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|Research Article|

Evaluation of Biofertilizers in Maize (Zea mays L.)

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Abstract- Bio-fertilizers are becoming increasingly popular in many countries and for many crops, but very few studies on their effect on grain yield have been conducted on maize. A field experiment was conducted at Agricultural Research Station, Karimnagar for two years during kharif 2016-17 & 2017-18, to evaluate the suitable bio-fertilizers in maize crop in red sandy loam soils. The initial soil status indicated high available N, P, K (613.9, 62.8, 436 kg/ha respectively). The experiment was carried out in Randomized block design with 12 treatments (T1- Control i.e. Recommended N & K, T2- PSB-I, T3- PSB-II, T4- NPK consortia, T5- 60 kg P_2O_5/ha, T6- 30 kg P_2O_5/ha + PSB-I, T7- 60 kg P_2O_5/ha + PSB-I, T8- 30 kg P_2O_5/ha + PSB-II, T9- 60 kg P_2O_5/ha + PSB-II, T10- 30 kg P_2O_5/ha + NPK consortia, T11- 60 kg P_2O_5/ha + NPK consortia, T12- 90 kg P_2O_5/ha). Among the different bio-fertilizers application to maize crop, the 30 kg P_2O_5/ha + PSB-II (8566 kg/ha) along with recommended dose of N & K recorded the highest grain yield and it is found to be on par with all the bio fertilizer treatments along with recommended dose of N & K applied to maize crop. This study reveals that as the available soil P high in status, the maize crop yield did not respond to the application of biofertilizers (PSB I or II and NPK consortia) with or without phosphorous application.

Keywords: maize, bio-fertilizers, PSB, NPK consortia, P_2O_5.

Introduction

Maize is called “King of cereals” because of its productivity potential compared to any other cereal crop. Being an exhaustive crop, it has very high nutrient requirement and its productivity closely depends on nutrient management system. Under the present trend of exploitative agriculture in India, inherent soil fertility can no longer be maintained on a sustainable basis. It is said that nutrient supplying capacity of soil declines steadily under continuous and intensive cropping system. The optimum levels of N, P, K failed to maintain yield levels probably due to increasing secondary and micronutrient deficiencies and also unfavorable alterations in the physical and chemical properties of soil. Apart from the soil fertility and productivity issues, use of chemical fertilizers is also becoming more and more difficult for the farmers due to their high costs and scarcity during peak season (Singhal et al., 2012 & Umesha et al., 2014). Farming practices which involve heavy application of chemical fertilizers may cause depletion of certain nutrients in soil and certain others would generally accumulate in excess resulting in nutrient imbalance which affects the soil productivity. Some of these problems can be tackled by using bio-fertilizers, which are natural, beneficial and ecologically friendly. Among the means available to achieve sustainability in agricultural production, organic manure and bio-fertilizer play an important and key role because they possess many desirable soil properties and exert beneficial effect on the soil physical, chemical and biological characteristics of the soil (Hossein and Farshad, 2013). Biofertilizers are defined as substances which contain living microorganisms and when applied to seed, plant surfaces or soil colonize the plant and promote its growth by increasing the nutrient availability (Vessey, 2003). The replacement of chemical fertilizer usage in agriculture necessitated the concept of using micro-organisms as biofertilizers. Application of biofertilizers (Azotobacter, Azospirillum and PSM) alone or in combination increased the growth parameters of maize seedlings in terms of plant height, stem base diameter as well as fresh and dry weight of

Table 1. Evaluation of New Bio-fertilizers on Yield of Maize (Kharif 2016 & 2017)

Treatment	Grain Yield (kg/ha)			Cob Yield (kg/ha)			Stover Yield (kg/ha)		
	I Year	II Year	Pool	I Year	II Year	Pool	I Year	II Year	Pool
Control (Recommended N & K)	8298	7848	8073	11038	12011	11524	7111	8015	7563
PSB-I	8461	7794	8127	11349	12140	11744	6805	8237	7521
PSB-II	7635	8458	8047	10126	12223	11174	6639	8528	7584
NPK consortia	8354	8292	8323	10713	12098	11406	6305	8723	7514
60 kg P_2O_5/ha	7789	8238	8014	10149	12682	11415	6500	8903	7702
30 kg P_2O_5/ha + PSB-I	7484	7809	7646	10009	11612	10811	6861	9348	8104
60 kg P_2O_5/ha + PSB-I	7935	8108	8022	10317	12182	11249	6166	9320	7743
30 kg P_2O_5/ha + PSB-II	8229	8566	8398	10870	13154	12012	6472	9376	7924
60 kg P_2O_5/ha + PSB-II	8724	7657	8191	11576	11765	11671	6972	8792	7882
30 kg P_2O_5/ha + NPK consortia	8932	8077	8505	11518	11848	11683	6555	9181	7868
60 kg P_2O_5/ha + NPK consortia	8679	8076	8378	11462	12404	11933	6555	8501	7528
90 kg P_2O_5/ha	8701	7888	8295	11481	11904	11692	6416	8431	7424
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

plants. Thus, increasing awareness is being created on the use of organics including biofertilizers which are the sources of macro, micro and secondary nutrients to sustain the soil fertility and productivity.

