. In case of planting during summer, adequate irrigation, mulching and growing cover crops like sun hemp in the basin would help in avoiding hot winds during summer. 12 -14 months old healthy seedlings with 1-1.3m height and 13 functional leaves are recommended for planting. While planting, 143 plants per hectare should be maintained with a spacing of 9m x 9m x 9m (triangular planting). Planting should be done in pit size of 60 cm x 60 cm x 60 cm (length, breadth and depth).

Apply 250g Di Ammonium Phosphate or 400g Single Super Phosphate, 50g Phorate and mix with the soil at the base of the pit. Immediately after planting, form basin and give copious irrigation.

Irrigation management: Oil palm requires sufficient irrigation, as it is a fast growing crop with high productivity and biomass production. Do not grow oil palm if assured and adequate irrigation facility is not available. For grown up yielding palms of 3 years age and above, a minimum of 150 to 200 liters of water per day is required. However, in older plantations during hot summer this quantity may be increased up to 300 lit.

Basin method of irrigation is to be taken up when irrigation water is not a constraint. Required quantity of water is to be given at 4-5 days interval. Prepare irrigation channels in such a way that the individual palms are connected separately by sub-channel. For light soils, frequent irrigation with less water to be given. In heavy soils, irrigation interval can be longer. Drip or Microjet irrigation method is practiced. If land is of undulated terrain, drip or

micro sprinkler irrigation can be advantageous. If drip irrigation is installed, four drippers are to be placed for each palm. If each dripper discharges 8 liters of water per hour, 5 hr. of irrigation per day is sufficient to discharge 160 lit/day. In case of micro sprinklers (180o or 360o) one each on either side of the palm can be installed. Drippers/jets should be periodically checked for proper discharge. Basins should be adequately mulched and covered with soil, which will help to conserve moisture

Fertilizer management: Oil palm is a gross feeder and demands a balanced and adequate supply of macro, secondary and micronutrients for growth and yield. It is advised to apply fertilizers at every three months interval.

Fertilizer requirement of oil palm: Four equal split doses of fertilizers are to be applied starting from June/July at three month interval. For the newly planted crop, the first dose of fertilizer needs to be applied three months after planting. Add 50-100 kg FYM or 100kg green manure per palm along with the second dose of fertilizer application. Five kg neem cake/palm can also be applied. Broadcast the fertilizers around the clean-weeded basin, about 50 cm away from the palm base and incorporate into the soil with the help of fork. Irrigate the palms immediately after fertilizer application.

Age of Oil Palm	Nitrogen	Phosphorous	Potassium	Magnesium	Boron
	Urea	SSP	MOP	Magnesium Sulphate	Borax
	(gms/palm/yr)				
1 st Yr	870	1250	670	125	25
2 nd Yr	1740	2500	1340	250	50
3 rd Yr onwards	2610	3750	2000	500	100

Basin management: During first year, basins of 1-m radius, second year 2- m radius, and the third year 3- m radius are to be taken around the palm by removing the soil from inside so that the soil will not accumulate at the collar region. Basin area of oil palm represents its active root zone. Hence it must be kept clean and weed free to avoid competition for nutrients and water

Weeding: Take up regular weeding manually or with the use of only recommended herbicides. Use preferably contact herbicides. Glyphosate (750ml/ha/year or 17.5 ml/basin) is recommended for effective weed control. Herbicide mixtures of Paraquat with Atrazine, Monuron and Diuron sprayed on ground, twice a year can control the weeds, effectively.

Inter-cropping: Oil palm is a wide spaced perennial crop with a long juvenile period of 3 years. Inter and intra row space can be used to generate income during the juvenile phase of the crop. Inter crop selected should be compatible with the main crop and should not compete with oil palm for light, water and nutrients. Any remunerative crop can be grown, but the most suitable crops are vegetables, banana, flowers, tobacco, chillies, turmeric, ginger, pineapple etc. While growing inter crops in mature oil palm gardens of 8- 12 years age or palms attained a height of 3 meters, intercrops should be able to grow under partially shaded conditions and should not compete with oil palm for water, sunlight and nutrients (eg. cocoa, pepper, heliconia and ginger lilly). Do not cut the oil palm fronds. Do not tie oil palm fronds close to the stem for inter-cropping, which will reduce photosynthetic activity. Do not plough close to the palm base, which will cut the absorbing roots and thereby reduce intake of water and nutrients. Maximum number of green leaves should be retained on the palm.

Flowering: Oil palm comes to flowering 14-18 months after planting. It produces both male and female flowers separately on the same palm. Male and female phases do occur naturally in consequent cycles in a palm.

Ablation: Ablation is the removal of male and female flowers produced in the early stages of plantation. This enables the plant to gain adequate stem girth, vigour and develop adequate root system. Flowering starts from 14th to 18th month after planting. Start ablation immediately after the appearance of inflorescences on the palms. They can be removed easily by hand pulling or using the tool developed at DOPR. Ablation can be extended up to 2-1/2 to 3 years depending upon the plant growth and vigour.

Pollination: Oil palm is a highly cross-pollinated crop. Wind and insects assist pollination, but wind pollination is not adequate. Effective pollinating insects like *Elaeiodobius kamerunicus* helps in good pollination and fruit set. Release of this weevil after 2-1/2 year of planting is advisable. If the plants are not having good girth and vigour, release the weevils after 3 years.

Mulching: Mulching is essential to conserve moisture as well as to control weeds in the oil palm fields. Mulching can be done with dried leaves, male flowers, coconut husk, empty bunches etc on basins of oil palm.

Harvesting: While harvesting a stalk length of 5 cm alone should be left. Harvesting should be done at 10-12 days interval. During rainy season, harvesting should be done at closer interval of 6-7 days as ripening is hastened after hot summer. In young plantations, we get more bunches with less bunch weight and in adult plantations the bunch weight is more but the bunch number is less.

Yield: At yield stabilizing period (4-8 years): 12t/ha

At yield stabilized period (>8 years): 20t/ha