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SHORT COMMUNICATION

EFFECT OF INOCULATION METHODS OF BIOZOTE-MAX (PLANT GROWTH PROMOTING RHIZOBACTERIA-PGPR) ON GROWTH AND YIELD OF RICE UNDER NATURALLY SALT-AFFECTED SOIL

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ABSTRACT

A field experiment was carried out at the experimental farm of Soil Salinity Research Institute, Pindi Bhattian during 2016-17 to assess evaluate different Rhizobial inoculation methods on growth and yield of rice (*Oryza sativa*) cv. Basmati-385 under naturally salt-affected soil (pH= 8.12, ECe= 7.88 dS $m^{-1}$and SAR=24.96). Seeds of rice were inoculated with Biozote–Max (Plant Growth Promoting Rhizobacteria-PGPR) produced in Soil Biology and Biotechnology Research Programme of Land Resources Research Institute, National Agricultural research Centre (NARC), Islamabad under PARC-Agrotech. Company (Pvt) Ltd. NARC, Islamabad in three ways i.e. rice seeds inoculated for direct seeding and nursery and dipping seedling roots in the solutions of these rhizobial strains comparable of control un-inoculated (control) by each inoculation method. The performances of Rhizobial strain Biozote–Max used as seed and seedling root dipping inoculation were superior to uninoculated control in all the parameters of the rice crop. Among the treatments, seed and seedling root dipping inoculation with Rhizobial strain Biozote–Max performed best in recording plant height, panicle length, number of tillers, 1000-grain weight and grain yield of rice crop. Maximum tillering was observed with all strains under different inoculation methods. Although, the strains performed better as compared to control, however, dipping of nursery roots produced significantly higher yield followed by seed inoculation for direct seeding. Overall, among all the inoculation methods seedling root dipping produced comparable paddy yield. The highest paddy yield (367 g m^{-2}) was harvested with SBCC (M8) seed inoculation which was 13% more than that of un-inoculated (control).

Keywords: Rhizobial strain; Rice; Growth and yield

INTRODUCTION

Biofertilizers are now a days an important mean of increasing crop production worldwide, as they are providing a sustainable solution for crop production without much problems of side effects to crops and soil [1]. The humus of vermicompost is considered as an efficient biofertilizer for crop plants [2] and has pest control actions as well [3] which can be utilized as a good alternative to chemical fertilizers [4, 5].

Throughout the world 33% of agricultural land is being under threat from salinity [6]. In Pakistan, about 14% of total agricultural field, which is under irrigation is affected by salinity [7]. Salinity affects the morphological, physiological and yield characteristics of plants by altering the metabolic functions of the plant [8]. In all salt affected soil, yield loss is the main problem in cultivation [9, 10]. It is mainly due to the morphological alterations which in turn inhibit or reduce the photosynthetic activity of plants [11, 12]. There are many methods tested for the amelioration of salinity like exogenous or foliar sprays of nutrients [13]. Therefore, a field experiment was conducted at Soil Salinity Research Institute, Pindi Bhattian, experimental farm to assess the best rhizobial inoculation method on growth and yield of rice (*Oryza sativa*) cv. Basmati-385 under natural salt-affected soil.

MATERIALS AND METHODS

A field experiment was carried out at the experimental farm of Soil Salinity Research Institute, Pindi Bhattian during 2016-17 to assess evaluate different Rhizobial inoculation methods on growth and yield of rice (*Oryza sativa*) cv. Basmati-385 under naturally salt-affected soil (pH= 8.12, ECe= 7.88 dS $m^{-1}$and SAR=24.96).

