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Effect of Soil NPK on Symbiotic Association of *Glomus macrocarpum* with *Allium cepa*

Dr. K. Amutha[1], Surjith Singh[2]

Abstract: ***The aim of the present study is to analysis the availability of nitrogen, phosphorus and potassium (NPK) content in the soil and to check the association of Glomus macrocarpum with Allium cepa roots in two different soil samples with and without NPK concentration. The result confirmed that the ECR road soil samples showed more number of AMF spores when compared to other region. Glomus macrocarpum was isolated and used for trap culture for multiplication of Spores. Pot A and Pot B showed significant growth when compared to other two pots without NPK. The statistical analysis of mycorhizal colonization was also revealed that mycorrhizal association was higher in pot with red soil.***

Keywords: Mycorrhiza, *Allium cepa*, NPK, *Glomus macrocarpum.*

1. Introduction

Arbuscular mycorrhizal fungi form mutualistic relationship with vascular plant (Smith and Read, 2008). AMF can help to enhance uptake of nutrients (Bolan 1991; George et al. 1995), increase resistance to disease (Newsham *et al*., 1995), and increase drought tolerance (Davies *et al*., 1993). Mycorrhiza and NPK enhance the growth of *Allium cepa* plant (Gergon et al., 2008). The Phosphorus is one of the most significant determinants in plant growth (Wang *et al*., 1998). The high soil phosphorus level leads to decreased mycorrhizal association (Amijee *et al.*, 1989). When the potassium level is low it leads to increases in the mycorrhizal association when compared to the high potassium level (Suresh et al., 2000). The aim of the study is to evaluate the availability of nitrogen, phosphorus and potassium content in the soil and to analyse the association of *Glomus macrocarpum* with *Allium cepa* roots.

2. Materials and Methods

2.1 Estimation of NPK

Two different types of soil samples were collected from Chennai. Black soil (Sample 1) and Red soil (sample 2) were analysed for measuring the nitrogen, phosphorus and potassium content in the soil. The estimation of NPK were done by collecting 100g of Black and Red soil and it dissolved in 1 litre of sterile distilled water and the water was filtered using whattman filter paper. To check the nitrogen, phosphorus and potassium availability it was given to the Commercial lab in Chennai.

2.2 Isolation of AMF spores

Wet sieving and decanting technique was used to isolate AMF spores from soil (Gerdemann and Nicholson's, 1963). The root-soil mixture was added and mixed vigorously to free the spores from the soil and roots. Heavier particles in suspension were allowed to settle for 15 to 45 minutes and the supernatant decanted through standard sieves. The sieves used are those with pores of diameters of 0.5 (the top one), and 0.045 mm. Most spores retain on the 0.045 mm sieve. The extracts are washed away from the sieves. Using a dissecting microscope, spores, aggregates, and sporocarps were picked.

2.3 Multiplication of AMF Spores

Pot trap cultures were established according to Morton *et al.*, (1993). Trap cultures are employed for multiplication of AMF spores. The red soil was mixed with sterile sandy soil at a ratio of 2:1 of soil: sand. *Allium cepa* was used as a host plant and watered with deionized water with fortnightly; sporulation of AMF spores was checked. Fresh and healthy spores were manually sorted under a dissecting microscope according to size, colour, attachment shape etc (Walker *et al*., 1993); (Schenck and Parez, 1990).

2.4 Assessment of *Glomus macrocarpum* Association with *Allium cepa*

Colonization of *Glomus macrocarpum* in the host plant root was examined under microscope to check the assessment of *Glomus macrocarpum* association in the *Allium cepa* roots. Cleared roots were stained with Trypan Blue (0.05%; w/vv). The colonization was calculated (Phillips and Hayman, 1970) and viewed under microscope (10 x / 40 x) to check the assessment of *Glomus macrocarpum*. The association were assessed by Grid line intersect method. (Alholeya and Gaur, 1994). Stastical analysis was used to calculate the values.

