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RESPONSE OF PEARL MILLET (*PENNISETUM AMERICANUM*) TO INOCULATION WITH VESICULAR-ARBUSCULAR MYCORRHIZAE AND *AZOSPIRILLUM BRASILENSE* WITH DIFFERENT SOURCES OF PHOSPHORUS

K. V. B. R. TILAK and C. S. SINGH
Division of Microbiology, Indian Agricultural Research Institute, New Delhi 110 012, India.

It has frequently been shown that vesicular-arbuscular mycorrhizal (VAM) plants are much more efficient than non-mycorrhizal plants in utilizing insoluble phosphate fertilizers applied to soil[1–3]. An attempt has been made in the present study to assess the effects of combined inoculation of pearl millet with VAM fungi and *A. brasilense* with single super phosphate and rockphosphate.

A pot culture experiment was conducted using unsterilized farm soil of sandy–loam type from the fields of this Institute, which was highly deficient of phosphorus content (5 ppm by Olsen's method)[4]. Ten kg of finely processed soil was taken in 30 cm dia pots. Phosphorus was added in the form of rockphosphate and single super phosphate at the rate of 50 kg P_2O_5/ha.

The top soil in pots up to a depth of 2–3 cm from 10 kg soil was mixed with 200 ml of soil containing finely chopped heavily infected root segments of the following endophytes, previously raised on cowpea separately as standard host: *Acaulospora* sp., *Gigaspora margarita* and *Glomus fasciculatum*.

The seeds of pearl millet var. BJ 104 were treated with a carrier-based (soil + farm yard manure in equal proportions) inoculant containing highly efficient strains (P–1 and P–2) of *A. brasilense*. The control treatment received neither VAM inoculum nor the seed inoculation with *A. brasilense*.

The treatments were replicated 6 times and the experiment was laid out in a randomized design.

The data on dry matter yield were recorded at 120 days of plant growth. The total phosphorus content in plants was estimated by the vanado-molybdate method after digestion with *tri-acid mixture*[4]. Percentage mycorrhizal infection in roots was determined by the slide technique on the 120th day of the plant growth after clearing the roots in 10% KOH and staining with trypon-blue lactophenon[5]. The percentage root colonization was calculated as follows: (number of VAM positive segments/total number of root segments scored) × 100.

Soil inoculation with VAM fungi in general,

Table 1 *Response of pearlmillet to inoculation with Azospirillum brasilense and different VA-mycorrhizal fungi with varying sources of phosphorus fertilization (mean of 6 pots—each pot containing 4 plants)*

	Control (0 kg P_2O_5/ha)			Single super phosphate (50 kg P_2O_5/ha)			Rock phosphate (50 kg P_2O_5/ha)		
Treatment	1	2	3	1	2	3	1	2	3
Uninoculated control	20	13.3	13.7	42	17.5	20.8	35	15.8	19.5
A. brasilense	35	14.4	20.1	45	20.5	28.2	48	18.0	26.2
Acaulospora sp.	55	15.5	22.5	68	17.6	20.5	65	15.8	24.2
G. margarita	65	16.5	26.0	68	18.5	25.7	62	16.5	22.2
G. fasciculatum	75	18.8	30.0	82	20.5	32.7	75	18.7	26.5
A. brasilense + *Acaulospora* sp.	62	17.4	25.5	75	19.2	23.5	70	18.5	22.5
A. brasilense + *G. margarita*	78	19.8	31.5	80	22.5	29.7	80	20.7	26.5
A. brasilense + *G. fasciculatum*	87	20.6	32.7	92	25.6	32.9	85	22.5	30.8

$P = 0.05\% - 1 : 10.57;\ 2 : 3.91;\ 3 : 7.41.$

1. Root colonization by VAM fungi (%); 2. Dry matter yield (g/pot); 3. Total phosphorus uptake by plant (mg/plant).

resulted in higher root infection than that of uninoculated control and seed inoculation with *A. brasilense* (table 1). Considerable variation existed among the three different VAM fungi and their combination with *A. brasilense* as far as the VAM colonization was concerned. Soil inoculation with *G. fasciculatum*, in general, resulted in maximum root infection.

One application of superphosphate or rock phosphate to soil at the rate of 50 kg P_2O_5/ha resulted in higher dry matter content and total phosphorus uptake in plants than that of the control (no P application). The preformance of plant, in general, was better with single super phosphate than that of rock phosphate (table 1). Soil inoculation with different VAM fungi in the presence of either single superphosphate or rock phosphate produced more dry matter production and greater phosphorus uptake than their corresponding controls. Dual inoculation with both the endosymbionts namely, *A. brasilense* and VAM fungi in the presence of superphosphate or rock phosphate also resulted generally in increased dry matter production and total P uptake in plants. Among the three VAM fungi tested, *G. fasciculatum* either singly or in combination with *A. brasilense* resulted in a better performance than that of the other mycorrhizae (table 1).

Azospirillum inoculation has been shown to increase the root biomass[6] and therefore, the significant increase in dry matter production and phosphorus uptake in plants inoculated with *A. brasilense* and different VAM fungi when tested singly or in combination with super phosphate or rock phosphate could be attributed to an increased phosphate transport by mycorrhizae aided by an increased root biomass.

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A NEW AND CHEAPER TECHNIQUE FOR RAPID MULTIPLICATION OF *ARTHROBOTRYS CONOIDES* AND ITS POTENTIAL AS A BOI-NEMATICIDE IN MUSHROOM CULTURE

P. S. GREWAL and H. S. SOHI
National Centre for Mushroom Research & Training, Chambaghat, Solan 173 213, India.

BIOLOGICAL control of pests seems to be a suitable alternative to avoid the hazards associated with pesticide use in mushroom culture. However, lack of simple and cost-effective techniques for mass production of the bio-control agents and their establishment in the new environment are the two major problems hindering their commercial use. In order to achieve these objectives, an effort was made to isolate the nematophagous fungi naturally occurring in synthetic compost during cropping. Two species of *Arthrobotrys* viz *A. conoides* and *A. oligospora* were isolated and studied for bio-management of *Aphelenchoides composticola* infesting *Agaricus bisporus*.

In the present study a simple technique for quick multiplication of *A. conoides* was developed. Both the species were isolated on malt extract agar (MEA) medium which supported good mycelial growth along with profuse sporulation. The technique used in the present study involved the use of wheat grain. The grains were soaked in water for 20 min followed by 10–15 min boiling. After draining excess water, these were dried overnight. Chalk ($CaCO_3$) and gypsum ($CaSO_4$) were mixed thoroughly with the grain at 2 and 6%. The mixture was filled in milk or glucose bottles and sterilized at 15 pounds pressure for one hour. The bottles were inoculated with culture bits under aseptic conditions. These were then incubated at 25 ± 1°C. The substrate was covered completely within 12 days. Profuse sporulation was noticed subsequently as pinkish coloration.

Since a number of pesticides are used in mushroom cultivation to control various pests and diseases, the effect of commonly used ones on the mycelial growth of both the *Arthrobotrys* species was studied using food poison technique. In general, *A. conoides* was less sensitive to different pesticides as compared to *A. oligospora*. The mycelial growth was inhibited by bavistin in both the species at