



Effect of organic farming practices on growth, yield and quality of rose onion (*Allium cepa*)

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ABSTRACT

A field experiment was conducted during 2005–08 to study the effect of levels of organic manure and conventional practices on growth, yield and quality of rose onion (*Allium cepa* L.). The trial was carried out in organic vegetable experimental plots of IIHR farm, Hesaraghatta, Bengaluru. The trial included four levels of organic manure treatment and two inorganic nutrient supply treatments. The treatment which received 100 % recommended N (RDN) equivalent through organics produced highest yield of 21.06 tonnes/ha, which was followed by the treatment received 75 % RDN through organics and conventional practices. (20.91 and 19.44 tonnes/ha). Plant growth characters such as plant height (32.5 cm), number of leaves / plant (8.5), leaf area/plant (375 cm²) and leaf area index (5.95) were also higher in this treatment resulting in better bulb yield. Yield parameter like bulb diameter (3.8 cm) and mean bulb weight (21.7g) were also higher in organic treatments that received 75 to 100 % nitrogen equivalent. There were no differences among the treatments for the quality parameters like total soluble sugars, but application of higher amount of organic manure resulted in higher bulb dry matter content than other treatments. The percentage of split bulb was comparatively less in organic treatments ranging from 15 to 18.5 % as compared to only chemical fertilizers (27.5 %) and conventional practice (26%). The benefit : cost ratio were higher with organic and conventional treatments than only chemical fertilizer treatment.

Key words: Economics, Growth, Organic manures, Quality, Rose onion, Yield

Consumer demand for organically grown vegetable is markedly increasing all over the world for both domestic and export market. This drastic change is due to human's concern over health which made him to produce pesticide residue and other harmful chemicals-free crops. The challenges are how to produce these crops in ways that are environmentally friendly and without lowering the yield levels achieved by conventional production system. Onion is being consumed as raw table vegetables, pickled or used in garnishing different food items. Small sized, shining dark red outer skin onions are called rose onion, which are more pungent as compared to commonly grown onion bulbs. Rose onion (*Allium cepa* L.) is grown in Bengaluru and Kolar districts of Karnataka and Cuddapah district in Andhra Pradesh. It is grown in about 5 000 ha with an annual production of 35 000 tonnes. It is mainly exported to Malaysia, Singapore, Indonesia, Brunei, Bangladesh and Srilanka with foreign exchange earnings of ₹ 480 million. The main growing season of this crop is winter with sowing done during October and harvesting in March. After curing for a few days the bulbs are normally exported in April–May months. The demand for organically

grown onions is likely to increase in the years to come; however, the research information on organic rose onion production in tropical regions is very meager. Hence, the present study was carried out with a view to study the effect of different levels of organic nutrients on crop performance with respect to crop growth, yield and quality of rose onion.

MATERIALS AND METHODS

Field experiment was carried out during winter (*rabi*) seasons of 2005–08 at Indian Institute of Horticultural Research, Bengaluru. The soil of experiment site was well drained sandy loam with pH of 6.81 and EC 0.22 dS/m. The initial organic carbon content of soil was 0.51% and available N, P₂O₅ and K₂O were 186, 20.9 and 168 kg/ha, respectively. The experiment was carried out in a randomized block design with four replications, where organic and inorganic plots having similar soil properties were situated 5 m apart from each other and were separated by a Glyricidia live hedge to protect any possible contamination. The experiment constituted six treatments, viz T₁: 25%, T₂: 50%, T₃: 75%, T₄: 100% of recommended dose of nitrogen equivalent to FYM application, T₅: conventional practice (recommended FYM @ 25 tonnes/ha + recommended NPK fertilizer) and T₆: only recommended NPK fertilizers. Recommended farm

