Proportional Substitution of Chemical Fertilizers with Vermicompost on Growth and Production Potential of Onion (*Allium cepa* L.)

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Abstract

An experiment was conducted at Horticulture Experiment and Demonstration Plot of Institute of Agriculture, Visva-Bharati, Sriniketan West Bengal, India during winter 2009-2010 to study the response of vermicompost (VC) and/or fertilizer NPK in various proportion on growth and yield of onion (*Allium cepa* L.). Significant variations were observed for different plant height, number of leaves, leaf girth, neck length and diameter, bulb polar and equatorial diameter, whole plant weight, average bulb weight and estimate yield per hectare. Application of 50% VC+50% NPK recorded maximum plant height, neck diameter, bulb polar and equatorial diameter, whole plant weight and average bulb weight. The same treatment also produced highest bulb yield (52.26 t ha^{-1}). Application of organic inputs in combination with chemical fertilizer were found better option than application of organic manure or chemical fertilizer alone. Maximum (15.01) total soluble solid was registered for 100% VC treated plots. Proportional increase of VC application also increases the TSS value. Proportional increase of VC in the given plant nutrient also increase TSS value.

1. Introduction

Onion (*Allium cepa* L.), belongs to family Alliaceae, is an important vegetable crop in India grown primarily for its edible bulb. High amount of chemical fertilizers are being used today in vegetable farming that guarantees higher production but apparently affects the environment and human health. Whereas vermicompost can be used in vegetable farming as organic input for safe food production and also sustain soil health. Using vermicompost the soil status can also be improved as it is rich in humus, different minerals, vitamins and growth substances that support excellent plant growth and production. Therefore, the present experiment was conducted to study the response of onion to vermicompost alone or in combination with chemical fertilisers in terms of its production. The objective of the investigation was to reduce the dependency on chemical fertilisers without compromising the production of onion.

2. Materials and Methods

The investigation was conducted at Horticulture Experiment and Demonstration Plot of Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal, India during winter 2009-10. The experiment was laid out in Randomized Block Design with 3 replications. Onion seedlings were transplanted on December 27th 2009, with a spacing of 15cm×10cm. The plot size was 4m×3m. The treatments comprises of control (T_1; *i.e.* no FYM/V.C. and no chemical fertilizers); 100% NPK (T_2; *i.e.* NPK @ 120:60:120 kg ha^{-1} and no FYM/V.C.); 25% V.C.+75% NPK (T_3); 50% V.C.+50% NPK (T_4); 75% V.C.+25% NPK (T_5); 100% V.C. (T_6) and 100% FYM (T_7). The inorganic fertilizers (NPK) were applied through urea, single super phosphate and muriate of potash. Half dose of N and full dose of P & K were applied during final land preparation. Remaining half dose of N was applied at 30 DAP. Standard package of practice was followed to grow the crop. After harvesting, yield response to various treatments along with its growth and yield attributing traits were recorded.

3. Results and Discussion

Analysed data in Table 1 revealed that the inclusion of vermicompost in plant nutrient increases plant height. Maximum value (42.7 cm) for this trait was recorded in T4 *(i.e.* 50% VC and 50% NPK) whereas minimum value was noted in control plots (30.5 cm). On an average the crop produced 6 to 7 leaves $plant^{-1}$. All the treatments were statistically *at par* with each other except control that produced marginally lower number of leaves. However, the treatment combinations of 50% VC and 50% NPK and 75% VC and 25% NPK produced maximum leaf girth while control plots produced the leaves with minimum leaf girth. Earlier, Jayathilake et al. (2002) reported highest plant height and number of leaves $plant^{-1}$ upon

Table 1: Growth, yield attributes and yield of onion as influenced by vermicompost and chemical fertilizers

