

# EFFECT OF CONTINUOUS APPLICATION OF MANURES AND FERTILIZERS ON RHIZOSPHERE MICROFLORA IN ARECANUT PALM\*

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## Key words

Arecanut Cultivation Inorganic fertilizer Organic manure Rhizosphere microflora

## Summary

The rhizosphere microflora of arecanut palm under continuous application of organic manures and inorganic fertilizers was studied. The nutrients applied are 100 g N, 40 g P<sub>2</sub>O<sub>5</sub> and 140 g K<sub>2</sub>O/palm/year in the form of organics and inorganics. The application of organic manure increased the microbial population. The increase in microbial population was observed between the rhizosphere samples collected at 0–30 cm and 30–60 cm depths. The surface cultivation of soil increased the microbial population. *Trichoderma* sp. and *Aspergillus* sp. dominated in the rhizosphere of arecanut palm.

## Introduction

In India arecanut (*Areca catechu* L.) is grown as one of the important perennial cash crops in the high rainfall regions of Kerala, Karnataka, Tamilnadu, Maharashtra, West Bengal and Assam States. In Karnataka there are three distinct regions viz coastal, malnad and maidan areas, where arecanut is cultivated. Vittal comes near to coastal region and the soils are lateritic. In the present investigation we studied the rhizosphere microflora under continuous application of manures and fertilizers to arecanut palm.

## Materials and methods

The soils of Vittal (Karnataka State) is texturally sandy clay loams, slightly acidic with pH 5.2 to 5.8. The soil contains appreciable amount of organic matter. An experiment to study the effect of continuous application of manures and fertilizers to arecanut palm is in progress at Vittal since 1969. The nutrients applied are 100 g N, 40 g P<sub>2</sub>O<sub>5</sub> and 140 g K<sub>2</sub>O/palm/Year in the form of organics and inorganics. The treatments included in the experiment are shown in Table 1. The inorganic nitrogen and potash fertilizers were applied in two split doses, during Sept.–Oct. and February–March.

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Table 1. Organic carbon, soil pH and microbial population in the rhizosphere of areca palm under different manurial and cultural treatments

Treatments*	Depth (cm)	Organic carbon (%)	pH**	Bacteria (10 <sup>4</sup> )	Fungi (10 <sup>3</sup> )	Actinomycetes (10 <sup>4</sup> )
T <sub>1</sub>	0-30	2.23	7.38	129.0	29.0	10.5
	30-60	1.32	6.98	25.6	14.5	22.0
T <sub>2</sub>	0-30	1.62	5.78	18.0	22.0	5.0
	30-60	0.91	5.48	30.0	12.5	8.0
T <sub>3</sub>	0-30	2.41	6.87	47.0	18.5	11.5
	30-60	1.56	6.56	25.5	4.0	6.0
T <sub>4</sub>	0-30	1.85	6.85	136.5	22.5	34.5
	30-60	1.32	6.62	36.5	9.0	18.0
T <sub>5</sub>	0-30	1.82	7.43	130.0	19.0	22.5
	30-60	1.00	6.48	39.0	7.5	8.0
T <sub>6</sub>	0-30	1.09	5.52	51.5	17.5	9.0
	30-60	0.68	5.33	12.5	6.0	4.0

\* Treatments:

T<sub>1</sub> = Application of organic manure alone.

T<sub>2</sub> = Application of inorganic Fertilizer alone.

T<sub>3</sub> = Application of organic manure + inorganic Fertilizer.

T<sub>4</sub> = T<sub>3</sub> + Cultivation.

T<sub>5</sub> = T<sub>1</sub> + cultivation.

T<sub>6</sub> = T<sub>2</sub> + Cultivation.

\*\* pH in 1:2.5 soil-water suspension.

Nitrogen was applied as calcium ammonium nitrate (CAN), P<sub>2</sub>O<sub>5</sub> as single super phosphate and K<sub>2</sub>O as muriate of potash. The organic manures are applied in the form of farmyard manure, green leaf, bonemeal and wood ash. The rhizosphere samples were collected on 6 March 1978 for the enumeration of microflora.

The rhizosphere samples were collected from the basin of areca palm at 45 cm lateral distance and two vertical depths (0-30 cm and 30-60 cm). Three samples were collected from each treatment. The dilution plating method was followed to enumerate the microbial population<sup>1</sup>. The enumeration of bacteria, fungi and actinomycetes was done using soil extract agar (0.2% glucose), Martin's rose Bengal agar and Kuster's agar respectively. The bacterial, fungal and actinomycetes colonies were counted using colony counter after 60, 72 and 144 hours of incubation under laboratory conditions (32°C ± 2) respectively. The fungal colonies were identified based on the morphology and sporulation. The bacteria and actinomycetes isolates were subjected to morphological, cultural, physiological and biochemical tests for identification<sup>1</sup>.

### Results and discussion

The rhizosphere microflora are presented in Table 1. The results indicated, that the application of organic manure increased the microbial population in all the treatments. This increase in population could be attributed to the increased organic carbon in soil. No

variation in bacterial numbers were observed between organic manure alone and organic manure + inorganic fertilizers application. The difference in bacterial counts were observed between the rhizosphere soil collected at 0–30 cm and 0–60 cm depths. Further the surface cultivation of soil increased the microbial population in the rhizosphere of the arecanut palm. The decline of bacterial population in treatments receiving inorganic fertilizers could be attributed to decreased soil pH and low organic matter level in the soil.

The fungal flora was not affected by the application of organic manures and inorganic fertilizers in all the treatments. The fungi population was less in 30–60 cm depth in organic manure + inorganic fertilizers and other treatments where cultivation was practiced. The increased population of actinomycetes were recorded in treatment receiving organic manure alone, organic manure cultivation and organic manure + inorganic fertilizers and cultivation at 0–30 cm depth.

The observation on qualitative fungal flora revealed that *Trichoderma* sp. and *Aspergillus* sp. dominated in the root region of arecanut palm. The fungi were more in rhizosphere sampled at 0–30 cm depth. The other fungi observed were belonged to the species of *Penicillium*, *Mucor*, *Rhizopus*, *Rhizoctinia*, *Fusarium*, *Cylindrocoryn*, *Cladosporium*, and *Trichosporiella*. Few colonies of non-sporulating fungi were also present. Among bacteria, the Gram positive bacteria were observed more. The bacteria found in the rhizosphere are *Bacillus*, *Arthrobacter*, *Micrococcus* and *Pseudomonas*. The actinomycetes population was represented by *Streptomyces*, *Nocardia*, *Micromonospora* and *Actinomyces*. Number of actinomycetes colonies antagonistic to bacteria were observed.

Our observation revealed that the application of organic manure and surface cultivation of soil increased the microbial activity in the rhizosphere of arecanut palms. The application of organic manure alone or inorganic fertilizers alone did not indicate any difference in the plant growth and yield of arecanut<sup>2</sup>. Large number of areca growers who apply only organic manures can be assured of good soil condition as revealed in this study.

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