Volume : 3 | Issue : 6 | June 2014 • ISSN No 2277 - 8160

Research Paper | Environment

A Study on Distribution of Arbuscular Mycorrhizae (AM) Fungi in Red Sanddunes, Bheemili, Visakhapatnam, Andhra Pradesh.

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ABSTRACT

AM fungi are ubiquitous in nature. They have shown a marked development in plant shoot and roots when inoculated with AM fungi.AM fungi is well known for its nature to survive in nutrient deficient conditions especially the deficiency of Phosphates. Bheemili is well known for Red Sand Dunes which has vast plantation of Cashew. Soil samples were collected from all four directions. The collected soil samples were analysed for physico-chemical (Nitogen, Potassium, Phosphates (NPK), pH, Conductivity) parameters. All the collected soil samples were screened for AM fungi. The nutrient level recorded in all the soil samples were low focusing on NPK while indirectly showed less isolated AM fungi number.

KEYWORDS : AM Fungi,Red sand dunes,NPK ,Anacardium occidentale

INTRODUCTION:

The cashew is a tropical evergreen tree that produces the cashew nut and the cashew apple. Officially classed as Anacardium occidentale. Nowadays cashew nuts have gained importance in commercial as well as in medicinal sectors. Cashew trees are large and evergreen growing to 10-12m tall, often with an irregular trunk. India stands second place in cashew production.

Cashew nuts act as a medicine to snake bites. Cashew nut oils have great medicinal value as an antifungal agent and also it is applied to sores and rashes and is a good anti-diarrheal applicator. Many parts of the plant are used in the traditional medicine of the Patamona of Guyana. They grind the seeds into a poultice for treating snakebites, apply nut oil to cracked heels or as an antifungal agent, and use the fruits, bark, and leaves for many other purposes including anti-fungal activity, as an antipyretic. The leaf extracts with petroleum ether and ethanol inhibited growth of several species of bacteria and fungi.

Maruthi et al (2013) stated that a fungi shows mutualistic relationship with roots of most plants species.AM fungi is known to be evolved ~400 million years ago.AM (Arbuscular Mycorrhizae) fungi is capable to survive in stress conditions such as drought ,increasing the biomass of the plants as well as rate of photosynthesis (Maruthi et al., 2013).AM fungi can survive in less nutrient soils and therefore are a good choice for land restoration purposes and sustainable agriculture (Divya rao and Maruthi,2013).

Crops benefited from AM fungi through enhanced uptake of nutrients with low mobility especially Phosphorus. The non-nutritional benefits of AM fungi include alleviation of plant stresses caused by biotic and abiotic factors and the stabilizing of soil aggregates (Muthukumar 2012).

Visakhapatnam is a port city with an area of 200 sq km. This city has now gained a lot of importance because of its well known recreational & tourist locations like Kailasagiri, RK beach, Zoological park, Bheemili etc. This is emerging as one of the metropolitan cities due to rapid growth in population and industrialization. Bheemili, being a village nearer to coastal has a great cover of Cashew plantation. Surprisingly no work has been reported till date on cashew –AM fungi relationship.

The work has been taken up keeping in view with one objective, to check the distribution of AM fungi along with concentrations of NPK in cashew plantation.

MATERIALS AND METHODS

Study area:

The soil samples were collected from some selected areas (in all direction North, South West and East using compass) of Red sand dunes, Bheemili, Visakhapatnam.

Collection of soil samples:

For collection of rhizosphere soil samples, a steel pipe (2"diam, 50cm long), was inclined at the angle of about 15^{0}C and driven using a hammer into the soil about 20-25cm at the root zone (Rodrigues and Muthukumar,2009). This method enables the collection of soil samples from different depths, thereby precisely accounts for better AM fungal diversity. About 4 soil samples were collected randomly from each point and in triplicates were collected along with control (GITAM Garden).

The collected soil samples at different places were analyzed for the following physico - chemical parameters by adopting standard procedures (Jackson et al 1963) like pH, Electrical Conductivity (mmhos), Organic Carbon(%), Total Nitrogen(kg/h),Phosphates(kg/h) and Potassium(kg/h).

AM fungal spores were isolated by wet sieving and decanting method . The isolated spores were then mounted to PVLG-Melzer's stain and were identified using compound microscope (Koske R E and B Tessier (1983).

RESULTS AND DISCUSSION:

All the collected soil samples were analyzed for physico-chemical parameters and the results were shown in (Table-1). The soil pH and Conductivity ranged from 4.8 to 7.4 and 0.03mmhos to 0.10mmhos respectively (Table-1). The Organic Carbon ranged from 0.29% to 0.81% (Table-1). The Total Nitrogen and Phosphate concentration of all soil samples ranged from 10 kg/h to 91 kg/h and 28 kg/h to 80 kg/h respectively (Table-1). The Potassium measured in all soil samples ranged from 37 kg/h to 134 kg/h (Table-1).

