

Original Research Article

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Effect of Different Organic Manures on Yield and Quality of Onion (*Allium cepa* L.)

Bhavana Dhaker*, R.K. Sharma, B.G. Chhipa and R.S. Rathore

Department of Horticulture, School of Agricultural Sciences,
Career Point University, Kota, Rajasthan, India

*Corresponding author

ABSTRACT

A field experiment was conducted during *Rabi* season 2016-17 to find out the effect of FYM and Vermi Compost with or without PSB and Azotobactor and rates of organic manures (50% and 100% RND) on yield, quality and economics of onion (Agri Found Dark Red) on clay loam soil. The treatments comprised of organic, inorganic fertilizer and biofertilizers with ten treatments 100% RDF through inorganic, 100% RDF through FYM (N Basis), 100% RDF through vermicompost, 50% RDF through Inorganic Fertilizers + 50 % through FYM, 50% RDF through Inorganic Fertilizers + 50 % through vermicompost, 50% RDF through Inorganic Fertilizers + 50 % through FYM + PSB, 50% RDF through Inorganic Fertilizers + 50 % through vermicompost + PSB, 50% RDF through Inorganic Fertilizers + 25 % vermicompost + PSB, 100% RDF through FYM (N Basis) + PSB + *Azotobactor* and 100% RDF through vermicompost + PSB + *Azotobactor*. Results revealed that the application of organic manure significantly influenced the diameter of bulb (cm), bulb weight (g), bulb yield ($q\ ha^{-1}$), total soluble solid ($^{\circ}B$) and allyl propyl content (ppm) with 100% RDF through Vermicompost + PSB + *Azotobactor*. Application of 100% RDF applied through vermicompost + PSB + *Azotobactor* (T_{10}) recorded maximum gross returns, net return and cost benefit ratio of onion crop.

Keywords

Organic manures,
Yield and quality,
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Introduction

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops grown extensively throughout the country. It is a bulbous biennial herb of the most important vegetable cum condiments, spice crops demanded worldwide. India is the second largest producer of onion in the world, next to China, with 70% of the total production comes as winter crop and remaining 30% as *kharif* onion as off season crop, accounting for 11.40 per cent of the area and 10.40 per cent of the world production and 16 per cent of productivity. In India, onion is being grown

in an area of 3.64 million hectares with production of 68.45 million tonnes and the average productivity is 18.82 tonnes per hectare. Maharashtra is the leading onion growing state of India (Anonymous, 2013). Organic manures not only provide plant nutrient but also improve the soil structure by effecting soil aggregates. They also decrease EC and increase water holding capacity and phosphate availability of soils, besides improving the fertilizer use efficiency and microbial activity. Bio fertilizers play a key role in increasing the availability of nutrient.

Inoculation of these bio-fertilizers in very small quantity supplemented with sufficient amount of organic matter converts the insoluble and unavailable form of nutrient in soluble and available form of nutrients. The organic manures contain nutrients in small quantities as compared to the chemical fertilizers, also it contain growth promoting substances like enzymes and hormones, besides improvement of soil fertility and productivity. Organic materials such as poultry manure, green manures and farmyard manure (FYM) can substitute for inorganic fertilizers to maintain productivity and environmental quality. The bio-fertilizers are alternative sources to meet the nutrient requirement of crops and to bridge the future gaps. Further, knowing the deleterious effect of using only chemical fertilizers on soil health, use of chemical fertilizers supplemented with organic waste and bio-fertilizers will be environmentally benign.

Materials and Methods

The experiment was conducted at the farmers field, village-Suwana, near Krishi Vigyan Kendra, Bhilwara, Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan, India in *Rabi* season, 2016-17 to find out the effect of coinjoint use of organic and inorganic sources of nutrients on growth, yield and quality of onion (*Allum cepa* L.) var. Agrifound Dark Red. The soil of the experimental field was clay loam in texture and having pH 7.85, EC 0.11 dSm⁻¹, organic carbon content 0.42%, low in available N (178 kg/ha), medium P (18.7 kg/ha) and high in K (348 kg/ha). The experiment was laid out in randomized block design with three replications. The treatments comprised of organic, inorganic fertilizer and biofertilizers with ten treatments T₁ -100% RDF through inorganic, T₂ -100% RDF through FYM (N Basis), T₃ -100% RDF through vermicompost, T₄ -50% RDF through

Inorganic Fertilizers + 50 % through FYM, T₅ -50% RDF through Inorganic Fertilizers + 50 % through vermicompost, T₆ -50% RDF through Inorganic Fertilizers + 50 % through FYM + PSB, T₇ -50% RDF through Inorganic Fertilizers + 50 % through vermicompost + PSB, T₈ -50% RDF through Inorganic Fertilizers + 25 % vermicompost + PSB, T₉ -100% RDF through FYM (N Basis) + PSB + *Azotobactor* and T₁₀ -100% RDF through vermicompost + PSB + *Azotobactor*.

