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Our Soils Our Future

Spatial Distribution of Phosphate Solubilizing Bacteria (PSB) and Arbuscular Mycorhiza (AM) Fungi in Oransbari Agricultural Soil

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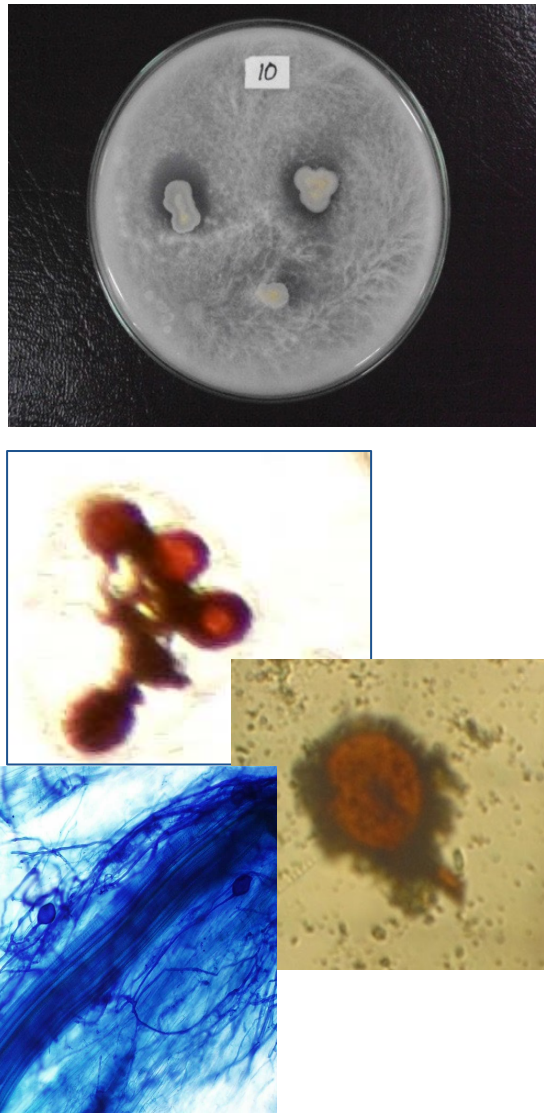
Outline

- Introduction
- Objectives
- Methodology
- Results and Discussions
- Conclusion
- Acknowledgement

Introduction

- Phosphate solubilizing bacteria is one of the soil bacteria that are able to dissolve P ions bound to soil cations in the form of Al, Fe, Ca and Mg then convert them into a form available for natural plant absorption (Keneni et al., 2010).
- AMF has a very important biological role including being able to improve soil nutrition and increase plant growth, as a biological protector, increasing plant resistance to drought.
- the use of these microorganisms as an alternative to improving the efficiency of phosphate fertilizers in overcoming the low available phosphate in the soil, especially in an acid soil

