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RESEARCH PAPER

Effect of Biofertilizers on Growth and Vigour of Oil Palm Seedlings

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ABSTRACT

A experiment was carried out to study the influence of different types of biofertilizers on growth and vigour of oil palm seedlings. There were significant differences among the treatments for all the growth characters studied. Among the treatments, 25 per cent of recommended dose of fertilizers + mixture of biofertilizers consisting of (*Azotobacter + Azospirillum + Bacillus + Glomus + Frateuria*) was the most promising treatment in enhancing seedling height, leaf and root production, leaf area, stem girth and dry matter and could be recommended for commercial oil palm nurseries.

Key words : Biofertilizers, fertilizers, seedlings, growth, oil palm

INTRODUCTION

Oil palm (*Elaeis guineencies* Jacq.) is the highest oil yielding crop in the world and is grown to an extent of 1.45 lakh ha in India. It is mainly propagated by seedlings which are grown in the nursery for a period of 12-14 months. It is a heavy feeder and requires huge amount of chemical fertilizers which are costly. Hence arises a need for looking for alternate source of nutrients which are cost effective. Biofertilizers are the formulation of living microorganisms which are capable of fixing atmospheric nitrogen convert insoluble form to available form and mobilize other nutritive elements through biological processes. Results showed that *Azospirillum* inoculation contributed up to 40% of the total nitrogen requirement of the oil palm plantlets, stimulated top and root growth by 30% and 60%, respectively and increased the host photosynthetic rates compared to that of control (Amir *et al.*, 2001). Of late, usage of biofertilizers during nursery stage has been picking up in many plantation crops. There is an urgent need for generation of scientific information on exploitation of biofertilizers in oil palm nursery. Hence, the present experiment was undertaken to study the effect of biofertilizers on growth and vigour of oil palm seedlings.

MATERIALS AND METHODS

The experiment was conducted at Directorate of Oil Palm Research, Pedavegi, Andhra Pradesh. It was laid out in completely randomized block design (CRD) with eleven treatments replicated five times. The treatments were T1-*Azotobacter chroococcum*, T2-*Azospirillum brasilense*, T3-*Bacillus megaterium*, T4-*Glomus aggregatum*, T5-*Frateuria aurentia*, T6-Mixture of all the microbial cultures, T7-Recommended dose of fertilizers (RDF - 30gN, 38gP and 25gK), T8-75% RDF + Mixture of biofertilizers, T9-50% RDF + Mixture of biofertilizers, T10-25 % RDF + Mixture of biofertilizers and T11-control (without fertilizers and biofertilizers). Each biofertilizer was applied thrice during the nursery period i.e., @10 g at the time of seed sprouts planting, @40 g after 4 months and 40 g after 8 months. Tank silt and FYM mixed in 2:1 ratio by volume were used as a potting mixture. Uniform sized seed sprouts of oil palm tenera hybrid 1140 Dx1988 P were raised in double stage nursery by adopting the recommended package of practices. Observations on growth parameters viz. seedling height, number of leaves/seedling, 3rd leaf area, leaf rachis depth and width, stem girth, number of primary roots/seedling, primary root length, total root volume and total dry matter were recorded using standard methods. The data were analyzed statistically by following standard procedures (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Results of the study revealed that different treatments of biofertilizers and chemical fertilizers influenced significantly all the growth parameters (Table 1). Seedlings exhibited maximum height in T10 which was significantly higher than that of other treatments and the minimum height was in T11. Improved seedling height under T10 may be due to increased nutrient availability, better uptake of nutrients and photosynthesis. In addition, growth promoting hormones released by bioinoculants might have promoted the seedling height. Leaf production was highest in seedlings treated with T10 and T7 followed by T6, T4, T9, T5, T8 and T1while the lowest was obtained in T11. Maximum leaf area was recorded in treatments T10 and T9 whereas the minimum leaf area in T11. The treatment T10 recorded the maximum stem girth and closely followed by T8 and T7 and it was the minimum in T2 which was on par with T5 and T11. Enhanced stem growth in T10 may be attributed to better partitioning of photosynthates. Leaves with maximum rachis depth and width were observed with T10 and minimum with T11. The seedlings grown with T10 were found vigorous and this may be attributed to better seedling height, leaf production and stem size. The results between treatments T10 and T8 were on par with each other for rachis width. Similarly, rachis depth did not differ significantly among the treatments T10, T6, T8, T7, T5 and T2.

