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Growth, Yield and Quality of Sweet Pepper (*Capsicum annuum* L.) as Influenced by the Application of VAM

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Abstract

A field experiment was conducted to assess the efficacy of VAM at two fertility levels on growth, yield and quality of sweet pepper during 2006-07. Application of mycoplex at 250 kg per hectare with 100% recommended dose of fertilizers gave highest total leaf area per plant (2538.7 cm^2), shoot fresh weight (210.2 g), shoot dry weight (74.7 g), root fresh weight (30.7 g), root dry weight (28.1 g), plant height (56.8 cm), number of primary branches (4.67), number of fruits per plant (5.37) and quality characters viz., average fruit length (10.8 cm), fruit diameter (8.9 cm), fruit weight (50.8 g), ascorbic acid (120 mg/100 g fresh weight), vitamin A (826 IU) and protein content (1.20%). The maximum (109.12 q/ha) and minimum (32.48 q/ha) fruit yield was observed with treatment T_4 having mycoplex at 250 kg/ha + 100 RDF and T_{11} (no application of fertilizers and VAM), respectively.

Key words : VAM, Sweet pepper, Growth, Yield, Quality.

Capsicum also known as sweet pepper or bell pepper is a popular vegetable and its cultivation is restricted to cool region. It is a good source of minerals and vitamin A, B and C. Being low in pungency and good source of vitamin C, it is mostly consumed as raw or salad in green mature stage. The symbiotic association of plant roots and fungi has intrigued many generations of biologists and in the late 1880s these associations were given the name mycorrhiza derived from the Greek word for fungus-root. VAMs are fungi which live in a harmonious relationship with plant roots. This is a symbiosis in which the fungi provide the plant with extra nutrients from the soil, especially phosphorus and zinc in exchange for sugars provided by the plants. VAMs extend the plant root system and the whole mycorrhiza can exploit the soil nutrients much more effectively than the plant alone. Some plant nutrients, such as phosphorus and zinc move slowly in the soil solution. Therefore, when a plant removes these nutrients from the soil near the root, there can be a delay before they are replaced at the root surface. A zone of nutrient depletion may occur near the root slowing down plant nutrient uptake. Use of chemical fertilizers to fulfill the requirement of plant nutrients was done from several years. Excessive use of inorganic fertilizers has the deteriorating effect on soil and environment. Their continuous use is creating nutritional imbalance in the soil, besides polluting the ground water and decreasing the nutritive value of the produce. On the other hand, biofertilizers provide balanced nutrition with respect to macro and micro nutrients to improve soil health which leads to grow crop successfully. Keeping this in view, the present experiment was conducted to find out the most efficient combination or arbuscular mycorrhiza and fertilizers for plant growth, yield and quality of sweet pepper.

Methods

Field experiments were conducted at Vegetable Research Center, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar during February to May 2006-07. The experimental material used was sweet pepper open pollinated variety California Wonder. The experiment was laid out in randomized block design with three replications. Arbuscular mycorrhiza was applied as soil application in the form of mycoplex, a commercial formulation of Mycorrhizae. Treatments consisted of 11 combinations i.e. T_1—Mycoplex (25 kg/ha) + 100% recommended dose of fertilizer (RDF), T_2—Mycoplex (50 kg/ha) + 100% RDF, T_3—Mycoplex (100 kg/ha) + 100% RDF, T_4—Mycoplex (250 kg/ha) + 100% RDF, T_5— Mycoplex

Table 1. Effect of VAM on growth and yield of sweet pepper.

Treatment	Total leaf area/plant (cm^2)	Shoot fresh weight (g)	Shoot dry weight (g)	Root fresh weight (g)	Root dry weight (g)	Plant height (cm)	Number of primary branches	Number of fruits/ plant	Yield (kg/ha)
T_1	2087.3	176.2	67.8	27.4	23.9	47.4	4.00	4.48	75.62
T_2	2131.2	179.3	68.3	27.6	24.8	48.2	4.00	4.51	76.85
T_3	2271.1	190.7	71.2	28.2	25.7	50.7	4.33	4.62	81.68
T_4	2538.7	210.2	74.7	30.7	28.1	56.8	4.67	5.37	109.12
T_5	1861.6	144.2	59.7	24,3	22.1	40.2	3.33	3.76	49.33
T_6	1872.7	146.1	60.8	25.2	23.1	40.7	3.33	3.76	49.63
T_7	1891.9	153.4	62.6	27.4	24.8	41.8	3.67	3.79	51.09
T_8	1957.4	160.3	63.1	29.8	28.0	44.2	3.67	4.00	57.28
T_9	2071.8	170.9	65.8	27.2	25.0	47.3	4.00	4.44	74.77
T_{10}	1667.3	140.2	53.5	23.1	20.8	40.0	3.33	3.64	47.17
T_{11}	1326.8	121.1	39.7	19.2	17.7	34.6	3.00	3.21	32.48
CD at (5%)	231.7	18.1	3.2	1.8	0.71	4.8	0.76	0.23	8.83

