Influence of Crop Mixing of Hybrid Napier on the Root Zone Microflora of the Coconut Palm

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Abstract

Intercropping of fodder hybrid napier with coconut palms resulted in the proliferation of total bacteria and nitrogen fixing organisms in the coconut rhizosphere, irrespective of the condition of the palm. Compared to the palms in the control plot, crop mixing enhanced phosphate solubilizing bacteria in root region of the palm with root (wilt) affected coconut palms harbouring significantly higher numbers. The trend was however reversed after the application of inorganic manures. There was decrease in the nitrogen fixing and phosphate solubilizing microflora in the soil adhering to the coconut roots. The difference between the experimental and control plot was also not significant.

Introduction

Mixed farming initiated at this Station has shown a beneficial influence on the yield of coconut palms. Microbiological analysis of the soil from plots cultivated with coconut palms and fodder crops revealed the presence of cellulolytic, nitrogen-fixing, and denitrifying organisms. Studies made in the past were concerned with the rhizosphere of coconut palms in relation to the root (wilt) disease (Radha and Menon, 1954; Radha and Rawther, 1959). In the present studies, attempts have been made to enumerate the microflora, particularly the nitrogen-fixing and phosphate-solubilizing organisms, in the rhizosphere of coconut palms in close proximity with the fodder grass hybrid napier. Counts were taken before and after the application of inorganic fertilizers and the results are presented in this paper.

Materials and Methods

Samples were collected one meter away from the bole of the palm from a depth of 50 cm from four sectors, from three apparently healthy and three diseased palms crop-mixed with napier grass. The soil adhering to the roots were gently shaken in sterile water and counts were made by

soil dilution technique. Soil extract agar (Lochhead and Taxton, 1952) was used for bacteria and Martin's Rose Bengal agar (Martin 1950) for fungi. Phosphate-solubilizing organisms were estimated using the medium of Pikoviskaya (Pikoviskaya, 1948) and nitrogen-fixing organisms were counted in nitrogen-free mannitol agar. The normal fertilizer dose for coconut is 0.5 kg N, 0.32 kg P and 1.2 kg K/palm/year and for grass 150 kg N, 50 kg K and 100 kg K/ha. Except N, others were applied once before and once after the monsoon for the coconut palm. The sampling was done twice, before and after the application of fertilizers.

Results

The relative incidence of rhizosphere microflora in the experimental and control plots is furnished in Table 1. In general, the samples of rhizosphere before the application of fertilizers gave an increase in the number of different microflora in experimental samples as compared to those from control plots. Both total bacteria and nitrogen fixing bacteria were higher in experimental palms as compared to control irrespective of the condition of the palm. The phosphate-solubilizing bacteria were significantly higher in the crop-mixed area with diseased palms harbouring significantly higher numbers. The incidence of phosphate solubilizing fungi on the other hand was more in the rhizosphere of healthy palms of the experimental plot. The trend however differed subsequent to the application of fertilizers. Except the fungal flora, all the other compo-

TABLE 1. Influence of crop mixing hybrid napier grass on the coconut rhizosphere microflora, before and after fertilizer application

Organisms	Coconut+Napier grass				Coconut alone			
	Pre-application		Post-application		Pre-application		Post-application	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
Bacteria	51.84	21.25	21.83	10.28	27.00	5.51	5.15	7.81
Fungi	37.62	29.46	28.67	206.71	6.76	76.11	1.05	20.48
Nitrogen fixing bacteria	84.20	35.86	9.92	8.25	35.86	8.71	3.47	7.88
Phosphate solubilizing								
Actinomycete	4.95	2.33	0.83	1.30	1.45	3.04	0.33	0.55
Bacteria	8.15	130.78	0.61	0.87	8.85	3.95	0.63	0.93
Fungi	6.58	5.26	1.12	1.21	2.40	2.40	1.52	1.46

nents of the microflora showed a lower population in the rhizosphere of palms of the experimental plot, irrespective of the condition of the palm. The fungal population recorded an increase in the rhizosphere of wilt-affected palms in the experimental as well as the check plots. In the case of phosphate-solubilizing flora, the fall in population in the crop-mixed plot was significant.

