

INTEGRATED PEST AND DISEASE MANAGEMENT IN GROUNDNUT



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JUNAGADH – 362 001**

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FOREWORD

Groundnut is an important oilseed and supplementary food crop of the world. Besides, edible oil production, groundnut is consumed as food item and processed for milk as well as butter, etc. India ranks first both in area and production, however its productivity (1257 kg/ha) is quite low as compared to many groundnut producing countries like USA, China and Myanmar. Major states which cover about 90% of total groundnut area in India are Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Rajasthan and Maharashtra. Besides these groundnut is also cultivated in Madhya Pradesh, Uttar Pradesh, Odisha, Punjab and Chhattisgarh etc.

Low productivity of groundnut in India is due to many reasons of which, rainfed cultivation, erratic or low rainfall, drought, soil salinity, continuous use of popular old cultivars coupled with attack by a variety of diseases and insect-pests are important. This crop is attacked by about 100 different insect-pests *viz.*, leafminer, tobacco caterpillar, gram pod borer, thrips, aphids, leafhoppers, white grub and termite etc. and by more than 50 diseases *viz.*, stem rot, collar rot, leaf spots, rust and bud necrosis virus etc. Besides, nematode diseases like, *Kalahasti* and root-knot are also reported on groundnut. Presently, excessive use of pesticides has been practiced in our agricultural cropping-systems for increasing crop productivity. Unfortunately, this is harming the ecological balance of nature and we are now facing problems like, pesticide residues and resistance, pest resurgence and secondary pest outbreaks etc. Considering the ill-effects of pesticides, many nations are developing agricultural practices that are sustainable and do not have negative impact on environment.

The publication of this bulletin “Integrated Pest and Disease Management in Groundnut” by DGR, Junagadh is a need of hour to reduce the crop-losses caused by insect-pests and diseases. The bulletin provides a brief description about identification, nature of damage of insect-pests and the disease symptoms and suggests their suitable eco-friendly management. The information given in this bulletin will ease farmers to identify a problem and accordingly, they will be able to choose a suitable management practice.

We hope that the information provided in this bulletin would be useful for increasing productivity of groundnut in India and will establish new milestone in both production and productivity of groundnut.

J B Misra
Director

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In India, groundnut is cultivated during *kharif*, *rabi* and summer seasons under various cropping systems. The major groundnut growing states are Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu, Rajasthan and Maharashtra covering about 90 per cent of total groundnut area. The productivity is, however, low (around 1257 kg/ha) as compared to other groundnut growing countries like United States of America, China, and Myanmar. Rainfed cultivation of groundnut coupled with attack by plethora of insect-pests and diseases are the major reasons for low productivity.

Knowledge about nature of damage caused by insect-pests and diseases, and identification of key pests are important for proposing a successful management of insect-pests and diseases. This bulletin is developed with a view to ease farmers in identifying pests and diseases, and then selecting an appropriate measure to manage the insect-pests and diseases in an eco-friendly manner.

MAJOR INSECT-PESTS

More than 100 insect-pests are reported to infest groundnut crop. The identification characters of major insect-pests and their nature of damage are described as under.

DEFOLIATORS

Groundnut leafminer (*Aproaerema modicella*)

The adults are dark brownish about 6 mm long with 10 mm wing span. The anterior margin of fore wings has conspicuous pale white spot. The moths lay eggs underneath leaves and are shiny white in colour. Soon after hatching, larvae which are about 1 mm long mine into the leaves. The mines later increase in size and the entire leaflet rolls, shrivels and finally dries up. The crop gives alike burnt appearance in severely infested fields.

Tobacco caterpillar (*Spodoptera litura*)

The adult moths are light brown and lay golden brown eggs in groups on upper surface of leaves. Freshly emerged larvae are light green and feed gregariously on leaves. Fully grown larvae are solitary feeders and are pale greenish-brown with distinctive dark markings. The early instars scrap surface of the leaves while the late instars can cause complete defoliation under severe infestation. The damage is mostly caused during night time and is concentrated on leaves and growing tips. In light soils, the pods can also be damaged by late larval instars.

