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IMPACT OF DIFFERENT ECO-FRIENDLY PEST MANAGEMENT TREATMENTS ON THE PERIODIC DEVELOPMENT AND SPREAD OF BIOTIC STRESSES IN GROUNDNUT CROP

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Multilocation field trials comprising of four different IPM Modules for the management of insect pests and diseases of groundnut crop at cultivators fields in Sardarpura Ladana area of Suratgarh Tehsil in Sriganganagar district, Rajasthan during Kharif 2007 revealed that the IPM module consisted of summer ploughing (2-3 times during April-May before sowing to expose the hibernating pests), seed treatment (imidacloprid 17.8 SL @ 2ml/kg seed, Trichoderma harzianum @ 10gm/kg seed), soil amendment (neem cake @ 500 kg/ha preferably 15 days before sowing), application of botanical pesticide (NSKE @ 5% at seedling stage on the occurrence of pests), installation of pheromone traps (Helicoverpa armigera and Spodoptera litura @ 5 traps/ha) and bird perches ("T" shaped wooden bird perches @ 10/ ha) is effective pest management option, being environmentally safe and providing maximum yield. The soil and seed treatment with Trichoderma harzianum (@ 4 kg/ha pre incubated in 50 kg of FYM for 15 days before sowing and subsequent seed treatment with same bioagent (T. harzianum) @ 10gm / kg of seed) under IPM module-II proved effective treatment in suppressing collar rot disease up to 90 days of sowing. The periodic development and spread of biotic stresses (termites, collar rot and early and late leaf spots) in groundnut crop was kept under suppress in IPM modules in comparison to farmers' practices.

Keywords : Biotic stress; Eco-friendly; Groundnut; Pest management.

Introduction

Oilseed crops are gaining great importance in the country owing to the increase in demands. India accounts for 7.4% of world oilseeds output; 6.1% of world oilmeal production; 5.3% of world oilmeal export; 5.5% of world vegoil production; 13.9% of world vegoil import and 10.3% of world edible oil consumption[1]. Groundnut occupies first place among the nine oilseed crops grown in India. Though India leads the world both in area and production of groundnut, however, the productivity is less. The low yield levels are attributed to growing the crop mostly in rainfed areas and in marginal lands with low inputs and lack of plant protection measures. Insect pests and diseases cause severe losses to groundnut in India and are recognized as one of the major constraints in groundnut production. At present, meager information on pest population progression and spread of these biotic stresses is known in groundnut crop particularly under different eco-friendly pest management options. Therefore, an attempt was made to study this aspect in the groundnut growing area of Sriganganagar district, Rajasthan, India.

Material and Methods

The trial was conducted on farmers' fields in Sriganganagar district, Rajasthan, India during kharif season of 2007. In this area, termites (*Odontotermes obesus* Rampur and *Microtermes obesi* Holmgren), white grub (Holotrichia consanguinea Blanch.) (among insect pests) and collar rot (*Aspergillus niger* Van Teighem), the early (*Cercospora arachidicola* Hori.) and late (*Phaeoisariopsis personata* (Berk. & Curt.) v. Arx.) leaf spots (among diseases) were considered the major biotic stresses in groundnut crop. To manage these biotic stresses, four different bio-intensive IPM modules were developed and evaluated on farmers' fields during Kharif 2007. Module-I consisted of summer ploughing (2-3 times during April-May before sowing to expose the hibernating pests), seed treatment (imidacloprid 17.8 SL @ 2ml/kg seed. *Trichoderma harzianum* @ 10gm/kg seed), soil amendment (neem cake @ 500 kg/ha preferably 15 days before sowing), application of botanical pesticide (NSKE @ 5% at seedling stage on the occurrence of pests), installation of pheromone traps (*Helicoverpa armigera* and *Spodoptera litura* @ 5 traps/ha) and bird perches ("T" shaped wooden

bird perches @ 10/ ha); Module-II included seed treatment (*T. harzianum* @ 10gm/kg seed) and soil amendment (application of T. harzianum @ 4 kg/ha preincubated in 50 kg of FYM for 15 days before sowing); Module-III included seed treatment (imidacloprid 17.8 SL @ 2ml/ kg seed), soil amendment (neem cake @ 500 kg/ha preferably 15 days before sowing) and Module-IV (farmers' practices). Under farmers' practices, groundnut crop was sown without any soil, seed treatment and no subsequent sprays to protect the crop against pest and diseases. This treatment was based upon common farmers' practices prevalent in this area.

