Research Paper

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Influence of bioinoculants on growth parameters of *Jatropha curcas* (L.)

Agriculture

KEYWORDS : Jatropha, *Azospirillum*, Phosphobacteria, AM fungi, *Trichoderma*, FYM

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ABSTRACT

A field experiment was conducted at Kodaikanal road village, Dindigul district, Tamil Nadu, India during 2007 – 2010 to study the influence of bioinoculants on growth parameters of Jatropha. The experiment was laid out in Randomized Block Design (RBD) with fifteen treatments and three replications. The treatment T_{15} (Azospirillum + Phosphobacteria +AM fungi +Trichoderma + FYM + 75% N + 75% P +100% K) recorded higher plant height (175 cm), collar diameter (11.22 cm), number of branches per plant (37) and number of leaves per plant (990) over the rest of the treatment combinations.

Introduction

The alarming depletion of petroleum reserves fascinated the use of biofuels as an alternative to diesel fuel. Among the biodiesel producing crops, *Jatropha* has gained momentum because of hardy nature, ease in establishment, quick growth, efficiency to grow on degraded lands and ability to withstand wide climatic conditions. Despite its focus as an important economic biofuel crop, little is known about the nutritional requirement of Jatropha. Due to escalating cost and high demand of chemical fertilizers, there is a strong need to adopt organic manures and biofertilizers combined with inorganic fertilizers. Biofertilizers are ecofriendly, environmentally safe, less expensive and therefore it plays a significant role in improving plant nutrient supply in complementary and supplementary ways. The beneficial microorganisms are added to soil to fix atmospheric nitrogen in the root zone and also increase the availability of native or applied phosphorus, solubilize and mobilize the inorganic forms of minerals. This study was conducted to determine the contribution of bioinoculants in combination with organic and inorganic fertilizers on the growth parameters of Jatropha.

Materials and Methods

The experiments were conducted in a farmer's field at Kodaikanal road village, Dindigul district, Tamil Nadu, India during 2007 to 2010. *Jatropha curcas* variety TNMC 6 was used for the study. Two month old seedlings were planted in the ploughed field (pit size 30 cm × 30 cm × 30 cm) in a randomized block design with 15 treatments and three replications. The field trial was raised with the following treatments. T_1 – Control, T_2 – Farm Yard Manure (FYM), T_3 - 100% NPK + FYM, T_4 - *Azospirillum* + FYM + 75% N + 100% P + 100 % K, T_5 – Arbuscular mycorrhizal fungi + FYM + 100% N + 75% P + 100% K, T_6 - Phosphobacteria + FYM + 100% N + 75% P + 100% K, T_7 - *Azospirillum* + Phosphobacteria + FYM + 75% N + 75% P + 100% K, T_8 - *Azospirillum* + Phosphobacteria + Arbuscular mycorrhizal fungi + FYM + 75% N + 75% P + 100% K, T_9 - *Azospirillum* + Phosphobacteria + *Trichoderma* + FYM + 75% N + 75% P + 100% K, T_{10} - *Azospirillum*+ Arbuscular mycorrhizal fungi + FYM + 75% N + 75% P + 100% K, T_{11} - *Azospirillum* + Arbuscular mycorrhizal fungi + *Trichoderma* + FYM + 75% N + 75% P + 100% K, T_{12} – Phosphobacteria + Arbuscular mycorrhizal fungi + FYM + 100% N + 75% P + 100% K, T_{13} – Phosphobacteria + Arbuscular mycorrhizal fungi + *Trichoderma* + FYM + 100% N + 75% P + 100% K, T_{14} - *Azospirillum* + Phosphobacteria + Arbuscular mycorrhizal fungi + *Trichoderma* + FYM and T_{15} - *Azospirillum* + Phosphobacteria + Arbuscular mycorrhizal fungi +*Trichoderma* + FYM + 75% N + 75% P + 100% K.

