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Effect of Phosphate Solubilising Rhizobacteria on pH, OC and available soil nutrients in Basmati-370 in Inceptions of Jammu, J & K

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Abstract

Phosphate solubilising rhizobacteria are considered as an important alternative for increasing the availability of accumulated phosphates through solubilization and plays an important role for improving productivity of rice crop through various direct and indirect mechanisms of interaction with crop by colonizing plant roots. An experiment was conducted during Kharif season 2019 at Division of Soil Science &Agriculture Chemistry, (SS&AC), SKUAST Jammu . The experiment was replicated thrice in CRBD design to evaluate the efficacy of single broth cultures as well as consortium of Pseudomonas auerginosa and Bacillus subtilis . Significant increase in available N,P,K content in soil were recorded with consortium of isolated broth cultures of PSRB isolates (B_3).Highest increase in available N (22.14%), available P (316.6%), available K (30.6%) over control were recorded in consortium of isolated broth cultures of PSRB isolates.. Increase in pH and OC values were observed due to inoculation of consortium of isolated broth cultures of PSRB isolates

***Keywords**: Rice, Rhizosphere, PSRB*

Introduction

Rhizosphere is a ecological niche present around the roots of plants and support various microorganisms[7,8]. Rhizospheric bacteria that are beneficial to plants are referred as plant growth promoting rhizobacteria which exhibit a significant interaction with plant roots and have both direct and indirect positive effects on plant growth and with the reduction of both biotic and abiotic stresses. Application of phosphatic fertilizers lead to conversion of phosphatic fertilizers to insoluble phosphates and thus the harmful effects of chemical fertilizers shifts the practical attention of the scientists towards the development of alternative environmental friendly microbial mediated P management. Rhizospheric microbes play an important role as direct plant growth promoters. Among the heterogenous rhizospheric microbes phosphate solubilising microorganisms promote plant growth with plant growth promoting abilities like biological nitrogen fixation, phytohormone production and biocontrol activities etc and are thus referred as plant growth promoting rhizpobacteria(PGPR) which can become a promising approach in sustainable agriculture. Phosphate solubilizing rhizobacteria are also reported to solubilize inorganic P by secretion of different kinds of organic acids, siderophores as well as hydroxyl ions. *Pseudomonas, Rhizobium, Bacillus, Beijerinckia, Burkholderia, Enterobacter, Flavobacterium, Azotobacter, Erwinia* and *Serratia* are considered as the most prominent PGPR in soil[1,4,6]. Therefore the present investigation aimed at estimation and influence of phosphate solubilising rhizobacteria as phosphorus source on pH, OC and available soil nutrients in soil of rice crop.

Materials and Methods

Pot experiment was conducted at Division of Soil Science & Agriculture Chemistry (SS & AC), SKUAST Jammu to study the potential of PGPR (two cultures of PGPR obtained from soil microbiology laboratory, SS & AC, SKUAST, Jammu) .Pots of dimensions 30*26*17 cm^3 were filled with polythene containing 6kg of soil sterilized with 0.5% formaldehyde. Roots of seven day old rice plantlets were dipped in bacterial broth culture of the two strains obtained from Division of Soil Science and Agriculture Chemistry SKUAST Jammu. The treatments were replicated thrice in a CRBD design and comprised of four treatments i. Soil (Control 1), ii. Soil+ PSRB-1 , iii Soil + PSRB -2 iv. Soil + Consortium (50:50) The treatments were replicated thrice. in a CRBD design The plants were harvested after 120 days and samples were collected and analysed for pH, OC and available nutrients. The experimental soil was analysed for pH, OC and available N, P and K using standard methods. The experimental soil had pH 6.6, OC 6.3g kg^{-1}, available N 79.3 mg kg^{-1}, available P 4.4 mg kg^{-1} and available K 73.9 mg kg^{-1}. The data recorded were subjected to statistical analysis using the technique of analysis of variance for CRBD design for the interpretation of results and subjected to statistical analysis using SPSS 16.0 version software.

Results and Discussion

Effect of PSRB isolates alongwith TCP on pH, OC and available nutrients of soil grown with rice crop

The effects of different treatments on pH, OC and available nutrients of rhizosphere soil of rice crop are described in Table 1. Rhizosphere soil pH was not significantly affected by the treatments ($P<0.05$) and ranged from 7.71 to 7.92 with lowest pH recorded in control and highest pH recorded in B3 (Consortium). OC of rhizosphere soil was significantly affected by the treatments with highest value of 7.43 mg/kg recorded in B_3 (Consortium) due to better root growth resulting in higher production of biomass as compared to control[3]. Inoculation with broth culture of both PSRB isolates either applied singly or as consortium showed a significant difference for the availability of major nutrients viz. N, P and K. Highest available N was recorded in the treatment B3 and increase was 22.14% as compared with control due to increased N fixation by both the isolates[2]. Application of broth culture of both PSRB isolates also increased the available P in soil and highest increase was recorded in the treatment and increase was 316.6% as compared with the control due to increased phosphate solubilisation activity of both the microorganisms that might have brought P from unavailable form to available form by the secretion of organic acids and phosphates enzymes[9]. Highest increase in available K was recorded with B3 treatment and increase was 30.6% as compared with the control due to secretion of organic acids by the isolates which help in release of mineral bond insoluble potassium that might have reduced potassium fixation[10].

Table 1 :Effect of PSRB isolates alongwith TCP on physico-chemical properties of soil grown with rice crop at harvest

Treatments	pH	OC(g kg^{-1})	Available N (mg kg^{-1})	Available P (mg kg^{-1})	Available K(mg kg^{-1})
Isolates					
B_0(Control)	7.71	5.16	77.18	4.14	70.49
B_1(PSRB1)	7.88	6.74	85.01	9.59	78.18
B_2(PSRB 2)	7.90	6.85	89.20	13.23	81.57
B_3(PSRB 1+2)	7.92	7.43	94.27	17.25	92.05
SEm(±)	0.32	0.32	0.41	0.32	0.37
CD	NS	1.07	1.35	1.08	1.23

Coefficient of correlation between pH, OC and available nutrients of soil grown with rice crop

Data from Table 2 depicted that OC is positively correlated with pH (0.98). Soil available nitrogen is found to be positively correlated with pH (0.96) and OC (0.91). Soil available phosphorus is positively correlated with pH (0.95), OC (0.89) and soil available nitrogen(1.00). Soil available potassium is also found to be positively correlated with pH(0.92), OC (0.82), soil available nitrogen (0.98) and soil available phosphorus (0.98).A positive correlation was observed between available phosphorus and organic carbon as after decomposition of organic matter, humus is formed which forms complex with Al and Fe and that is a protective cover for P fixation with Al and Fe thus reducing P fixation. Similarly a positive correlation between available K and OC was observed due to creation of favourable soil environment with presence of high organic matter.

Table 2 :Coefficient of correlation between pH, OC and available nutrients of soil grown with rice crop

	pH	OC	Av. N	Av. P	Av. K
pH	1				
OC	0.98	1			
Av. N	0.96	0.91	1		
Av. P	0.95	0.89	1.00	1	
Av. K	0.92	0.82	0.98	0.98	1

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