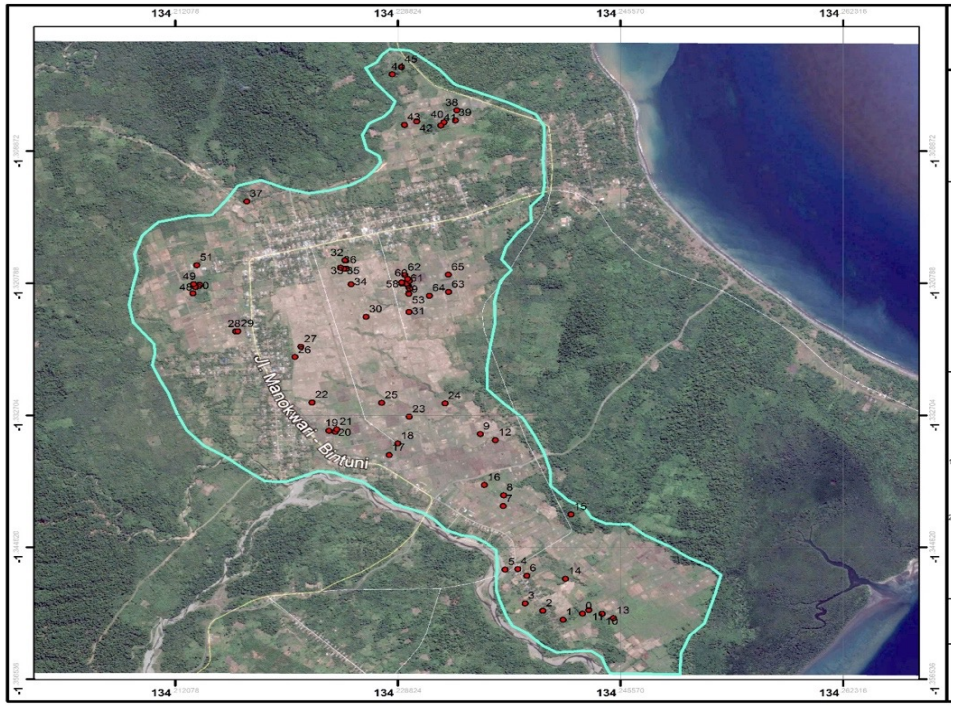


Objectives of the study

To determine the number and population of PSBs, spores and percent colonization of AM Fungi roots of several agricultural crops, and their spatial distribution in Agricultural land of Oransbari District, South Manokwari

Methodology

- Study Area
  - 7 villages
  - 37 composite samples



- Collection of Soil and Root samples

Methodology

Laboratory Analysis :

- **PSBs :**
  - **-Isolation and Identification**
- **AM Fungi :**
  - **- Wet Sieving Technique**
  - **- Cleaning and Staining**
  - **- Gridline method**
  - **- Spores identification**
- **Soil Analysis**

Result and Discussions

Table 1. Number of PSBs and AM Fungi at Different Plants in Agricultural Soil

No	Location	Plants	PSBs		AM Fungi	
			Number of Coloni (CFU/g soil)	Population(Bacteria/gram soil dried)	Number of Spores (spores/ 50 gr soil)	Percentage of Root Infected by AF Fungi (%)
1	M1	Solanum lycopersicum	47×10^5	605×10^3	21	58,33
2	M2	Oriza sativa	45×10^4	55×10^3	23	76,38
3	M3	Capsicum frutescens L.	98×10^3	1412×10^3	12	31,8
4	M4	Zea mays	61×10^4	925×10^3	20	57,5
5	M5	Capsicum annum	37×10^5	460×10^3	18	30,6
6	M6	Phaseolus vulgaris	58×10^4	68×10^3	14	59,5
7	MM1	Oriza sativa	22×10^5	540×10^3	5	68,05
8	MM 3	Solanum lycopersicum	105×10^5	154×10^3	35	65,2
9	MR 1	Oriza sativa	87×10^5	451×10^3	20	75,30
10	MR 2	Solanum lycopersicum	114×10^3	16×10^3	21	58,33
11	MR 3	Capsicum annum	41×10^4	90×10^3	20	60,5
12	SM 1	Oriza sativa	31×10^4	39×10^3	14	59,5
13	SM 2	Solanum lycopersicum	126×10^5	1716×10^3	21	46
14	SM 3	Vigna Sinensis L.	68×10^3	7×10^3	17	46,4
15	SM 4	Cucumis sativus	83×10^3	10×10^3	20	57,5
16	W1	Oriza sativa	80×10^3	11×10^3	5	68,05
17	W2	Zea mays	35×10^4	39×10^3	20	57,5
18	W3	Capsicum annum	75×10^3	8×10^3	20	60,5
19	**W4**	**Zea mays**	**87×10^5**	**1097×10^3**	**23**	**76,38**
20	A1	Zea mays	37×10^4	45×10^3	20	57,5
21	A2	Capsicum annum	38×10^4	51×10^3	20	60,5
22	A3	Allium cepa	136×10^3	16×10^3	19	15,3
23	A4	Phaseolus vulgaris	65×10^4	72×10^3	14	59,5
24	A5	Solanum lycopersicum	37×10^4	41×10^3	27	56,6
25	A6	Vigna Sinensis L.	91×10^4	116×10^3	14	59,5
26	SJ1	Oriza sativa	71×10^3	11×10^3	28	53,5
27	SJ2	Capsicum annum	60×10^4	83×10^3	19	15,3
28	SJ3	Vigna radiate	80×10^3	11×10^3	14	59,5
29	SJ4	Solanum lycopersicum	113×10^2	1×10^3	27	56,6
30	SJ5	Phaseolus vulgaris	88×10^2	1×10^3	28	53,5
31	SJ6	Allium cepa	52×10^3	6×10^3	15	74
32	SJ7	Zea mays	92×10^2	1×10^3	20	57,5
33	SJ8	Arachis hypogaea L.	120×10^3	13×10^3	14	59,5

