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Performance of *Glomus* sp. and maize grown under different levels of fertilizer treatment

N. Gupta* and S. Routaray

Microbiology Laboratory, Division of Biotechnology, Regional Plant Resource Centre, BHUBANESWAR (ORISSA) INDIA

ABSTRACT

The effect of different N , P and K fertilizer on the maize grown under glass house in inoculated and uninoculated condition was analyzed for growth and colonization pattern of arbuscular mycorrhizal fungi (Glomus sp.) . At the final stage of growth mycorrhizal inoculation showed better growth as compared to fertilizer treatment. Enhancement in root growth could be observed in AM inoculation and phosphorus and Nitrogen supplementation. The fertilizer application in combination of phosphorus and potassium exhibited better dry biomass yield in inoculated plants. The fertilizer treatment reduced the AM colonization in maize roots. Similarly data on the number of vesicles in roots and spore number in soil showed poor performance with fertilizer treatment. Data analysed statistically and presented in this paper.

Key words : Mycorrhiza, Maize, Fertilizer, Glomus, Tea

INTRODUCTION

Among the biological processes involved in the rhizoplane, the unique role of symbiotic bacteria and the mycorrhizal fungi which ensure fixation and mobilization, and availability of nitrogen and phosphorus of plants have been well recognized (Freitas *et.al*., 2004; Singh *et al*., 2004). AM fungi are cosmopolitan in distribution and found in association with plants in agricultural fields, aquatic environments, forests, along sea coasts, sand dunes and captive plantations (Trappe and Fogel , 1977 Cornquist , 1981; Trappe , 1989 ; Rahangdale and Gupta , 1999, 2001; Ranjan *et al*., 2000 ; Mosse , 1973, Hall, 1984, Miller *et al*., 1986, Kabir and Koide, 2000, Vosatka *et al*.,1999; Jentscheke *et al*., 1999; Beena *et al*., 2000) . Arbuscular mycorrhizal fungi are of immense value for being a transporter and carrier of various minerals like P , Zn, Mn, Mg , Cu, and Al etc. from soil to the host plants to enhance growth and productivity in plants (Maiti and Variar , 2000; Ammani *et al.* 1985; Secilia and Bagyaraj , 1994).

A plethora of research findings on many agricultural, horticultural and ornamental crop plants recommended mycorrhizal inoculation for improved growth and yield as well as for effective utilization of the soil phosphates (Gautum and Mahmood , 2002; Rani and Bhaduria, 2001; Mulani *et al*.,2002 ; Nelson and Achar, 2001).. The latter aspects of the AM inoculation will effect saving in amounts of the usable phosphate fertilizer. Therefore, mass inoculation of crops with AM fungi requires a suitable technology (Bagyaraj ,1989; Sreenivas and Bagyaraj ,1988) Present work has been done on arbuscular mycorrhizal fungi occurring in the tea gardens. The present study attains more importance due to the study sites that Bhuyanpirh tea plantations of Orissa, India that never surveyed before has been taken into consideration.

MATERIALS AND METHODS

Source of AM fungi

The AM fungi used in this study was isolated from from the tea (*Camelia sinensis* L.) plantations of the Bhuyanpirh tea estate of M/S Orissa Tea Plantation Limited situated in Tarmakanta about 48 Km away from Keonjhar city of Orissa, India. The pure culture of AM fungi that was identified as *Glomus* sp., was maintained and multiplied in pot culture with maize as host plants.

Experimental set up

Maize Seedlings were raised in the earthen pots having 5-Kg capacity containing soil sand mixture (1:1) as growing media irrigated with fresh water and cultivated under glass house conditions at 32 ±2 ºC and 80 ± 5 % relative humidity. Total of 40 uniform and 15 days old seedlings of maize were distributed in to four treatments groups i. e. 10 seedlings of each group were sub irrigated according to following experimental protocol.

- Experimental group I: only soil (Black cotton soil +sand + compost , 2:1:1) + maize plants + daily watering
- Experimental group II: soil inoculated with AM fungi + maize plants +daily watering
- Experimental group III. soil inoculated with AM fungi + 15 day-old- maize seedlings treated with following sub treatments for 60 days of growth period. Six subgroups were taken into consideration under this experimental set. In three subgroups, urea (for N_2), muriate of potash (for Potassium), single super phosphate (for phosphorus) were given individually in separate pots at the rate of 5g, 3g and 1g respectively. In the fourth and fifth subgroups, phosphorus was added along with the urea or potash at the same rate. Uninoculated control was set along with above-mentioned treatments of fertilizer.

In this experiment the maize plants were uprooted and measured for the growth parameters at an interval of 30 days up to 75 days of growth period. Final observations were taken on fresh and dry biomass, plant height (shoot and root length), leaf number, and mycorrhization in terms of % colonization, spore count and vesicle number in the treated and the untreated control plants .

Analysis of growth parameters and AM colonization

Simple biological norms were taken into consideration for the determination of growth parameters including shoot height, root length, leaf no., leaf area, wet and dry biomass of shoot, root, and leaf, shoot: root ratio. AM infection and colonization in the roots of maize grown under different treatments were analyzed following the root clearing & staining technique, and slide method (Phillips and Hayman, 1970; Kormanic and McGraw, 1982). Total number of vesicles / cm root was also calculated during this experiment. Rhizosphere soil of maize grown under different treatments was treated for the AM spore isolation and total number of spore present in 100/g of soil were counted simply with the help of stereo zoom microscope (Gerdemann and Nicolson,1963).

The response of host plants towards its mycorrhization by the indigenous fungi was evaluated by measuring the growth parameter such as fresh and dry biomass , plant height, leaf number and mycorrhization in terms of % colonization, spore count and vesicle number. Data obtained at the final stage of 75 days of growth have presented in this paper .

RESULTS AND DISCUSSION

The maximum length of stem (71.87cm) was noted in the plants inoculated without fertilizer treatment after 60 days of sowing (Table 1). In all the inoculated plants, shoot length, root length, fresh and dry biomass and leaf number increased as compared to the uninoculated plants (C1). Fertilizer supplementation alone and /or in

***Author for correspondence**