



EFFICACY OF BIOFERTILIZERS ON GROWTH, YIELD AND QUALITY OF SPROUTING BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALIC PLANK*)”, cv. PUSA BROCCOLI KTS-1

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Abstract

A field experiment was carried out entitled “Efficacy of biofertilizers on growth, yield and quality of Sprouting broccoli (*Brassica oleracea* var. *italic Plank*)” cv. Pusa Broccoli KTS-1 in Randomized Block Design with three replications. The experiment was conducted at the Horticulture Research Farm of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Rae Bareilly Road, Lucknow (U.P.), India; during *rabi* season of 2015-16. The experiment comprises of different doses of biofertilizers *i.e.* Control, RDF (100%), Azotobacter (100%), Azospirillum (100%), VAM (100%), PSB (100%), Azotobacter + Azospirillum (50% + 50%), Azotobacter + PSB (50% + 50%), RDF + VAM (50% + 50%), RDF + Azotobacter (50% + 50%), RDF + PSB (50% + 50%) and Azospirillum + VAM (50% + 50%). The growth, yield and quality attributing characters were recorded maximum plant height (54.75 cm), number of leaf (21.35cm), length of leaf (47.71cm), leaf width (23.37cm), curd diameter (16.8cm), curd weight with leaf (533.5g), curd weight without leaf (467.25g), yield kg/plot (7.5kg), TSS (8.93^o brix), vitamin C (92.18), sugar (3.37), reducing sugar (2.96) and non-reducing sugar (0.88).

Key words : Broccoli, azospirillum, VAM, yield and quality.

Introduction

Broccoli (*Brassica oleracea* L. var. *italica* Plenck 2n=x=18), which is originated from the Mediterranean region commonly known as *Hari gobhi* in Hindi and a member of Cole group, belongs to the family Brassicaceae or Cruciferae (mustard family). The term *Cole* has originated from the word “*Colewort*” meaning wild cabbage while the broccoli derived its name from the Latin word *Brachium* meaning an arm or branch. On the other hand, the USA it first appeared in 1806, but it was commercially cultivated of broccoli was started around 1923 (Decoteau, 2000). In Jordan, broccoli is cultivated on a limited area (Ministry of Agriculture, 2006). However, over half of the world population fails to benefit from this because they lack a specific gene (GSTMI) that helps retain the compound in the body (Kirsh *et al.*, 2007). Eating a few portions of broccoli each week may help to reduce the risk of cancer. The cancer-fighting

properties of broccoli are not new and previous studies have related these benefits to the high levels of active plant chemicals called glucosinolates (Zhao *et al.*, 2007). Eating more than one serving of broccoli a week reduces the risk of prostate cancer by up to 45 percent. Eating larger portions may also have additional benefits, since broccoli is also a rich source of many vitamins and minerals such as vitamin A and C, carotenoids, fiber, calcium and folic acid (Michaud *et al.*, 2002). Growing broccoli in the newly reclaimed soils is faced by various problems, such as cultivars, fertilization, low amounts of available nutrients and low organic matter content as well as poor hydrophilic, chemical and biological properties. Nkoa *et al.* (2002) found that using mineral fertilizer (N, P, K) increasing broccoli vegetative growth, yield and quality.

Organic manure play direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization and improving

physical and chemical properties of soils (Chaterjee *et al.*, 2005). Anant-Bahadur *et al.* (2006) pointed that organic matter plays an important role in the chemical behaviour of several metals in soils throughout its active groups (Flavonic and humic acids), which have the ability to retain the metals in complex and chelate forms.

However, due to increase in its popularity, there is a trend to increase cultivation by farmers as well as consumption by consumers. Broccoli is an important vegetable crop and has high nutritional and good commercial value (Yoldas *et al.*, 2008). It is low in sodium food, fat free and calories, high in vitamin C, A, B₂ and calcium. Nowadays, broccoli attracted more attention due to its multifarious use and great nutritional value (Salunkhe & Kadam, 1998; Talalay & Fahey, 2001; Rangkadilok *et al.*, 2002). Generally, excessive amounts of inorganic fertilizers are applied to vegetables in order to achieve a higher yield (Stewart *et al.*, 2005) and maximum value of growth (Badr & Fekry, 1998).

