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EFFECT OF PHOSPHATE SOLUBILIZING MICROORGANISMS ON THE GROWTH, YIELD AND SOIL P STATUS OF MAIZE (*Zea mays* L.)

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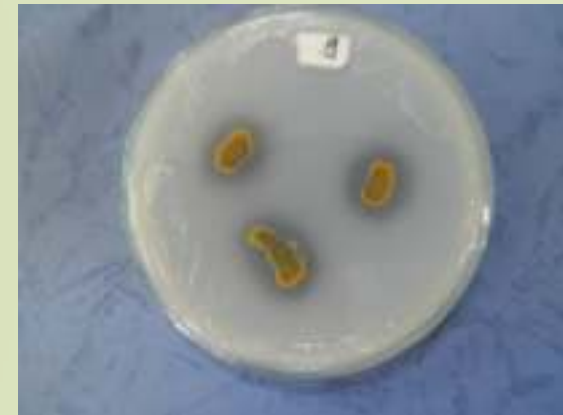
Outline

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Introduction

- Phosphate solubilizing microorganisms (PSM's) can dissolve the phosphate unavailable become available in the soil so that it can be easily absorbed by plants, they can also increase soil-P availability, potentially enhancing crop yield when P is limiting.
- Phosphate solubilizing microorganisms include different groups of microorganisms, which are not only assimilate phosphorus from insoluble forms of phosphates, but they also cause a large portion of soluble phosphates to be released in quantities in excess of their requirements.
- Phosphate solubilizing microorganisms are most common now days because the use of these microorganisms as a biofertilizers and one of the alternatives to improve the efficiency of phosphate fertilizer in overcome the low phosphate available in the soil
- The routine use of chemical fertilizers had given negative impacts in the environment, therefore the use of these microorganisms is advantageous in the sustainable agricultural practices.





Objectives of Study

- To investigate the effects of PSM as a biofertilizer on the growth and yield of maize, and soil phosphorus status of acid soil

Methodology

- A pot experiment has been conducted at the screen house
- An Acid soil of Warmare used as media of plant growth



- The inoculant of PSM isolated from agricultural soil of Oransbari were used as a biofertilizers



Methods cont....

Completely Randomized Design (CRD) with 3 replications. The treatment consisted of :

- P0 : Control
 - P1 : NPK
 - P2 : Isolate 1 (174 CFU/gram soil of PSB and < 30 CFU/gram soil of PSF
 - P3 : Isolat3 2, (142 CFU/gram soil and PSF < 30 CFU/gram soil
 - P4 : Isolate 1 + Isolate 2
 - P5 : Isolate 1 + NPK
 - P6 : Isolate 2 + NPK
 - P7 : Isolate 1 + Isolate 2 + NPK
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- N 300 kg/Ha, TSP 150 kg/Ha and KCl 100 kg/Ha
 - Application of animal manure 2 tons/ha for all treatments
 - 8 treatments with 3 replication, 24 Units



Methods cont....



Observation variables :

- **Plant Heights (2, 4, 6, 8, 10 WAP)**
- **Plant Height Growth Rate**
- **Leaves Number**
- **Fresh and Dry Weight of Plants**
- **Numbers and Dry Weight of Corncob**
- **PSM Population**
- **Soil Chemical Properties (pH, N, P, C-organic, and Moisture content)**
- **Plant P uptake**

Data Analysis :

- **ANOVA, DMRT**



Results and Discussions

1. PLANT HEIGHTS

Table 1. Plant Heights at 2, 4, 6, 8, and 10 WAP

Treatments	Plant Heights (cm)				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
P0 (Control)	5,83 a	7,25 b	17,16 a	24,67 a	34,33 b
P1 (NPK)	5,16 ab	8,91 b	19,50 a	28,16 a	42,16 ab
P2 (Isolate 1)	5,33 ab	8,67 b	18,16 a	27,67 a	46,83 ab
P3 (Isolate 2)	5,41 ab	9,50 b	19,00 a	29,00 a	43,33 ab
P4 (Isolate 1 + Isolate 2)	5,41 ab	10,58 ab	21,33 a	34,83 a	55,67 ab
P5 (Isolate 1 + NPK)	4,41 b	10,16 ab	22,00 a	35,67 a	69,83 a
P6 (Isolate 2 + NPK)	4,63 b	8,91 b	21,16 a	31,33 a	51,00 ab
P7 (Isolate 1 + Isolate 2 + NPK)	5,21 ab	13,67 a	24,33 a	41,33 a	55,67 ab



