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Effect of organic substances on yield and quality of onion, *Allium cepa* L

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ABSTRACT

A field experiment was conducted to study the effect of organic substances on yield and quality of onion, *Allium cepa* L variety Agrifound Light Red during the year 2012-13. The experiment was laid out in randomized block design with three replications and eight treatments with combination or individual application of organic manures, biofertilizer and inorganic fertilizers. After analysis of performance of different treatments the results indicated that 100 per cent recommended doses of fertlizers (RDF) resulted into maximum polar diameter, equatorial diameter, neck thickness, maximum A^+ grade bulbs and average weight of bulb. Cent per cent RDF also showed beneficial effect in increasing marketable yield, total yield and total soluble solids which was at par with the treatment containing RDF (75%) + vermicompost (3 tons/ha) + PSB (2 kg/ha) + *Azotobacter* (2 kg/ha).

Keywords: Onion; biofertilizers; inorganics; organics; quality; yield

INTRODUCTION

Onion, *Allium cepa* L is one of the important commercial bulbous vegetable crops grown throughout the world. It is the only vegetable in which India figures prominently in the world for its production and export. However the average productivity of onion is still very low. India is the second largest producer of onion in the world and occupies 756200 ha area with a production of 12.15 MT and productivity of 16.1 tons/ha (Anon 2010). Surguja, Durg, Raipur and Raigarh are the major districts in Chhattisgarh state occupying an area under onion estimated at 11196 ha with a production of 0.17 MT and productivity of 15.55 tons/ha (Anon 2011). The yield of onion in Chhattisgarh is low as compared to other onion producing states. One of the reasons for low yield is the use of inadequate and imbalanced fertilization; so concept of adding biofertilizers is required to be adjusted along with judicious combinations of chemical and organic fertilizers. Due to high cost we should emphasize on using different sources of nutrients such as farm yard

manure, vermicompost and biofertilizers. Organic farming reduces the cost of production by utilization of organic wastes as fertilizers which are said to be potential source for pollution unless they are used in productive and efficient way. There is a good scope of increasing onion yield and quality for which nutrient management is one of the most important considerations under organic production system (Patel et al 2005).

MATERIAL and METHODS

A field experiment was carried out during the year 2012-13 in Rabi season under All India Network Research Project on Onion and Garlic at Horticulture Instructional cum Research Farm of Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh to assess the effect of organic substances on growth of onion (*Allium cepa* L) variety Agrifound Light Red. The experiment was laid out in randomized block design with eight treatments viz T_0 (control, without nutrient application), T_1 (100 % RDF), T_2 (75 % RDF), T_3 (75 % RDF + vermicompost @ 3 tons/ha, T_4 (75 % recommended doses of fertlizers (RDF) + *Azotobacter* @ 2 kg/ha), T_5 (75 % RDF + PSB @ 2 kg/ha), T_6 (75 % RDF + *Azotobacter* @ 2 kg/ha + PSB @ 2 kg/ha), T_7 (75 % RDF + vermicompost @ 3 tons/ha + PSB @ 2 kg/ha + *Azotobacter* @ 2 kg/ha).

Nursery beds were prepared where adequate irrigation facility was available. Each bed was 15 cm raised and 1 m wide with desired length. The soil was well pulverized in which well-rotteneded FYM was mixed. To avoid damping off beds were drenched with formaldehyde (0.1%) two weeks before sowing. Recommended fertilizer dose for onion ie 75:60:100 $N:P_2O_5:K_2O$ kg/ha was applied as per the treatment. Full doses of phosphorus and potassium and half dose of nitrogen were applied in soil before transplanting of seedlings. Remaining half nitrogen was applied 30 days after transplanting (DAT). Nitrogen, phosphorous and potassium were applied through urea, single super phosphate (SSP) and muriate of potash (MOP) respectively. PSB, *Azotobacter* and vermicompost were applied as per the treatments at the time of transplanting.

Ten randomly selected plants from each plot were tagged for recording observations. The observations were recorded on yield and quality parameters. Data were analyzed statistically adopting the technique of analysis of variance (ANOVA) using randomized block design (Panse and Sukhatme 1967).