However, the use of inorganic fertilizers alone may cause problems for human health and the environment. So, inorganic fertilizer is considered a major source of plant nutrients (Adediran *et al.*, 2004; Naeem *et al.*, 2006). Organic manure can serve as alternative practice to mineral fertilizers (Gupta *et al.*, 2010) for improving soil structure (Dauda *et al.*, 2008) and microbial biomass (Suresh *et al.*, 2004).

Use of organic manures improve soil texture, structure, humus, aeration, water holding capacity and microbial activity (Pare *et al.*, 2006). Good soil has more than 3% organic matter content but soil of Bangladesh have less than 1.5% organic matter even less than 1% organic matter. Productivity of soils is declining due to depletion of organic matter caused by high cropping intensity. On an average well rotted cow dung contains 0.5% N₂, 0.2% P₂O₅ and 0.5% K₂O. Application of vermin-compost and poultry manure subsequently increase yield attributing characters and yield of broccoli (Sameera *et al.*, 2005).

Materials and Methods

The present experiment entitled entitled “Efficacy of biofertilizers on growth, yield and quality of Sprouting broccoli (*Brassica oleracea* var. *italic* Plank) cv.Pusa Broccoli KTS-1” was conducted at Research Farm of Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow of 2015-2016. The experiment was conducted during *Rabi* season under Randomized Block Design with three replications. Details of material used and methodology

employed to plan and execute the experiment are described in this chapter. Geographically Lucknow is situated at 26°50' N latitude, 80°52' E longitude and altitude of 111 meter above mean sea level (MSL).

The seed of broccoli collected from IARI, Regional Research Station kattrain kullu valley (H.P) Broccoli seeds KTS-1 were sown on nursery beds of Horticultural Research Farm, Babasaheb Bhimrao Ambedkar University, Lucknow, by broadcasting method. Transplanting was done when the seedlings were 30 days old on first Transplanting 24th Nov. 2015. A spacing of 45x30 cm was adopted for transplanting. Seedlings of uniform size were selected from the nursery for this purpose. All the agronomic package of practices was taken to grow a healthy crop in each replication. In each replication, randomly fine plants were selected for taking observation. The experimental materials included twelve treatment combinations *viz.* T₀ (Control), T₁ RDF (100%) (NPK:150 :100 :100 Kg/ha), T₂ Azotobacter (100%), T₃ Azospirillum (100%), T₄ VAM (100%), T₅ PSB (100%), T₆ Azotobacter + Azospirillum (50% + 50%), T₇ Azotobacter + PSB (50% + 50%), T₈ RDF + VAM (50% + 50%), T₉ RDF + Azotobacter (50% + 50%), T₁₀ RDF + PSB (50% + 50%) and T₁₁ Azospirillum + VAM (50% + 50%). The observations were recorded on 15 characters under growth, yield and quality attributing traits in broccoli, *i.e.* height of the plant, number of leaves of per plant, length of leaf, width of leaf (cm.), yield character, weight of curd with leaf, weight of curd without leaf, yield (Kg./plot), yield (q./ha.), curd length, curd diameter, vitamin – C, T.S.S., total sugar, reducing sugar, non-reducing sugar.

Results and Discussion

Data from tables 1 and 2 revealed that the differences with respect to the growth, yield and quality were significant among different treatment combinations. The maximum plant height (54.75cm) was recorded under treatment T₆ [Azotobacter 50% +Azospirillum 50%], number of leaves was maximum (21.35cm) under treatment T₇ [Azotobacter 50%+ PSB 50%], maximum length of leaf was (48 cm) under T₆ [Azotobacter 50% + Azospirillum], maximum leaves width (23.37cm) was recorded under treatment T₆ [Azotobacter 50% + Azospirillum 50%], maximum (533.50gm) under treatment T₆ [Azotobacter 50% + Azospirillum 50%], maximum (467.25 gm) under treatment T₆ [Azotobacter 50% + Azospirillum 50%], maximum (7.51kg) under the treatment T₆ [Azotobacter 50% + Azospirillum 50%], maximum (347.53q) under the treatment T₆ [Azotobacter 50% +Azospirillum 50%], curd diameter and it was

Table 1 : Efficacy of bio- fertilizers on growth and yield parameter of broccoli at harvesting stage.