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yard manure (FYM) (25tonnes/ha) were also applied to treatments T₁ to T₄, besides the required quantities as per the treatments. The treatments under organic cultivation received well decomposed FYM as source of nutrient two weeks before sowing. Quantity of FYM required for different treatments was calculated on dry weight basis and total nitrogen content of manure used, which ranged from 0.90 to 1.10%. In T₅ and T₆ the recommended dosage of N: P: K @ 125:75:150 kg/ha was given in form of inorganic fertilizers in two equal splits doses for N and K (as basal and side dressed after thirty days of sowing) and entire amount of P was applied as basal dose. Farmyard manures applied in organic treatments was enriched with biofertilizers and bioagents like *Azospirillum*, phosphate-solubilizing bacteria (PSB), *Pseudomonas fluorescence* and *Trichoderma harzianum* before field application. Supplemental P was given through PSB treated rock phosphate @ 50 kg/ha/year for treatment T₁ to T₄. neem cake (3.6 % N) was added @ 625 kg/ha to all the treatments. Direct sowing of rose onion variety Arka Bindu seed was done @ 25 kg/ha. After two weeks of germination thinning was done to retain about 150–160 seedlings/m². The crop was irrigated with inline drip system having the discharge rate of 4 litres/hr as and when required to supply irrigation @ 0.7 Epan losses. Organic plant protection was taken up using *T. harzianum* and *P. fluorescence* for the management of *Alternaria* purple blotch, while *Beauveria basiana*, *Verticillium lecani*, neem seed powder extract (4%), neem and pongamia soap (0.7%) for managing thrips incidence. For recommended inorganic plant protection, chemicals were used based on necessity. The crop was harvested at 140 days after sowing. The observation on crop growth, yield parameters and bulb quality were recorded and analyzed by the statistical method adopted by Gomez and Gomez (1983).

RESULTS AND DISCUSSION

The experimental results of rose onion on growth, yield and quality components as influenced by different levels of organic nutrient supply are presented in Table 1. Plant growth parameters such as plant height, number of leaves/plant, leaf area/plant, leaf area index were significantly influenced by different levels and sources of nutrients. Higher plant height (31.7 and 32.5 cm) coupled with higher leaf area/plant (363 and 375 cm²) and leaf area index (5.76 and 5.95) was observed with supply of organic manure equivalent to 75 and 100% of recommended nitrogen levels. The treatment which received 100% N equivalent as organic manure resulted in significantly superior plant growth parameters as compared to organic treatment receiving 25 and 50% N equivalent of FYM as well as conventional treatment. This higher leaf area/plant provides more surface area for producing higher quantities of photosynthates and finally results in better plant growth and development in onion crop. Lal *et al.* (2002) found that in onion crop, increased rates of organic manure application

Table 1 Growth, yield and quality parameters of rose onion variety Arka Bindu as influenced by source and quantity of manure and fertilizers

Treatment	Plant height (cm)	Leaves / plant	Leaf area/ plant (cm ²)	Leaf area index	Bulb diameter (cm)	Bulb weight (g)	Bulb yield (tonnes/ha)	Split bulb (%)	Dry matter content in bulbs (%)	TSS (°Brix)
T ₁ (organic manure equivalent to 25 % of RDN)	30.2	8.0	352	5.58	3.3	19.2	18.21	18.5	17.5	17.0
T ₂ (organic manure equivalent to 50 % of RDN)	30.7	7.8	320	5.08	3.5	19.0	18.60	18.0	17.6	16.3
T ₃ (organic manure equivalent to 75 % of RDN)	31.7	7.7	363	5.76	3.8	21.6	20.91	16.0	17.8	16.8
T ₄ (organic manure equivalent to 100 % of RDN)	32.5	8.5	375	5.95	3.8	21.7	21.06	15.0	18.8	16.5
T ₅ (conventional practice (recommended FYM+ NPK fertilizers)	28.9	7.0	354	5.61	3.2	19.1	19.44	26.0	17.3	16.9
T ₆ (recommended NPK fertilizers alone)	26.0	6.9	341	5.41	3.1	17.7	17.34	27.5	16.7	16.3
CD (P = 0.05)	0.67	0.65	17.35	0.33	0.36	0.93	0.82	3.12	0.86	NS