Red hairy caterpillar (*Amsacta albistriga*, *A. moorei*)

The moths are brownish-white, and young larvae are light brown and turn reddish as they grow and have reddish-brown dense hairs up to 2 cm long on the body. Black bands encircling a red band are present on anterior and posterior parts of the body of the larvae. Young larvae feed gregariously on the under surface of the leaves by scrapping them. The grown-up larvae defoliate the crop and gives field a cattle grazed appearance. Majority of the foliage damage is done during night time.



Groundnut leafminer
(*Aproaerema modicella*)



Tobacco caterpillar
(*Spodoptera litura*)



Red hairy caterpillar
(*Amsacta albistriga*, *A. moorei*)



Gram pod borer
(*Helicoverpa armigera*)



Thrips
(*Caliothrips indicus*, *Frankliniella schultzei*,
Thrips palmi, *Scirtothrips dorsalis*)



Aphids
(*Aphis craccivora*)

Gram pod borer (*Helicoverpa armigera*)

The moths are dull brown and lay creamy eggs individually on young leaves and flower buds. The larvae are greenish-brown and do not have black spots on thorax. The larvae feed voraciously on flowers and foliage, and defoliate the plants. When larvae feed on leaf buds which upon unfolding produce symmetrical holes on leaves.

SUCKING PESTS

Thrips (*Caliothrips indicus*, *Frankliniella schultzei*, *Thrips palmi*, *Scirtothrips dorsalis*)

Thrips are yellowish-brown or black in colour and are small sized insects about 2 mm long. Nymphs and adults cause damage by lacerating the leaf surface. Thrips suck the oozing sap resulting in white patches on lower surface of the leaves. The unfolded leaves become distorted, which results in condition called “pouts”. In severe infestation, plants become stunted. Thrips are also known to transmit groundnut bud necrosis virus.

Aphids (*Aphis craccivora*)

The adults are small sized (2 mm long) having greenish-brown or black colour. Nymphs are mostly dark brown in colour. Wingless adults are mainly responsible for causing infestation. However, winged are responsible for colonization and migration. Damage is caused by adults and nymphs that suck sap from tender shoots and flowers. Plants become stunted with distorted foliage and stem. The characteristic sign of aphid attack is presence of ‘sooty mould’ that is developed on honey dew excreted by aphids. Aphids also act as vectors for viral diseases such as peanut stripe and groundnut rosette.

Leafhopper/Jassids (*Empoasca kerri*, *Balclutha hortensis*)

The adults are light green in colour and lay eggs near midrib. Nymphs and adults cause damage by sucking the sap from the central portion of leaves and petioles. Prolonged exposure to leafhoppers results in a ‘V’ shaped yellowing on the tips of leaflets, which may spread to entire leaflet turning yellow. Severely infested crop gives a scorched appearance commonly called as “hopper burn”.

Mealybugs (*Phenacoccus solenopsis*)

Mealybugs are soft oval shaped insects measuring 5-8 mm in length and 3-6 mm in width. Adults are covered with white powdery wax layer, hence appear cottony. Moreover, due to presence of wax layer it becomes difficult to control with pesticide spray. The young ones are called crawlers and are pinkish in colour. Mealybugs cause direct damage by sucking sap from leaves and stems.



