



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 1069-1072
Received: 07-03-2019
Accepted: 09-04-2019

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A studies on the effect of different organic sources on onion (*Allium cepa* L.) productivity and soil health

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Abstract

A field experiment was conducted during karif season 2016-17 at Chitrakoot, Satna (M.P.) to assess the response of different organic source. Treatments used in the experiment are given in the FYM (25%,50%,75%,100% @t/ha), Vermicompost (25%,50%,75%,100% @t/ha), and Goat Manure (25%,50%,75%,100% @t/ha), levels on growth and yield, economics of oted treatment, productivity and soil helth by Onion (*Allium cepa* L.). Each successive increase in treatment up to 100% Vermicompost and 100% FYM, harvest fresh weight of bulb(kg/plot), and total bulb yield, but in most of the cases increase was Significantly maximum 125q/ha yield and maximum 164.73q/ha yield of bulb was exhibited in the treatment of FYM manure(T4) and Vermicompost (T8) respectively significant increase but minimum yield production of 121 q/ha (T12) Treatment T₈ (100% Vermicompost), was recorded the maximum 164.73 q/ha total bulb yield followed by T₄ (100% FYM) (125.24), T₁₃ (100% Goat manure) (121.08), T₇ (75% Vermicompost) and which were at par with each other. However, lowest 86.84 q/ha total bulb yield was noted in T₀ (Absolute control). Data revealed that significantly maximum bulb yield of 164.73q/ha was obtained in treatment T₈ (100% Vermicompost). The highest net return of 106730 Rs./ha was obtained in treatment T₄ (75 % FYM), followed by T₇ (75 % Vermicompost), (69240 Rs/ha) but maximum benefit cost ratio 2.84 was observed under the treatment T₈ due to cost of cultivation 58000 rs/ha. While, lowest bulb yield 86.84 q/ha and net return of 40840 Rs/ha along with cost benefit ratio 1.88 was observed in treatment T₀ (Absolute control).

Keywords: Onion, fym, vermicompost, goat manure, productivity, growth and yield

Introduction

Onion (*Allium cepa* L.) known as “Queen of kitchen”, it is one of the most important vegetable grown in India. It belongs to the family Alliaceae and genus *Allium* is very large comprising of more than 500 species usually perennial bulbous plants. It is consumed as both vegetable and condiment. Green leaves and immature bulbs of onion are eaten as green vegetable. It is an indispensable item in every kitchen and used to enhance flavor of different recipes. Onion is one of the most important commercial vegetable crops grown extensively throughout the country. India ranks first in area (1064 ha) and second in production (60 m tones) of onion bulbs in the world. Madhya Pradesh ranks third (13.66%) in onion production after Maharashtra (30.41%) and Karnataka (15.51%). The annual production of onion in the world is about 60 million tones and India accounts 19.90% of the total world production and ranks second after China (26.99%). Besides, 70% of foreign exchange earnings among fresh vegetables come from only onion (2010-11). The continuous use of chemical fertilizer deteriorate crop while organic manures improves the property (Watson *et al.* 2002) ^[10].

Materials and Methods

The experiment was conducted during karif season of 2016-17 at Rajoula Agriculture Farm of Mahatma Gandhi Chitrakoot, Gramodaya, Vishwavidyalaya, Chitrakoot, and Satna (M.P.). The soil of experimental field was soil of the experimental field was Sandy loam with 19.87% clay, 22.67 % silt and 57.46% Sand with Ranging PH from 7.3-7.6. The soil was Medium Organic carbon, low in available nitrogen, low in available phosphorus and medium in available potassium. The treatments of manure were applied as par respective plot, full dose of organic manures FYM (25%, 50%, 75% & 100%), Vermicompost (25%, 50%, 75%, & 100%), and Goat manure (25%, 50%, 75% & 100%). Was given 15 days before transplanting. The seed of onion variety “Agrifound Dark Red” were treated with Bavistin + Carbandazim (SAAF) @ 3 gm kg⁻¹ before sowing in nursery. The total 13 treatments were tested in a factorial R.B.D. with 3 replications. The seed of variety “Agrifound Dark Red” was transplanting in row to row 15cm. and plan to plant 10 cm. apart behind Nursery sowing on

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22.06.2016. Of transplanting on 02.08.2016 three hand weeding was done at full maturity on 05.12.2016.

