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Short Communication

Influence of integrated nutrient management in onion (*Allium cepa* L.)

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Onion has occupied an important place in Indian diet being consumed throughout the year by almost all classes of people. It is indispensable item in every kitchen as it adds flavor to various vegetable preparations, hence it is called as queen of kitchen. As the availability of land is decreasing day by day, application of chemical fertilizers has become necessary to meet the demand for food grains. So, to sustain soil health and benign environment, balanced application of organic and inorganic fertilizers is essential. Much research has been conducted on the use of inorganic fertilizers in onion to increase the production and productivity of the crop. Onion is important bulbous vegetable, widely grown in Maharashtra. The integrated use of organic and inorganic fertilizers along with biofertilizers, offer good opportunity to increase the yield and quality parameters. Hence, an attempt has been made to study the influence of integrated nutrient management on yield and quality characters of onion.

The experiment was conducted at All India Coordinated Research Project on Vegetable Crops, Mahatma Phule Krishi Vidyapeeth, Rahuri during *Rabi* season of 2010-11. The trial was laid out in a Randomized Block Design with three replications having ten treatments including one control i.e. recommended dose of fertilizers. The onion variety N-2-4-1 was used for present investigation. The soil of the experimental plot was medium black with pH of 8.17, EC (d Sm^{-1}) 0.28, $CaCO_3$ – 0.45%, organic carbon 4.10% and available N, P_2O_5 and K_2O were 169.50, 14.25 and 360.0 kg/ha respectively. The available zinc was 0.46 mg kg^{-1}, available Boron was 0.45 mg kg^{-1} and available sulphur was 6.90 mg kg^{-1}. The details of treatment schedule are T_1- 100:50:50 kg NPK ha^{-1} + 20 t FYM ha^{-1} (RDF), T_2- 100:50:50 kg NPK ha^{-1} + 20 t FYM ha^{-1} (with biofertilizers), T_3- 150:50:80:50 kg NPKS + 20 t FYM ha^{-1}, T_4-110:40:60:40 kg NPKS+15 t FYM ha^{-1}, T_5-110:40:60:40 kg NPKS+7.5 t FYM ha^{-1}, T_6-110:40:60:40 kg NPKS+7.5 t VC ha^{-1}, T_7-110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM ha^{-1}, T_8- 110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t VC ha^{-1}, T_9- 110:40:60:40 kg NPKS + 3.5 t PM + 3.5 t VC ha^{-1}, T_{10}- 110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC ha^{-1}. The half dose of nitrogen and full dose of phosphrous, potasium, FYM (Farm yard manure), PM (Poultry manure), VC (Vermicompost) and sulphur were given at the time of transplanting and half of nitrogen was applied one month after transplanting i.e. top dressing with Urea and biofertilizers 5 kg each of Azospirillum and phophobacteria per hectare to all treatments except treatment no. T_1. Seeds of cultivar N-2-4-1 were sown on raised bed on 28th October 2010. The main field was prepared to fine tilth and flat beds of 3 x 2 m^2 were prepared. Eight weeks old, healthy and uniform seedlings having about 15-20 cm height were used for transplanting. The transplanting was done on 5th January 2011 at 15 x 10 cm spacing. Recommended agronomic practices and plant protection measures were taken up to grow healthy crop. Five randomly selected plants were taken for recording the biometrical characters like plant height (cm), number of leaves, neck thickness (cm), polar and equatorial diameter of bulb (cm), average weight of bulb (g), bolting (%), twin bulbs (%), total bulb yield (t/ha), marketable bulb yield (t/ha), total storage losses % as quality parameters. The data was analyzed by the method advocated by Panse and Sukhatme (1985). The 10 kg of uniform bulbs of each treatment were used for studying the storage losses from May to October 2011. The soil nutrient status was analyzed before the application of treatments and after the harvesting of the crop by adopting the methods suggested by A.O.A.C. (1990).

