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Influence of Microbial Inoculants on Yield and Disease Incidence in Yard long bean (*Vigna unguiculata* L.)

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ABSTRACT

A farmer participatory research was carried out during the summer season of 2017-18 at farmers' field of Kollam district, Kerala to study the effect of microbial inoculants *viz.,* arbuscular mycorrhizal fungi and pink pigmented facultative methylotrophs on the pod yield and disease incidence of yard long bean. The experiment was laid out in randomized block design at the farmers' fields at 7 different locations. This experiment consisted of three treatments; T_1 – farmer's practice (without any microbial inoculants), T_{2-} Use of Arbuscular mycorrhizhal fungi (AMF) (@ 9 g/ pit as basal application, T_3 - Use of Pink pigmented facultative methylotrophs (PPFM) @1 % foliar spray thrice at 30 days interval. Significantly higher pod yields were obtained with the use of AMF @ 9g/ pit as basal application (14.51 t/ha) compared to PPFM foliar spray @ 1% (12.53 t/ ha) and Farmer's practice (10.27 t /ha) . Lowest incidence of diseases was also observed with the use of AMF which was significantly superior to both the other treatments. The same treatment also registered the highest net returns and benefit: cost ratio. Based on the results of the study, inoculation with AMF @ 9g/ pit as basal could be recommended for Yard long bean for wide spread adoption in Kollam district during summer season.

Key Words: Yard long bean, microbial inoculant, AMF, PPFM, pod yield, disease incidence.

INTRODUCTION

Yard Long Bean (*Vigna unguiculata* var. *sesquipedalis* (L.) Verdcourt), a member of Fabaceae family is a popular vegetable among consumers because of its varied nutritional benefits. The crop is a big hit among farmers as well, owing to its adaptability across seasons, demand all year round, as well as stable and reasonable price.The tender, long, green, and succulent pod which is highly nutritive contains crude protein (28%), iron (2.5mg/ 100 g), calcium (80 mg /100 g), phosphorus (74 mg/ 100 g), vitamin A (941 IU/ 100 g), vitamin C (13 mg/ 100 g), and dietary fibre (2 g/ 100 g), that make it an excellent vegetable (Singh *et al*, 2001). The crop also enriches soil by fixing atmospheric nitrogen.

Microbial inoculants are beneficial micro organisms which improve plant nutrition and promote plant growth by stimulating production of plant hormones (Sullivan, 2001) and improve the tolerance of plants to several diseases and other stress. Use of microbial inoculants for sustainable crop production is gaining popularity among farmers globally. Commonly used microbial inoculants include *Azospirillum*, *Rhizobium*, *Azotobacter*, plant growth promoting rhizobacteria, AMF, PPFM, *Pseudomonas*, *Trichoderma*, *Verticillium*, *Metarrhizium* etc. Among these microbial inoculants,AMF (Arbuscular mycorrhizal fungi) and PPFM (Pink pigmented facultative methylotrophs) are two promising microbial inoculants especially beneficial for use during summer season.

Krishi Vigyan Kendra, Kollam, functioning under Kerala Agricultural University is the sole production centre of AMF in Kollam district and the Kendra has produced 2.5 t of AMF during the financial year 2018-19. In recent years, the Department of Agricultural Development and

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Farmers Welfare, Government of Kerala has conducted demonstrations on the use of PPFM (Pink pigmented facultative methylotrophs) against moisture stress in Kerala. The Kendra has also conducted an on farm testing programme to evaluate the effect of PPFM and AMF under organic package in rice and identified it a promising technology. So far no research work has been done in Kollam district to compare the effect of these microbial inoculants in vegetable cowpea. Hence the KVK undertook a farmer participatory - on farm testing programme to evaluate the effect of the microbial inoculants AMF and PPFM to enhance crop production and to protect the crop from biotic and abiotic stress.

MATERIALS AND METHODS

This on farm testing programme was conducted during the summer season of 2017-18 at the farmers' fields of Kottarakkara and Sasthamkotta blocks of Kollam district. The programme was implemented with the active participation of farmers from cultivation practices right from sowing to harvest. The experiment was laid out in randomized block design and the farmers' fields of 7 different locations were taken as replications.