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Table 1: Effect of Rhizobial Inoculation methods on growth and yield of rice under naturally salt-affected field

Treatments	Plant Height (cm)		Panicle Length (cm)		Number of tillers (m^{-2})		1000-Grain weight ($g\ m^{-2}$)		Grain Yield (gm^{-2})	
	Increase (%)		Increase (%)		Increase (%)		Increase (%)		Increase (%)	
T_1	103	0.96	20	4.8	231	1.2	18	10	333b	2.0
T_2	104		21		234		20		340b	
T_3	106	1.81	22	0	232	3.3	17	15	320c	1.5
T_4	108		22		240		20		325bc	
T_5	106	2.72	21	4.5	235	0.84	19	5	326b	13.0
T_6	109		22		237		20		367a	
LSD	NS		NS		NS		NS		21	

T_1= Transplanting of rice seedlings without inoculation T_2=Transplanting of seedlings with Biozote inoculation after uprooting T3=Direct seeding rice without inoculation T4= Direct seeding rice with Biozote inoculation T5= Rice nursery without seed inoculation T6= Rice nursery with Biozote seed inoculation Increase (%)= Increase inoculation over un-inoculation, means with different letters are significantly different at 5% level of probability

Seeds of rice were inoculated with Biozote–Max (Plant Growth Promoting Rhizobacteria-PGPR) produced in Soil Biology and Biotechnology Research Programme of Land Resources Research Institute, National Agricultural research Centre (NARC), Islamabad under PARC-Agrotech. Company (Pvt) Ltd. NARC, Islamabad in three ways i.e. rice seeds inoculated for direct seeding and nursery and dipping seedling roots in the solution of Biozote–Max strain comparable of control un-inoculated (control) by each inoculation method. Treatments of the field experiment were; T_1= Transplanting of rice seedlings without inoculation, T_2=Transplanting of seedlings with Biozote inoculation after uprooting, T3=Direct seeding rice without inoculation, T4= Direct seeding rice with Biozote inoculation, T5= Rice nursery without seed inoculation and T6= Rice nursery with Biozote seed inoculation. Randomized complete block design was applied with three replications. The data obtained were subjected to statistical analysis using the STATISTIX statistical software (Version 8.1) and the mean values were compared using least significant difference (LSD) [14].

RESULTS AND DISUSSION

Growth and yield parameters (plant height, panicle length, tillering, 1000-grain weight and grain yield**)** data was represented in table-1. Plant height, panicle length, tillering, 1000-grain weight showed non-significant results among three inoculation methods. The performances of rhizobial strain Biozote–Max used as seed and seedling root dipping inoculation were superior to uninoculated control in all the parameters of the rice crop. However all the inoculation methods exhibited better results of growth and yield of rice crop under salt-affected soil comparable to control. Seedling root dipping inoculation method attained the highest plant height (109 cm) that was 2.72 % higher than the control treatment of this inoculation method. In panicle length case same rend was indicated in seedling root dipping inoculation method but maximum higher percentage (4.8) was received by transplanting of seedlings with Biozote inoculation after uprooting. Regarding number of tillers maximum increase (%) i.e.3.3 was attained by direct seeding rice with Biozote inoculation. Ullah *et al.* [15] concluded that biozote enhanced germination, root length, fresh weight and dry weight in all mung bean varieties. Arshadullah *et al.* [16] reported a partial amelioration of salinity in maize plants with different rhizobial strain.

Data regarding 1000-grain weight and grain yield indicated in table-1. Non-significant results were attained in 1000-grain weight among inoculation methods. But three inoculation methods performed better than control. Direct seeding rice with Biozote inoculation produced the maximum increase (%) i.e.15 among other inoculation methods. In one of the previous study [17], growth of wheat plants increased with different rhizobial strains under stressed conditions. Grin yield showed significant results. The highest paddy yield (367 gm^{-2}) was harvested with rice nursery with Biozote seed inoculation method which was 13% more than that of un-inoculated (control). Arshadullah *et al.* [18] reported the reduced uptake of sodium under inoculation, having ACC deaminaze activity under saline environment is an encouraging sign to induce salt tolerance naturally and reduce the toxic effects of utilization of chemicals for reclamation of-affected lands.

CONCLUSION

This study concluded that the highest paddy yield (367 gm^{-2}) was harvested by rice nursery with Biozote seed inoculation method which was 13% more than that of un-inoculated (control).

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