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Diseases of Groundnut and Their Eco-friendly Management

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Abstract

India is the largest producer of Groundnut in the world, however its productivity (1,257 kg/ha) is quite low as compared to major groundnut producing countries like USA, China and Myanmar. Rainfed cultivations, soil salinity, non-replacement of seeds coupled with biotic stress (diseases and insect-pests) are the major limiting factors for low productivity of groundnut in India. Diseases being one of the major players in lowering the productivity of the crop, it has been discussed in this article. More than 50 diseases *viz*., stem rot, collar rot, leaf spots, rust and bud necrosis virus *etc*. has been recorded in India. Integrated Pest Management (IPM) is the most viable, economic and eco-friendly approach to deal with the menace and hence the purpose of the article.

Introduction

Groundnut also known as Peanut is the most important oilseed crop in India. The vegetable oil is rich in Omega-3 fatty acids and extensively used as edible oil. In addition, to providing high quality edible oil (48-50%), easily digestible protein (26-28%), and nearly half of 13 essential vitamins and 7 of 20 essential minerals necessary for human growth & maintenance, it produces high quality fodder for livestock. India is the largest producer of groundnut in the world. Out of the 9 oilseed crops grown in India, groundnut comprises of 45% of oilseeds area and 55% oilseeds production. 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 comprising of 90 percent of total groundnut area. Rainfed cultivation coupled with attack by plethora of insect-pests and diseases are the major setback of groundnut production and hence the average productivity is only around 1,257 kg/ha. Diseases are a major reason in reducing yield and it has been clearly demonstrated many a times (Subrahmaniyam *et al.*, 1985). Leaf spots, Rust, collar rot, Peanut bud necrosis are the major diseases of national importance in Groundnut. If all possible pest control measures are integrated in an optimum proportion and surveillance activity is strengthened further, good returns could be realised and the approach will also be eco-friendly.

Major diseases of groundnut and their integrated management are discussed below.

1. Collar Rot (*Aspergillus niger*)

Prevalence

Collar rot is prevalent in almost all groundnut growing areas of the country. It is particularly serious in the sandy loam and medium black soils of Punjab, Tamil

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Symptomatology

Pre-emergence rotting of seeds and hypocotyls, post-emergence seedling blight, rapid wilting of entire plant or its branches are characteristic diagnostic symptoms [Figure 1(a)]. 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 resulting yield loss of 25-50 percent (Ghewande, 1985). The collar rot disease spreads by the spores and mycelium adhering to the seeds pods from season to season. The main carry over from season to season is in plant debris rotting in the soil and on the seeds harvested from an infected field.

2. Stem Rot (*Sclerotium rolfsii*)

Prevalence

Stem rot occurs in all groundnut growing states, particularly more severe in Gujarat, Maharashtra, Madhya Pradesh, Odisha and Tamil Nadu. Latur, Raichur, Dharwad, Junagadh and Hanumangarh have been identified as **'hot spots'** for the disease. About 25-30% yield loss due to this disease has been reported from different parts of India. In addition there is also reduction in dry weight and oil content.

Symptomatology

Initial symptoms result in partial or complete withering and drooping of the stem or branches which are in contact with the infected soil. The leaves turn brown and show drying but remain attached to the plant. White mycelial growth is visible around the infected stem and at later stage abundant mustard like small black sclerotia are formed. Infection of pods, pod-rot and leaf blight are often observed in the infected plants. The pathogen spreads through infected soil, wind splashed rain and sclerotia. Deeply buried sclerotia survive a year or less while those near soil surface remain viable for many years.

3. Dry Root Rot (*Macrophomina phaseolina*)

Prevalence

Dry root rot also called as Charcoal rot), is sporadic disease and is found in parts of Rajasthan, Uttar Pradesh, Tamil Nadu, Andhra Pradesh and Maharashtra. The pathogen causes severe seedling mortality resulting in patchy crop stand.

Symptomatology

Water-soaked necrotic spots appear on the stem just above the ground level. If the initial lesion girdles the stem, wilting follows [Figure 1(b)]. 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. The pathogen is a facultative saprophyte and a soil dweller. Infected soil, plant debris and pods serve as sources of inoculums.

4. Leaf Spots

(i) Early Leaf Spot (*Cercospora arachidicola*)

Prevalence

The disease was initially more prevalent in northern groundnut growing states; however, in the last decade, it has assumed a serious status in southern and central groundnut growing states too. The losses in yield estimated to be in the range of 15-59%. The disease usually found 30 days after sowing.

Symptomatology

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 and the corresponding lower surface of the leaf shows light brown colour [Figure 1(c)]. Severely infected leaves drop off prematurely and lesions sometime extend to the stem as well as branches. The pathogen survives through conidia on affected plant debris and also survives from one season to another on volunteer groundnut plants.

(ii) Late Leaf Spot (*Phaeoisariopsis personata*)

Prevalence

Yield losses ranges from 20-60% and vary from place to place and between seasons. The disease normally occurs on 60 days old crop to till harvesting.