Table 2. Plant Heights Growth Rate

Treatments	Plant Height Growth Rate (cm/mg)			
	2 to 4	2 to 6	2 to 8	2 to 10
	WAP			
P0 (Control)	0,54 h	2,80 h	3,11 h	3,54 h
P1 (NPK)	1,88 f	3,59 e	3,83 f	4,63 f
P2 (Isolate 1)	1,17 g	3,09 g	3,64 g	5,13 e
P3 (Isolate 2)	2,13 e	3,36 f	3,93 e	4,32 g
P4 (Isolate 1 + Isolate 2)	2,59 c	3,98 d	4,90 c	6,28 c
P5 (Isolate 1 + NPK)	2,88 b	4,40 b	5,21 b	8,18 a
P6 (Isolate 2 + NPK)	2,14 d	4,13 c	4,45 d	5,80 d
P7 (Isolate 1 + Isolate 2 + NPK)	4,23 a	4,78 a	6,02 a	7,08 b



Table 3. Number of Leaves at 2, 4, 6, 8 and 10 WAP

Treatments	Number of Leaves				
	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP
P0 (Control)	2,67 a	4,33 a	4,67 a	6,00 a	7,00 a
P1 (NPK)	3,33 a	3,67 a	5,00 a	6,33 a	7,67 a
P2 (Isolate 1)	3,33 a	4,33 a	5,33 a	6,33 a	6,67 a
P3 (Isolate 2)	3,33 a	4,33 a	5,00 a	6,00 a	7,00 a
P4 (Isolate 1 + Isolate 2)	3,67 a	4,67 a	6,00 a	7,00 a	8,00 a
P5 (Isolate 1 + NPK)	3,67 a	4,33 a	6,00 a	7,33 a	8,33 a
P6 (Isolate 2 + NPK)	3,33 a	4,00 a	5,67 a	6,67 a	7,67 a
P7 (Isolate 1 + Isolate 2 + NPK)	3,00 a	4,33 a	6,33 a	7,33 a	8,67 a



Table 4. Fresh Weight, Dry Weight and Water Loss of Plants

Treatments	Fresh Weight (gr)	Dry Weight (gr)	Water Loss (gr)
P0 (Control)	39,89 b	18,04 a	21,85 c
P1 (NPK)	50,89 ab	14,15 a	36,74 ab
P2 (Isolate 1)	51,02 ab	16,25 a	34,77 bc
P3 (Isolate 2)	65,22 a	18,54 a	46,68 ab
P4 (Isolate 1 + Isolate 2)	61,49 ab	16,62 a	44,86 ab
P5 (Isolate 1 + NPK)	58,44 ab	17,98 a	40,46 ab
P6 (Isolate 2 + NPK)	49,54 ab	13,38 a	36,16 abc
P7 (Isolate 1 + Isolate 2 + NPK)	68,40 a	18,19 a	50,20 a



Table 5. The Numbers and Dry Weight of Corncob

Tretments	Number of Corncob/plant	Dry Weight (gram/plant)
P0 (Control)	0,66 a	3,54 ab
P1 (NPK)	1,00 a	2,81 b
P2 (Isolate 1)	1,00 a	2,60 b
P3 (Isolate 2)	0,66 a	3,53 ab
P4 (Isolate 1 + Isolate 2)	1,00 a	4,18 ab
P5 (Isolate 1 + NPK)	1,00 a	3,58 ab
P6 (Isolate 2 + NPK)	1,00 a	3,14 ab
P7 (Isolate 1 + Isolate 2 + NPK)	1,00 a	6,20 a