Results and discussion

Growth and yield

The plant height of onion was influenced by different treatment of organic manure is given in table 1 and 2. Plant height, number of leaves per plant, Neck thickness of bulb was recorded at various growth stages 30, 60 and 90 DAT. A critical examination of the data revealed that plant height was comparatively lower at the stage (DAT) and their after increased up to 90 DAT. Diameter of bulb was recorded at harvesting time. plant height 30,60,90 DAS was numerically maximum (27.60 cm) in treatment T₁₂(100%Goat manure), whereas, minimum plant height (19.26cm) was in control (T₀), followed by (26.40 cm) in T₄ and (27.33cm) in T₈ respectively, T₄ having application of (100% FYM) (37.60cm) over rest of the treatment except T₈ (100%Vermicompost) (37.40cm), which was being statically at par respectively, while, minimum plant height (31.40cm) was found in absolute control (T₀). Plant height showed significant increase and maximum plant height was recorded in T₈ having (100%Vermicompost), (40.96cm), over rest of the treatment except (39.33cm), T₄ (100% FYM), which was being statistically at par respectively, while minimum plant height (33.90cm) was found in absolute control (T₀).

Number of leaves per plant at 30,60,90 DAT significantly by different treatment combination is presented in Table 1 the result revealed that number of leaves per plant was numerically maximum (5.40) in treatment T₁₂(100% Goat manure), whereas, minimum plant height (2.90) was in control (T₀), followed by (5.30) in T₄ and (5.43) in T₈ respectively. Maximum number of leave per plant was recorded in T₈ having application of (100%Vermicompost) (7.40) over rest of the treatment except T₄ (100% FYM) (7.30), which was being statically at par respectively, while, minimum number of leaves per plant (5.73) was found in absolute control (T₀). showed significant increase and maximum number of leaves per plant was recorded in T₄ having (100% FYM), (9.73), over rest of the treatment except (8.60), T₄ (100% Goat manure), which was being statistically at par respectively, while minimum number of leaves per plant (5.96) was found in absolute control (T₀).

A critical examination of the data revealed that neck thickness was comparatively lower at the stage (DAT) and their after increased up to 90 DAT.

Neck thickness of bulb at 30 DAT did not significantly by different treatment combination is presented in the result revealed that neck thickness of bulbwas numerically maximum (0.68 cm) in treatment T₈ (100% Vermicompost), whereas, minimum neck thickness of bulb (0.58cm) was in control (T₀), followed by (0.66 cm) in T₁₂ and (0.63 cm) in T₄ respectively

Neck thickness of bulb at 60 DAT is presented in a showed significant increase and maximumneck thickness of bulbplant height was recorded in T₈ having application of (100% Vermicompost) (2.20cm) over rest of the treatment except T₁₂ (100% Goat manure) (1.80cm), which was being statically at par respectively, while, minimum neck thickness of bulb (0.80cm) was found in absolute control (T₀).

The neck thickness of bulb at 90 DAT influenced significantly by different treatment combination and presented in Table 2 the data onneck thickness of bulb showed significant increase and maximumneck thickness of bulb was recorded in T₈ having (100%Vermicompost), (2.33cm), over