Leafhopper/Jassids
(*Empoasca kerri*, *Balclutha hortensis*)



Mealybugs
(*Phenacoccus solenopsis*)



White grubs/Root grubs
(*Holotrichia consanguinea*, *H. serrata*)



Termites
(*Odontotermes obesus*, *Microtermes obesi*)



Bruchid
(*Caryedon serratus*)

SOIL PESTS

White grubs/Root grubs (*Holotrichia consanguinea*, *H. serrata*)

The pest is more common in sandy-loam and light-red soils. The adults are dark brown measuring 18-20 mm and lay white round eggs. Damage is caused by both adults and larvae. The young grubs are white translucent, 5 mm long and feed on fine rootlets, while mature grubs are 'C' shaped and attack both roots and pods. The affected plants show varying degrees of wilting, which ultimately die and died plants can easily be pulled out. The grubs cause infestation in patches leading to 'patchy appearance' of field.

Termites (*Odontotermes obesus*, *Microtermes obesi*)

Termites prefer sandy as well as red soils and live in termitaria (termite mound). The termite workers (other castes like king, queen and soldiers do not take part in causing damage) cause damage by penetrating as well as hollowing the taproot causing wilting and premature death of plants. They also feed on pod-shell by removing the corky material between the strands of vascular tissues, resulting in 'scarification', which render them more susceptible to invasion by soil fungi, *Aspergillus flavus* that produces aflatoxin.

STORAGE PEST

Bruchid (*Caryedon serratus*)

The adults are brown in colour, measure 4-7 mm long and 5 mm wide. They lay milky-white eggs. Grubs feed internally on pods and kernels. The larva burrows through the pod wall and starts eating the seed. The characteristic damage can be identified by the presence of 'exit hole' on the pod wall before pupation. Field infested groundnuts are crucial for establishment and damage during storage. The large population of bruchids coupled with their high metabolic activity in storage increases heat and moisture which ultimately increases the risk of mold growth. This indirectly spoils the quality of groundnut by contaminating produce with aflatoxin, rendering it unfit for human and animal consumption, hence leading to huge qualitative losses.

MAJOR DISEASES

More than 50 diseases are reported on groundnut crop. The characteristic symptoms of major diseases of groundnut are described as under:

Collar rot (*Aspergillus niger*)

Pre-emergence rotting of seeds and hypocotyls, post-emergence seedling blight, rapid wilting of entire plant or its branches are characteristic diagnostic symptoms. Hypocotyl region of the affected plants become shriveled and later shredded and appears dark brown or black due to abundant production of conidia on conidiophores. Roots of the infected plants are disintegrated.

Stem rot (*Sclerotium rolfsii*)

Initial symptoms result in partial or complete withering and drooping of the stem or branches that are in contact with the infected soil. The leaves turn brown and show drying but remain intact to the plant. White mycelial growth is visible around the infected stem and at later stage abundant sclerotia are formed. Infection of pegs, pod-rot and leaf blight are often observed.

Aflaroot/Yellow mold (*Aspergillus flavus*)

Infected plants generally become stunted and leaf size is reduced with symptoms of vein clearing and chlorosis on the leaflets. Such seedlings lack a secondary root system (aflaroot).

Dry root rot (*Macrophomina phaseolina*)

Water-soaked necrotic spots appear on the stem just above the ground level. If the initial lesion girdles the stem, wilting follows. The infected portion of stem is shredded with the development of sclerotia resulting in black and sooty appearance. In severe conditions, roots, pegs, and pods also get rotten and then growing sclerotia results in blackening of infected kernels.

Early leaf spot (*Cercospora arachidicola*)

The disease generally occurs after 30 days of sowing. Initially minute circular to sub-circular chlorotic spots develop on upper surface of leaf and later turn to brown in colour surrounded by yellow halo. Sporulation appears mostly on upper surface and the corresponding lower surface of the leaf shows light brown colour. Severely infected leaves may drop off prematurely and lesions may extend to the stem as well as branches.