Discussion

The rhizosphere microflora in general is influenced by age of the plant, nutritional status of the soil, the zone of sampling, and cultural practices (Walksman, 1932). Due to non-availability of desired criteria, it was not possible to collect samples from palms of identical age group. This was also the reason for collecting samples from the four sectors of each palm. But, samples from each sector were treated as separate entities. Samples were collected from a distance of one meter from the bole because the roots are dense in this region under normal cultivation. The depth of collection was kept to 0-50 cm on the basis of our earlier observations. The very objective of present investigation was to see how best inter-cropping of coconut with hybrid napier would influence the rhizosphere of the main crop in a beneficial manner. The method followed for the enumeration in the present investigation might not as well hold appropriate for the fungi.

The abundance of phosphate solubilizers in the rhizosphere had been observed by other investigators also (Sperber and Rovira, 1959; Sperber, 1958a; Katznelson and Bose, 1959). Higher incidence of phosphate-solubilizing flora will make possible the conversion of the organic phosphorus available in the soil into a form assimilable to crops. This increased availability of P in the root region can as well help in the proliferation of nitrogen fixing organisms.

The differences in the quantitative distribution of different components of coconut rhizosphere microflora changed with the application of fertilizers. Venkatesan (1962) had also observed a retarding effect of N, P, and K on the rhizosphere bacteria and fungi of rice. Shetty and Rangaswamy (1969) has observed that an inhibition of the phosphate-solubilizing microflora in the rhizosphere of pearl millet was inhibited by the application of phosphate fertilizers.

Acknowledgement

We thank Dr. G. Rangaswami, Vice Chancellor, Tamil Nadu Agricultural University, for his valuable suggestions on this fascinating area of the microbiology of the coconut root region way back in 1972.

References

Katznelson, H. and Bose, B. (1959). Metabolic activity and phosphate dissolving capacity of bacteria isolates from wheat rhizosphere. *Can. J. Microbiol.* **5** : 79-83.

Lochhead, A.G. and Taxton, R. H. (1952). Quantitative studies of soil microorganisms. X. Bacteria requiring vitamin B_{12} as growth factor. *J. Bact.* **63** : 219-225.

Martin, A. (1950). Use of acid, Rose bengal and streptomycin in the plate method for estimating soil fungi. *Soil Sci.* **69** : 215-233.

Pikovskaya, R.I. (1948). Mineralization of phosphates in soils in connection with the vital activity of certain micro-organisms. *Microbiology.* **17** : 362-370.

Radha, K. and Rawther, T.S.S. (1959). Observations on the seasonal variation in the rhizosphere microflora of coconut with special reference to fungi. 298-305 pp. in *Proc. First Conf. Coconut Res. Workers of India,* CPCRI, Kasaragod.

Radha, K. and Menon, K.P.V. (1954). Studies on the wilt (root) disease of the coconut palm : A comparative study of the rhizosphere microflora of coconut from diseased and healthy areas. *Indian Coconut J.* 7 : 99-106.

Shetty, K.S. and Rangaswami, G. (1969). Studies on the influence of the phosphate build up of the soil and rhizosphere of ragi (*Eleusine coracana* Gaertn.) *Mysore J. Agri. Sci.* **4** : 425-428.

Sperber, J.I. (1958). The incidence of apatite-solubilizing organisms in the rhizosphere and soil. *Australian J. Agri. Res.* **9** : 778-781.

Sperber, J.I. and Rovira, A.D. (1959). A study of the bacteria associated with the roots of subterranean clover and wimmera rye grass. *J. Appl. Bacteriol.* **22** : 85-88.

Venkatesan, R. (1962). Studies on the actinomycete population of paddy soil. PhD thesis. Anamalai University, Annamalainagar, India.

Walksman, S.A. (1932). *Principles of soil microbiology,* 2nd ed. Bailliere, Tindall and Cox, London.