3. Results and Discussion

Two type of soil sample were used for the experiment.

1) Sample soil 1 was red soil collected from Pallavaram.
2) Sample soil 2 was black soil collected from a farm land in ECR road.

Table 1: NPK in sample soils

	Nitrogen	Phosphorous	Potassium
Soil sample 1	6.3	1.4	8.5
Soil sample 2	5.6	1.7	6.5

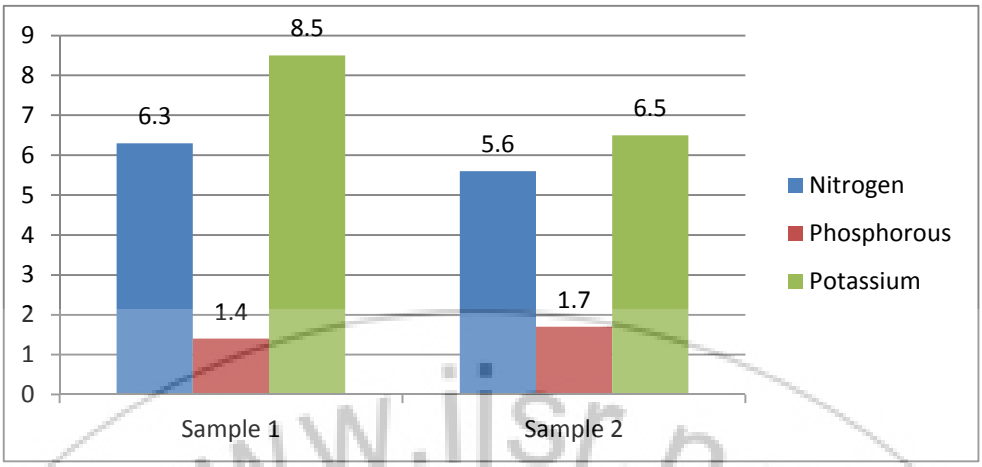

Figure 1: Result of NPK test for sample 1 (Red soil) and sample 2 (Black soil)

The overall concentration of nutrient in the Red soil was higher as compared to Black soil but the availability of Phosphorous was higher in Black soil (Fig. 1).

Table 2: Number of AMF Spores

Area	*Number of AMF spores/ 1Kg*
Tambaram	56
ECR Road	89
Mahabalipuram	81
Velachery	45
Tirusulam	32

Rhizosphere soil samples were collected from different parts of Chennai following which spores were collected from each soil sample. In my present study the number of AMF spores gets varied in different region and its shows similar results (Kehri and Chandra, 1988). The result of the number of spores that were collected per 1kg of soil is listed in (Tab. 2).

Figure 2: Trap culture of AMF using *Allium cepa*

When compare to other AMF spores Glomus was predominat in number .This result was correllates with (Swarupa rani *et al.*, 2010) findings.

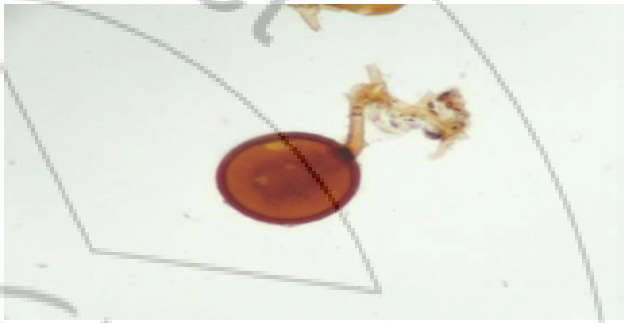

Figure 3: *Glomus macrocarpum*

It was observed that the availability of AMF spores were less in places with less vegetation. Among the collected spores *Glomus macrocarpum* was chosen for trap culture under laboratory conditions (Fig. 2)**.** *Glomus macrocarpum* was identified on the basis of morphological characters (Fig. 3).