Table 1: Physico-chemical parameters of soil samples

S.No	Sample code	pH	Conductivity (mmhos)	Organic Carbon (%)	N (Kg/h)	P (Kg/h)	K (Kg/h)
1.	ES1	7.4±0.1	0.07±0.01	0.32±0.1	10±1	63±1	64±0.1
2.	ES2	6.0±0.34	0.04±0.34	0.40±0.14	45±0.23	46±0.01	37±1
3.	ES3	6.0±0.3	0.04±0.01	0.38±0.19	20±0.34	72±0.1	96±0.32
4.	ES4	6.1±0.5	0.05±0.23	0.35±0.41	25±0.01	58±0.23	62±0.01
5.	WS1	5.8±0.2	0.08±0.1	0.36±0.34	35±0.1	28±0.27	52±0.35
6.	WS2	5.5±0.43	0.06±0.45	0.44±0.51	45±0.23	75±0.34	73±0.45
7.	WS3	4.8±0.4	0.10±0.5	0.29±0.23	40±0.26	80±0.1	84±0.01
8.	WS4	5.3±0.1	0.05±0.18	0.45±0.1	50±1	42±0.01	134±0.24
9.	NS1	6.9±0.6	0.07±0.22	0.41±0.01	55±0.01	40±0.2	113±0.34
10.	NS2	6.5±0.1	0.05±0.01	0.35±0.1	25±1	46±1	113±1
11.	NS3	6.3±0.21	0.04±0.1	0.48±0.01	30±0.1	43±0.2	101±0.3
12.	NS4	6.4±0.1	0.05±0.01	0.43±0.01	35±1	45±1	98±1
13.	SS1	6.2±0.2	0.04±0.45	0.48±0.1	30±0.1	50±0.01	61±0.43
14.	SS2	5.6±0.01	0.07±1	0.47±0.34	66±0.3	56±0.1	49±0.32
15.	SS3	5.7±0.23	0.05±0.34	0.81±0.54	91±0.2	59±0.4	87±0.45
16.	SS4	6.0±0.32	0.03±0.54	0.53±0.23	43±0.2	53±0.6	72±2
17	CS	7±1	0.02± 0.43	0.93±0.01	96 ± 0.01	75 ± 0.02	73±0.02

± All are mean values

Organic Carbon of the soil is an indirect measure of vital status of the soil. It also retains nutrients and supports microbial life. Soil sample with highest Organic Carbon percentage was 0.81% (SS3) and lowest was 0.29% (WS3). The soil sample with highest Organic Matter was 81% (SS3) and lowest was 29% (WS3). (Table-1).

The NPK values recorded was low which shows plants are in of need of surplus nutrients. Soil samples with highest Nitrogen content was 91 kg/h (SS3) and lowest was 10 kg/h (ES1). Whereas the Phosphorus content measured highest was 80 kg/h (WS3) and lowest was 28 kg/h (WS1). The highest Potassium content of soil sample was 134 kg/h (WS4) and lowest was 37 kg/h (ES2). (Table-1)

The values of NPK and Organic Carbon were recorded with least values which shows that there is an alarming stage of nutrients in these soils due to which AM colonization was also recorded least in number and species.

TABLE: 2 Percentage of Occurrence of AM Fungi in Various Soil Samples

S.No	Sample code	AM fungal species per gram of soil	
		Glomus Species (%)	Acaulospora species(%)
1.	ES1	40	-
2.	ES2	45	40
3.	ES3	-	45
4.	ES4	-	35
5.	WS1	-	-
6.	WS2	30	40
7.	WS3	60	40
8.	WS4	-	-
9.	NS1	-	-
10.	NS2	-	-
11.	NS3	30	-
12.	NS4	-	45
13.	SS1	-	50
14.	SS2	-	-
15.	SS3	40	-
16.	SS4	-	-

In present study Arbuscular Mycorrhizae spores Glomus species and Acaulospora Species (Table-2)(Plate-2) were extracted from all the collected soil samples. Though the spores were present but the spore percentage recorded was minimal which may be due to lack of necessary nutrients in red sand dunes.

CONCLUSION:

Arbuscular Mycorrhizae (AM) is ubiquitous in nature. AM fungi are present in 90% of vascular plants. These provide nutrients to plants and help them grow. In the present study, after estimation of physico-chemical parameters of soil samples of cashew plantation it is observed that addition of natural fertilizers along with AM Fungi can rapidly increase nutrient content (Nitrogen, Phosphate, Potassium) in soils via to plants. Mycorrhizal association shows an increase in the absorptive surface area of the plant due to extrametrical fungal hyphae exploring rhizosphere beyond root hair which in turn increases water and mineral uptake.

Acknowledgements

All authors are thankful to management of GITAM University for providing necessary laboratory facilities.

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