Collar rot
(*Aspergillus niger*)



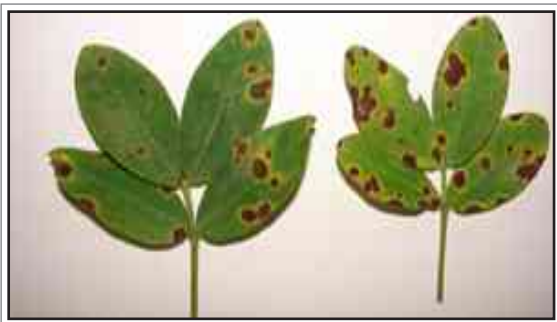
Stem rot
(*Sclerotium rolfsii*)



Aflaroot/Yellow mold
(*Aspergillus flavus*)



Dry root rot
(*Macrophomina phaseolina*)



Early leaf spot
(*Cercospora arachidicola*)



Late leaf spot
(*Phaeoisariopsis personata*)

Late leaf spot (*Phaeoisariopsis personata*)

The disease occurs on around 60 days old crop and continues up to harvest. On the lower surface of the leaves, small, irregular dark brown to black colour spots appear with abundant sporulation. Several lesions may coalesce and in severe cases, infected leaves may drop off prematurely. Oblong lesions occur on the stem and branches. Simultaneously, both the leaf spots can be observed on standing crop in the field and are commonly called as ‘Tikka disease’.

Rust (*Puccinia arachidis*)

Initially chlorotic flecks develop on upper surface of the leaf and on corresponding lower surface, orange colored pustules appear which later turn to brown in colour. Severely infected leaves turn necrotic and desiccate; however remain attached to the plant. Symptoms appear on the all above ground parts of the plant except flowers. The kernels formed in the affected plants are shriveled and small. Simultaneous presence of leaf spots and rust on the same plants are common in fields.

Alternaria leaf blight (*Alternaria* spp.)

Blighting starts from apical portions of leaflets, showing light to dark brown colour with ‘V’ shaped spots. The symptom extends to midrib and the entire leaf shows blighted appearance. In the later stages of infection, blighted leaves curl inward and become brittle. Adjacent lesions join together, giving the leaf a ragged and blighted appearance in field.

Groundnut bud necrosis (Groundnut bud necrosis virus)

Infected plants become stunted; leaves become narrow and smaller than normal leaves. Infected plants look bushy in appearance. Circular chlorotic rings appear on leaves and at the advanced stage of infection, terminal buds become necrotic, showing characteristic symptom of bud necrosis disease. The disease is transmitted by the thrips.



Rust
(*Puccinia arachidis*)



Alternaria leaf blight
(*Alternaria* spp.)



Groundnut bud necrosis
(Groundnut bud necrosis virus)



Root-knot
(*Meloidogyne arenaria*, *M. javanica*)



Pod speckling/Root lesion
(*Pratylenchus* spp.)



Kalahasti malady
(*Tylenchorhynchus brevilineatus*)

MAJOR NEMATODE DISEASES

More than 90 species of plant-parasitic nematodes are associated with groundnut. Major nematode species attacking groundnut in India and their diagnostic symptoms are described below.

Root-knot (*Meloidogyne arenaria*, *M. javanica*)

Infested plant shows various degrees of stunting and chlorosis. Infected area gives ‘patchy appearance’. Galls often formed on roots, pegs, and pods of infected plants and develop into various sizes resulting from an internal swelling of the root tissue. Pegs and pods occasionally begin to deteriorate at maturity. Pod set can be drastically reduce under severe root-knot infestation.

Pod speckling/Root lesion (*Pratylenchus* spp.)

Discoloration occurs on below-ground plant parts and reduced root system. The lesions on pods begin as tiny and tan to brown colored spots. Older lesions are characterized by a ‘blotchy appearance’ without distinct margins (pod speckling).

Kalahasti malady (*Tylenchorhynchus brevilineatus*)

Symptoms appear in patches in the field, and plants become stunted with greener than normal foliage. Small brownish-yellow lesions appear on the pegs as well as developing pods. In advanced stage of infection, entire pod surface becomes blackened giving a scabby appearance. Kernels from diseased pods are healthy, but are usually smaller than normal.

