



Precision Farming
GROUNDNUT
With Jain Technology™



JAIN®

Jain Irrigation Systems Ltd.

Small Ideas. Big Revolutions.®

Groundnut (*Arachis hypogaea* L.) is believed to be native of Brazil from where it was introduced into India via Chinese Pacific islands.

Groundnut, in general, has a short-statured plant, with the main axis being upright (15 to 40 cm long) but the major part of the plant consists of the primary branches. Secondary and tertiary branches are found in the semi-spreading and spreading (Virginia) types, giving them a prostrate stature.

About 7.5 million hectares is under ground nut annually in India and the production is about 6 million tonnes. 70% of the area and 75% of the production are concentrated in the four states of Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka.

Soil

- Medium soils with very good drainage and loam soils are preferable. Heavy deep black cotton soils (clay) to be avoided.
- Lack of proper drainage adversely affects root growth ultimately affecting the crop.
- In the absence of adequate oxygen in the root zone, beneficial soil bacteria, especially the nitrogen - fixers become ineffective and uptake of nitrogen by roots is hampered.
- The pegs can penetrate the soil easily and pods can be harvested from such soils with minimum losses
- Adequate supply of calcium mineral in the soil is very essential for the production of groundnut pods .
- Heavy and fine - textured soils with stiff clay cause difficulties in groundnut harvesting .
- Where groundnuts must be grown on heavier - textured soils, runner varieties of groundnut are more suitable than the Virginia types.
- High yields are obtained on soils with moderate acidic reaction (soil pH 6.0 to 6.4), alkaline soils being undesirable. Yellowing of groundnut leaves and blackening of parts of pods occur when the pH was 7.5 - 8.5. Soils having pH less than 5.0 are also not suitable for groundnut cultivation.
- Application of gypsum alleviates soil salinity by improving leaching of salts below the root zone.

Climate

- Groundnut is grown in the Tropical and SubTropical countries lying between 45° North and 35° South and up to an altitude of 1000 meters and receiving a minimum rainfall of 500 mm and a maximum of 1250 mm.
- The groundnut crop however, can not stand frost for long and severe drought or water stagnation.

Varieties

Some of the recommended varieties are:

Andhra Pradesh : ICGS-11 (Bunch - Spanish); Kadiri 2, Kadiri 3, TMV-10, TG 1 (vikram) (Semi Spreading); Kadiri 71-1 (Spreading) TMV-2, JL-24, POLACHI, GG-20, Gangapuri & Narayani.

Tamil Nadu : Spanish Improved, S-206, DH 3-30, KRG-1, DH-8, ICGS-11 (Bunch- Spanish); S-230 (Spreading).

Karnataka : ICGS-11, TMV-2, TMV-5, TMV-7, POL-1, TMV-9, POL-2, TMV-12, CO-1, CO-2 (Bunch- Spanish); TMV-11 (Bunch-Valencia); TMV-6, TMV-8, TMV-10 (Semi Spreading); TMV-1, TMV-3, TMV-4 (Spreading).

Maharashtra : AK 12-24, SB XI, JL 24, TG 17, ICGS-11 (Bunch - Spanish); Kopergaon (Bunch-Valencia); TG 1 (Vikram), Kopergaon 1, UF 70-103 (Semi Spreading); Karad, 11- Apr (Spreading), HD 11.

Orissa : Kisan, Jawan (Bunch - Spanish).

Madhya Pradesh : Jyoti, ICGS-11 (Bunch - Spanish); Gangapuri (Bunch- Valencia).

Gujarat : J 11, GAUG 1, GAUG 2, GG 2 (Bunch - Spanish); GAUG 10, GG 11, TMV-3, TMV-4 (Spreading), Ah 334.

Rajasthan:RSB 87s (Semi Spreading); RS 1 (Spreading).

Uttar Pradesh : T 28, T 64, Kaushal (G 201) (Semi Spreading); Chandra, Chitra (MA 10) (Spreading)

Bihar : BG 1 (Semi Spreading).

Haryana: MH 1 (Bunch - Spanish); MH 2 (Bunch- Valencia)

Punjab: SG 84(Bunch - Spanish); C 501, M 145, M 197 (Semi Spreading); PG 1, M 13, M 37, M 335 (Spreading), Punjab-1

Source: NRCG, Junagadh.