The treatments of manure, chemical fertilizers and bio-fertilizers were applied as per treatment in respective plot. Vermicompost and FYM were applied prior to 15 days of transplanting of Onion. PSB and *Azotobactor* bio-fertilizer was applied at the time of transplanting. Inorganic fertilizer *i.e.* SSP and Murate of Potash were applied as a basal dose during transplanting whereas as 1/2 dose of urea was applied at the time of transplanting and remaining 1/4 – 1/4 dose applied at 30 and 60 days of transplanting respectively. The seeds of onion variety “Agrifound Dark Red” were treated with bavistin + carbendazim (SAAF) @ 3 gm kg⁻¹ before sowing in nursery. The seed of onion variety Agrifound Dark Red was raised in the nursery of 3 m long and 1.2 m wide and 10 cm above the ground level was prepared and manured as per the recommendation treatments. Treated seed were sown on 22 December 2016 in line and all the intercultural operations were done as and when required. 57 days old seedlings of uniform size were transplanted on 19 February, 2017 in the prepared field. The spacing 15 cm row to row and 10 cm plant to plant was maintained. The seedlings were transplanted in cool evening according to the layout plan. A light irrigation was applied just after the transplanting and subsequent irrigation was given at an interval of 10-12 days depending upon the soil condition. Harvesting of onion was done on 31st May 2017.

Table.1 Effect of different organic and inorganic sources and their combinations on yield and quality parameters of onion

Treatment	Diameter of bulb (cm)	Average weight of bulb (g)	Bulb yield (Q/ha)	Total soluble solids (°B)	Allyl propyl content (ppm)
T ₁ - 100 % RDF through Inorganic Fertilizers	5.78	81.00	137.70	9.27	17.00
T ₂ - 100 % RDF through FYM (N basis)	5.98	85.17	144.78	8.67	17.17
T ₃ - 100 % RDF through Vermicompost (N basis)	6.37	93.69	159.28	9.71	18.13
T ₄ - 50 % RDF through Inorganic Fertilizers + 50 % through FYM	6.64	94.53	160.71	10.05	18.69
T ₅ - 50 % RDF through Inorganic Fertilizers + 50 % through Vermicompost	7.03	104.00	176.80	10.37	19.23
T ₆ - 50 % RDF through Inorganic Fertilizers + 50 % through FYM + PSB	7.33	109.00	185.30	10.76	19.50
T ₇ - 50 % RDF through Inorganic Fertilizers + 50 % through Vermicompost + PSB	7.36	113.00	192.10	10.95	20.23
T ₈ - 50 % RDF through Inorganic Fertilizers + 25 % Vermicompost + 25 % FYM + PSB	7.20	117.17	199.18	11.11	20.80
T ₉ - 100 % RDF through FYM + PSB + <i>Azotobactor</i>	7.75	120.00	204.00	11.35	21.80
T ₁₀ - 100 % RDF through Vermicompost + PSB + <i>Azotobactor</i>	8.77	129.08	219.44	12.04	22.73
SEm±	0.32	1.27	2.16	0.09	0.31
C.D. (5%)	0.96	3.77	6.40	0.26	0.92

Table.2 Effect of different organic and inorganic sources and their combinations on economics of onion