The recommended dose of fertilizer for one hectare of Jatropha was 46: 48: 24 kg of NPK (Patil *et al*., 2003). Half the dose of nitrogen (23 kg N ha^{-1}) and potassium (12 kg P ha^{-1}) and full dose of phosphorous (48 kg K ha^{-1}) and farm yard manure (12.5 t ha^{-1}) were applied during January 2009, *i.e*., 735 DAT as per the treatments around the basin at 30 cm distance from the trunk. One week later, the microbial inoculum of *Azospirillum,* phosphate solubilizing bacteria, Arbuscular Mycorrhizal fungi and *Trichoderma* were applied as per the treatments. The remaining half of the dose of nitrogen and potassium were applied during April 2009 (821 DAT) as per the treatment schedule.

Biometrical observations from five randomly selected plants were recorded in three replications at the end of final fruiting for plant height, collar diameter, number of branches per plant and number of leaves per plant. All the data collected from three replications were analyzed according to least significant difference (LSD) test to find out statistically significant differences among the treatments following the Agres package version 3.01 data entry module.

Results and Discussion

The growth parameters differed significantly due to treatments (Table.1). The plant height showed gradual increase and it was found significant among the fifteen treatments studied. The treatment T_{15} recorded the maximum plant height (175 cm). This might be due to optimum supply of nutrients from organic, inorganic sources and bioinoculants, that helped in better uptake of nutrients, more synthesis of nucleic and amino acids, amide substances in growing region and meristematic tissues ultimately enhanced cell division and thereby increased the growth of plants. This was in conformity with the findings of Saxena *et al.* (2001) in soybean, Nanjundappa *et al.,* 2000, in maize and Shanmugam and Veeraputhran, 2000 in rice. Absolute control (T_1) recorded the least plant height of 152 cm. The shorter plants found in the control might have resulted due to insufficient quantity of nutrients when compared to bioinoculant, organic and inorganic fertilizers applied plants.

Collar diameter was significantly influenced by different treatments and showed an increasing trend over the period of plant growth. The treatment T_{15} recorded the highest collar diameter (11.22 cm), followed by T_8 (11.18 cm). The application of nutrients showed positive effect on collar diameter and this positive response might be due to the prolongation of cambial activity. The results were supported by Subrahmanyam (1988) increase in trunk diameter of Eucalyptus. The lowest collar diameter (10.82 cm) was recorded by T_1.

The treatment T_{15} favoured the production of more number of branches per plant (37). This might be due to increased availability of nutrients from farm yard manure, production of growth promoting substances from bioinoculant application and better availability of nutrients from inorganic source to the plant resulted in production of more number of branches per plant. Minimum number of branches per plant was observed in control T_1 (16).

The treatment T_{15} produced more number of leaves (990). The results revealed that a consortium of a nitrogen fixer, phosphate solubilizer, phosphate mobilizer might have produced growth promoting and antibiotic substances and there by increased

the number of leaves per plant. While in control it was only 825 leaves.

From this study it is concluded that in Jatropha with the application of *Azospirillum* + Phosphobacteria +AM fungi +*Trichoderma* + FYM + 75% N + 75% P +100% K (T_{15}) recorded higher plant height, collar diameter, number of branches per plant and number of leaves per plant.

Table : 1. Influence of bioinoculants on growth parameters of Jatropha

Treatments	Plant height (cm)	Collar diameter (cm)	Number of branches / plant	Number of leaves / plant
T_1	152	10.82	16	825
T_2	157	10.90	20	855
T_3	165	11.00	29	920
T_4	167	11.02	32	935
T_5	166	11.05	30	935
T_6	166	11.03	30	925
T_7	169	11.09	33	955
T_8	174	11.18	36	985
T_9	173	11.14	34	975
T_{10}	170	11.09	32	955
T_{11}	173	11.15	35	980
T_{12}	171	11.08	31	950
T_{13}	172	11.16	34	970
T_{14}	160	10.94	23	860
T_{15}	175	11.22	37	990
SEd	6.58	0.10	2.77	48.30
CD (0.05)	13.49	0.21	5.68	98.95

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