Seed rate

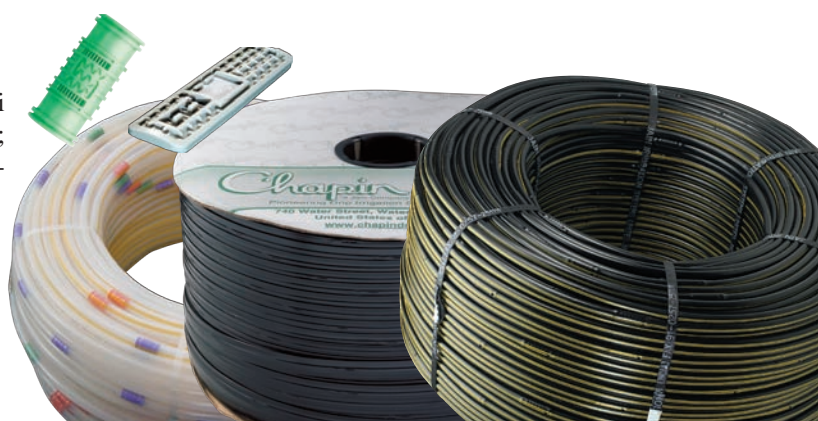
- Generally spreading and bunch varieties requires 90-120 kg/ha in *Kharif*, in rainfed situation.
- In *Rabi*, in irrigated conditions spreading varieties require 140-150 kg/ha.

Seed Treatment

- Treat the seed with Mancozeb or Thiram 3 g/kg of the seed.
- Chlorpyrifos @ 250 ml / 45 kg of seed to prevent the seed damage from soil insects at initial stages.

Seed Inoculation

- For inoculation 100 kg kernels of groundnut 800 ml jaggery (5% solution) and 200 g carrier based Bradyrhizobium culture (like NC- 92, IGR-6, IGR-40, TAL-1000 & TNAU - 14) is required. Seed are evenly spread over cement surface or polythene sheet and poured this slurry and gently smeared on the kernel surface. The treated seeds are then soon immediately.



Season and Sowing time

- Groundnut is raised mostly as a rainfed *Kharif* crop, being sown from May to June.
- As an irrigated crop it is grown between January and March and between May and July.

Land Preparation

- Optimum plant population of groundnut can be established with a seed bed having good tilth.
- After the harvest of the previous crop, soil is prepared by ploughing and harrowing several times before sowing of groundnut.
- Ploughing may be carried out after the receipt of pre-monsoon rains in May. The land is ploughed 2 to 3 times or more, followed by working with blade - harrow twice.
- A soil preparation depth of 15 - 20 cm is generally considered for groundnut cultivation.

Plant Spacing

- In rainfed condition, for the bunch varieties 30 x 10 cm
- For the spreading varieties 30 x 15 cm
- In Rabi, in irrigated conditions, for the bunch varieties 25 x 10 cm
- For the spreading varieties 30 x 10 cm

These plant spacings are easily accommodated on 1.2 m wide broad beds with 30 cm furrows on either side of the bed. Four rows of groundnut at 30 cm spacing is recommended per bed.

Earthing up

- Before flowering.
- Interculture after sowing before flowering.

Crop Rotation

- Groundnut in general should be rotated with cereals like maize, wheat, bajra, jowar or minor millets and tobacco. Some of the crop rotation is given below:

Rainfed (monocropping 2 years) :

Groundnut - Sorghum; Groundnut - Millet; Groundnut - Tobacco.

Residual moisture (Double cropping in 1 year) :

Groundnut - Bengal gram; Groundnut-Safflower; Groundnut- Sesame.

Irrigated (Double or Triple Cropping in 1 year) :

Groundnut-Maize; Groundnut-Wheat; Groundnut - Onion.

Weed control

- Spray Basalin (fluchloralin @ 1.5 l/ha in 500 ml water as a presowing at last ploughing.

- Pre-emergence application of Alachlor @ 1-2 kg a.i./ha plus one hand – weeding, 30 days after sowing, effectively control weeds in groundnut.

Irrigation of Groundnut

- Groundnut is very sensitive to salinity of soil and irrigation water quality.
- The irrigation water for groundnut should have EC less than 4.0 mmhos/cm .
- Vigorous flowering is the period of greatest sensitivity to moisture stress which is 6-8 weeks after seeding.
- The pegs cannot enter the soil if the soil surface is hard due to prolonged dry-spell.
- Flowering, peg penetration and early pod formation are the moisture sensitive phases of groundnut growth.