S. no.	Treatment	Characters								
		Plant height (cm)	Number of leaf plant	Leaf length (cm)	Width of leaf	Curd weight with leaves	Curd weight without leaves	Yield (Kg/plot)	Yield (Q/ha)	Curd diameter (mm)
1.	T ₀	47.83	17.61	41.52	19.20	439.00	363.67	5.57	257.71	158.34
2.	T ₁	52.83	19.67	46.58	22.43	507.42	444.08	7.10	328.70	165.17
3.	T ₂	52.75	19.85	46.31	22.30	506.67	438.17	7.07	326.69	165.75
4.	T ₃	53.42	19.73	46.56	22.40	514.00	441.50	7.14	330.39	167.50
5.	T ₄	54.33	19.17	46.48	22.84	525.25	456.00	6.97	322.53	166.25
6.	T ₅	49.69	18.86	45.52	22.97	478.50	417.75	6.69	310.03	153.00
7.	T ₆	54.75	21.35	47.71	23.36	533.50	467.25	7.51	347.53	168.00
8.	T ₇	54.47	20.77	46.88	22.80	528.67	458.08	7.21	333.49	166.75
9.	T ₈	53.50	20.16	45.60	22.47	519.50	443.42	6.97	322.68	165.83
10.	T ₉	53.75	20.04	45.01	22.97	517.42	447.33	6.97	328.08	166.42
11.	T ₁₀	49.33	18.99	42.42	21.57	477.58	377.83	6.47	299.380	159.42
12.	T ₁₁	49.00	18.72	42.89	21.67	478.08	375.17	6.16	285.03	161.75
CD at 5%		3.907	0.629	1.516	0.212	41.597	40.290	0.293	13.471	0.272

Table 2 : Efficacy of bio- fertilizers on leaf length, total sugar, reducing sugar, non-reducing sugar, vitamin C and T.S.S of broccoli at harvesting stage.

S. no.	Treatment	Characters					
		Leaf length (cm)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Vitamin C	T.S.S. (°Brix)
1.	T ₀	41.52	2.55	2.86	0.71	85.43	7.60
2.	T ₁	46.58	2.89	2.47	0.67	86.17	8.16
3.	T ₂	46.31	3.25	2.07	0.55	87.19	8.10
4.	T ₃	46.56	3.33	2.29	0.66	91.76	8.94
5.	T ₄	46.48	3.07	2.96	0.88	92.19	8.20
6.	T ₅	45.52	3.11	2.67	0.66	88.92	8.16
7.	T ₆	47.71	3.08	2.85	0.61	90.21	8.10
8.	T ₇	46.88	3.11	2.63	0.73	91.44	8.57
9.	T ₈	45.60	3.20	2.48	0.59	88.69	7.97
10.	T ₉	45.01	3.37	2.66	0.70	87.65	8.30
11.	T ₁₀	42.42	2.99	2.64	0.68	90.29	7.94
12.	T ₁₁	42.89	3.08	2.92	0.79	90.02	8.20
CD at 5%		1.516	0.876	0.073	2.121	0.331	0.212

recorded maximum (16.8cm) under treatment T₆ [Azotobacter 50% + Azospirillum 50%], Vitamin-C, it was obtained maximum (93.21mg) under treatment T₃ [VAM], T.S.S was maximum (9.21°Brix) under the treatment T₃ [VAM], total sugar was recorded maximum (3.37%) under treatment T₉ [RDF50% + Azotobacter 50%], reducing sugar was recorded maximum (3.21%) under treatment T₄ [PSB] and non reducing sugar was recorded maximum (0.89%) under treatment T₄ [PSB].

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