MATERIALS & METHODS

This experiment was conducted at Agricultural Research Station, Karimnagar during kharif 2016–17 & 2017–18 in red sandy loam soils. The initial soil status indicated high available N, P, K (613.9, 62.8, 436 kg/ha respectively). The experiment was carried out in Randomized Block Design with 12 treatments (T1 – Control i.e. Recommended N & K, T2 – PSB-I, T3 – PSB-II, T4 – NPK consortia, T5 – 60 kg P_2O_5/ha, T6 – 30 kg P_2O_5/ha + PSB-I, T7 – 60 kg P_2O_5/ha + PSB-I, T8 – 30 kg P_2O_5/ha + PSB-II, T9 – 60 kg P_2O_5/ha + PSB-II, T10 – 30 kg P_2O_5/ha + NPK consortia, T11 – 60 kg P_2O_5/ha + NPK consortia, T12 – 90 kg P_2O_5/ha). The biofertilizers are applied through seed treatments before sowing as per the treatments.

RESULTS AND DISCUSSION

Among the different biofertilizers application to maize crop, the 30 kg P_2O_5/ha + PSB-II (8566 kg/ha) along with recommended dose of N & K has recorded the highest grain yield and it is found to be on par with all the biofertilizer treatments along with recommended dose of N, K & different dosages of P_2O_5 (30, 60, 90 kg/ha) applied to maize crop. This study reveals that as the available soil P is high in status, the maize crop yield did not respond to the application of biofertilizers (PSB-I or PSB-II and NPK consortia) and with or without phosphorous application. The incorporation of biofertilizers (N fixers) plays a major role in improving soil fertility, yield attributing characters and thereby final yield has been reported by many workers (Subashini et al., 2007; Kachroo and Razdan, 2006). In addition, their application in soil improves soil biota and minimizes the sole use of chemical fertilizers (Subashini et al., 2007).

Table 2. Evaluation of new bio-fertilizers on yield attributes of maize during Kharif 2016 & 2017

Treatment	Cob Length (cm)			Cob Girth (cm)			Kernel Rows/Cob			No. of Kernels/Row		
	I Year	II Year	Pool	I Year	II Year	Pool	I Year	II Year	Pool	I Year	II Year	Pool
T1: Control (Recommended N & K)	19.5	19.9	19.7	17.2	15.8	16.5	14.4	14.1	14.3	35.5	35.1	35.3
T2: PSB I	19.3	20.6	20.0	16.5	15.9	16.2	14.3	13.7	14.0	37.0	33.9	37.5
T3: PSB II	19.9	21.6	20.8	16.6	16.3	16.5	14.1	14.4	14.3	35.8	35.7	35.8
T4: NPK consortia	18.8	19.5	19.2	16.4	15.8	16.1	14.7	13.7	14.2	35.1	37.2	36.2
T5: 60 kg P_2O_5/ha	20.1	20.2	20.2	16.9	15.7	16.3	14.8	13.9	14.4	38.4	34.1	36.3
T6: 30 kg P_2O_5/ha + PSB I	19.8	20.4	20.1	16.9	16.0	16.5	14.8	13.6	14.2	38.2	35.1	36.7
T7: 60 kg P_2O_5/ha + PSB I	18.7	21.6	20.2	16.5	16.6	16.6	15.3	13.9	14.6	35.3	34.3	34.8
T8: 30 kg P_2O_5/ha + PSB II	18.7	21.4	20.1	16.5	16.5	16.5	15.1	13.7	14.4	35.1	37.5	36.3
T9: 60 kg P_2O_5/ha + PSB II	19.1	23.6	21.4	16.6	17.3	17.0	14.7	14.4	14.6	35.7	37.9	36.8
T10: 30 kg P_2O_5/ha + NPK consortia	19.2	19.7	19.5	16.8	15.7	16.3	14.1	13.6	13.9	35.2	34.0	34.6
T11: 60 kg P_2O_5/ha + NPK consortia	18.8	19.7	19.3	17.3	16.0	16.7	15.1	13.9	14.5	35.7	35.9	35.8
T12: 90 kg P_2O_5/ha	19.7	19.9	19.8	16.7	16.6	16.7	14.9	13.6	14.3	36.3	34.8	35.6
CD (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

CONCLUSION

Application of biofertilizers is essential in the production of maize and therefore recommended for its proper use as an environmentally friendly way of strengthening plant growth and improvement. The application of biofertilizer and conventional fertilizer combined at full rates were antagonistic as most of the parameters tested had lower counts than when independently applied. Therefore, the findings of this study have clearly showed that combined application of biofertilizers did not show any enhancement in growth & yield.

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Conflict of Interest

The authors don't have any conflict of interest.

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