Sprinkler Irrigation

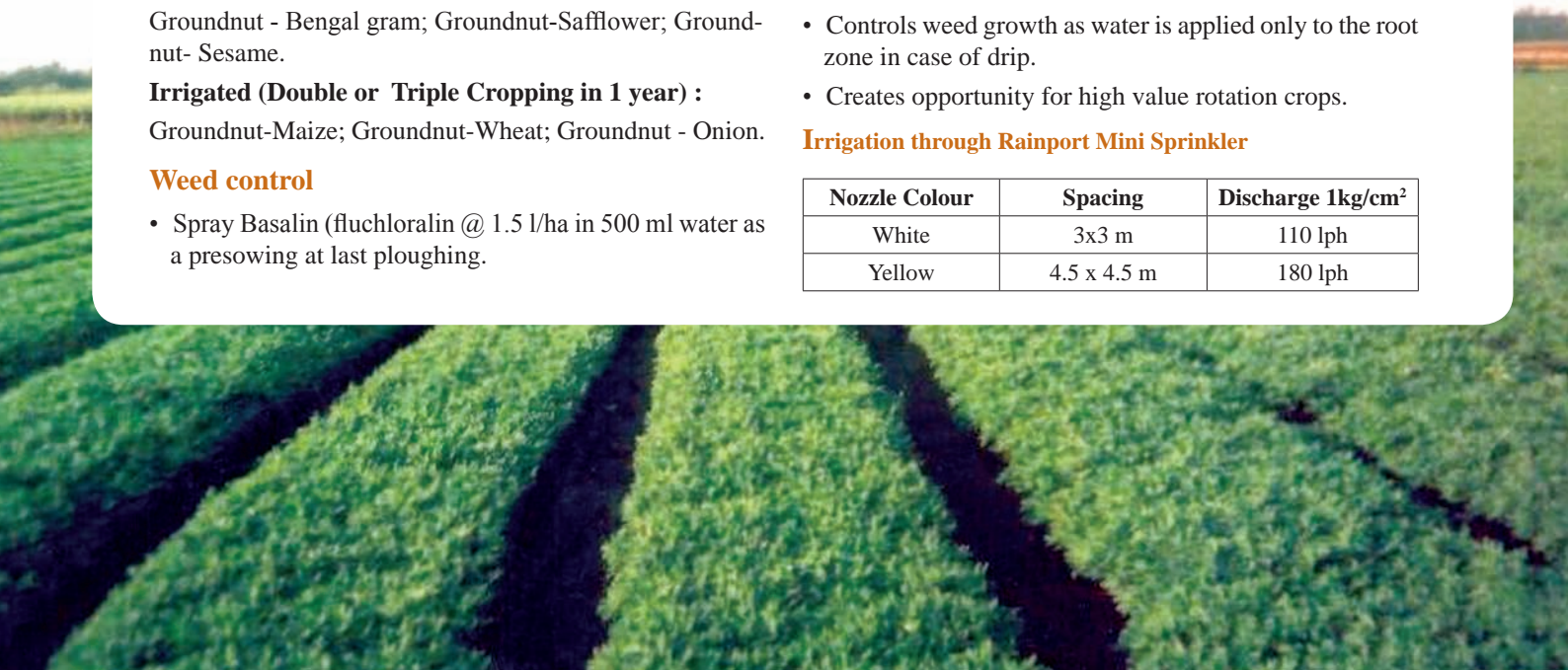
- Sprinkler irrigation is generally adopted for groundnut considering the crop height and the nature of fruiting.
- The costs are also low for sprinkler compared to drip. We recommend Rainport Minisprinkler and Rainport 5022-U Impact Sprinkler system for Groundnut.
- The irrigation quantum (mm) is decided after studying the soil texture and its infiltration capacity .
- Application rate per irrigation should be equivalent to the infiltration rate of the soil of each location approximately this would be 15-20 mm at a time for the soil types mentioned above.

