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Assessing the Impact of Composts and Biofertilizers on the Growth of Rabi Maize (*Zea mays* L.) in Sandy Loam Soil

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ABSTRACT: A field experiment was conducted at the Department of Agriculture at Himalayan University, Jullang, Arunachal Pradesh, to assess the impact of composts and biofertilizers on plant growth. The available nutrient status was medium in N, High in P and medium in K. The treatments considered of T_1- Control 100 % RDF, T_2 - Vermicompost + *Phosphorus solubilizing bacteria*, T_3 – Poultry manure + *Azotobacter*, T_4 – Compost + *Phosphorus solubilizing bacteria* + *Azotobacter*, T_5 – Compost+ *Phosphorus solubilizing bacteria*, T_6 – Poultry manure + *Azotobacter*, T_7 – Vermicompost + *Phosphorus solubilizing bacteria* + *Azotobacter*. The highest plant height recorded 20.87 at 20 DAS, 53.27 at 40 DAS, 124.67 at 60 DAS, 142.73 at 80 DAS and 193.73 at 100 DAS, highest number of leaves plant^{-1} recorded 4.80 at 20 DAS, 5.80 at 40 DAS, 7.44 at 60 DAS, 8.47 at 80 DAS and 12.60 at 100 DAS and plant dry weight recorded 6.23 at 20 DAS, 54.87 at 40 DAS, 122.00 at 60 DAS, 138.67 at 80 DAS and 159.33 at 100 DAS were obtained with treatment (T_7) receiving Vermicompost + *Phosphorus solubilizing bacteria*+ *Azotobacter*. Some of the challenges we faced were slow and time-consuming in conducting research trail. Also faced difficulty in getting biofertilizers.

Keywords: Maize, Vermicompost, *Phosphorus Solubilizing Bacteria*, *Azotobacter*, Compost.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most versatile and multi-utility crops. Maize can be cultivated in different seasons and Agro-climatic conditions. After rice and wheat, maize is the third most important food crop in the world. Globally, it is known as the queen of cereals because of its highest genetic potential. It is the major source of food, feed, fodder and industrial raw material. In India, it is grown over an area of 9.43 m ha with a total production of 24.35 m tones **(**Ram *et al*., 2017). The predominant rabi maize growing states are Andhra Pradesh (45.5%), Bihar (20.1%), Tamil Nadu (9.3%), Karnataka (8.5%), Maharashtra (7.7%), and West Bengal (5.3%) (Moi *et al*., 2022). Maize is being grown in rabi season suffers from mostly by the weeds as well as soil moisture present in the root zone, moisture stress and nutrient deficiencies are the key reasons for low yield of maize in India. Therefore, the proper research addressing these problems needs to be done to increase the productivity of maize. A weed is a serious problem in maize particularly during rabi season as it compete with maize for nutrients and causes yield loss upto 35%. The Application of mulching and biofertilizer helps in increasing the yield productivity and growth of the plants.

MATERIALS AND METHODS

The experiment was conducted during the rabi season of 2022 at Himalayan University, Itanagar. The farm is located in Jullang, University campus. The Crop Research Farm is situated at 27.14°N latitude and 93.62°E longitudes and at an altitude of 320 m above mean sea level. The site comes under the Eastern Himalayan region and the agro-climatic zone is under the sub-tropical zone of Arunachal Pradesh.

Initial soil properties of field experiment	
Soil properties	**Status**
Sand (%)	53.47%
Silt (%)	37.65 %
Clay (%)	23.98 %
Soil texture	Sandy loam
Organic carbon	5.2%
Ph	5.10
EC	0.6 dS/m
Available Nitrogen	290 Kg/ha
Available Phosphorus	35.50 Kg/ha
Available Potassium	157.9 Kg/ha

The experiment was laid out in a Randomized Block Design (RBD) in the year of 2022. The treatments includes T_1 - Control 100 % RDF, T_2 - Vermicompost + *Phosphorus solubilizing bacteria*, T_3 – Poultry manure + *Azotobacter*, T_4 – Compost + *Phosphorus solubilizing bacteria* + *Azotobacter*, T_5 – Compost+ *Phosphorus solubilizing bacteria*, T_6 – Poultry manure + *Azotobacter*, T_7 – Vermicompost + *Phosphorus solubilizing bacteria* + *Azotobacter*. All plots received the recommended dose of organic fertilizers.

