STUDIES ON PLANT PARASITIC NEMATODES IN HIGH DENSITY MULTISPECIES CROPPING SYSTEMS

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The concept of multispecies cropping systems in plantation for maximum productivity from unit area of land involves growing together of several species of plants. Such a cropping systems involving nematode susceptible crops, provides most congenial environment for the multiplication of polyphagous/species like root-knot, lesion and burrowing nematodes. The deleterious effect can be brought down by using nematode-free planting materials, resistant cultivars, frequent change of nursery sites and judicious use of broad spectrum nematicides. Managing nematode population by growing non-host plants is another widely accepted method. In the multiple cropping systems adopted in Kerala and Karnataka, it is imperative to standardise crop combinations and effective management practices that ensure optimal growth, high yield and minimum nematode level in the soil.

Survey : A detailed survey carried out in coconut, arecanut and multispecies cropping systems based on these crops raised in Kerala and Karnataka states revealed widespread occurrence of the burrowing nematode, Radopholus similis on coconut, arecanut, banana, black pepper, cardamom and betel vine. The root-knot nematode Meloidogyne incognita was recorded in black pepper, cacao, banana, pineapple and betel vine whereas the lesion nematode, Pratylenchus coffeae was recorded only from coffee plants.

Problems of burrowing, root-knot and lesion nematodes in different crops and their seasonal fluctuations :

The annual periodicity of plant parasitic nematodes on various species of plants involved in the multispecies cropping systems was studied during 1984-85. The results showed that the burrowing nematode populations present in banana, coconut, black pepper, clove and reached their maximum during October and November. R. similis population was very low in coconut when cultivated as a monocrop. The root-knot nematode was

recorded from most of the crops throughout the year with high population on black pepper, papaya and subabul (Leucaena leucocephala) during December and January. Pratylenchus coffeae was recorded from coffee plants and the nematode population reached its maximum during November-December. Nematodes being moisture dependent, their population levels are markedly affected during summer months. In the light of these observations, it is felt that the collected data may be utilized for conducting future surveys and for the applications of nematicides for the various crop combinations.

It is preferable to avoid susceptible crops while selecting crop combinations, especially for nematode infested areas. Its severity increases when susceptible crops are planted together or in succession on the same land. In the burrowing nematode-infested area, it may become necessary to avoid the crop combinations involving coconut, pepper, arecanut or banana since all the crops are highly susceptible to R. similis. Under such conditions one may have to go in for a minimum use of nematicides to control the nematodes.

Control of nematodes in the nursery :

Raising seedlings in nematode-infested soil in nurseries and their subsequent transplanting into plantation is a common way for long range spread of nematodes in plantation crops. Nurseries serve as a breeding ground for nematodes as planters very seldom change their nursery sites. Hence it is recommended to fumigate the nursery soil with methyl bromide. It is preferable to supply seeds instead of seedlings to places other than Kerala, Karnataka and Tamil Nadu to prevent the spread of the nematode to uninfested areas.

Chemical and non-chemical control of nematodes :

Among the nematicides tested so far aldicarb, phenamiphos, phorate, fensulfothion and carbofuran were effective in reducing the nematode population considerably, both in soil and root at different dosages to different crops. In view of the high cost, inaccessibility, environmental pollution and the likelihood of residual toxicity in plant products, use of nematicides needs to be minimized. Developing an integrated nematode management schedule with greater emphasis on use of tolerant/resistant varieties and biological control methods is essential for different cropping systems. The biological control of plant parasitic nematodes has received greater attention recently by the demonstration that some species of fungi and bacteria prevented nematode multiplication and even reduced the damage caused by nematodes.

In France, two nematode-trapping fungi, Arthrobotrys robusta and A. irregularis are commercially available for use against some nematode pests. Hence studies were initiated at CPCRI on the above direction.

Some of the trap plants viz., Tagetes errecta and T. patula are practically used to control nematodes. Three months cultivation of T. patula in summer months was found to be effective to control Pratylenchus penetrans on radish in Japan. Hence studies were initiated at CPCRI to find out the effect of antagonistic plants in controlling nematodes in different cropping systems.

Screening of green plasm :

One of the most economical and effective ways to control nematodes is growing nematode resistant plant cultivars. In view of the importance, various crops grown in multispecies cropping systems are being screened against the major pathogens viz., root-knot, lesion and burrowing nematodes. Based on the information available a suitable crop combination for nematode infested areas are developed.

Nematode-mycorrhizae interaction :

Since plant parasitic nematodes and VA mycorrhizal fungi are intimately associated in feeder roots, it is logical to consider an interaction between these two groups of organisms, in terms of their combined effect on plant growth. The effect of VAM on nematodes susceptible plants is promoting tolerance to nematodes. Thus plants heavily colonized by mycorrhizal fungi are able to grow well in spite of the presence of damaging levels of plant parasitic nematodes. Mostly these studies have been conducted under greenhouse conditions. Although such controlled studies are important, it is imperative that these systems, especially those known to be antagonistic to the nematode, be evaluated under field conditions. Studies were started at CPCRI, to find out the effect of VAM in importing tolerance to R. similis and M. incognita infestation on plantation crops in different cropping systems.

Future Thrusts : Based on the information available, the following strategies have been suggested to alleviate the nematode infestations in high density multispecies cropping systems.

(1) Estimation of crop losses at different population levels under field conditions, in correlation with crop health and determination of

threshold levels for important crops beyond which economic loss can be expected.

(2) *Identification of sources of resistance/tolerance among important plantation crops with regard to the major pathogenic nematodes.*

(3) *Utilization of natural enemies for the control of nematodes.*

(4) *Development of integrated nematode management for various crops combinations.*