INTEGRATED PEST AND DISEASE MANAGEMENT

- Carry out deep ploughing to a depth of 8-10 inches during summer to reduce pests and inoculum of pathogens in soil.
- Remove volunteer groundnut plants, crop debris and weeds.
- Adopt groundnut in rotation with cotton, wheat, maize, sorghum, onion and garlic or mixed cropping with moth bean to reduce inoculum of *Sclerotium rolfsii* in soil.
- Crop-rotation with cereals reduces root-knot nematode population in soil.
- Grow 3-4 rows of pearl-millet as border crop and castor as trap crop (250 g seeds/ha mixed with groundnut seeds) to reduce tobacco caterpillar damage.
- Pearl-millet or maize as intercrop reduces the movement of thrips and bud necrosis disease.
- Groundnut inter-cropping with pearl-millet or sorghum or maize or pigeonpea reduces the severity of leaf spots and rust.
- Groundnut inter-cropping with soybean reduces leafminer, thrips and leafhoppers. Cowpea as inter-crop reduces leafminer attack.
- Apply neem/castor/mustard cake @ 500 kg/ha 15 days before sowing or in seed furrow at the time of sowing to reduce disease incidence of collar rot and stem rot as well as to improve plant vigour.
- In the endemic area of nematode disease, apply neem/castor cakes @ 1 t/ha preferably seven days prior to sowing or in combination with carbosulfan 25 DS @ 3% a.i. (w/w) as seed treatment in order to reduce nematode population or apply carbofuran 3 G @ 1-2 kg a.i./ha at the time of sowing.
- Use insect and disease resistant or tolerant varieties.
- Use certified quality seeds that are free from diseases or any insect damage.
- Sow crop early in the season to avoid damage by leafminer, white grubs and collar rot.
- Avoid deep sowing to prevent collar rot disease.
- Treat the seeds with commercial formulation of *Trichoderma harzianum* or *T. viride* @ 10 g/kg seeds or tebuconazole 2 DS @ 1.5 g/kg seeds or carbendazim @ 2 g/kg seeds or mancozeb @ 3-4 g/kg seeds, and soil application of *Trichoderma* spp. @ 4 kg enriched in 250 kg FYM or 200 kg castor cake to prevent seed and soil borne diseases.
- For monitoring moth activity, install 1-2 light traps/ha and pheromone traps @ 10 traps/ha for tobacco caterpillar and gram pod borer and 25 traps/ha for leafminer.
- Collection and destruction of egg mass, gregarious larvae (tobacco caterpillar and red hairy caterpillars) and adults (white grub).
- Conserve the natural enemies like, coccinellids, spiders, hymenopteran and dipteran parasitoids.

