Recent Advances in Plantation Crops Research, 2000, pp.393-395.

STANDARDISATION OF SAMPLING ZONE AND TYPE OF ROOT FOR ARBUSCULAR MYCORROHIZAL FUNGAL ESTIMATION ON COCONUT*

P.K. KOSHY, V.K. SOSAMMA and RACHEL SAMUEL

Central Plantation Crops Research Institute
Regional Station, Kayangulam, Krishnapuram 690 533, Kerala

Root and soil samples collected from varying distance and depths in the rhizosphere of five elite coconut palms were processed for arbuscular mycorrhizal fungal (AMF) population estimation. Samples were collected every month for a period of one year. Maximum number of resting spores of AMF were recovered at a distance of one meter away from the bole of the coconut palm within a depth of 26 to100 cm from the soil surface. All type of roots of coconut palm harboured AMF. However, maximum colonization was noticed in the fine yellowish brown to light brown tertiary roots of coconut.

INTRODUCTION

Coconut being a perennial crop has a massive adventitious root system. Menon and Pandalai (1958) reported maximum concentration of active coconut roots within a radious of 150 cm from the bole and at a depth of 50 to 100 cm in palms grown in sandy loam soil. However, in coconut, it produces numerous uniformly thick roots from the base of stem throughout its life. The main roots measure six m in length on an average and in rare instances they may even grow vertically even up to 25 m down towards the water table. Arbuscular mycorrhizal fungi, obligate symbionts on coconut, generally have a stimulatory effect on plant growth characters and its antagonistic effect to plant parasitic nematodes within the host root is well established. However, informations on the type of root having maximum colonization and the depth at which maximum resting spores occurrence from the base of the palm are not reported. Therefore, the present studies were undertaken to standardise the sampling area within the massive root zone of coconut for maximum recovery of vesicular and arbuscular mycorrhizal resting spores and their colonization in different types of roots.

MATERIALS AN D METHODS

Five, elite West Coast Tall coconut palms from five different blocks of CPCRI Farm, Kayangulam were selected for the study. Soil and root samples were collected at monthly interval for one year. Soil samples from the rhizosphere were collected with an augur from three different angles of the coconut basin at a distance of 50, 75, 100, 150 and 200 cm away from the bole and at different depths (0-25, 26-50, 51-75 and 76 - 100 cm). Soil samples collected from each depth at different angles were mixed together and a composite sample (50 g) was drawn for further studies.

*CPCRI Contribution No.1009

Soil evenly suspended in water and then passed through sieves of 60 (710 μ), 150 (105 μ), 200 (75 μ) and 350 (45 μ) meshes. Remnant of each sieve was washed and made up to 100 ml suspension. Two ml of the suspension was pipetted out into a Doncaster counting dish and observed under a binocular stereo microscope. Number of spores present in the suspension was recorded and identified using Trappe's synoptic key. Three observations were made with each suspension. Primary, secondary and tertiary roots of coconut palms grown in sandy loam soils were also collected. Collected roots were washed thoroughly and cut into one cm long bits. Root bits were stained as per the standard methods and observed for mycorrhizal infection (Philips and Hayman, 1970; Koske and Jemma 1989). In each category 100 numbers of root bits were analysed for AMF infection.

RESULTS AND DISCUSSION

Recovery of the AMF resting spores was higher at 100 cm away from the bole and within a depth of 26 to 100 cm (Table 1). Sieving on the 150 mesh yielded maximum number of the resting spores followed 200 mesh (Table 2). Among the roots (primary, secondary, tertiary) maximum

Table 1. AMF resting spores recovered at different depths and distances

Depth (cm)	Distance from the bole of the palm (cm) 50	75	100	150	200
0-25	45	60	62	31	31
26-50	41	70	121	44	24
51-75	62	107	125	71	35
76-100	78	86	119	64	24

Table 2. AMF resting spores recovered from different sieves

Sieve Pore size (μ)	No. of spores/ 50 g soil
250	4
105	24
75	29
45	4

Table 3. Type of coconut root showing maximum colonization

Root morphology	Root infection (%)
Feeder roots (Tertiary)	
Tender creamy (1 mm thick)	80*
Semi hard yellow to brown (1 mm)	100**
Tender creamy (3-4 mm)	10
Hard light brown (3-4 mm)	20
Lateral roots (Secondary)	
light brown hard (6-7 mm)	50
Primary roots (Main)	
Brown hard (6-7 mm)	40

*, **, 40 and 30 per cent of roots infected with hypae, arbuscules and vesicles while others were infected only by hyphae and arbuscules

colonisation was observed in the fine yellowish brown to light brown tertiary roots up to 100 per cent followed by secondary and primary roots, respectively (Table 3). In coconut, the juvenile roots are fleshy and cream yellow to light brown in colour. In correspondence with aging, root colour changes to orange and then reddish brown. Colonisation was less in hard reddish brown to dark brown roots (primary, secondary and tertiary) compared to tender, yellowish brown to light brown coloured roots (Table 4). Tunstall (1930) also reported that the white and the cream coloured roots of tea harboured mycorrhiza while it was absent in red coloured roots. Results obtained in the present study substantiate the earlier findings of Ramesh and Rohini Iyer (1979). Growing roots at root cap region were

Table 4. AMF colonization in different types of coconut roots

Types of root	Roots infection (per cent) A*	B	C	D
Tertiary	10	100	40	12
Secondary	10	50	40	20
Main	10	40	0	0

* A - Creamy white; B - Yellowish to light orange; C - Orange to light brown; D - Dark Brown

found to be free from AMF mycelial growth. Maximum number of resting spores recovered from a distance of 100 cm away from the bole within a depth of 26 to 100 cm. This may be due to the maximum concentration of actively proliferating coconut roots within a radius of 150 cm away form the bole at a depth of 50 to 100 cm. Intensity of infection dose not have any corelation with roots of different depths.

ACKNOWLEDGEMENTS

We express our thanks to the Indian Council of Agricultural Research for the grant through the AP Cess Fund towards the scheme on" Interactions between Vesicular Arbuscular Mycorrhizae (VAM) and burrowing nematode on coconut". Our thanks are also due to Mr. Jacob Mathew, Principal Scientist (Statistics) and Mr.C. Kesavan Nampoothiri, Statistical Assistant, CPCRI (RS), Kayangulam for their co-operation.

REFERENCES

Koske, R.E. and Jemma, J.N. 1989. A modified procedure for staining roots to detect VA mycorrhiza. *Mycological Research* 92: 486-505.

Menon, K.P.V. and Pandalai, K.M. 1958. *The coconut palm A monograph* - Indian Central Coconut Committee, Ernakulam, South India. pp.384.

Philips, J.M. and Hayman, D. S. 1970. Improved procedures for clearing roots and staining parasitic and vesicular arbuscular mycorrhizal fungi for rapid assessment of infection. *Transaction of British Mycological Society* 55: 158-161.

Ramesh, C.R. and Rohini Iyer. 1979. Mycorrhiza of plantation Crops. pp. 99-104. In: *Proceedings of PLACROSYM II Plant Protection.* Ed-in-Chief C.S. Venkata Ram. Indian Society for Plantation Crops, Kasaragod, Kerala.

Tunstall, A.C. 1930. Some observation on tea roots. *The Indian Tea Association Quarterly Journal* Part 1:75-78.