rest of the treatment except (1.86cm), T₄ (100% FYM), which was being statistically at par respectively, while minimumneck thickness of bulb (0.76cm) was found in absolute control (T₀). The data on bulb diameter at harvest was affected significantly by different treatment combination and presented in Table 2. The maximum bulb diameter was recorded in T₈ having application of (100% Vermicompost) (5.36cm) over rest of the treatment except T₄ having (100%Vermicompost) (5.26cm) which are statistically at par. respectively, whereas minimum diameter of bulb (3.88cm) was found in absolute control (T₀). Fresh weight of bulb in different organic manure is given in the ANOVA Significantly maximum 86.30 kg/plot and 74.33 kg/plot fresh weight of bulb par plot was exhibited in the treatment of T₈ (100% Vermicompost) and T₄ (100% FYM) respectively and which was at par with each other, where the minimum fresh weight of bulb per plot was observed inT₀ (Absolute control). Treatment T₈ (100% Vermicompost), was recorded the maximum 164.73 q/ha total bulb yield followed by T₄ (100% FYM) (125.24), T₁₃ (100% Goat manure) (121.08), T₇ (75% Vermicompost) and which were at par with each other. However, lowest 86.84 q/ha total bulb yield was noted in T₀ (Absolute control).

Studies on post-harvest parameter of crop

Among post-harvest parameters of crop, the bulb weight plant-1 (g), bulb yield (q ha-1), weight was studies in onion.

Bulb weight plant-1(g)

Significantly maximum bulb weight of bulb was exhibited in the treatment T₈ (100% Vermicompost), followed byT₄ (100% FYM), whereas, the minimum weight of bulb was observed in T₀ (absolute control). Probable region for increased weight of bulb due to humus substances could have mobilized the reserve food materials to the plant through increased activity of hydrolyzing and oxidizing enzymes. Similar results have been reported by.

Total bulb yield (qha-1)

The yield of any crop is the final index of the experiment which indicates the success or failure of any treatment with this view the bulb yield of onion was recorded. Treatment T₈ (100% Vermicompost), followed by T₄ (100%FYM), and which was at par with each other. However, lowest total bulb yield was recorded in treatment T₀ (absolute control). The higher yield is due to increase in plant height, number of leaves, and yield attributes viz., polar and equatorial diameter of bulb, fresh weight of whole plant, fresh and dry weight of bulb. This might be due to the good availability of the nutrients in readily available form and the C: N was high over control.

Amongst the organic manures (100% Vermicompost), application alone proved the not beneficial for growing onion in this region. It yielded the maximum onion bulbs (164.73 q/ha), with bulb weight is maximum (86.30 gm/plant).The yield of any crop is the final index of the experiment which indicates the success of failure of any treatment with this view the bulb yield of onion was recorded.

The data for the yield par plot under different treatment was recorded and converted into total bulb yield q/ha. The data was analysed statistically and the analysis of variance is given in Appendix-I The total bulb yield/ha as affected by different treatment is presented in Table

Effect of different organic manure on Morphological characters of onion

The data in summary reveal that the plant height, number of leaves, neck thickness and diameter of bulb of onion was in general, enhanced with the successive growth. All these four characters increased steadily right from 30 DAT stage up to the harvest stage in all the treatments.

As regards with the treatments effect, plant height, number of leaves, neck thickness, diameter of bulb, were influenced significantly due to various treatments at every stage of observation. Among the organic manures T₈ (100%Vermicompost), application resulted in significantly higher all these growth characters over control and few other treatments having organic manures. Accordingly at harvest the maximum plant height was (40.96cm), number of leaves (9.73 plant-1), neck thickness (2.33 cm), diameter of bulb (5.36

cm), application. This was however, equally followed by T₈ (100% Vermi-compost).

Quality, yield and physiological attributing parameters

The results on Quality, Yield and physiological attributing parameters are also summarized in this paragraph. The bulb weight, bulb yield, was recorded maximum (86.30gm/plant and 164.73 q/ha) due to application of T₈ (100% Vermicompost). These were none significantly higher to that of control treatment as well as some treatments followed by T₄ (100% FYM) application.

The summary indicated that the application of T₈ (100% Vermicompost), resulted in higher yield of onion bulb over rest of the treatment. Among these treatment T₈ (100% Vermicompost), produced the maximum bulb yield (164.73 q/ha), being significantly higher to some rest of treatment followed by T₄ (100% FYM), (125.24 q/ha).

Table 1: Growth and yield parameters of onion as influenced by different organic manure levels.