- Release adults of *Trichogramma chilonis* or *Telenomus remus* @ 50000/ha, two times at 7-10 days interval followed by release of *Bracon hebetor* @ 5000/ha two times at 7-10 days against leafminer and defoliators.
- Spray commercial formulation of nuclear polyhedrosis viruses (NPV-*Spodoptera* and NPV-*Helicoverpa*) for the management of tobacco caterpillar and gram pod borer @ 0.4 ml/L and granulosis virus (GV-*Amsacta*) @ 0.3 ml/L for red hairy caterpillars.
- Spray entomopathogenic bacteria, *Bacillus thuringiensis* @ 2 g/L against red hairy caterpillar, tobacco caterpillar and gram pod borer.
- Spray entomopathogenic fungus like, *Nomuraea rileyi* and *Beauveria bassiana* @ 2 g/L for defoliator pests and *Verticillium lecanii* @ 5 g/L for sucking pests.
- Spray neem oil @ 5 ml/L along with suitable surfactants like soap powder 1 g/L or neem seed kernel extract @ 5% for managing defoliators. It also reduces the severity of leaf spots and rust.
- Need based application of fungicides: for leaf spots and rust, spray propiconazole 25 EC @ 1 ml/L or hexaconazole 5 EC @ 1 ml/L or tebuconazole 25.9 EC @ 1.5 ml/L.
- Need based application of dimethoate 30 EC @ 2.0 ml/L or monocrotophos 36 SL @ 2.5 ml/L or imidacloprid 17.8 SL @ 0.3 ml/L or thiacloprid 480 SC @ 0.3 ml/L or thiamethoxam 25 WG @ 0.2 g/L or acetamiprid 20 SP @ 0.2 g/L between 25 and 30 days after sowing for managing sucking pests like, thrips and leafhoppers.
- Need based application chlorpyrifos 20 EC @ 2.5 ml/L or quinalphos 25 EC @ 2 ml/L or profenofos @ 50 EC @ 2 ml/L or flubendiamide 480 SC @ 0.2 ml/L or novaluron 10 EC @ 1 ml/L for managing the defoliator pests like, tobacco caterpillar and gram pod borer.
- Need based application profenofos @ 50 EC @ 2 ml/L or spinosad 45 SC @ 0.3 ml/L or flubendiamide 480 SC @ 0.2 ml/L or quinalphos 25 EC @ 2 ml/L for managing leafminer.
- For managing red hairy caterpillar, dig furrow trenches around field and dust with carbaryl 50 WP @ 5%.
- For managing tobacco caterpillar, spread the poison bait (rice bran 12.5 kg + molasses/jaggery 2.5 kg + carbaryl 50 WP 1.25 kg) in the field at the evening hours.
- Spray malathion 50 EC @ 5.0 ml/L or deltamethrin 2.5 SC @ 0.5 ml/L on the walls, floor and roof of the warehouses or godowns before storage and aluminium phosphide 56% @ 1 pouch (10 g)/t of pods for the managing bruchids, *Caryedon serratus*.

DO's AND DON'T s IN GROUNDNUT PEST MANAGEMENT

Do's:

- Soil solarization, deep tillage and clean cultivation (keep the field free from weeds and crop debris).
- Seed treatment, crop rotation and intercropping practices.
- Need-based application of fertilizers.
- Surveillance and monitoring of the pest for need-based management practices.
- Prefer bio-pesticides over synthetic pesticides unless the situation warrants.
- Conserve natural enemies of pests by growing refuge crops.
- Apply pesticides including bio-pesticides (entomopathogenic bacteria, fungus and viruses) during morning and evening hours of the day.
- Remove and destroy plants infected by groundnut bud necrosis disease.

Don'ts:

- Avoid deposition of soil particles on germinated plants during inter-cultural operations.
- Do not apply overdose of N fertilizers which increase the plant growth and crop susceptibility to insect-pests and diseases.
- Avoid indiscriminate use of pesticides.
- Avoid spurious pesticides.
- Do not spray pesticides during hot sunny hours and against the direction of wind.
- Do not use broad spectrum pesticides.
- Do not keep groundnut bud necrosis affected plants in the field.
- Avoid storing produce with >9% moisture in storage structures/godowns.
- Do not store produce in infested godowns or gunny bags.