Benefits of drip or sprinkler irrigation for groundnut

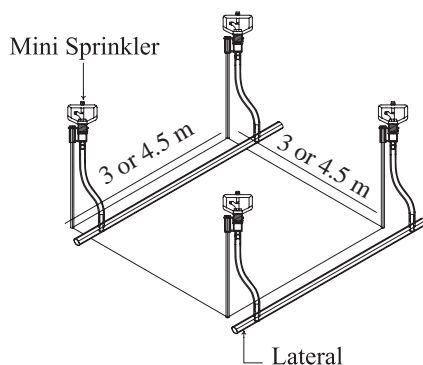
- Increases yield upto 100%
- Reduces water used for irrigation up to 55%
- Allows uniform high percentage of germination.
- Drip is suitable for any type of seed bed- flat, ridges and furrows and rise bed.
- Helps in early planting which is a pre-requisite for IPM
- Allows for a Summer crop (pest free environment)
- Early and uniform maturity
- Allows the user to control vegetative growth by precision irrigation and fertigation and increase flowering and nut formation.
- Controls weed growth as water is applied only to the root zone in case of drip.
- Creates opportunity for high value rotation crops.

Irrigation through Rainport Mini Sprinkler

Nozzle Colour	Spacing	Discharge 1kg/cm ²
White	3x3 m	110 lph
Yellow	4.5 x 4.5 m	180 lph



Rainport Mini Sprinkler Layout



Groundnut Irrigation through Rainport Mini Sprinkler (spacing 3 or 4.5 m)

June Planting

Month	Water requirement		Irrigation duration (Min./day)	
	mm / day	L/ha/day	Nozzle Colour	
			White	Yellow
June	0.91-1.07	9100-10700	7-9	10-12
July	1.97-2.50	19700-25000	16-20	22-28
August	3.07-4.18	30700-41800	25-34	35-47
September	5.17-5.84	51700-58400	42-48	58-66
October	2.30-3.03	23000-30300	19-25	26-34

October Planting

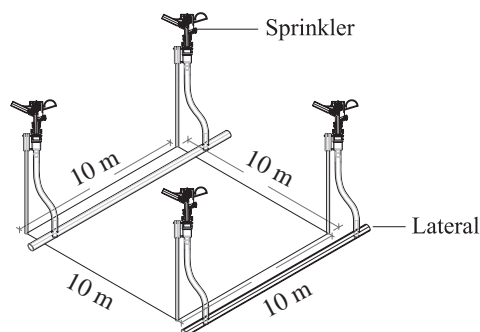
Month	Water requirement		Irrigation duration (Min./day)	
	mm / day	L/ha/day	Nozzle Colour	
			White	Yellow
October	0.82-0.98	8200-9800	7-8	9-11
November	2.10-2.44	21000-24400	17-20	24-27
December	2.90-3.65	29000-36500	24-30	33-41
January	4.59-5.21	45900-52100	38-43	52-59
February	2.30-3.30	23000-33000	19-27	26-37

January Planting

Month	Water requirement		Irrigation duration (Min./day)	
	mm / day	L/ha/day	Nozzle Colour	
			White	Yellow
January	0.7-0.85	7000-8500	6-7	8-10
February	2.0-2.5	20000-25000	16-20	23-28
March	4.8-5.2	48000-52000	39-43	54-59
April	6.5-7.3	65000-73000	53-60	73-82
May	3.4-3.8	34000-38000	28-31	38-43

Groundnut Irrigation through Rainport 5022-U. (520 lph at 2.5 kg/cm² pressure & spacing 10x10m)

Rainport Sprinkler Layout



June planting

Month	Water requirement		Irrigation duration
	mm/day	L/ha/day	Minutes/day
June	0.91-1.07	9100-10700	18-21
July	1.97-2.50	19700-25000	38-48
August	3.07-4.18	30700-41800	59-80
September	5.17-5.84	51700-58400	99-112
October	2.30-3.03	23000-30300	44-58

October planting

Month	Water requirement		Irrigation duration
	mm/day	L/ha/day	Minutes/day
October	0.82-0.98	8200-9800	16-19
November	2.10-2.44	21000-24400	40-47
December	2.90-3.65	29000-36500	56-70
January	4.59-5.21	45900-52100	88-100
February	2.30-3.30	23000-33000	44-63

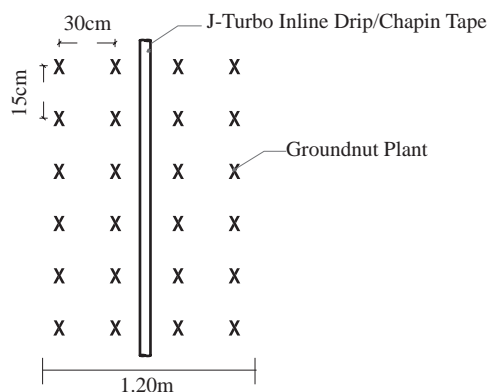
January planting

Month	Water requirement		Irrigation duration
	mm/day	L/ha/day	Minutes/day
January	0.7-0.85	7000-8500	13-16
February	2.0-2.5	20000-25000	38-48
March	4.8-5.2	48000-52000	92-100
April	6.5-7.3	65000-73000	125-140
May	3.4-3.8	34000-38000	65-73

