

**EFFECT OF DIFFERENT LEVELS OF PSB AND ORGANIC STARTER SOLUTION ON GROWTH AND YIELD
OF BROCCOLI (*Brassica oleracea* var. *italica* L.) c v. Lucky**

ABSTRACT

The present investigation entitled “EFFECT OF DIFFERENT LEVELS OF PSB AND ORGANIC STARTER SOLUTION ON GROWTH AND YIELD OF BROCCOLI” was conducted in the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj (UP) During October 2021 to February 2022. The experiment was laid out in RBD with 9 treatments with 3 replications. The results revealed that Treatment T₈ (40ml/Plant PSB + 40ml/Plant Starter Solution TA41 (Diluted)) performed the best in terms of days to Plant Height (30.56), Leaf length (46.86), Leaf width (16.71), No. of Leaves (14.89), Days to initiation (49.5), Head weight (530g), Head yield per plot (3.22Kg), Head yield per hectare (14.6t/ha), B:C Ratio (4.9). Therefore, the Treatment T₈ (40ml/Plant PSB + 40ml/Plant Starter Solution TA41 (Diluted)) is the best when compared to other treatments. As, the highest benefit cost ratio was observed in treatment T₈ (40ml/Plant PSB + 40ml/Plant Starter solution TA41 (Diluted)) i.e., (4.9) which states that it is economically profitable compared to all other treatments.

Keywords: Broccoli, Growth, yield, PSB, Starter solution

1. INTRODUCTION

Broccoli (*Brassica oleracea* var. *italica*) belongs to the genus Brassica and family Brassicaceae which includes a wide range of crop plants derived from the Mediterranean sea and modified over the years by selection and breeding (Decoteay, 2000). Broccoli is often boiled or steamed but may be eaten raw. P-solubilization ability of rhizosphere microorganisms is considered to be one of the most

important traits associated with plant phosphate nutrition. Phosphate solubilizing bacteria play an important role in supplementing phosphorous to plant allowing sustainable use of phosphate. PSB (Phosphate Solubilizing Bacteria) are beneficial bacteria capable of solubilizing inorganic phosphorus from insoluble compounds.

Starter solution are mixtures of soluble fertilizer and water used to get young plants off to a good start. Improvement in broccoli growth and yield under starter solution was observed by (Roy *et al.*, 2010). The starter solution supplies readily available nutrients directly to the soil-rhizosphere system.

2. MATERIALS AND METHOD

The experiment was conducted at Experimental Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, and Prayagraj (UP) during 2021. Broccoli was planted in field at a spacing of 60×45cm in plot of 1×1.5m size PSB (Phosphate Solubilizing Bacteria) and organic starter solution (TA41). Normal cultural and plant protection measures were followed during the cultivation process. Plants were selected randomly from each plot as representative sample for recording data.

The experiment considered of nine treatments with T₀ Control, T₁ 20ml/plant PSB (diluted), T₂ 40ml/plant PSB (diluted), T₃ 20ml/plant starter solution TA41(diluted), T₄ 40ml/plant starter solution TA41(diluted), T₅ 20 ml/plant PSB+ 20ml/Plant Starter SolutionTA41 (diluted), T₆ 20ml/plant PSB+ 40ml/Plant Starter solutionTA41 (diluted), T₇ 40ml/plant PSB+ 20ml/Plant Starter solutionTA41 (diluted), T₈ 40ml/plant PSB +40ml/Plant Starter solution TA41(diluted) was laid out in randomized block design with three replications.