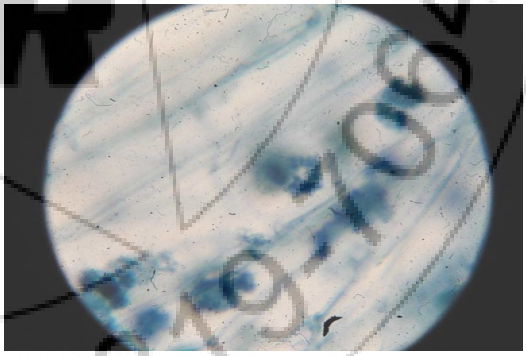

Figure 4: Arbuscule Formation

Figure 5: Vesicle Formation

A clear formation of arbuscules within the cells of the root of *Allium Cepa* was observed. It was seen that the formation of arbuscules were visible in almost all the root sample. Outside the cytoplasm Formation of Vesicles and intraradical mycelium were noticed (Fig 4 and 5).

Table 3: Morphological Parameters of AMF Associated Allium cepa

Treatment	*Length of Plant (cm)*	*Fresh weight of root (g)*	*Dry weight of root (g)*
Control	14.1	6.02	1.12
N-P-K Red Soil+ *Glomus macrocarpum* (pot A)	18.7	14.23	3.66
N-P-K Black Soil + *Glomus macrocarpum* (Pot B)	17.9	13.54	2.96
Glomus macrocarpum + Red Soil (Pot C)	17.3	13. 39	2.34
Glomus macrocarpum + Black Soil (Pot D)	16.7	12.56	1.89

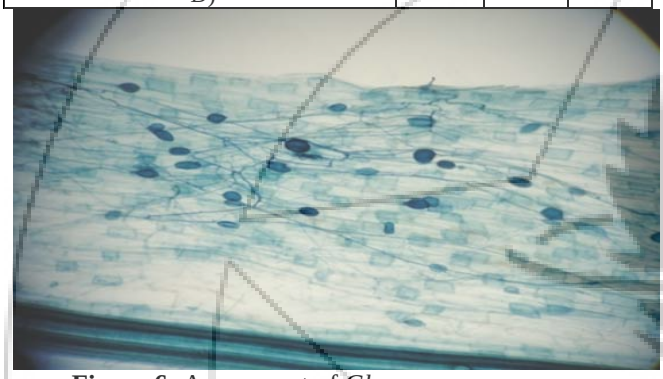

Figure 6: Assessment of *Glomus macrocarpum* association with *Allium cepa* roots

The percentage of mycorrhizal association with *Allium cepa* roots was similar as Reddy *et al* ., (2007) results.

Table 4: Percentage of Mycorrhizal Association

Treatment	*Mycorrhizal colonization (%) Mean ± SEM*
Control	57 ± 4.00
Pot A	77 ± 4.09
Pot B	73 ± 2.98
Pot C	63 ± 3.94
Pot D	59 ± 3.89

Readings of five samples of *Allium cepa* were taken from each Pot following which the average count of the variable were noted down for the estimation of the percentage of mycorrhizal colonization (Fig.6 and Tab.4).

4. Conclusion

In my presence study I have chosen red soil and Black soil samples which were subjected for NPK test and red soil gave good result with N-6.3µg per 100gm soil, P-1.4 µg per 100gm soil.K-8.5 µg per 100gm soil. The overall concentration of nutrient in the Red soil was higher as compared to Black soil but the availability of Phosphorous was higher in Black soil. Low P soil gave higher level of mycorrhizal association with host plants. Spores were collected from different parts of Chennai. It was observed that the availability of AMF spores were less in places with less vegetation. The term mycorrhizosphere denotes that soil was surrounded by the mycorrhiza (Rambelli, 1973; Andrade et al., 1998), Low level of P content gave very good mycorrhizosphere in my study that reveals in the colonization of *Glomus macrocarpum* was higher in red soil when compared with black soil.

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