GROUNDNUT VARIETIES RESISTANT/TOLERANT TO BIOTIC STRESSES*

Name of pest/disease	Name of groundnut variety
Leafminer	Girnar-3, GG-16, Durga, Pratap Mungphali-1, Pratap Mungphali-2, Pratap Raj Mungphali, Phule Unap, Co (Gn)-5, VRI (Gn)-7 and GG-14.
Tobacco caterpillar	GG-16, Kadiri Harithandhra, Pratap Mungphali-1, Pratap Mungphali-2, Pratap Raj Mungphali, HNG-123, Abhaya, Phule Unap, Vasundhara, Co (Gn)-5 and GG-14.
Gram pod borer	Kadiri Harithandhra.
Thrips	Girnar-2, Girnar-3, GG-16, Durga, Kadiri Harithandhra, Pratap Mungphali-1, Pratap Mungphali-2, Pratap Raj Mungphali, Abhaya, Jawahar Groundnut-3, Phule Unap, Prutha, Vasundhara, Kadiri-7, Kadiri-8 and GG-14.
Aphids	Girnar-2, Jawahar Groundnut-3, Prutha, Kadiri-7 and Kadiri-8.
Leafhoppers/Jassids	Girnar-2, Durga, Kadiri Harithandhra, Pratap Raj Mungphali, Prutha, Abhaya, Jawahar Groundnut-3, Kadiri-7, Kadiri-8 and Kalahasti.
Collor rot	GG-8, TG-37A, Smruti, BAU-13, HNG-69, Mallika, GJG-22 and M-548.
Stem rot	GG-8, GJG-31, ICGV-00350, Kadiri Harithandhra, Smruti, TG-38B, TG-51, HNG-69, Phule Unap, Ratneshwar, Vasundhara and GJG-17.
Dry root rot	TG-51 and VL-Moongphali-1.
Early leaf spot	Jawahar Groundnut-23, Kadiri-6, Kadiri Harithandhra, Pratap Mungphali-1, Pratap Mungphali-2, Pratap Raj Mungphali, Smruti, VRI-2, BAU-13, HNG-69, ICGV-00348, Kaushal, Ambar, Chitra, Jawahar Groundnut-3, Kadiri-5, Vemana, Kadiri-8, M-522, M-548 and Somnath.

Late leaf spot	Girnar-2, GG-7, GPBD-5, ICGV-00350, ICGV-91114, Jawahar Groundnut-23, Kadiri-6, Kadiri Harithandhra, Pratap Mungphali-1, Pratap Mungphali-2, Pratap Raj Mungphali, Smruti, TG-26, TG-37A, TMV (Gn)-13, Vikas, VRI-2, VL-Moongphali-1, BAU-13, ICGV-00348, Ambar, Abhaya, Apoorva, ALR-3, Co (Gn)-4, Jawahar Groundnut-3, Kadiri-4, Kadiri-5, Phule Unap, Prutha, Ratneshwar, Vemana, VRI (Gn)-5, VRI (Gn)-6, AK-265, Co 6, Kadiri-7, Kadiri-8, VRI (Gn)-7, M-548 and Somnath.
Rust	Girnar-2, GPBD-5, ICGV-00350, ICGV-91114, Kadiri Harithandhra, Smruti, TG-26, TG-37A, TMV (Gn)-13, VRI-2, Vikas, ICGV-00348, Ambar, Chitra, ALR-3, Co (Gn)-4, Phule Unap, Ratneshwar, VRI (Gn)-5, VRI (Gn)-6, AK-265, Co 6, Co (Gn)-5 and VRI (Gn)-7.
Groundnut bud necrosis	GG-8, Kadiri Harithandhra, Pratap Mungphali-1, Pratap Mungphali-2, Pratap Raj Mungphali, SG-99, TG-26, TMV (Gn)-13, Vijetha, BAU-13, Mallika, GG-16, Ajeya, Apoorva, Kadiri-4, Kalahasti, R-9251, Ratneshwar, Vasundhara, Vemana, VRI (Gn)-6, Co (Gn)-5 and Divya.
Groundnut stem necrosis	Girnar-2.
<i>Kalahasti</i> malady	Kalahasti, Prasuna, Tirupati-2 and Tirupati-3.
Aflatoxin (Seed colonization)	Greeshma and TKG-19A.

*Among 194 varieties released so far

Source : Groundnut: A crop profile and compendium of varieties notified in India, Directorate of Groundnut Research, Junagadh-362 001.

