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Effect of Liquid Biofertilizers on Growth and Yield of Direct Sown Rice

B Prasanth Naik, A Lalitha Kumari, P Venkata Subbaiah and M Martin Luther
Department of Soil Science and Agricultural Chemistry, Agricultural College, Bapatla, A. P.

ABSTRACT

A field experiment was conducted to study the response of direct sown rice to liquid biofertilizers and different levels of fertilizers at Agricultural College Farm, Bapatla during *kharif*, 2019-20. The experiment was laid out in randomized block design with eleven treatments replicated thrice. The results of the experiment indicated that higher drymatter, yield attributes and yield were recorded with the application of 100% RDF+ *Azospirillum*+ PSB+ KRB (T6) which was on par with T5 (100% RDF + *Azospirillum*+ KRB) and T4 (100% RDF + *Azospirillum*+ PSB). The treatments that received 75% RDF along with liquid biofertilizers were on par with 100% RDF along with liquid biofertilizers in direct sown rice.

Keywords: *Azospirillum, Direct sown rice, KRB, Liquid Biofertilizers and PSB.*

Rice (*Oryza sativa* L.) is one of the staple food crop that feeds around 60% of the world's population. Unlike conventionally transplanted rice, direct sown rice avoids puddling, transplanting and standing water at initial growth stages. At present, 26 and 28 per cent of rice is direct-seeded in south Asia and in India, respectively (Rao *et al.* 2007).

Liquid biofertilizer (LBF) formulation is the promising and updated technology. LBF facilitates a long survival of the organism by providing suitable medium which is sufficient for the entire crop cycle and they are believed to be the alternative for the conventional carrier based biofertilizers.

MATERIAL AND METHODS

A field experiment was conducted during *kharif*, 2019-2020 at Agricultural College Farm, Bapatla. The experiment was laid out in RBD with eleven treatments replicated thrice. The experimental soil was sandy clay loam in texture, slightly alkaline in nature (7.74). The soil was medium in organic carbon (0.50%), low in available nitrogen(261 kg ha^{-1}), medium in available phosphorus (46 kg ha^{-1}), high in available potassium (389 kg ha^{-1}) and sufficient in all available divalent cationic micronutrients (Zn, Fe. Mn and Cu). The treatments comprised of T1 – Control, T2 - 100% Recommended Dose of Fertilizer (RDF), T3 - 100% RDF +*Azospirillum,* T4 - 100% RDF + *Azospirillum* + Phosphorus Solubilising Bacteria (PSB), T5 - 100% RDF + *Azospirillum* + Potassium releasing bacteria (KRB), T6 -100% RD + *Azospirillum* +PSB+ KRB, T7 - 75% RDF + *Azospirillum*, T8 - 75% RDF + *Azospirillum* +PSB, T9- 75% RDF + *Azospirillum* + KRB, T10 - 75% RDF + *Azospirillum* +PSB+ KRB, T11 - *Azospirillum* +PSB+ KRB.

A common dose of nitrogen @ 180 kg ha^{-1} was applied in the form of urea in three equal splits *i.e.,* $^1/_3$ as basal, $^1/_3$ at active tillering and $^1/_3$ at panicle initiation stage. Phosphorus in the form of single super phosphate was applied as per the treatments as basal just before sowing. A common dose of 40 kg K2O ha^{-1} was applied as muriate of potash, in two equal splits as half at basal and half at panicle initiation stage. Vermicompost was mixed with biofertilizers *viz., Azospirillum*, PSB and KRB @ 1L ha^{-1} were applied at 3 DAS as per the treatments.

RESULTS AND DISCUSSION

Dry matter accumulation

The results (Table 1) indicated progressive increase in drymatter with advancement of crop growth in all the treatments. However, the magnitude of such changes varied with treatments. The highest drymatter production (2893, 5781 and 10681 kg ha^{-1}) was recorded in the treatment T6 (100% RDF+ *Azospirillum*+ PSB+ KRB) followed by T5 (100% RDF + *Azospirillum*+ KRB) (2872, 5776 and 10175 kg ha^{-1}) and T4 (100% RDF + *Azospirillum*+ PSB) (2859, 5763 and 9924 kg ha^{-1}) at maximum tillering, panicle initiation and harvest stages, respectively. The lowest drymatter production (2027, 4439 and 7121 kg ha^{-1}) was recorded in the treatment T1 (Control) at maximum tillering, panicle initiation and harvest stages, respectively. The drymatter content increased significantly by application of liquid biofertilizers along with inorganic fertilizers. The biofertilizers might reduce the leaching losses by fixation of nutrients and converts the unavailable nutrients forms to available forms and increases the nutrient concentration availability to plant thus resulted positive influence on drymatter accumulation in plant. Similar results were

Table 1. Effect of liquid biofertilizers on drymatter production in direct sown rice