The plots selected under this study experiences tropical humid monsoon type climate and come under the Agro Ecological Units (AEUs) 9 and 3. AEU 9 holds a probability of moderate drought once in ten years and in AEU 3 a probability of moderate drought exists twice in ten years. In general, the selected plots had low to medium organic carbon, high available P, and low to medium available K. The plot size was 100 m^2. The variety selected was Vellayani Jyothika having long and light green pods and a potential yield of 19.33t/ ha. This trial consisted of three treatments; T_1 - Farmers's practice (Without any microbial inoculants), T_2 - Use of AMF(@ 9 g /pit as basal application, T_3- Use of PPFM @1 % foliar spray thrice at 30 days interval. AMF used in the trial was obtained from the Kendra and PPFM was purchased from the Department of Agricultural Microbiology, College of Agriculture and Research Station, TNAU, Madurai. All the agronomic and plant protection measures as per the package of practices of KAU were followed. Observations on pod yield (t/ ha), pod length (cm), pod weight (g) and disease incidence (%) *i.e., Fusarium* wilt were recorded. There was direct involvement of farmers at all stages of the experiment right from the conduct of field experiments, recording of observations, evaluation of data and arriving at conclusions. The data were analyzed using standard statistical procedures (Panse and Sukhatme,1985). Economical analysis (net income and benefit cost ratio) of the technologies was also performed.

RESULTS AND DISCUSSION

The effect of microbial inoculants was significant in improving pod yield and pod weight as well as lowering of disease incidence while its effect on pod length was not significant.

Yield and disease incidence

The results revealed that the use of microbial inoculants had a significant influence in determining the yield of yard long bean. Inoculation with AMF @9g /pit resulted in an yield of 14.51 t /ha which was significantly higher than PPFM foliar spray(T_2) and farmers practice (T_1). The yield increase with use of AMF was 15% higher over PPFM spray (12.53 t/ ha^-. Farmer's practice recorded the lowest pod yield of 10.27 t /ha which was significantly lower to all other treatments.

Soil application of AMF @ 9g/pit recorded the highest pod weight (21.96g) which was statistically on par with foliar spray of PPFM @1% (21.61 g) and was significantly higher compared to farmers practice (20.93 g).Treatment T_1 (Farmers practice) registered the maximum incidence of Fusarium wilt (22.86%) and was comparable with T_3 (PPFM as 1 % foliar spray). Significantly lower incidence of Fusarium wilt (6.29%) was noticed in plants which were inoculated with AMF, compared to both the above treatments.

The increased pod yield could be related to the increased pod weight and lower incidence of disease. AMF increased the solubility of nutrients viz., P, K, Mg as well as micro nutrients (Jiang *et al*, 2013; Liu *et al*, 2002) in soils there by facilitating increased uptake of nutrients (Rouphael *et al*, 2010; Ali *et al*, 2018). The growth of roots were also improved (Wu *et al,* 2011) through the stimulation of auxin production in mycorrhized roots (Ruzzi and Aroca, 2015; Colla *et al*, 2015) which in turn improved the growth parameters resulting in increased pod weight and pod yield of yard long bean.

Inoculation of AMF reduced the incidence of Fusarium wilt also. This might be due to the proliferation of beneficial organisms in the rhizosphere which increases the plant tolerance to phytopathogens. Smith and Read (2008) reported that AMF inoculation reduced the disease incidence and contributed to better plant stand. In the present experiment also increased tolerance of disease by inoculation of AMF might have helped the plant to tolerate the disease which in turn increased plant stand that eventually increased the pod yield. Use of PPFM 1% as foliar spray also enhanced the pod weight and yield which might be due to the release of growth promoting substances like IAA and GA by methylotrophs (Madhaiyan *et al,* 2005).

Economics of cultivation

Among the three different treatments, highest net return (Rs.1,46,170/-) and Benefit: Cost ratio (1.51) were observed for the treatment T_2 (inoculation of AMF). This was followed by treatment T_3 (foliar application of PPFM) with a net return of 87,270/- and Benefit: Cost ratio of 1.31. Farmer's practice recorded the lowest net income (Rs.25,130/-) and Benefit: Cost ratio (1.09).

CONCLUSION

From the results of the present experiment it could be concluded that inoculation of AMF@9g/ pit in yard long bean at the time of sowing could increase the pod weight and disease tolerance which eventually resulted in higher pod yield, net income and benefit : cost ratio. Hence, this management practice could be recommended for wide spread adoption in Kollam district during summer season.

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Table 1. Effect of microbial inoculants on the yield and disease incidence of yard long bean .

Treatment	Pod yield (t/ ha)	Pod length (cm)	Pod weight (g)	Disease incidence (%)
T_1	10.27	51.04	20.93	22.86
T_2	14.51	51.63	21.96	6.29
T_3	12.53	51.83	21.61	14.86
CV	5.890	1.454	1.778	22.64
CD(0.05)	0.863	NS	0.445	5.740
SEm $\pm$ ($P \leq 0.05$)	0.277	0.283	0.144	1.842

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