RESULT AND DISCUSSION

At 20, 40, 60, 80 and 100 DAS in plant height, highest number of leaves plant^{-1} and plant dry weight was found to be statistically significant in T_7 (Vermicompost + *Phosphorus Solubilizing Bacteria* + *Azotobacter*) and T_2 (Vermicompost + *Phosphorus Solubilizing Bacteria*) was found to be statistically at par with T_7. The least plant height, number of leaves plant^{-1} and plant dry weight was observed in treatment T_1 (control). The probable reason for recording higher plant height under treatment T_7 (Vermicompost + *Phosphorus Solubilizing Bacteria* + *Azotobacter*) is due to the highest plant height, stem diameter and LAI was recorded for plant grown on Vermicompost (Frankem and Hanway 2008) and maximum in seedling treated with *phosphorus Solubilizing Bacteria* (PSB) when compare to control crops. The results of PSB inoculation in the protein content showed a greater increase in PSB plants than in control seedlings (Shankar *et al.*, 2013). The probable reason for recording higher number of leaves plant^{-1} under treatment T_7 (Vermicompost + *Phosphorus Solubilizing Bacteria* + *Azotobacter*) is due to the season long weed control could be achieved either with the application of black polythene mulch or white polythene mulch (Ram *et al*., 2017) and the application of *Azotobacter* and *Phosphorus Solubilizing Bacteria* was registered net positive balance status in soil in relation to available nitrogen and phosphorus over initial soil status and it improved fertility status of the soil in sustainable manner (Mortvedt *et al*., 2006); Habibi *et al.* (2011) and seed inoculation with *Azotobacter* and *Phosphorus solubilizing bacteria* cultural maximized the stover yield and protein content in grain (Singh, 2010).

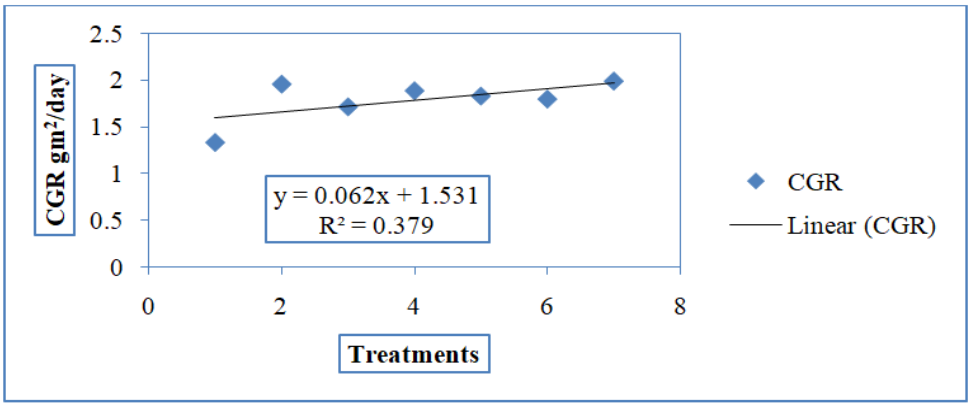

Fig. 1. Linear relationship of Crop Growth Rate (gm^2/day) with Treatments.

