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Effect of Biofertilizers on Seed Yield and Quality Parameters in Jatropha (*Jatropha Curcas* L.)

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

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ABSTRACT *A field experiment was conducted at Kodaikanalroad village, Dindigul district, Tamil Nadu, India during 2007 – 2010 to study the effect of bioinoculants on seed yield and quality of Jatropha. The experiment was laid out in Randomized Block Design with fifteen treatments and three replications. The treatment T15 (Azospirillum + Phosphobacteria +AM fungi +Trichoderma + FYM + 75% N + 75% P +100% K) recorded higher seed yield (4376 kg ha^{-1}), oil content (35.50 per cent), oil yield (947 kg ha^{-1}) and biodiesel yield (813 lit. ha^{-1}) over the rest of the treatment combinations.*

Introduction

Biofertilizers are new generation cost effective and renewable sources of plant nutrients to supplement chemical fertilizers. The role of biofertilizers in agricultural production assumes greater importance, particularly in the present context of very high cost of chemical fertilizers. Though biofertilizers cannot totally replace the conventional chemical fertilizers, upto 20-25 per cent of nitrogen requirement can be met through biofertilizers. This situation coupled with cost advantage provides vast scope for promotion of alternative source of nitrogen particularly biofertilizer to different crops. In this context, the present study was undertaken to assess the influence of biofertilizers like Azospirillium, Phosphobacteria, Arbuscular mychorrhizal fungi and Trichoderma along with organic and inorganic fertilizers in Jatropha. The objective of the present study was to increase the seed yield and improve the seed quality of Jatropha by use of organic, inorganic fertilizers with biofertilizers.

Materials and Methods

The experiments were conducted in a farmer's field at Kodaikanalroad 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 fifteen treatments and three replications. The field trial was raised with the following treatments.

T_1 - Control

T_2 - FYM

T_3 - 100% NPK + FYM

T_4 - Azospirillum + FYM + 75% N + 100% P + 100% K

T_5 - AM 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 + AM fungi + + FYM + 75% N + 75% P + 100% K

T_9 - Azospirillum + Phosphobacteria + Trichoderma + FYM + 75% N + 75% P + 100% K

T_{10} - Azospirillum+ AM fungi + FYM + 75% N + 75% P + 100% K

T_{11} - Azospirillum +AM fungi +Trichoderma + FYM + 75% N + 75% P + 100% K

T_{12} - Phosphobacteria+ AM fungi + FYM + 100% N + 75% P + 100% K

T_{13} - Phosphobacteria++AM fungi +Trichoderma + FYM + 100% N + 75% P + 100% K

T_{14} - Azospirillum + Phosphobacteria+ +AM fungi + Trichoderma + FYM

T_{15} - Azospirillum + Phosphobacteria +AM 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.

The total seed yields of six harvests were expressed in kg ha^{-1}. The seeds were dried at 70°C for one hour and the oil content was determined by Soxhlet extraction using petroleum ether as a solvent as per the standard AOAC (Association Of Agricultural Chemists) procedure (Horowitz, 1984). The oil content was calculated from the weight of oil and weight of seed and reported as percentage. Oil yield was worked out by multiplying oil content with seed yield and expressed in kg ha^{-1}. Biodiesel yield (lit. ha^{-1}) was calculated by following formula (Biswas et al., 2006).

$$\text{Biodiesel yield} = \frac{\text{Seed yield (kg ha}^{-1})}{3.28}$$

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.

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Table : 1. Effect of biofertilizers on seed yield and quality parameters of Jatropha

Treat-ments	Seed yield (kg ha^{-1})	Oil content (per cent)	Oil yield (kg ha^{-1})	Biodiesel yield (kg ha^{-1})
T_1	3033	31.50	543	526
T_2	3145	32.00	573	546
T_3	3352	32.05	630	599
T_4	3500	32.30	687	648
T_5	3540	32.50	675	633
T_6	3505	32.50	673	631
T_7	3879	32.55	745	698
T_8	4228	34.50	877	775
T_9	4076	32.70	794	740
T_{10}	4009	32.55	785	736
T_{11}	4096	33.40	821	749
T_{12}	3805	32.70	758	706
T_{13}	4102	33.55	823	747
T_{14}	3280	32.25	617	584
T_{15}	4376	35.50	947	813
SEd	22.75	0.51	17.63	14.11
CD (0.05)	46.60	1.04	36.10	28.91

Results and discussion

The seed yield and quality parameters differed significantly due to treatments (Table.1). The total seed yield ranged from 3033 to 4376 kg ha^{-1}, the highest being in treatment T_{15} (4376 kg ha^{-1}), the increased seed yield of 44 per cent greater than control (T_1). The application of organic, inorganic fertilizers with bioinoculants produced higher seed yield compared to other treatments. The control recorded the lowest seed yield of 3033 kg ha^{-1}.

The per cent oil content of seeds was influenced significantly by different treatments ranging from 31.50 to 35.50. The treatment T_{15} recorded higher oil content of 35.50 per cent followed by T_8 (34.50 per cent). The bioinoculants, organic and inorganic sources of nutrients application did not exert any significant influence on oil content. Similar findings were reported by several earlier researchers (Raghavaiah, 1999; Khadke and Riazuddin Ahmed, 2000). In oil seeds, the synthesis of oil in the seeds is a function of genetic makeup of a genotype and is not much altered by management practices. The control (T_1) recorded the lowest oil content of 31.50 per cent.

Oil yield (product of seed yield and oil content) was significantly influenced by various treatments. The treatment T_{15} was found to be superior to all other treatments by producing 947 kg oil ha^{-1} which was followed by T_8 (877 kg oil ha^{-1}). This might be due to higher seed yield and increased oil content, while the control (T_1) recorded the lowest oil yield of 543 kg oil ha^{-1}.

Biodiesel yield varied from 526 to 813 lit. ha^{-1}. The treatment T_{15} (813 lit. ha^{-1}) which was followed by T_8 (775 lit. ha^{-1}) was found to be yielding more biodiesel than other treatments. This might be due to increased seed yield. These results were in conformity with the findings of Biswas et al. (2006) in Jatropha. The control (T_1) produced the lowest biodiesel yield of 526 lit. ha^{-1}.

From this study it was concluded that in Jatropha with the application of Azospirillum + Phosphobacteria +AM fungi +Trichoderma + FYM + 75% N + 75% P +100% K (T_{15}) recorded higher seed yield, oil content, oil yield and biodiesel yield in Jatropha.

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