3. RESULT AND DISCUSSION

The broccoli results of the growth and yield was taken and presented

Data was compared between the treated plots and the control to find out the best possible combination of PSB and Organic starter solution. The findings are given below:

3.1 Growth parameters

The treatment significantly altered with all the growth parameters all the growth parameters at all the successive stage of growth. The treatment T₈ (40ml/plant PSB +40ml/Plant Starter solution TA41(diluted)) was observed maximum at all successive stage of growth with plant height (cm) (16.89,18.67,30.56), leaf length (cm) (16.47,21.76,28.10), leaf width (cm) (9.68,12.90,16.71), leaf area (m²) (161.78,305.09,475.35), number of leaves per plant (10.78,12.44,14.89), Days taken to head initiation (49.5). Application of PSB generate higher yield by providing valuable nutrients to the plant and soil and also PSB could play a pivotal role in making of soluble phosphorus available to plants while Starter Solution gives the plants higher survival rate and earlier renewal rate. PSB and Starter Solution improved the broccoli growth and growth parameter. The performance of the plants was better in treated treatments in comparison to the control. These similar findings were recorded by (Shima *et al.*, 2016, Munsu *et al.*, 2013 and Sivasakthivelan *et al.*, 2021)

3.2 Yield parameters

The highest head weight was in the treatment T₈ (40ml/plant PSB +40ml/Plant Starter solution TA41(diluted)) (440.00g), highest yield per plot (3.22kg) and the maximum yield per hectare (14.6t/ha) followed by T₇ (40ml/Plant PSB +20ml/Plant Starter Solution TA41 (Diluted)). Similarly, Pathak and Ram (2020) reported that the yield improvement through application of biofertilizers might be due to available nutrients, particularly N and P and micronutrients, increase microbial activity, production of growth promoting substance and plant-soil-microbes interaction in broccoli, cabbage, tomato.

Table No. 1 Effect of different levels of PSB and organic starter solution on growth traits of Broccoli (*Brassica oleracea* var. *italic* L.)
c v. Lucky

Notations	Treatment combinations	Plant height			Leaf length		
		25 DAT	50 DAT	75 DAT	25 DAT	50 DAT	75 DAT
T ₀	Control	9.00	10.78	14.11	12.92	15.94	18.28

T ₁	20ml/Plant PSB(Diluted)	12.67	14.67	27.00	14.27	19.87	23.78
T ₂	40ml/plant PSB (diluted)	13.44	15.67	21.56	15.42	18.90	24.43
T ₃	20ml/plant starter solution TA41(diluted)	11.44	13.33	24.44	14.01	16.39	23.36
T ₄	40ml/plant starter solution TA41(diluted)	11.22	11.83	21.00	13.09	18.97	22.77
T ₅	20 ml/pant PSB+ 20ml/Plant Starter SolutionTA41 (diluted)	14.33	15.33	25.33	13.67	18.34	22.31
T ₆	20ml/plant PSB+ 40ml/Plant Starter solutionTA41 (diluted)	15.33	16.67	28.11	16.26	19.46	25.69
T ₇	40ml/plant PSB+ 20ml/Plant Starter solutionTA41 (diluted)	16.33	18.33	29.67	15.53	19.87	26.79
T ₈	40ml/plant PSB +40ml/Plant Starter solution TA41(diluted)	16.89	18.67	30.56	16.47	21.76	28.10
	SE.d(±)	0.34	0.33	0.66	0.22	0.59	0.88
	CD	1.01	0.99	1.98	0.66	1.76	1.86
	CV	4.28	3.88	4.64	2.60	5.40	4.50

Table No. 2 Effect of different levels of PSB and organic starter solution on growth traits of Broccoli (*Brassica oleracea* var. *italic* L.)

c v. Lucky

Notations	Treatment combinations	Leaf width			Leaf area		
		25 DAT	50 DAT	75 DAT	25 DAT	50 DAT	75 DAT
T ₀	Control	7.26	10.19	11.36	101.00	154.70	207.60
T ₁	20ml/Plant PSB(Diluted)	8.74	12.23	13.17	128.19	223.60	313.14
T ₂	40ml/plant PSB (diluted)	9.68	13.48	14.06	139.32	221.72	336.52
T ₃	20ml/plant starter solution TA41(diluted)	9.09	10.71	12.29	101.37	186.12	272.85
T ₄	40ml/plant starter solution TA41(diluted)	8.52	10.30	14.01	121.51	197.55	319.743
T ₅	20 ml/pant PSB+ 20ml/Plant Starter SolutionTA41 (diluted)	8.69	10.89	15.53	127.49	213.49	344.79
T ₆	20ml/plant PSB+ 40ml/Plant Starter solutionTA41 (diluted)	9.21	12.52	14.32	148.28	234.38	403.39
T ₇	40ml/plant PSB+ 20ml/Plant Starter solutionTA41 (diluted)	9.76	12.27	16.58	158.35	265.36	447.69
T ₈	40ml/plant PSB +40ml/Plant Starter solution TA41(diluted)	9.68	12.90	16.71	161.78	305.09	475.35