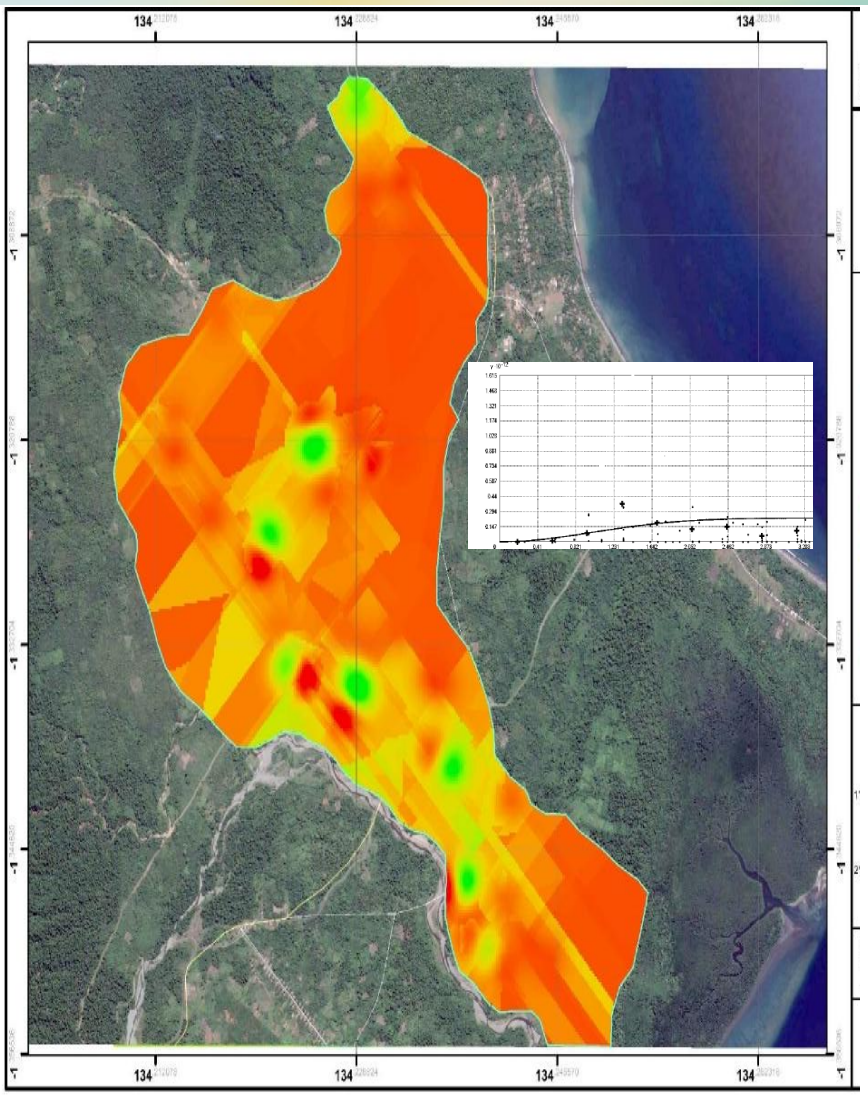
Result and Discussions

2. Analysis of Semivariogram and Kriging

Table 2. Semivariogram analysis of PSBs and AM Fungi in Oransbari Agricultural Soil

Variabels (n=37)	Nugget (C0)	Sill (C=C0 + C1)	Range (m)	Relative nugget effect (C0/C)	Spatial Dependence (C1/C)	Forms
PSBs	23×10^{7}	23×10^{10}	0,002	0,001	0,99	Spherical
Water Content	147,44	907,77	0,0009	0,16	0,84	Spherical
pH	0,12	0,29	0,0031	0,41	0,59	Spherical
P	548,74	2377,54	0,0013	0,19	0,81	Spherical
N-total	0,008	0,008	0,06	1	0	Stable
C-organic	0,02	0,47	0,0011	0,037	0,96	Spherical