RESULTS and DISCUSSION

The treatment comprising of application of nutrients through organic manures, biofertilizers and inorganic

fertilizers showed significant differences on the yield and quality parameter of onion viz polar diameter (cm), equatorial diameter (cm), neck thickness (cm), average weight of bulb (g), grade-wise yield (ton/ha), marketable bulb yield (ton/ha), total yield (ton/ha) and total soluble solids (%).The polar diameter of bulb showed significant difference for different treatments. Among the evaluated treatments numerically maximum polar diameter (5.13 cm), bulb equatorial diameter (5.23 cm), neck thickness (1.25 cm) and maximum weight of bulb (66.98 g) were recorded under T_1 (100% of RDF). Higher levels of inorganic substances/fertilizers significantly influenced the bulb polar and equatorial diameter which determines the bulb weight. Similarly increased bulb equatorial diameter with the application of higher levels of inorganic was obtained by Chowdappan (1972), Thimmiah (1989), Singh et al (1993), Mallanagouda et al (1995) and Varu et al (1997) and the bulb polar diameter by Setty (1988). The possible reason of maximum bulb weight could be that optimum availability of fertilizers increases the rate of metabolism and synthesizes more carbohydrates thus increasing the bulb yield. Similar results were also reported by Amin et al (1995). On the other hand farm yard manure seems to be directly responsible in increasing crop yields by accelerating the respiratory process which increases cell permeability with hormone acceleratory growth and combination of all these processes. It has important role in supply of nitrogen, phosphorus and potassium of which phosphorus is involved in cell division, photosynthesis and metabolism of carbohydrates and potash regulates proper translocation of photosynthesis and stimulated enzyme activity which in turn increase the rate of growth and positive development in yield characters which results in high bulb yield of onion. Similar finding was also reported by Patil (1995) in onion, Kale et al (1991) in cereals, vegetables and ornamental plants, Suresh (1997) in garlic, Krishna (2002) in tomato and Mamatha (2006) in onion. The data on soluble solids of Rabi onion bulbs recorded for each treatment have been presented in Table 1. The maximum total soluble solids were noted in T_1 (8.71%) followed by organic substances (75%). Similar results finding was also reported by Yeptho et al (2012).

The onion bulbs were graded in different categories according to their bulb size viz A^+, A, B, C, D and the data are depicted through the Table 2.

The A^+ grade bulbs showed significant difference among the different treatments. The maximum A^+ grade (9.66 tons/ha), A grade (8.75 tons/ha), B grade (7.72 tons/ha) bulb yield was recorded in T_1 however contrast results were observed in case of C and D grade bulbs. C grade bulb yield differed significantly with different onion treatments. The maximum C grade bulb yield was recorded in T_6 (9.66 tons/

Table 1. Effect of organic substances on physical parameters and total soluble solids of onion

Treatment	Polar diameter (cm)	Equatorial diameter (cm)	Neck thickness (cm)	Average weight of bulb (g)	Total soluble solids (%)
T_0	03.63	04.60	00.94	42.81	05.16
T_1	05.13	05.23	01.25	66.98	08.71
T_2	04.83	04.73	01.04	46.15	07.10
T_3	05.10	04.80	01.01	48.80	08.39
T_4	04.90	04.90	01.08	54.23	07.77
T_5	04.80	04.53	01.00	55.48	08.10
T_6	04.93	04.90	01.17	56.92	08.51
T_7	05.00	05.03	01.23	62.12	08.64
SEm±	00.12	00.09	00.06	03.63	00.12
$CD_{0.05}$	00.36	00.27	00.20	11.02	00.38

Table 2. Effect of organic substances on grade-wise, marketable bulb and total yield of onion

Treatment	Grade-wise yield (tons/ha)					Marketable bulb yield (tons/ha)	Total yield (tons/ha)
	A^+	A	B	C	D		
T_0	0.093	1.58	4.44	9.33	6.00	15.44	21.44
T_1	9.66	8.75	7.72	4.91	3.83	31.04	34.87
T_2	2.66	4.16	5.47	5.66	8.58	17.95	26.53
T_3	3.08	2.91	6.17	7.91	6.91	20.07	26.98
T_4	6.00	4.33	6.50	5.75	4.50	22.58	27.08
T_5	5.50	1.58	5.22	6.66	8.91	18.96	27.87
T_6	5.50	2.33	5.53	9.66	5.83	23.02	28.85
T_7	6.66	6.00	7.70	5.00	6.51	25.36	31.87
SEm±	01.49	01.33	00.32	00.89	01.05	01.42	01.03
$CD_{0.05}$	04.52	04.03	00.97	02.71	03.19	04.31	03.14

ha) however maximum D grade bulb yield was recorded in T_5 (8.91 tons/ha). The maximum marketable bulb yield (31.04 tons/ha) and maximum total yield ie 34.87 tons/ha was recorded under T_1 (100% RDF). The optimum level of inorganic fertilizers significantly affected yield attributing characters and enhanced good growth and development which might be due to better nutrient availability and uptake by crop. It might be due to the reason that major nutrients supplied by inorganic fertilizers were utilized quickly. The combination of two nutrient sources helped to increased growth parameters and yield contributing characters resulting in good bulb yield. Similar results were also obtained by Sankar et al (2005) in onion crop. Sadaria et al (1997) reported that the yield was found highest with 100 kg nitrogen/ha.

CONCLUSION

The study concluded that onion yield and quality were significantly increased due to application of RDF (100%) might be due to availability of optimum quality of essential nutrients in appropriate proportion.

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