Treatment	Bulb yield (q ha ⁻¹)	Cost of cultivation (Rs. ha ⁻¹)	Gross return (Rs. ha ⁻¹)	Net return (Rs. ha ⁻¹)	BC ratio
T ₁ - 100 % RDF through Inorganic Fertilizers	137.70	57674	96390	38716	1.67
T ₂ - 100 % RDF through FYM (N basis)	144.78	67700	101346	33646	1.50
T ₃ - 100 % RDF through Vermicompost (N basis)	159.28	62699	111496	48797	1.78
T ₄ - 50 % RDF through Inorganic Fertilizers + 50 % through FYM	160.71	62687	112497	49810	1.79
T ₅ - 50 % RDF through Inorganic Fertilizers + 50 % through Vermicompost	176.80	65200	123760	58560	1.90
T ₆ - 50 % RDF through Inorganic Fertilizers + 50 % through FYM + PSB	185.30	62887	129710	66823	2.06
T ₇ - 50 % RDF through Inorganic Fertilizers + 50 % through Vermicompost + PSB	192.10	65400	134470	69070	2.06
T ₈ - 50 % RDF through Inorganic Fertilizers + 25 % Vermicompost + 25 % FYM + PSB	199.18	61637	139426	77789	2.26
T ₉ - 100 % RDF through FYM + PSB + <i>Azotobactor</i>	204.00	68150	142800	74650	2.10
T ₁₀ - 100 % RDF through Vermicompost + PSB + <i>Azotobactor</i>	219.44	65149	153608	88459	2.36

The diameter of bulb (cm), average bulb weight (g), bulb yield (q ha⁻¹), total soluble solid (°B) at harvest, Allyl Propyl content (ppm) and economics parameters were recorded and thereafter, tabulated and analyzed statistically by method of analysis of variance. The data were analyzed statistically and results were interpreted by using methods suggested by Panse and Sukhatme (1967).

Results and Discussion

Yield parameters

Diameter of bulb increased significantly with different treatments of organic manures, inorganic fertilizers and biofertilizer (Table 1). This may be due to application of organic

manures which provide major and micro nutrients resulted in increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improving the diameter of bulb.

Significantly maximum bulb weight of bulb was exhibited in the treatment T₁₀ (100% RDF through Vermicompost + PSB + *Azotobactor*) followed by T₉ (100 % RDF through FYM + PSB + *Azotobactor*), Bulb yield per hectare differed significantly due to application of 100% RDF through Vermicompost + PSB + *Azotobactor* significantly increased the bulb yield of onion. The higher yield might be due to increase in plant height, number of leaves,

and other yield attributes viz., fresh weight of whole plant, fresh and dry weight of bulb. Similar results have been reported by Shinde *et al.*, (2013) and Gurjar *et al.*, (2017).

The maximum TSS (12.04%) was recorded with T₁₀ followed by 11.35% TSS in T₉ (Table 1). The superior quality of onion under vermicompost treatments might be due to beneficial effect of organism which is brought about by mucous deposited epidermal cell and coelomic cell of earthworm containing plant growth factor and B group vitamin. The effect of organic manure on quality parameters was also reported by Singh *et al.*, (2015). The allyl propyl content (ppm) of onion influenced by different organic and inorganic treatments. Significantly maximum allyl propyl content was observed under the treatment T₁₀ (100% RDF applied through vermicompost + PSB + *Azotobacter*) and found significantly superior over rest of the treatment followed by T₉ where 100% RDF applied through FYM + PSB + *Azotobacter*. Whereas the minimum allyl propyl content at harvest was recorded in T₁ (100% RDF through inorganic fertilizer).

Economics

The cost of cultivation, gross returns, net returns and benefit cost ratio as influenced by different treatments are presented in Table 2. Application of 100% RDF applied through vermicompost + PSB + *Azotobacter* (T₁₀) recorded maximum gross returns of Rs. 153608 ha⁻¹ followed by treatment having 100% RDF applied through FYM + PSB + *Azotobacter* (T₉), whereas minimum gross return (Rs 96390 ha⁻¹) was recorded in treatment T₁ (100% RDF through inorganic fertilizers). Data also revealed that the highest net return of Rs 88459 ha⁻¹ was obtained in treatment T₁₀ (100% RDF applied through vermicompost + PSB + *Azotobacter*) along with cost benefit ratio 2.36. While, lowest net return (Rs 33646 ha⁻¹) along with lowest cost

benefit ratio 1.50 was observed in treatment T₂ (100 % RDF through FYM). Similar results have been reported by Gurjar *et al.*, (2017).

The results of present investigation revealed that the diameter of bulb (cm), bulb weight (g), bulb yield (q ha⁻¹), total soluble solid (°B) and allyl propyl content (ppm) significantly increased with 100% RDF through Vermicompost + PSB + *Azotobacter*. Application of 100% RDF applied through vermicompost + PSB + *Azotobacter* (T₁₀) recorded maximum gross returns, net return and cost benefit ratio.

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