Drip irrigation

Inline or tape is suitable for groundnut with 12mm or 16 mm lateral and drippers (4 lph) placed at 40 cm (sandy loam) 60 cm (clayey soils). One drip line on each bed (1.2m wide) is enough for adequate irrigation. The layout of drip irrigation is shown below.

Drip Layout



Groundnut irrigation through drip Irrigation - Inline or tape (Lateral to lateral - 40 or 60 cm and discharge- 4 lph)

June Panting

Month	Water requirement		Irrigation duration (Min./day)	
	mm / day	L/ha/day	Dripper Spacing	
			40 cm	60 cm
June	0.91-1.07	9100-10700	7-9	11-13
July	1.97-2.50	19700-25000	16-20	24-30
August	3.07-4.18	30700-41800	25-33	37-50
September	5.17-5.84	51700-58400	41-47	62-70
October	2.30-3.30	23000-30300	18-24	28-36

October planting

Month	Water requirement		Irrigation duration (Min./day)	
	mm / day	L/ha/day	Dripper Spacing	
			40 cm	60 cm
October	0.82-0.98	8200-9800	7-8	10-12
November	2.10-2.44	21000-24400	17-20	25-29
December	2.90-3.65	29000-36500	23-29	35-44
January	4.59-5.21	45900-52100	37-42	55-63
February	2.30-3.30	23000-33000	18-26	28-40

January Planting

Month	Water requirement		Irrigation duration (Min./day)	
	mm / day	L/ha/day	Dripper Spacing	
			40 cm	60 cm
January	0.7-0.85	7000-8500	6-7	8-10
February	2.0-2.5	20000-25000	16-20	24-30
March	4.8-5.2	48000-52000	38-42	58-62
April	6.5-7.3	65000-73000	52-58	78-88
May	3.4-3.8	34000-38000	27-30	41-46

Fertilizer Management

- Add 3 t FYM/acre to be applied at final ploughing
- An average crop of groundnut removes about 112 kg N, 27 kg P₂O₅ and 34 kg K₂O from 1 ha of land. It is capable of fixing atmospheric nitrogen by the root nodule bacteria.
- But a starter dose of N in small quantities has to be applied for early growth and vigour.
- A minimum of 50 Kg P₂O₅/ha is required or as per soil test data.
- Recommendation for irrigated groundnut for Andhra Pradesh is 30: 60: 45 (NPK).
- Nitrogen is recommended in two equal split doses, i.e. half of the nitrogen at the time of sowing and the remaining half 35-40 days after sowing preferably after weeding. The common sources of N used for groundnut are given below:
 1. Ammonium Sulphate (20% N)
 2. Urea (46% N)
 3. Calcium ammonium nitrate (26% N)
- Furrow placement is the best method of phosphorus application in the soil as it minimizes the fixation of P₂O₅ with soil colloids.
- SSP is the preferred source of phosphorus. It contains 16% P₂O₅ besides Ca (19.5%) and sulphur (12.5%). Soil application is recommended.
- As for Potassium the two sources are given below:
 1. Potassium chloride-muriate of potash (KCl-60% K₂O).
 2. Potassium sulfate (K₂SO₄-50% K₂O)

Fertigation

50 % of N and all the K can be fertigated through drip system

Period	Quantity of fertilizer	Rate of fertigation
35-65 days after sowing	15 N (75 kg Ammonium Sulphate)	18.8 kg /week
	or (32 kg Urea)	8kg/week
	or (57.5 kg CAN)	14 kg/week

Special requirement of Calcium and Sulphur

- These two nutrients are taken up from the pod zone by the pegs and developing pods.
- Groundnut has the unique characteristic of uptake of Ca and S by the developing pegs and pods.
- The major function of calcium in groundnut is the improvement in the quality of the nuts as evidenced by thin strong shell besides well - filled pods.
- Sulphur is directly involved in the biosynthesis of oil and is usually deficient in the groundnut soils.
- Gypsum (24% Ca, 18.6% S) is the cheapest source for Calcium and Sulphur elements.
- Higher quantities of gypsum than necessary are applied at early flowering stage to ensure adequate calcium supply in the pod zone.