Result and Discussions



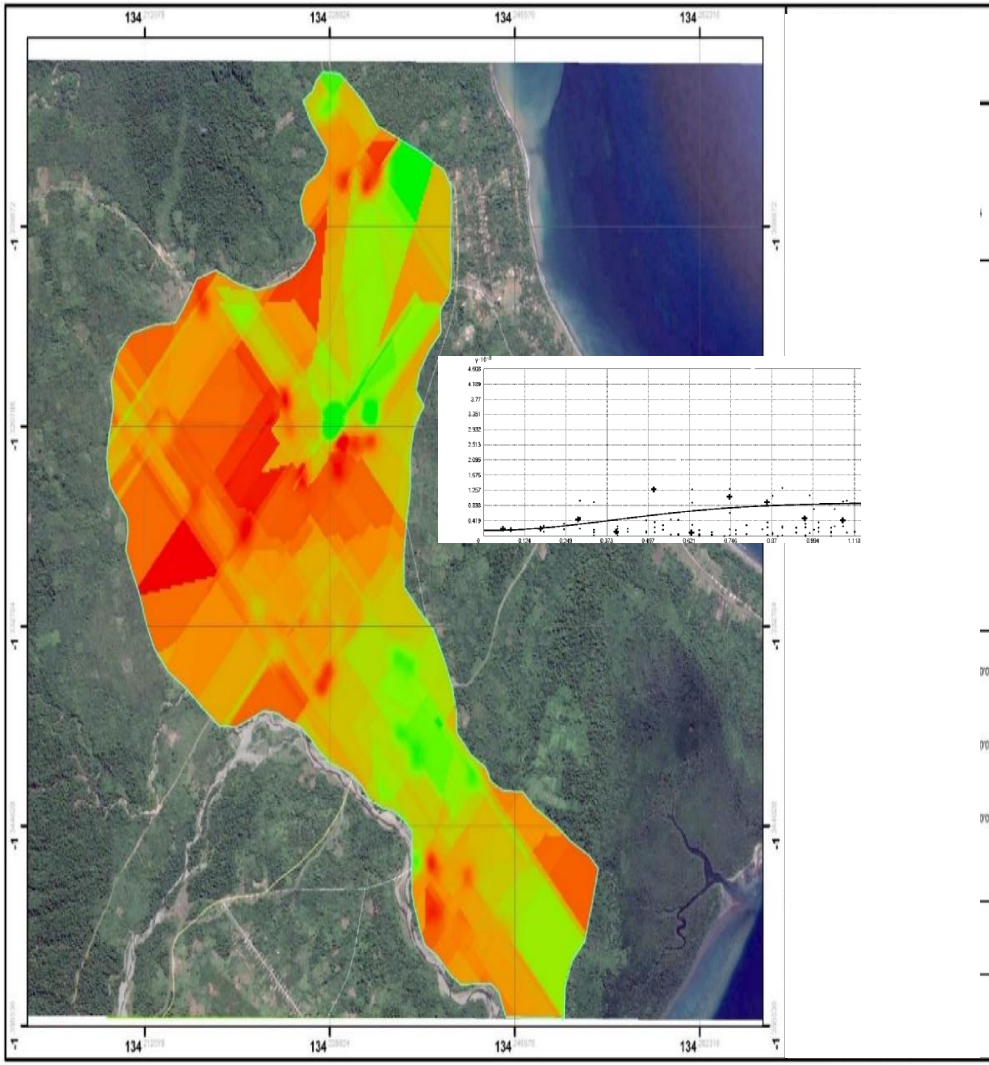


Figure 1. Map of Distribution of PSBs and AM Fungi Spores in Oransbari Agricultural Soil

Result and Discussions

3. Soil Properties

Table 3. Some soil characteristics of Oransbari Agricultural Soil

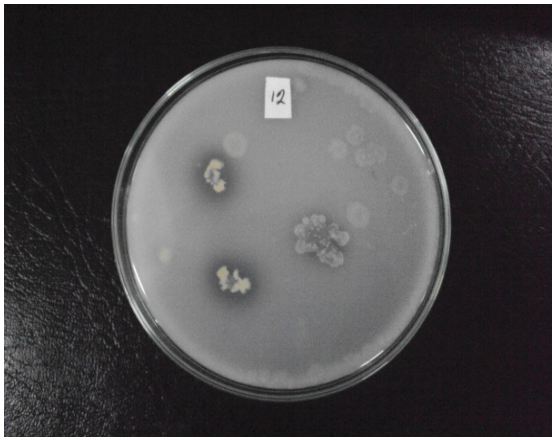
Soil Parameters	Samples Location								
	Or1	Or2	Or3	Or4	Or5	Or6	Or7	Or8	Or9
pH									
H_2O	5.84	5.78	6.07	6.39	5.99	5.67	6.10	5.92	6.22
KCl	5.17	5.23	5.46	5.89	5.23	5.18	5.65	5.23	5.65
	SA	SA	SA	SA	SA	SA	SA	SA	SA
C-org (%)	1.11	0.25	1.44	1.95	1.81	2.61	1.80	3.34	2.85
	L	VL	L	L	L	M	L	H	M
N-Total (%)	0.14	0.19	0.17	0.25	0.21	0.21	0.21	0.24	0.27
	L	L	L	M	M	M	M	M	M
P_2O_5 (ppm)	5.19	11.59	4.32	5.74	7.72	4.14	7.12	3.61	4.12
	R	T	SR	R	S	R	S	SR	SR
P_2O_5 HCl 25% (mg100g-1)	101.40	151.46	49.19	66.16	162.66	159.03	87.86	109.52	116.58
	VH	VH	H	VH	VH	VH	VH	VH	VH
Ca (cmolnkg)	1.52	2.78	38.94	37.81	35.15	26.96	34.68	39.74	34.03
	VL	L	VH	VH	VH	VH	VH	VH	VH
Mg	0.90	1.59	9.41	11.53	8.36	7.38	10.04	15.68	12.89
	L	M	VH	VH	VH	H	VH	VH	VH
K	0.41	0.59	0.33	0.09	0.38	0.17	0.19	0.17	0.09
	M	H	M	VL	M	L	L	L	VL
Na	0.28	0.35	0.78	0.74	0.77	0.66	0.80	0.86	0.80
	L	M	H	H	H	M	H	H	H
CEC	18.20	20.95	50.41	59.71	48.54	45.28	45.47	53.28	47.70
	M	M	VH	VH	VH	VH	VH	VH	VH
BS (%)	17.05	25.31	98.13	84.01	92.02	77.71	100.00	100.00	100.00
	VL	L	VH	VH	VH	VH	VH	VH	VH
Al	tr	tr	tr	tr	tr	tr	tr	tr	tr
H	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
DTPA (ppm)									