	SE.d(±)	0.25	0.47	0.41	7.29	12.70	15.10
	CD	0.75	1.41	1.23	15.45	26.92	32.00
	CV	4.85	6.94	5.01	6.76	6.99	5.33

Table No. 3 Effect of different levels of PSB and organic starter solution on growth traits of Broccoli (*Brassica oleracea* var. *italic* L.) c v. Lucky

Notations	Treatment combinations	No. of leaves per plant			Days taken for head initiation
		25 DAT	50 DAT	75 DAT	
T ₀	Control	8.78	10.11	11.78	55.72
T ₁	20ml/Plant PSB(Diluted)	8.89	10.44	11.89	54.8
T ₂	40ml/plant PSB (diluted)	10.22	11.22	12.56	54.23
T ₃	20ml/plant starter solution TA41(diluted)	9.00	10.22	11.78	53.72
T ₄	40ml/plant starter solution TA41(diluted)	9.78	11.00	12.44	53.34
T ₅	20 ml/pant PSB+ 20ml/Plant Starter SolutionTA41 (diluted)	8.89	10.44	12.67	52.69
T ₆	20ml/plant PSB+ 40ml/Plant Starter solutionTA41 (diluted)	9.67	11.22	12.78	51.3
T ₇	40ml/plant PSB+ 20ml/Plant Starter solutionTA41 (diluted)	9.33	11.56	14.22	50.46
T ₈	40ml/plant PSB +40ml/Plant Starter solution TA41(diluted)	10.78	12.44	14.89	49.5
	SE.d(±)	0.26	0.25	0.41	0.68
	CD	0.77	0.74	1.24	1.44
	CV	4.69	3.91	5.58	1.58

Table No. 4 Effect of different levels of PSB and organic starter solution on yield traits of Broccoli (*Brassica oleracea* var. *italica* L.) c v. Lucky

Notations	Treatment combination	Head weight(g)	Head weight per plot (kg)	Head yield per tones (t/ha)
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T ₀	Control	171.56	1.05	5.7
T ₁	20ml/Plant PSB(Diluted)	227.11	1.52	7.5
T ₂	40ml/plant PSB (diluted)	268.00	1.72	8.9
T ₃	20ml/plant starter solution TA41(diluted)	296.42	1.63	9.8
T ₄	40ml/plant starter solution TA41(diluted)	267.16	1.63	8.8
T ₅	20 ml/pant PSB+ 20ml/Plant Starter SolutionTA41 (diluted)	317.53	2.10	10.5
T ₆	20ml/plant PSB+ 40ml/Plant Starter solutionTA41 (diluted)	346.04	2.37	11.5
T ₇	40ml/plant PSB+ 20ml/Plant Starter solutionTA41 (diluted)	394.11	2.69	13.1
T ₈	40ml/plant PSB +40ml/Plant Starter solution TA41(diluted)	440.00	3.22	14.6
	SE.d(±)	23.71	0.15	0.45
	CD	50.27	0.33	0.96
	CV	9.58	9.47	5.52

4. CONCLUSION

On the basis of present investigation, it is concluded that the treatment T₈ (40ml/Plant PSB+40ml/Plant TA41 Starter Solution) was found best in respect to plant height, leaf length, leaf width, No. of leaves per plant, leaf area, days to head initiation, head weight, head yield per plot, head yield per hectare. This treatment also showed maximum gross return, net return and benefit cost ratio (4.96).

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UNDER PEER REVIEW