- Application of gypsum - 500 kg/ha at pod formation stage.
- Well - powdered gypsum (30 mesh) should be applied on soil surface when the crop is in peak flowering stage.

Micronutrients

- Apply 50kg Zinc sulphate/ha at last ploughing.
- Application of 10 kg / ha borax to the seed bed.
- Spraying of 0.5 - 1.0% FeSO₄ + 0.1% citric acid has been found to correct iron the deficiency.
- Application of 1 kg/ha Ammonium Molybdate to correct Molybdenum deficiency. Apply it along with basal application of Phosphorus.

Yield

Kernels yield and oil content of groundnut varies with variety, soil type, climate, sowing season and management practices. In general, it was notice that application of impact sprinkler for irrigation give 20-30 per cent additional yield.

Insect and disease control

Integrated pest and disease management is recommended.

IPM for insect control

- The cultural practices, starting from selecting the disease-free and robust planting material.
- Right sowing time.
- Deep tilling to weeding out unwanted vegetation and soil-borne pests and pathogens
- Crop hygiene, keeping clean field and practicing hygiene by workers will contribute significantly in controlling crop pests.
- The pest surveillance and monitoring exercises based on frequent visits to the fields and sweeping with insect nets,
- 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).
- The need-based application of safe botanical insecticides not only cuts the costs, but also helps in reducing the pollutant load in the environment.
- 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.
- Friendly birds are good custodians of crops, and they help manage the number of serious insect pests within the thresholds. By providing suitable perches the birds could be encouraged to visit the crop fields.
- 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.
- Castor and sunflower planted around the field of groundnut acts as insect traps.
- Groundnut should not follow Soybean.
- 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.

- The pests can be managed well by judiciously following the mixed-cropping groundnut (marigold or sorghum) , alley cropping (marigold, softwood trees like sesbania) and border cropping (marigold, Castor) with suitable crop varieties.
- The light traps are mostly used for monitoring the pest movements in the fields.
- Use NPV for caterpillar Control.

Effective practices pest & Disease control.

- Deep Summer ploughing
- Bon firing against Red Hairy Caterpillar
- Seed treatment with chlorpyriphos 6 ml/kg of seed + mancozeb 3 g/kg of seed
- Groundnut + pigeon pea intercropping in 11 : 1 ratio
- Growing Bajra (pearl millet) as guard crop
- Removal of alternate weed hosts for virus.
- Pheromone trap- 10/ha
- Application of HNPV 250 LE/ha
- Spray : Carbendazim 0.05% and mancozeb 0.2% at 70 Days after sowing.

Diseases of Groundnut and their Control

IPM for Disease control

- The cultural practices, starting from selecting the disease-free and robust planting material.
- Right sowing time.
- Deep tilling to weeding out unwanted vegetation and soil-borne pests and pathogens
- Crop hygiene, keeping clean field and practicing hygiene by workers will contribute significantly in controlling crop pests.
- Promote early maturing groundnut varieties with resistance to groundnut rosette virus, or to the aphid vector.
- As a control of tikka disease intercropping with sorghum (7:1) ratio is recommended.
- Follow rotation with chickpea or Sorghum or Millet.
- Apply Trichoderma viride at the rate of 2kg in 50 kg FYM to the soil before sowing.

Chemical control of insects

Leafminer

Carbaryl 2ml/l water Fenitrothion 400 ml in 400 litres of water/ha. Monocrotophos 1.6 ml/l water

White grubs

Seed treatment with Chlorpyriphos 12.5 ml/kg of seed.

Soil application of Quinalphos 1.5 kg/ha.

Jassid

Plant Jassid resistant Variety Gimar - 1

Dimethoate 2ml/l water

Monocrotophos 1.6 ml/l water

Aphid

Plant aphid resistant variety - ICGV-87160

Dimethoate 2ml/l water, Monocrotophos 1.6 ml/l water

Thrips

Dimethoate 2ml/l water.

Monocrotophos 1.6 ml/l water.

Apply a mixture of 1l neem oil 1 kg surf in 200 l water at 20 days after sowing.