Symptomatology

Dark brown to black, circular to sub-circular lesions measuring 1-6 mm diameter appear on lower surface of the leaves [Figure 1(d)]. Several lesions may coalesce and in severe cases, infected leaves may drop off prematurely. Oblong lesions occur on the stem and branches. Like early leaf spot the pathogen survives through conidia on affected plant debris and also survives from one season to another on volunteer groundnut plants.

5. Rust (*Puccinia arachidis*)

Prevalence

The disease is reported from all groundnut growing parts of India but more severe in the southern states. Losses in yield due to rust have been reported in the range of 10-52%.

Symptomatology

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 all the 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. The disease spread through urediniospores and volunteer groundnut plants.

6. Peanut Bud Necrosis (Groundnut Bud Necrosis Virus)

Prevalence

The disease causes yield losses of the tune of 30-90% depending upon growth stage of the plant. The reported hot spots for the disease are Jagtiyal and Hyderabad in Andhra Pradesh, Latur in Maharastra, Tikamgarh in Madhya Pradesh, Raichur in Karnataka and Mainpuri in Uttar Pradesh.

Symptomatology

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 [Figure 1(e)]. In late infections pod size is reduced, seeds are often shrivelled and have mottled and discoloured testa . Groundnut bud necrosis virus also known as Peanut bud necrosis virus (PBNV) is placed in the genus Tospovirus and is transmitted by the thrips (Kendre *et al*., 2000).

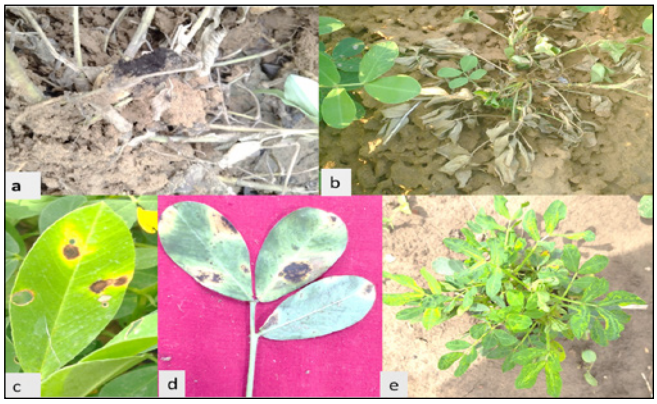

Figure 1: (a) Collar rot; (b) Wilting and rot due to complex of pathogens; (c) Early leaf spot; (d) Late leaf spot; (e) peanut bud necrosis

Emerging Diseases

Besides these major diseases *Alternaria* leaf blight had been occurring severely in summer groundnut since last few years (Kumar *et al*., 2012). More than 70 species of plant parasitic nematodes have been reported in association with groundnut disease worldwide but only a few species are known to cause severe outbreak. Though ,Pod and root knot disease caused by four species of *Meloidogyne* are very common in India, the nematode (*Tylenchorynchus brevilineatus*) causing "Kalahastimalady" disease (locally observed in Chittoor and Nellore district of Andhra Pradesh) have the potential to cause havoc. Aflatoxin contamination mediated by *Aspergillus flavus* and its processed product is another major challenge to groundnut growers, processors and exporters. Peanut clump, Peanut mottle virus are some of other minor viral diseases having sporadic appearance.

Integrated Disease Management (Nataraja *et al*., 2014)

1. Presowing Stage

• Deep summer ploughing (8-10 inches) to expose soil borne pathogens.

• Crop rotation with Wheat/ Maize/ Sorghum/ Pearl millet to reduce stem rot.

• 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.

• Early sowing to avoid vector borne viral diseases if irrigation facility is available.

2. Seed and Seedling Stage

• 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

• Soil application of *Trichoderma* spp. @ 4 kg enriched in 250 kg FYM or 200 kg castor cake to prevent seed and soil borne diseases.

3. Vegetative Stage

• Rogue out bud necrosis affected and clump infected plants.

• 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.

4. Flowering Stage

• 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.

5. Peg and Pod Formation Stage

• Need based application of fungicides: for leaf spots, rust & stem rot, spray propiconazole 25 EC @ 1 ml/L or hexaconazole 5 EC @ 1 ml/L or tebuconazole 25.9 EC @ 1.5 ml/L.

6. Harvest and Storage

• Store in polythene lined gunny bags on raised platform. Bags should not be stitched or sealed as it may lead to germination.

• Harvest at optimum maturity stage of Pod to avoid

contamination by *Aspergillus flavus.*

Conclusion

Diseases pose a major threat in groundnut production leading to heavy yield losses. Blanket application of pesticides by the farmers is economically not feasible and detrimental to environment. Hence, the integration of different components of IPM like, timely surveillance, adoption of cultural and biological practices and need based application of pesticide is the need of the hour to increase the productivity of Indian groundnut growing farmers.

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