(25 kg/ha) + 50% RDF, T_6 —Mycoplex (50 kg/ha) + 50% RDF, T_7—Mycoplex (100 kg/ha) + 50% RDF, T_8—Mycoplex (250 kg/ha) + 50% RDF, T_9—100% RDF, T_{10}—50% RDF and T_{11}—untreated (control). Recommended dose of fertilizers was 80 : 60 : 50 kg N, P_2O_5 and K_2O per hectare, respectively. The sources of chemical fertilizers were as urea, single super phosphate and murate of potash for N, P_2O_5 and K_2O, respectively. The full amount of VAM was applied as soil application one day before transplanting. The plant distance was maintained at 50 cm between and within the rows. Regular cultural operations were done to raise a healthy crop. The observations were recorded on total leaf area per plant (cm^2), shoot fresh weight (g), shoot dry weight (g), root fresh weight (g) root dry weight (g), plant height (cm), number of primary branches and number of fruits per plant recorded at the time of last harvesting from five randomly selected plants. Fruit quality parameters like average fruit length (cm), average fruit diameter (cm) and average fruit weight (g). Ascorbic acid (mg/100 g), vitamin A (IU) and protein (%) was recorded by following the procedure as suggested by standard methods (1). The fruit yield was recorded on plot basis and the same was converted into quintal per hectare.

Results and Discussion

All the treatments related to growth and fruit yield showed a significant increase over the control (Table 1). The highest total leaf area per plant (2,538.7 cm^2) was obtained with treatment T_4 having mycoplex (250 kg/ha) + 100% RDF followed by treatment T_3 (2,271.1 cm^2) and T_2 (2,131.2 cm^2). The lowest total leaf area per plant (1,326.8 cm^2) was observed with treatment T_{11} followed by treatment T_{10} (1,667.3 cm^2) and T_5 (1,861.6 cm^2). The maximum shoot fresh weight, shoot dry weight, root fresh weight and root dry weight were recorded in treatment T_4 (mycoplex at 250 kg/ha + 100% RDF), which were 210.2 g, 74.7 g, 30.7 g and 28.1 g, respectively. Increased in plant height, number of primary branches and number of fruits per plant (56.8 cm, 4.67 and 5.37, respectively) were also recorded with the increasing rate of mycoplex i.e. 250 kg per hectare with the 100% RDF. The result also indicated that the inoculation of vescular arbuscular mycorrhizae increase the growth of plant with solubilization of complex phosphate. The may be due to the reason that VAM make more nutrients available to the plants, improve soil texture, water holding capacity and improve disease resistance. A similar result on higher plant growth was found in capsicum by application of VAM (2).

The VAM applied plots had significantly highest total fruit yield over the other treatments. The highest yield (109.12 q/ha) was observed with treatment T_4(mycoplex at 250 kg/ha + 100% RDF), followed by treatments T_3 (81.68 q/ha), T_2 (76.85 q/ha) and T_1 (75.62 q/ha). The significantly highest fruit yield in VAM treated plots may be due to supplying growth regulating substances, vitamins and protecting against pollutants and soil borne pathogens (3).

Table 2 revealed significant variations between treatments for fruit quality parameters. The maximum

Table 2. Effect of VAM on fruit quality of sweet pepper.

Treatment	Average fruit length (cm)	Average fruit diameter (cm)	Average fruit weight (g)	Ascorbic acid (mg/100 g)	Vitamin A (IU)	Protein (%)
T_1	8.7	6.7	42.2	117	800	1.17
T_2	9.1	6.7	42.6	118	807	1.18
T_3	10.0	7.2	44.2	118	810	1.18
T_4	10.8	8.9	50.8	120	826	1.20
T_5	6.7	4.9	32.8	107	736	1.08
T_6	6.7	4.9	33.0	107	738	1.08
T_7	6.8	5.0	33.7	108	740	1.08
T_8	7.1	5.1	35.8	111	756	1.10
T_9	8.6	6.4	42.1	117	800	1.17
T_{10}	6.5	4.4	32.4	106	730	1.07
T_{11}	5.1	4.4	25.3	98	700	0.94
CD at (5%)	0.71	0.67	3.98	4.37	14.61	0.03

average fruit length (10.8 cm), fruit diameter (8.9 cm) and fruit weight (50.8 g) were recorded with treatment T_4 followed by treatment T_3 (10.0 cm, 7.9 cm and 44.2 g), respectively. The minimum average fruit length (5.1 cm), fruit diameter (4.4 cm) and fruit weight (25.3 g) were obtained with treatment T_{11} having no application of NPK and VAM. The highest ascorbic acid (120 mg/100 g), vitamin A (826 IU) and protein (1.20%) were found with treatment T_4. These three parameters were not significantly influenced by the different doses of VAM but affected by different doses of fertilizers. The lowest ascorbic acid (98.0 mg/100 g), vitamin A (700 IU) and protein content (0.94%) were found with treatment T_{11} having no application of chemical fertilizers and VAM. Inoculation of VAM in sprouting broccoli increased the head growth and quality characters i.e. head weight, head diameters, ascorbic acid, vitamin A, protein (4). The effect of Mycorrhizae in increasing plant growth and yield has been well documented by different workers for capsicum. The beneficial effect of Mycorrhizae on plant growth has mostly been attributed to an increase in the uptake of nutrients especially phosphorus. Mycorrhizal fungi improve the soil phosphorus availability by solubilizing inorganic forms of phosphorus or by mineralization of organic phosphorus (5).

A perusal of data indicated that combined application of mycoplex at 250 kg/ha + 100% recommended dose of fertilizers gave good plant health, quality and maximum fruit yield of capsicum.

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