Red hairy caterpillar

Carbaryl or Parathion @ 25-30 kg/ha Dichlorovos 2ml/l water. Quinalphos 1l mixed with Jaggery 1 kg plus rice bran placed around the field prevents entry of of this insect.

Tobacco caterpillar

Plant tobacco capler piller resistant Variety - Kadiri-3, BG-2

Quinolphos 1ml/l water Carbaryl 2ml/lwater Endosulfan 4ml/l water.

Over irrigation should not be done.

Gram caterpillar

Quinolphos 1ml/l water Carbaryl 2ml/lwater Endosulfan 4ml/l water.

Over irrigation should not be done.

Managment of Diseases

Early and late leaf spots

Spray application of Carbendazim (Bavistin) 0.5g/l water plus Mancozeb 2g/l water at 2-3 weeks interval, from 4-5 weeks after planting.

Rust

Plant rust resistant varieties - ICG FDRS-10, ICGV-86590, R-8808, R-9201, ICGV-92093, ICGV-92092.

Spray application of Tridemorph 7g/l water at 14-21 days interval 3-4 times after initiation of the infection.

Collar rot

Seed treatment with Captan 80% WP @ 3g/kg seed or Thiram 75% WP @ 3-5 g/kg seed or Carbendazim 2 g/kg seed.

Do not sow deep.

Stem rot / Sclerotium wilt

Dry seed treatment with Carbendazim/thiram/Captan @ 2-3 g.

Soil application of a mixture of fungicide viz., terrachlor + terrazole @ 20 kg/ha + 40 kg/ha at pegging stage.

Dry wilt or Dry root rot

Seed treatment with Captafol 0.2%.

Drenching with Brassicol 75% WP (0.5%) @ 1 l/m² or soil application @ 25 kg/ha in two split, 12.5 kg/ha before sowing and the other 12.5 kg/ha 15 days after.

Bud necrosis

Thrips transmitted

Control vectors (thrips) with Dimethoate @ 400 ml/ha or Methyl demeton @ 360 ml/ha community basis.

Use bud necrosis resistant variety - 'ICGS- 11', 'ICGS-44'.

Peanut mottle

Aphid transmitted, seed-borne also

(0.1 to 3.5%) As above

Peanut clump

Soil application of Nemagon and Temik one week before planting.

Dos

- Ensure good drainage in the field.
- Adopt Rainport Mini-Sprinkler irrigation or Impact sprinkler system or Drip irrigation Systems for irrigation.
- Compulsorily apply organic manure as per recommendation
- Select high yielding, disease and pest tolerant variety suitable for each location
- Strictly follow the irrigation schedule given by the engineer.
- Compulsorily weed/ inter-cultivate, timely operation helps in crop growth.
- Follow fertigation schedule as given by the engineer.
- Apply micronutrient as and when needed.
- Follow disease and pest control measures timely and effectively. Spray in the evening or early morning only.



Don'ts

- Don't over irrigate the crop at anytime.
- For fertigation don't mix solid fertilizers and dissolve them together. Prepare individual solutions and mix them before application.
- Don't spray the crop under hot sunlight.
- Don't use the fertigation unit for bulky organic manure and fertilizers that are not soluble in water.
- Don't add solid fertilizer from the fertilizer bag directly to the fertilizer tank. Prepare solution only in plastic buckets. Don't use metal container.
- Don't stir the solution with naked unprotected hand. Use wooden spoon or stick.
- Don't heat the fertilizer solution to increase solubility.

Frequently asked questions (FAQ's)

1. Whether the meare quantity of water supplied through irrigation system is enough?

- Irrigation rate is estimated based on the Evapotranspiration of the location and therefore it is enough.
2. Whether surface application of water will cause root accumulation near the surface and thereby affect the pod formation.
 - The absorptive roots of groundnut are located near the surface and get directed by moisture and nutrient availability. Pod formation is not connected with the method of irrigation.
 3. Can I prefer Sprinkler method of irrigation for Groundnut?
 - Yes. Rainport system is most suitable for groundnut in terms of cost, and operation ease.
 4. Can I take an intercrop with irrigation?
 - Yes. As per the practice existing in the area. In case of Drip adoption use separate drip lines for the intercrop.

Crop yields depend on climate, soil and management and therefore can't be guaranteed by the company.



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Tel: +91-257-2258011; **Fax:** +91-257-2258111; **E-mail:** jisl@jains.com; **Website:** www.jains.com;
Toll Free: 1800 599 5000