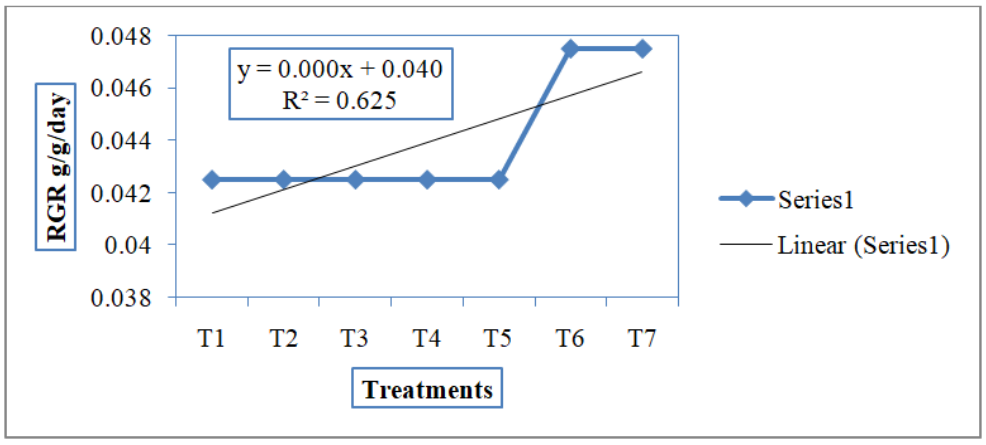

Fig. 2. Linear relationship of Relative Growth Rate (g/g/day) with Treatments.

Table 1: Effect of composts and biofertilizers on plant height (cm) of rabi maize.

Treatments	Plant height (cm)				
	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
T_1	14.87	46.20	118.27	137.60	188.00
T_2	18.53	51.27	123.47	140.80	192.67
T_3	17.20	49.60	121.00	139.93	191.13
T_4	18.20	50.87	123.13	140.47	192.13
T_5	17.60	50.80	122.53	140.47	191.73
T_6	17.53	50.33	122.47	140.27	191.67
T_7	20.87	53.27	124.67	142.73	193.73
F Test	NS	S	S	S	S
SEd (±)	0.64	0.53	1.00	0.54	0.41
CD (P=0.05)	1.40	1.16	2.18	1.17	0.88

Table 2: Effect of composts and biofertilizers on number of leaves/plant.

Treatments	Number of leaves/plant				
	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
T_1	3.67	4.73	6.13	7.33	10.53
T_2	4.47	5.33	6.80	8.00	11.80
T_3	4.07	5.13	6.67	7.73	11.40
T_4	4.33	5.27	6.67	7.93	11.73
T_5	4.27	5.20	6.67	7.87	11.60
T_6	4.20	5.20	6.67	7.73	11.60
T_7	4.80	5.80	7.44	8.47	12.60
F Test	S	S	S	S	S
SEd (±)	0.22	0.18	0.15	0.11	0.23
CD (P=0.05)	0.49	0.40	0.34	0.24	0.53

Table 3: Effect of composts and biofertilizers on plant dry weight of rabi maize.

Treatments	Plant dry weight				
	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
T_1	4.60	35.67	96.67	116.67	137.00
T_2	5.57	53.27	119.9	136.00	158.00
T_3	5.17	46.40	108.67	123.00	142.33
T_4	5.53	51.07	117.67	134.00	157.00
T_5	5.30	50.65	114.33	132.00	154.00
T_6	5.17	49.75	111.33	128.00	148.33
T_7	6.23	54.87	122.00	138.67	159.33
F Test	S	S	S	S	S
SEd (±)	0.22	0.40	0.56	1.56	0.62
CD (P=0.05)	0.44	0.86	1.23	3.40	1.34

CONCLUSIOS

Considering the salient findings in perspective, the study revealed that application of Vermicompost with *Phosphorus Solubilizing Bacteria* and *Azotobacter* (T_7) was found to be best combination for maximizing the growth parameters (plant height, Number of leaves plant^{-1} and plant dry weight) of maize. Treatments with Vermicompost and *Phosphorus Solubilizing Bacteria* was also observed best in CGR (g m^{-2} day^{-1}) and RGR (g g^{-1} day^{-1}) in treatment (T_7).

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