

Organic Farming Technology for Higher and Eco-Friendly Capsicum Production in Tarai Region of Uttarakhand

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Abstract

The studies were undertaken during 2004-05 and 2006-07 to develop an effective package of organic farming for capsicum crop. Five treatment combinations resulting from three organic sources i.e. T₁—Farmyard manure + biofertilizers, T₂—Poultry manure + biofertilizers, T₃—Vermicompost + biofertilizers, T₄—Combination of farmyard manure, poultry manure, vermicompost along with biofertilizers and T₅—Recommended dose of chemical fertilizers were tested. The experiment was laid out in randomized block design with four replications. The emanated results revealed that treatment having recommended dose of chemical fertilizers (ICM) gave higher fruit yield but at par with combined application of various organic sources i.e. FYM at 10 t/ha + PM at 1.5 t/ha + VC at 1.5 t/ha + biofertilizers. The organically produced capsicum fruits possessed long shelf at room storage. Maximum uptake of nutrients was obtained from the treatment having recommended dose of fertilizers. However, plot treated with 20 t FYM + biofertilizers showed maximum nutrient balance in the soil.

Key words : Capsicum, Organic farming, Yield, Nutrient balance, Shelf life.

Capsicum (*Capsicum annum L.*) is one of the most important Solanaceous vegetable crop grown for its fruits which are a rich source of minerals, vitamins and proteins. Excessive use of inorganic fertilizers has alarmed the environmentalists. 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, organic manures provide balanced nutrition with respect to macro and micro nutrients to improve soil health which leads to grow crop successfully. The long term sustainable crop production needs balanced supply of essential plant nutrients in available form along with suitable physical and biological properties to attain a better growth of roots and efficient utilization of nutrients from the rhizosphere. Several agro techniques have been tested for increasing the yield of capsicum in conjunction with nutritional requirement for mainland, but the findings may not hold good for Uttarakhand. Therefore, it is necessary to evaluate organic farming technology for higher and eco-friendly production of capsicum for this climatic zone separately. Thus, there is urgent need to develop a protective alternative production system for sustainable capsicum production. Keeping this in view, the present study was made to investigate ef-

fect of organic manures and biofertilizers on nutrients uptake, yield and shelf life of capsicum.

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Methods

Field experiments were conducted at Vegetable Research Center, Govind Ballabh Pant University Agriculture & Technology, Pantnagar during June to September of 2004-05 and 2006-07. The experimental material used was capsicum cultivar California Wonder. The experiment was conducted in a fixed plot. The soil of the experimental plot was clay loam having good drainage and contained 1.29% organic carbon. The soil contained 245.79 kg N, 23.4 kg P and 141.21 kg K/ha with 7.29 pH value. The experiments were laid out in randomized block design with three replications. Treatments consisted of five combinations i.e. T₁ (farmyard manure at 20 t/ha + *Azotobacter* + phosphorus solubilizing bacteria), T₂ (poultry manure at 5 t/ha + *Azotobacter* + phosphorus solubilizing

Table 1. Effect of different organic manures and their combination on fruit yield, nutrient uptake, balance and shelf life of capsicum. * Phosphorus solubilizing bacteria.

Treatments	Yield (q/ha)	Nutrient uptake (kg/ha)			Nutrient balance (kg/ha)			Shelf life at room temp (h)
		N	P	K	N	P	K	
FYM 20 t + Azotobacter + PSB*	75.09	30.3	2.9	34.0	267.5	25.9	155.1	36
PM 5 t + Azotobacter + PSB*	75.71	31.6	3.0	36.4	246.2	21.0	134.6	36
VC 7.5 t + Azotobacter + PSB*	66.23	30.6	2.8	33.8	252.0	25.8	139.6	36
FYM 10 t/ha + PM 1.5 t/ha + VC 1.5 t/ha + Azotobacter+ PSB*	90.78	34.7	3.3	39.0	250.1	25.4	149.3	36
Recommended dose of fertilizers (RDF)	94.33	39.3	4.0	42.3	240.6	24.6	131.9	24
CD (0.05)	8.86	2.7	1.0	1.8	10.2	1.0	4.6	—