Treatment	Dry matter (kg ha^{-1})		
	Tillering	Panicle initiation	Harvest
T_1-Control	2027	4439	7121
T_2-100% RDF	2715	5725	9226
T_3-100% RDF + *Azospirillum*	2834	5754	9759
T_4-100% RDF +*Azospirillum* + PSB	2859	5763	9924
T_5-100% RDF + *Azospirillum* + KRB	2872	5776	10175
T_6-100% RDF+*Azospirillum* +PSB+ KRB	2893	5781	10681
T_7-75% RDF + *Azospirillum*	2632	5389	8984
T_8-75% RDF + *Azospirillum* + PSB	2659	5457	9036
T_9-75% RDF + *Azospirillum* + KRB	2674	5465	9094
T_{10}-75% RDF + *Azospirillum* + PSB+ KRB	2696	5479	9159
T_{11} -*Azospirillum* +PSB + KRB	2189	4789	7441
S. Em(±)	117.68	238.52	396.03
CD (p=0.05 %)	347.12	703.54	1168.13
CV (%)	7.66	7.59	7.53

Table 2 Effect of liquid biofertilizers on yield attributes and yield of direct sown rice

Treatment	No.of panicle m^{-2}	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1-Control	391	2606	4694
T_2-100% RDF	520	4672	6232
T_3-100% RDF + *Azospirillum*	567	4740	6485
T_4-100% RDF +*Azospirillum* + PSB	576	4815	6595
T_5-100% RDF + *Azospirillum* + KRB	573	4885	6653
T_6-100% RDF+*Azospirillum* +PSB+ KRB	581	5026	6749
T_7-75% RDF + *Azospirillum*	465	4416	5785
T_8-75% RDF + *Azospirillum* + PSB	473	4478	5842
T_9-75% RDF + *Azospirillum* + KRB	476	4504	5912
T_{10}-75% RDF + *Azospirillum* + PSB+ KRB	489	4557	6089
T_{11} -*Azospirillum* +PSB + KRB	402	2915	5025
S. Em(±)	25.03	183.65	280.32
CD (p=0.05 %)	73.84	541.72	826.84
CV (%)	8.65	7.34	8.08

also reported by Iwuagwu *et al*. (2013).

Yield attributes

The data in table 2 pertaining to number of panicles per m^{-2} (581) was recorded in the treatment T6 (100% RDF+ *Azospirillum*+ PSB+ KRB) and was markedly superior over other treatments. This is done to improved soil conditions and continuous supply of nutrients in adequate quantities due to mineralisation and enhanced solubilisation of nutrients from insoluble sources. The lowest number of panicles per m^{-2} (391) was recorded in T1 (Control). Which is due to increased translocation of photosynthates from source to sink. Such an increase number of panicles per m^{-2} with the inoculation of biofertilizers was reported by Khorshidi *et al.* (2011).

Grain yield and straw yield

The perusal of the data presented in table 2 revealed that significantly higher grain yield (5026 kg ha^{-1}) was recorded in treatment T6 (100% RDF+ *Azospirillum*+ PSB+ KRB) followed by T5 (100%

RDF + *Azospirillum* + KRB) and T4 (100% RDF +*Azospirillum* + PSB) (4885 kg $ha^{-1}$and 4815 kg ha^{-1}, respectively) and these were at par with each other. The lowest grain yield of 2606kg ha^{-1} was recorded in the treatment T1 (Control).

Straw yield followed the same pattern as grain yield. The highest straw yield (6749 kg ha^{-1}) was recorded in the treatment T6 (100% RDF+ *Azospirillum*+ PSB+ KRB) followed by T5 (100% RDF + *Azospirillum*+ KRB) and T4 (100% RDF + *Azospirillum* + PSB) (6653 kg ha^{-1} and 6595 kg ha^{-1}, respectively) and these were on par with each other. The lowest straw yield (4694 kg ha^{-1}) was recorded in the treatment T1 (Control). The grain and straw yields were increased in the treatment with combined application of biofertilizers and inorganic fertilizers. This might be due to enhanced level of nutrients soil. The results in accordance with the findings Kumari *et al.* (2000) who stated that increased N level brought about significant increase in grain and straw yields. The grain and straw yield of rice was also increased by inoculation of biofertilizers (Gopalswamy and Vidhyasekaran 1988 and Jayaraman 1990). The increase in yield due to biofertilizers inoculants could be due to release of growth promoting substances, control of plant pathogen, and proliferation of beneficial organism in the *Azospirillum*, Azotobacter and PSB.

CONCLUSION

It can be concluded that the increase in fertilizer levels significantly influenced the dry matter accumulation, number of panicles per m^{-2}, grain and straw yield. The combined application of RDF and along with liquid biofertilizer found superior than individual application of either RDF or liquid biofertilizer alone. Addition of 75% RDF along with liquid biofertilizer was found to be on a par with addition of RDF along with biofertilizers. Hence the fertilizer dose can be reduced by integrating with biofertilizer.

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