	A	B	C	D	E	F	G	H	I	J	K	L
T_1 Control (T_1; i.e. no FYM/V.C. and no chemical fertilizers)	30.5	5.3	0.70	2.60	0.74	4.42	3.43	40.5	36.1	24.04	8.8	10.89
T_2 100% NPK (i.e. NPK @ 120:60:60 and no FYM/V.C.)	32.8	6.1	0.85	2.46	1.07	4.25	4.50	60.9	54.7	36.49	7.9	11.70
T_3 25% V.C.+75% NPK	35.7	6.9	0.83	2.33	1.14	3.92	4.41	54.7	52.9	35.27	6.7	11.59
T_4 50% V.C.+50% NPK	42.7	6.3	0.96	2.86	1.31	4.65	5.11	83.2	78.4	52.26	7.2	12.16
T_5 75% V.C.+25% NPK	41.0	6.7	1.00	3.60	1.03	4.19	3.90	66.9	54.8	36.56	7.9	12.80
T_6 100% V.C.	42.5	6.7	0.88	1.71	0.96	4.43	4.28	58.7	42.8	28.56	7.7	15.01
T_7 100% FYM	37.2	6.9	0.64	2.67	1.22	3.98	3.91	54.1	41.8	27.87	8.3	12.18
Mean	37.5	6.4	0.84	2.60	1.07	4.26	4.22	59.9	51.6	34.44	7.8	12.33
SEm±	1.7	0.5	0.02	0.12	0.05	0.13	0.26	1.2	1.9	1.34	0.6	0.26
CD (p=0.05)	5.3	1.4	0.08	0.36	0.15	0.41	0.79	3.8	6.0	4.02	1.7	0.79

A=Plant height (cm); B=No. of leaves; C=Leaf Girth (cm); D=Neck Length (cm); E=Neck Diameter (cm); F=Bulb Polar Diameter (cm); G=Bulb Equatorial Diameter (cm); H=Whole plant wt. (gm); I=Average Bulb weight (g); J=Estimated yield/ha (t); K=No. of Scales; L=T.S.S. (˚Brix)

treatment with biofertilizers+50% recommended N through organic manures+50% N and 100% PK through chemical fertilizers in onion. Maximum neck length (3.60 cm) and neck diameter (1.31 cm) were recorded in 75% VC and 25% NPK and 50% VC and 50% NPK, respectively. On the other hand, lowest values for these traits were noted for 100% FYM (1.71 cm) treated and control plots (0.74 cm), respectively.

Average bulb polar diameter recorded was 4.26 cm. Maximum values for these traits were recorded in 50% VC and 50% NPK (4.65 cm), 100% VC (4.43 cm) and control plots (4.42 cm). Least value for this trait was noted in 25% VC and 75% NPK (3.92 cm) treated plot. Similarly, maximum values for bulb equatorial diameter were recorded in 50% VC and 50% NPK (5.11 cm), 100% NPK (4.50 cm), 25% VC and 75% NPK (4.41 cm) and 100% VC (4.28 cm) treated plots. Control plot produced the bulb with minimum equatorial diameter (3.43).

Whole plant weight at maturity, bulb weight and yield ha^{-1} were followed the similar trend. Maximum values for these three important traits were noticed in 50% VC and 50% NPK treated plots while control plots registered minimum values. It was calculated that the application of 50% VC and 50% NPK produced about 40% and 100% more whole plant weight than its mean performance and control, respectively.

The data on estimated yield revealed that the production was doubled when the plants were applied with equal amount of VC and NPK than applying only organics (VC or FYM). Jayathilake et al. (2003) observed that the application of 50% of recommended N through organic manure with other 50% N and 100% PK supplied through chemical fertilizer was better option than application of chemical fertilizer alone or application of organic manure alone. Plants treated with 50% VC and 50% NPK produced 45% more bulb yield (52.26 t ha^{-1}) than feeding with 100% fertilizer NPK (36.49 t ha^{-1}). Similarly, Jayathilake et al. (2002) recorded a significantly higher bulb weight and bulb diameter upon treatment with Azospirillum+50% recommended N through vermicompost+50% N and 100% PK through chemical fertilizers (60.31 g and 6.46 cm, respectively). Mehla et al. (2006) obtained highest bulb yield in onion (141 q ha^{-1}) when inorganic fertilizer was supplemented (50%) with vermicompost. More recently, Sankar et al. (2009) reported that the marketable bulb yield was significantly improved by the addition of organic manures and application of organic growth stimulants. Number of scales bulb^{-1} was almost same for all the treatments with mean value of 7.8. Total soluble solid (TSS), an important quality parameter, was registered its maximum value (15.01) for 100% VC treated plots while control plot registered the minimum value (10.89). It was observed that the TSS increased linearly with the proportional increase of VC in the given plant nutrient.

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