In all the treatments, the crop (variety HNG-10) was sown in second week of May, 2007 (total 7500 sq meter per treatment). Recommended basal dose of fertilizers (N 40, P 60) were given to the crop.

Periodic observations were recorded from sowing till harvest of the crop on plant mortality due to termites, collar rot and early (*Cercospora arachidicola* Hori.) and late (*Phaeoisariopsis personata* (Berk. & Curt.) v. Arx.) leaf spot diseases. The scoring of leaf spot diseases was done on 1 -9 scale where 1=0% severity, 3 = 6-10 % severity, 5= 21-30 % severity, 7= 41-60 % severity and 9 = 81-100 % severity. Finally pod yield was obtained in all the treatments.

Results and Discussion

The incidence of insect pest and diseases under different modules has been depicted in Fig. 1,2,3 & 4. During the study period, termites (among insect pests), collar rot and leaf spots (among diseases) were observed the main biotic stresses on groundnut crop in this area.

The crop sown under different IPM Modules remained free from collar rot incidence up to 15th June (24 meteorological week) (MW) period. The disease appeared suddenly after mid June. There after the disease showed progressive increase (Fig. 1).

Data indicate minimum disease development and spread under Module II where groundnut crop was sown after basal soil application of T. harzianum @ 4 kg/ha pre incubated in 50 kg of FYM for 15 days before sowing and subsequent seed treatment with same bioagent (T. harzianum) @ 10gm / kg of seed. Under this bioagent based Module, the crop remained free from collar rot up to 90 days (32 MW) of sowing. The disease developed between 15th August and 19th Aug. period (33 MW). During this period the overall incidence of disease was 2.38 per cent only. The further progress of disease during the crop period was slow. At the time of maturity, the disease incidence was only 7.4 per cent compared to incidence of 33.97 per cent in Module IV where the crop was sown under farmers' practice with out any bioagent and other similar inputs.

The comparative periodic progress of disease during the crop period was 2.38 % during 2st week of Aug. (33 MW), 2.58 % during end of Aug. (35MW), 3.93 % during 2nd week of Sept. (37 MW), 5.55 % during end of Sept. (39 MW) and 7.41 % during 2nd week of Oct. (41 MW) when the crop was near to harvest.

Module 1st under which integrated approach (bioagent, botanicals, chemical and mechanical based) was applied to check pest and disease was next in order of efficacy against collar rot. Under this IPM based Module, the crop remained free from collar rot incidence up to 75- days of sowing. The disease initiated to develop during 31st meteorological week i.e., between 30th July and 5th Aug. period. The disease incidence during this period was 1.42 per cent only. However, at the time of maturity of crop during 2nd week of Oct. (41 MW), the incidence reached to the extent of 8 per cent compared to 33.97 per cent under untreated block (farmers' practice). The progressive disease incidence during periodic interval was 1.42 % (July 30 - Aug. 5), 4.57 % (13th Aug.-19th Aug.), 4.73 % (27th Aug. - 2nd Sept.), 5.47 % (10th Sept. - 16th Sept.), 6.62 % (24th Sept. - 30th Sept.), and 8.02 per cent when the crop was near to harvest in 41st meteorological week.

Module III which was formulated to safe guard the groundnut crop from termite attack and no preventive measures were adopted against collar rot disease exhibited significantly higher collar rot incidence compared to Module II and I. Under this Module, the crop remained free from collar rot incidence for 30 days of sowing. The disease developed during 3rd week of June (25 MW) to the extent of 1.15 per cent and reached to the level of 23.13 % at the time of harvesting of crop. The comparative incidence of collar rot under this Module (III) was significantly higher (1.15 - 23.13%) than Module II (2.38 - 7.41%) and Module I (1.42 - 8.02%) but lower than Module IV (farmers' practice) which exhibited disease incidence between 5.48 - 33.97 per cent. The fortnightly progress of disease during the crop period under this Module was 1.15 % in 25th MW (18-24 June), 1.37 % in 27th MW (2-8 July), 5.80 % in 29th MW (16-22 July), 9.10 % in 31st MW (30th July-5th Aug.), 15.9 % in 33rd MW (13-19th Aug.), 16.12 % in 35th MW (27th Aug.-2nd Sept.), 17.63 % in 37th MW (10-16 Sept.), 20.42 % in 39th MW (24-30 Sept.), and 23.13 % in 41st MW (8-14 Oct.).