bacteria), T₃ (vermicompost at 7.5 t/ha + *Azotobacter* + phosphorus solubilizing bacteria), T₄ (farm yard manure at 10 t/ha + poultry manure at 1.5 t/ha + vermicompost at 1.5 t/ha + *Azotobacter* + phosphorus solubilizing bacteria) and T₅ RDF (recommended dose of fertilizers). The same treatments were used for all the three years of study. The plant distance was maintained as 50 cm between and 50 cm within the rows. The capsicum seedlings were treated half an hour before transplanting with *Azotobacter* culture and phosphorus solubilizing bacteria. The soil samples were analyzed using standard procedure for nitrogen (1), phosphorus (2) and potassium (3) and based on the content of nutrient uptake value were calculated. The NPK composition of vermicompost, farm yard manure and poultry manure were 1.80 N, 1.20 P, 1.43 K; 0.60 N, 0.26 P, 0.60 K and 2.90 N, 2.80 P, 2.40 K, respectively. Regular cultural operations were done according to the need of crop. The yield was recorded on plot basis. Observations on shelf life of green fruits were recorded after the regular interval of 12 hours under room temperature.

Results and Discussion

Fruits Yield

Yield of green fruits was affected significantly due to various sources of organic manures. The maximum yield of green fruits (94.33 q/ha) was recorded with the treatment T₅ (RDF) having chemical fertilizer (Table 1). However, it was statistically at par (90.78 q/ha) with the treatment T₄ (farm yard manure at 10 t/ha + poultry manure at 1.5 t/ha + vermicompost 1.5 t/ha +

Azotobacter + phosphorus solubilizing bacteria). Such increase in yield due to farm yard manure has been reported to be associated with the release of macro and micro nutrients during the course of microbial decomposition. The beneficial response of farm yard manure to increase the crop yield might also be attributed to the availability of sufficient amounts of plant nutrients throughout the growth period and especially at critical growth periods of crops resulting is better uptake, plant vigor and superior yield attributes (4).

Shelf Life of Green Fruits

The shelf life of capsicum fruits was observed at room temperature. In general, all organic manure treatments have more shelf life than inorganic treatment. The fruits grown under inorganic mode have less shelf life and are not found to be fit for consumption after 36 hour of storage whereas, the organically produced fruits are fit for consumption more than 36 hour after harvest. The less shelf life of fruits under inorganic mode of nutrition might be due to high level of nitrogen as compared to organic manure (Table 1). Increased shelf life of green cowpea pods in organic mode was also reported (5). It was reported that higher rate of N fertilizers reduced the total marketable fruit yield of chillies (6). More shelf life of the fruits under organic mode might be due to the continuous supply of macro and micro nutrients by the organic sources throughout the growth period.

Uptake of Nutrients

The maximum uptake of nitrogen was observed

under the treatment T₁ having recommended dose of fertilizers. But application of farm yard manure at 10 t/ha + poultrymanure at 1.5 t/ha+ vermicompost at 1.5 t/ha + Azotobacter + phosphorus solublizing bacteria significantly increased the uptake of N, P and K (kg/ha) by the plant (Table 1) might be due to the improvement in physico-chemical properties of soil along with increase mineralization of nutrients and due to combined effect of Azotobacter and phosphorus solublizing bacteria on availability of nitrogen through more availability of phosphorus needed for more fixation of nitrogen. Increased uptake of nitrogen with higher levels of farm yard manure could be assigned to supplementation of soil reservoir on mineralization of organic nitrogen of compost (7).

The uptake trend of phosphorus and potassium was the same as that of nitrogen. However, among the organic source of nutrition maximum P and K uptake was recorded under the treatment of farm yard manure at 10 t/ha + poultry manure at 1.5 t/ha + vermicompost at 1.5 t/ha + Azotobacter + phosphorus solublizing bacteria. It might be due to more availability of phosphorus by the mechanism of mineralization of organic compost and solubilization of fixed phosphorus in the soil. The uptake of phosphorus is synergistic with uptake of nitrogen and higher uptake could be due to solubilization effect of organic acids produced by phosphorus solublizing bacteria and during decomposition of compost improved aeration and better root proliferation (8).

Nutrient Balance

Nutrient balance in soil after harvest of crop shows higher balance of N, P and K nutrients in all the treatments. Synergism among Azotobacter + phosphorus solublizing bacteria might have resulted in better nitrogen fixation and potassium solubilization and slow mineralization of compost thereby higher net balance of N, P and K in soil after harvest of crop (Table 1). Increase in available nitrogen due to Azoto-

bacter inoculation and available phosphorus due to phosphorus solubilizing bacterial inoculation (9).

Thus it may be concluded that organic farming techniques can be opted in capsicum production for improving the productivity and shelf life, which would be sustainable, environment friendly, free from chemical health hazard and remunerative than that of conventional production system.

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