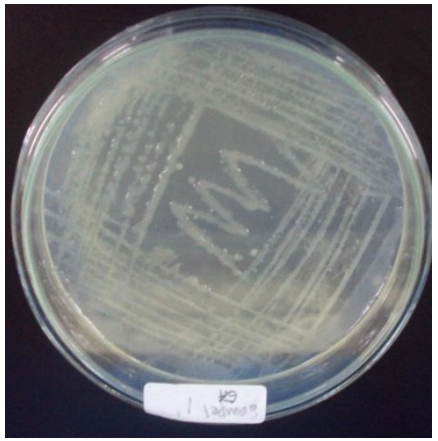
Result and Discussions

4. Identification results :

- **PSBs :**

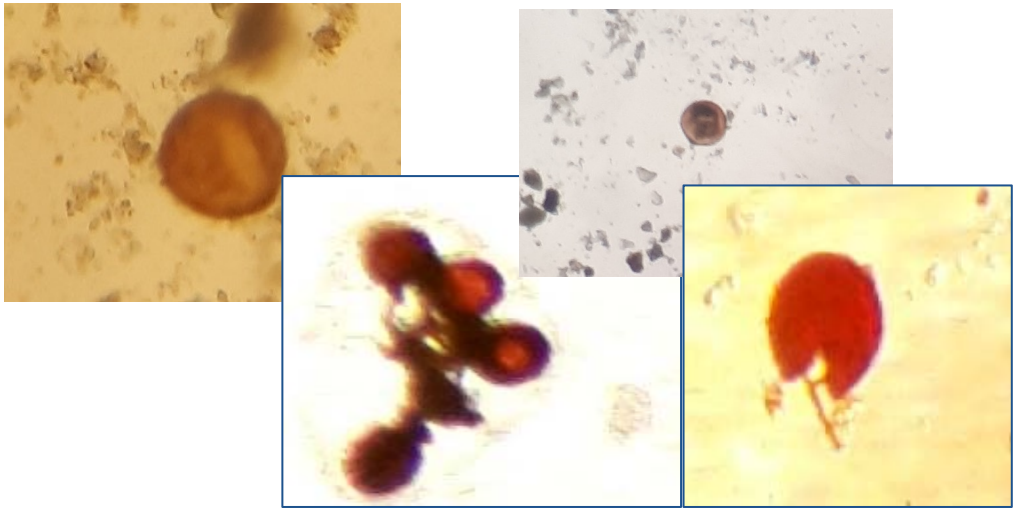
***Pseudomonas* sp, *Bacillus* sp, *Chromobacterium* sp, *Caulobacterium* sp, and *Micrococcus* sp.**





- **AM Fungi :**

Glomus sp, Scutelospora sp, Acaulospora sp, Gigaspora sp



Conclusion

- The PSBs population ranged from 1 x 10^3 to 1716 x 10^3/gram dry soil, while the number of PSB colonies ranged from 67 x 10^2 to 126 x 10^5 CFU/gram soil with a coefficient of diversity of 194.47. %, this shows that the PSBs population is very high with a very diverse level of distribution.

- The average number of AM Fungi spores was 18.66-22.25 spores/50 grams of soil and the percentage of AMF colonization was moderate (48.7%) to very high (56.18%).

- The results of semivariance analysis of the number of PSB and AM Fungi are evenly distributed in each location with a spherical distribution graph.

Acknowledgement

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Thank You !