ECONOMIC THRESHOLD LEVEL (ETL) FOR KEY PESTS

Common name	ETLs
Leaf miner	5 mines per plant at 30 days of crop age
Tobacco caterpillar	20-25% defoliation at 40 days of crop age
Gram pod borer	20-25% defoliation at 40 days of crop age
Hairy caterpillars	20-25% defoliation at 40 days of crop age
Thrips	5 thrips/terminal bud at seedling stage
Leafhopper/Jassids	5 to 10 adults per plant up to 30 days of crop emergence
Aphids	5-10 aphids per terminal at seedling stage
White grub/Root gurb	1 grub per square meter

AVAILABLE PESTICIDES WITH THEIR TRADE NAMES

Generic name of pesticide	Trade name of pesticide
Tebuconazole 2 DS	Raxil, Treat
Carbendazim 50 WP	Chemestin, Zen, Clear, Bengard, Bevistin, Zoom, Dhanustin, Derosal, Benfil, Carzim, Agrozim, Supersten
Mancozeb 80 WP	Indofil M-45, Dhanuka M-45, Abic M-45, Sparsh M-45, Tata M-45, Super M-45
Carbosulfan 25 DS	Marshal
Propiconazole 25 EC	Cleaner, Tilt, Teer, Super Propi
Hexaconazole 5 EC	Danzole, Contaf, Hexon, Trigger, Super Hexa, Chemet Hexaconazole
Tebuconazole 25.9 EC	Folicur, Devikure
Dimethoate 30 EC	Tara-909, Tafgor, Teeka, Rogar, Chem-o-gor, Rogrus
Monocrotophos 36 SL	Nuvacron, Monocil, Monostar, Parryphos, Manodhan, Luphos, Balwan, Monocrown, Bilphos, Mono Plus, Permono, Mon-o-chem, Monochem, Agromonar, Topcil, Hilcron
Imidacloprid 17.8 SL	Imigro, Ultimo, Imigrow, Agromida, Imida Plus, Confidor, Tata Mida, Hil Mida
Thiacloprid 480 SC	Splendour, Calypso
Thiamethoxam 25 WG	Actara, Evident, Status, Anant, Willoxam, Dotara, Sitara
Acetamiprid 20 SP	Ace, Wapkil, Empire, Nagarjuna Ennova, Rekord, Acital, Hilprid
Chlorpyrifos 20 EC	Dursban, Durmet, Danusban, Masssban, Tricell, Dhanwan, Force, Strike, Classic, Topline

Quinalphos 25 EC	Ekalux, Flash, Smash, Shakti, Dhanulux, Vazra, Hinquin, Agroquin
Profenofos 50 EC	Profen 50, Profex, Carina, Prudent, Hilphos, Celcron
Novaluron 10 EC	Rimon
Spinosad 45 SC	Demand, Tracer, Taffin
Carbofuran 3 G	Furadan
Flubendiamide 480 SC	Fame
Carvaryl 50 WP	Sevin, Cavin
Deltamethrin 2.5 SC	Raven
Malathion 50 EC	Jithion, Kthion, Cythion, Agromala, Himala
Aluminium phosphide 56%	Celphos, Alphos
NPV- <i>Spodoptera</i>	Spodocide, Spodokil, Spodonash, Spodoguard
NPV- <i>Helicoverpa</i>	Helicide, Helikil, Helinash, Heliguard
<i>Beauveria bassiana</i>	Myco Jaal, Racer B B, Despel, GMax Bioguard, Peak Badsha, Beau Shakti
<i>Verticillium lecanii</i>	Mealkil, Peak Victor, Bio Catch
<i>Bacillus thuringiensis</i>	Dipel, Delfin, Halt, Bactin, Bio Tek, Bio Bit
<i>Trichoderma viride</i>	Trichomo, G Max Tricon, Peak Tricho, Niprot, Eco Som T V, Sanjeevini
<i>Trichoderma harzianum</i>	GMax Tricon H, Sardar Eco Green, Eco Som T H

Note: “There could be several trade names of the product apart from above mentioned”

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