Tretment. Symb.	Treatments	Pre-harvest observation									Post-harvest observation		
		Plant height (cm)			Number of leaves			Neck thickness of bulb (cm)			Diameter of bulb (cm)	Fresh weight of bulb (kg/plot)	Total bulb yield (q/ha)
		30 Dat	60 Dat	90 Dat	30 Dat	60 Dat	90 Dat	30 Dat	60 Dat	90 Dat			
T ₀	Absolute control	19.26	31.40	33.90	2.90	5.73	5.96	0.58	0.80	0.76	3.88	40.03	86.847
T ₁	25 % FYM	21.46	32.73	35.83	3.53	6.43	7.50	0.60	0.96	1.20	4.30	58.36	91.810
T ₂	50 % FYM	22.83	34.63	37.10	4.13	6.60	8.03	0.61	1.20	1.40	4.53	63.16	106.247
T ₃	75 % FYM	24.03	35.83	38.26	4.33	6.76	8.63	0.62	1.33	1.56	4.70	68.46	119.597
T ₄	100 % FYM	26.40	37.60	39.33	5.30	7.30	9.73	0.63	1.66	1.86	5.26	74.33	125.247
T ₅	25 % Vermicompost	21.80	32.53	34.83	3.63	6.53	6.73	0.58	0.86	0.96	4.20	51.13	103.850
T ₆	50 % Vermicompost	24.10	34.23	36.26	3.86	6.46	7.43	0.63	1.23	1.23	4.33	60.01	109.693
T ₇	75 % Vermicompost	25.66	35.73	37.60	4.56	6.93	8.03	0.65	1.56	1.50	5.26	66.90	121.150
T ₈	100 %Vermicompost	27.33	37.40	40.96	5.43	7.40	8.50	0.68	2.20	2.33	5.36	86.30	164.730
T ₉	25 % Goat Manure	22.00	34.10	33.70	3.26	6.50	6.23	0.58	0.92	0.83	4.03	52.96	103.800
T ₁₀	50 % Goat Manure	24.66	35.36	35.26	3.63	6.53	7.23	0.62	1.20	1.20	4.23	56.86	105.163
T ₁₁	75 % Goat Manure	26.53	36.40	36.03	4.53	6.56	7.80	0.63	1.36	1.43	4.40	61.60	110.110
T ₁₂	100 % Goat Manure	27.60	37.20	38.60	5.40	6.90	8.60	0.66	1.80	1.60	4.73	73.16	121.080
	SEm±	0.28	0.15	0.23	0.13	0.18	0.13	0.02	0.05	0.06	0.08	2.88	0.88
	C D (p=0.05)	0.83	0.46	0.68	0.39	0.55	0.40	NS	0.17	0.19	0.23	0.98	2.58

Table 2 Economics of different treatments of organic manure for Onion. *Sale rate of produce was Rs 1000 q-1.

Tretment. Symb.	Treatments	Bulb yield (q/ha)	Gross income (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	B:C ratio
T ₀	Absolute control	86.84	86840.00	46000	40840	1.88
T ₁	25 % FYM	91.81	91810.00	48500	43310	1.89
T ₂	50 % FYM	106.24	106240.00	51000	55240	2.08
T ₃	75 % FYM	119.59	119590.00	53500	66090	2.23
T ₄	100 % FYM	125.24	125240.00	56000	69240	2.23
T ₅	25 % Vermicompost	103.85	103850.00	49000	54850	2.11
T ₆	50 % Vermicompost	109.69	109690.00	52000	57690	2.10
T ₇	75 % Vermicompost	121.15	121150.00	55000	66150	2.20
T ₈	100 % Vermicompost	164.73	164730.00	58000	106730	2.84
T ₉	25 % Goat Manure	103.80	103800.00	49750	54050	2.08
T ₁₀	50 % Goat Manure	105.16	105160.00	53500	51660	1.96
T ₁₁	75 % Goat Manure	110.11	110110.00	57250	52860	1.92
T ₁₂	100 % Goat Manure	121.08	121080.00	61000	60080	1.98

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