Module IV, which was based on local farmers' practices where no inputs were given to the crop to check pest and disease attack, completely failed to safe guard the crop against collar rot incidence. Mortality of

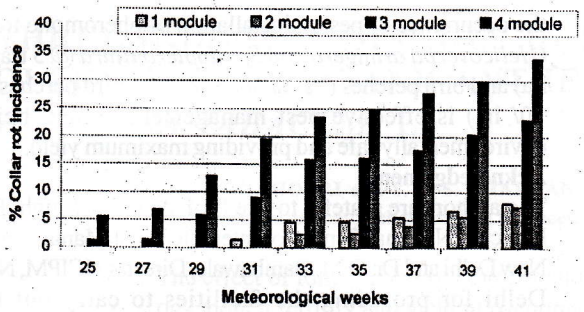

Fig.1. Periodic per cent collar rot incidence in groundnut under different IPM modules.

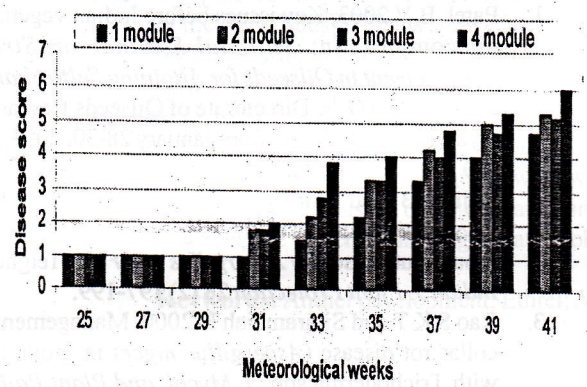

Fig.2. Average disease score (1-9) of learly leaf spot (*Cercospora personata)* in groundnut under different IPM modules

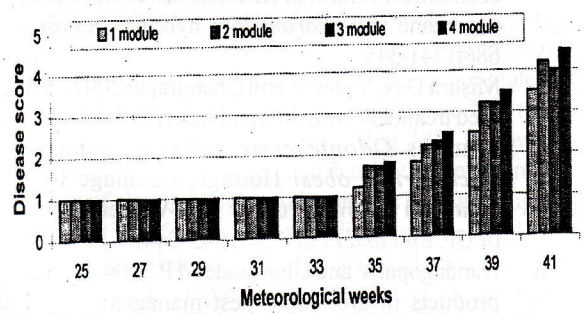

Fig.3. Average disease score (1-9) of late leaf spot (*Cercospora personata)* in groundnut under different IPM modules

germinating plants was observed in 3rd week of June itself. During 18 to 24th June period (25 MW), when the crop was completely free from collar rot attack under Module I and II, the incidence of disease under this Module IV was 5.48 per cent. At the time of maturity of crop, the collar rot incidence reached to the level of 33.97 per cent compared to incidence of 7.41, 8.02 and 23.13 per cent under Module II, I and III respectively. The progressive increase of disease under this farmers' practice

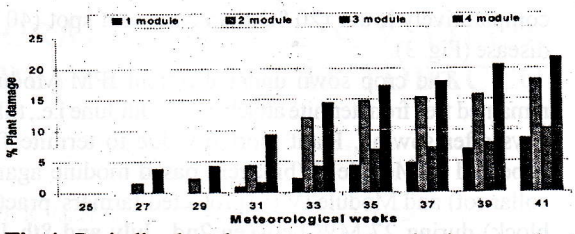

Fig.4. Periodic plant damage due to termite in groundnut under different IPM modules

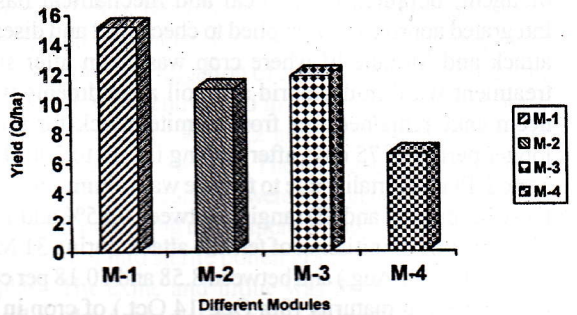

Fig.5. Yield under different modules.