Table 2 Cost economics (₹) of rose onion variety Arka Bindu as influenced by different source and quantity of manure and fertilizers

Treatment	Cost of cultivation	Cost of treatment manure and fertilizer	Cost of plant protection chemicals	Gross investment	Gross revenue	Net income	Benefit: cost ratio
T ₁ (organic manure equivalent to 25% of RDN)	43 550	3 125	5 000	51 675	2 18 400	1 6 6725	3.22
T ₂ (organic manure equivalent to 50% of RDN)	43 550	6 250	5 000	54 800	2 23 200	1 68 400	3.07
T ₃ (organic manure equivalent to 75% of RDN)	43 550	9 375	5 000	57 925	2 50 800	1 92 875	3.32
T ₄ (organic manure equivalent to 100% of RDN)	43 550	12 500	5 000	61 050	2 52 000	1 90 950	3.13
T ₅ (recommended FYM + NPK fertilizers)	43 550	17 200	8 200	68 950	1 74 600	1 05 650	1.53
T ₆ (recommended NPK fertilizers alone)	31 050	4 700	8 200	43 950	1 56 060	1 12 110	2.55

resulted in better plant growth parameters such as plant height and number of leaves/plant which in turn resulted in higher bulb size and bulb yield.

The higher rates of organic manure application recorded significantly higher bulb diameter and bulb weight than lower quantity of organic manure applied as well as integrated and only chemical fertilizer application. Onion bulb yield was markedly influenced by different treatments and significantly higher bulb yields (20.91 and 21.06 tonnes/ha) were obtained with 75 to 100% recommended nitrogen supply through organic manures (T₃ and T₄) which were significantly superior to treatments which received organic manure equivalent to 25 to 50% recommended nitrogen application as well as conventional treatments wherein chemical fertilizers were applied. Similar results in other vegetable crops like tomato (Sharma and Sharma 2004) and garden pea (Pandey *et al.* 2006) have also been reported. This significant increase in higher bulb yields may be attributed to the higher values of important yield components such as bulb diameter and bulb weight recorded in these treatments compared to other treatments. Chaurasia *et al.* (2003) reported similar results in their studies.

Quality attributes such as split bulbs (%), dry matter content in bulbs (%) and total soluble solids (°Brix) were also recorded and presented in Table 1. The data on per cent split bulbs indicated marginal decrease with increase in levels of organic manure supply. Treatment receiving 100% nitrogen equivalent through organics showed lowest split bulbs (15%) which were significantly lower than organic treatment receiving only 25% nitrogen equivalent of organic manure (T₁), conventional practice (T₅) and only chemical fertilizer application (T₆). Similarly, the same treatment (T₄) has recorded significantly higher percentage of dry matter content in bulbs (18.8%) than all other treatments which shows that organic treatments help in producing better quality bulbs. Sankar *et al.* (2009) reported improved quality of onion bulbs by imposing organic treatments in its cultivation. There were no significant differences among the treatments in case of total soluble solids. Krishnamurthy and Sharanappa (2005)

reported improved quality of rose onion bulbs with organic farming practices.

All the organic manure treatments recorded higher benefit:cost ratio than only chemical fertilizers and conventional practice treatments. The economics of cultivation (Table 2) revealed that the highest benefit: cost ratio was recorded in treatment where the 75% nitrogen equivalent of organic manure (3.32) was applied, followed by T₁ and the least with only chemical fertilizer application. Jayathilake *et al.* (2003) also reported higher net returns and benefit: cost ratio by organic manure application in place of chemical fertilizers in onion. A moderate gross investment coupled with high yield and net income resulted in higher B: C ratio in T₃, while higher gross investment with lowest net income is the reason for least B:C ratio (1.53) in the conventional practice (T₅).

From this result it is clearly evident that organic rose onion production is feasible by following appropriate scientific organic farming practices with emphasis on organic nutrient supply through locally available manures enriched with suitable biofertilizers and bioagents. The yield performance under organic treatments are comparable to conventionally grown rose onion.

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