Population of PSM

Table 6. Population of Phosphate Solubilizing Microorganisms

Treatments	Number of Colony (CFU/g soil)	Population of PSM/gr Dry weight of soil
P0 (Control)	50,00 x 10 ³	6.330,27x 10 ³
P1 (NPK)	64,33 x 10 ³	8.351,22 x 10 ³
P2 (Isolate 1)	80,00 x 10 ³	10.265,90x 10 ³
P3 (Isolate 2)	84,67 x 10 ³	10.785,86 x 10 ³
P4 (Isolate 1 + Isolate 2)	91,33 x 10 ³	6.587,52 x 10 ³
P5 (Isolate1+ NPK)	71,33 x 10 ³	9.310,20 x 10 ³
P6 (Isolate 2 + NPK)	70,67 x 10 ³	9.308,73 x 10 ³
P7 (Isolate 1 + Isolate 2 + NPK)	94,33 x 10 ³	10.479,29x 10 ³



Table 7. Some Chemical Properties of Soil and P uptake

Treatments	pH (H ₂ O)		C-Organic (%)		N-Total (%)		P (ppm)		Kadar Air (%)	P-Uptake	
										HNO ₃ :HClO ₄	H ₂ SO ₄ :H ₂ O ₂
P0 (Control)	4,35	VA	0,29	VL	0,07	VL	2,43	VL	39,56	0,38	0,38
P1 (NPK)	4,48	VA	0,38	VL	0,08	VL	2,61	VL	41,64	0,34	0,33
P2 (Isolate 1)	4,45	VA	0,39	VL	0,07	VL	2,93	VL	38,47	0,42	0,41
P3 (Isolate 2)	4,35	VA	0,38	VL	0,08	VL	2,65	VL	37,69	0,38	0,36
P4 (Isolate 1 + Isolate 2)	4,42	VA	0,37	VL	0,08	VL	2,16	VL	38,64	0,39	0,38
P5 (Isolate 1 + NPK)	4,49	VA	0,49	VL	0,07	VL	2,48	VL	39,69	0,32	0,34
P6 (Isolate 2 + NPK)	4,47	VA	0,38	VL	0,10	L	2,65	VL	37,77	0,40	0,37
P7 (Isolate 1 + Isolate 2 + NPK)	4,48	VA	0,57	VL	0,13	L	2,85	VL	35,21	0,38	0,37



Table 8. Correlation Analysis of Plant Growth, Yield, Number of MPF and Soil Chemical Properties

Variables	Number of MPF	Plant Height	Number of Leaves	Plant Dry Weight	Dry weight of Corncob	Number of Corncob	pH	N-Total	C-Organic	P-Available	Water content
Number of MPF	1										
Plant Height	-0.380	1									
Number of Leaves	-0.612	0.620	1								
Plant Dry Weight	-0.071	-0.459	-0.345	1							
Dry weight of Corncob	-0.226	-0.010	.028	0.495	1						
Number of Corncob	-0.321	0.902**	0.722*	-0.520	0.089	1					
pH	-0.154	0.843**	0.656	-0.468	0.112	0.925**	1				
N-Total	0.128	0.072	0.032	-0.040	0.783*	0.298	0.366	1			
C-Organic	-0.067	0.334	0.355	0.267	0.686	0.515	0.648	0.659	1		
P-available	0.654*	-0.036	-0.400	-0.067	0.025	0.140	0.293	0.378	0.402	1	
Water content	-0.346	0.208	0.245	-0.353	-0.727*	-0.014	0.011	-0.757*	-0.547	-0.397	1



Conclusions

- No significant effect of PSM application on the growth and the yield of maize plants, however the PSM treatments tend to increase all the parameters observed
- There was a correlation between soil P contents and the number of PSM in the soil



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Thank you