Seedlings with highest number of primary roots were noticed under treatment T10 and T9 and both were on par with rest of the treatments except T11 and T5.The treatment T11 recorded the lowest number of primary roots and was found on par with T5. Maximum primary root length was in T6 followed by T10 and T7 whereas the minimum root length was observed in T11 followed by T1. Maximum and minimum root volume was noticed in T10 and T11, respectively. There were no significant differences among the treatments T11, T2 and T4 for root volume. The total dry matter production was maximum in T10 while it was minimum in T11 which was on par with T2. Increased dry matter production in T10 might be due to better vegetative growth particularly more leaf and root production and large stem.

It is evident from the results that better growth was realized in combination of different types of microbial cultures as compared to individual application. Similarly, enhanced seedling growth was reported in tamarind (Parameshwari *et al.*, 2001), coffee (Swarupa, 1996), cashew (Kumar *et al.*, 1998), mango ((Sivakumar, 2001). The results also reveal that performance of seedling growth and vigour was better under combined application of chemical fertilizers and biofertilizers rather than individual application and this might be due to positive interaction between chemical fertilizers and biofertilizers (Sharma and Bhutani, 1998). It is a proven fact that micro organisms multiply at faster rate in combined application particularly at lower dose of chemical fertilizers. Similar results are reported in oil palm (Carvalho *et al.*, 1999), coconut (Reddy *et al.*, 2001) and ber (Aseri and Rao, 2005). In most of the cases, the growth of seedlings was significantly better under individual treatments of biofertilizers as compared to the control. The present results are in agreement with Shamala (2010) in oil palm seedlings. The beneficial effects of biofertilizers on plant growth are attributed to production of plant growth promoting substances such as gibberellins, cytokinins and auxins (Dobbelaere *et al.*, 1999), improvement of water and nutrient uptake, especially those of limited availability in soil such as P, N and micronutrients (Bashan *et al.,* 1990), production of antibiotic metabolites which are effective against soil borne pathogens (Kraus and Loper,1990) and production of B-group vitamins and amino acids that promote rooting capacity (Rodelas *et al.*, 1993). The above factors might have promoted the growth in seedlings treated with bioinoculants as compared to the control.

It can be inferred from the results that the treatment T10 (25 per cent RDF + Biofertilizers) gave better results for most of the key growth parameters i.e., seedling height, leaf production, stem girth and total dry matter and could decrease the fertilizer dose. Hence, the mixture of biofertilizers along with 25 per cent of recommended dose of fertilizers can be used for oil palm nursery.

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Table 1: Effect of biofertilizers on growth parameters in oil palm seedlings

Treatment	Seedling height (cm)	Leaves	Leaf area (sq.cm)	Stem girth (cm)	Rachis width (cm)	Rachis depth (cm)	Primary root length (cm)	Primary roots	Root volume (cu.cm)	Total dry matter (g)
T1	128.16	17.33	1992.59	28.00	1.93	3.03	63.50	30.00	460.00	378.95
T2	128.86	16.33	1589.28	24.90	1.86	3.23	67.10	29.66	390.00	284.35
T3	131.63	16.66	1654.35	27.46	2.06	3.16	73.23	29.00	470.00	323.10
T4	136.03	17.66	2028.04	28.36	1.96	3.03	76.63	28.66	393.33	356.35
T5	131.73	17.33	1633.93	25.33	1.93	3.23	70.50	24.66	400.00	346.54
T6	137.66	17.66	1917.01	29.26	2.03	3.50	86.63	28.66	473.33	394.73
T7	144.13	18.00	2710.64	30.20	1.96	3.30	81.10	28.33	546.66	430.30
T8	143.26	17.00	2443.11	30.60	2.10	3.46	77.60	29.66	496.66	474.40
T9	144.50	17.33	2983.14	29.36	2.03	3.06	75.46	31.00	496.66	460.76
T10	151.86	18.00	3094.65	32.26	2.26	3.53	83.06	31.00	593.33	497.43
T11	121.36	15.66	1493.02	25.40	1.73	2.60	57.76	24.33	370.00	253.69
CD (P-0.05)	5.83	1.21	200.84	2.22	0.18	0.28	8.79	3.62	50.02	49.37

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