Module was 5.48 (25 MW), 6.75 (27 MW), 12.87 (29 MW), 19.50 (31 MW), 23.53 (33 MW), 24.88 (35 MW), 27.82 (37 MW), 29.90 (39 MW) and 33.97 (41 MW) per cent. The efficacy of Trichoderma spp. in controlling collar rot disease in groundnut crop has also been well documented by Raju and Murthy[2] and Rao and Sitaramaiah[3].

The crop sown under different IPM Modules remained free from early leaf spot up to 1st week of Aug. i.e. till 80 days after sowing and up to 3rd week of Aug. i.e. 100 days after sowing from late leaf spot disease.

Early leaf spot infection appeared during second week of Aug. (33 MW) in traces only in Module I, II and III. Farmers' practice based Module IV revealed slightly higher incidence of disease during this period. However, overall incidence of disease in the crop remained below 40 per cent (6 score). At maturity of crop during 2nd week of Oct. minimum early leaf spot infection of 4.68 score level was observed in Module I where all integrated approaches were applied to check pest and disease attack (Fig. 2).

Module II (seed and soil application of *T. harzianum*) and Module III (seed treatment with imidacloprid + soil application of neem cake) revealed more or less at par disease incidence (5.33 - 5.17 score). Farmers' practice based Module IV exhibited marginally higher (6 score) incidence of early leaf spot disease.

More or less same trend of disease progress at periodic interval was recorded in late leaf spot disease which appeared nearly 15 days after early leaf spot disease. However, pressure of this disease in groundnut was

comparatively lower (20 %) than early leaf spot (40 %) disease (Fig. 3).

The crop sown under different IPM Modules remained free from termite attack up to 30th June i.e., till 45 days after sowing. Plant mortality due to termite first appeared in Module II (bioagent based module against collar rot) and Module IV (unprotected farmers' practice block) during 27 MW between 2nd July and 8th July period. However, crop sown under Module I where bioagent, botanicals, chemical and mechanical based Integrated approach was applied to check pest and disease attack and Module III where crop was sown after seed treatment with imidacloprid and soil amendments with neem cake remained free from termite attack for much longer period of 75 days after sowing i.e. up to 30th July period. Plant mortality due to termite was minimum under these Modules (I and III) ranging between 0.85% and 1.63 % at the time of initiation of termite attack during 31 MW (30th July - 5th Aug.) and between 8.58 and 10.18 per cent respectively at maturity (8th Oct.-14 Oct.) of crop in 41 meteorological week. On the contrary significantly higher plant mortality was observed under farmers' practice (3.78 - 21.73 %) and Module II (1.53 - 18.12 %) where no input was provided to protect the crop against termite attack. The periodic plant mortality progress remained slow under Module I and Module III compared to Module IV under farmers' practice, which exhibited significantly higher plant mortality of 3.78, 418, 9.27, 14.40, 17.21, 17.87, 20.52, and 21.73 per cent during 33rd, 35th, 37th, 39th and 41st meteorological weeks respectively (Fig. 4). The efficacy of imidacloprid as seed treatment against termites has also been well reported[4, 5]. The efficacy of biorational pesticides in the management of insect pests and diseases of groundnut crop has also been well documented[6, 7].

The higher crop yield was obtained from module 1, followed by module 3 and module 2. The least crop yield was obtained under farmers' practices (Fig. 5).

Hence, It can be concluded that T-I consisted of summer ploughing (2-3 times during April-May before sowing to expose the hibernating pests), seed treatment (imidacloprid 17.8 SL @ 2ml/kg seed. *Trichoderma harzianum* @ 10gm/kg seed), soil amendment (neem cake @ 500 kg/ha preferably 15 days before sowing), application of botanical pesticide (NSKE @ 5% at seedling stage on the occurrence of pests), installation of pheromone traps (*Helicoverpa armigera* and *Spodoptera litura* @ 5 traps/ ha) and bird perches ("T" shaped wooden bird perches @ 10/ ha) is effective pest management option, being environmentally safe and providing maximum yield.

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