Significant variations among the treatments were observed for the characters plant height, number of leaves, neck thickness, polar diameter, equatorial diameter, average weight of bulb, % premature bolters,

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% doubles, total yield (t/ha) and marketable yield (t/ha) (Table1). The integrated approach of nutrient application improved these characters when compared to sole application of recommended dose of fertilizer. The treatment T_{10} i.e. application of 100:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC ha^{-1} recorded maximum plant height (68.52 cm) number of leaves (14.10) and neck thickness (1.64cm) as compare to T_1 i.e. application of 100:50:50 kg NPK + 20 t FYM ha^{-1} (59.58 cm, 9.41 and 0.56 cm respectively). With regard to yield and yield attributes, the treatment T_{10} recorded the maximum polar diameter (6.22 cm), equatorial diameter (7.87 cm) and average weight of bulb (78.41 g) than other treatments. The total yield (t/ha) was also maximum in T_{10} treatment i.e. 57.61 t/ha followed by T_9 (54.26 t/ha) and T_7 (52.59 t/ha). The same trend was also observed for marketable yield (t/ha). This may be due to the presence of more % N in poultry manure than the other two organic manures. FYM alone in combination with RDF observed low yields of 35-82 t/ha. The beneficial effect of organic manure on yield and other characters could be attributed to the fact that the decomposition and mineralization of organic manures made the nutrients readily available to the plant (Singh and Asrey, 2005) and also had solubilizing effect on fixed form of nutrients in the soil (Kumaran *et.al*., 1998).

An average of 45-60 per cent increase in total bulb yield by combination of organic, inorganic and bio-fertilizers in onion crop was observed, in general, over the control i.e. only recommended dose. The maximum (60%) increases in total bulb yield was recorded in treatment T_{10} (110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC ha^{-1}) over the treatment T_1 (Control), which revealed minimum total yield (35.82 t/ha). These results are in close agreement with those of Jayathilake *et.al.* (2002) and Sharma *et.al*., (2002). The total number of marketable bulbs per unit is compared of different sized bulbs which can be graded into A grade (above 6.5 cm), B grade (6.5-4.5 cm) and C grade (4.5-3.5 cm size bulbs). The percentage of premature bolters and doubles were regarded as unmarketable bulbs. The A grade bulbs percentage recorded in the range of 10.30 to 14.84. The B grade was 69.39 to 75.60 and C grade was 5.38 to 22.30% and was non-significant. The bolters range from 0.08 to 0.75% and doubles % was in the range from 0.61 to 1.78 in various treatments.

As regards storage studies in onion bulbs influenced by various INM treatments, the treatment T_{10} recorded the maximum losses viz., 19.49, 23.74, 27.58, 31.73, 34.39 and 40.39% as compare to control i.e. T_1 treatment viz., 9.58, 13.98, 19.40, 21.18, 26.97 and 31.02% total storage losses (Sprouting, rotting and PLW losses) for 30, 60, 90, 120, 150 and 180 days after storage (Table 2). The increased level of nutrient applications was responsible for increasing the total losses in onion. Similar findings were also reported by Kumar *et al.* (2000).

Table 2: Total storage losses (%) in onion as influenced by INM.

Treatment	Days after storage					
	30	60	90	120	150	180
T1	9.58	13.98	19.40	21.18	26.97	31.02
T2	9.90	21.11	22.02	23.68	33.88	39.74
T3	12.12	23.52	26.51	27.76	34.41	37.26
T4	11.72	18.00	20.79	24.83	27.36	37.85
T5	13.08	18.34	22.37	27.31	27.34	32.84
T6	10.80	16.36	21.12	30.12	30.02	33.81
T7	12.58	16.89	19.84	25.02	28.55	32.10
T8	14.03	20.42	22.24	27.11	29.24	34.68
T9	15.12	19.66	21.69	24.30	28.74	33.82
T10	19.49	23.74	27.58	31.72	34.29	40.37
S.E.±	2.02	2.31	2.73	1.97	1.77	1.76
C.D. at 5%	NS	NS	NS	5.85	5.27	5.24

Table 1: Yield and yield attributing characters of onion as influenced by INM.

Treatments	Plant height (cm)	Number of leaves	Neck thickness (cm)	Polar diameter (cm)	Equatorial diameter (cm)	Average weight of bulb (g)	% AGB	% BGB	% CGB	% Bolters	% Doubles	Total yield (t/ha)	Marketable yield (t/ha)
T1	59.58	9.41	0.56	3.59	4.47	58.65	10.53	66.38	22.30	0.17	0.62	35.82	31.34
T2	62.22	11.76	0.89	4.70	6.25	63.53	12.79	71.11	14.88	0.49	0.73	44.36	41.55
T3	60.19	11.85	0.97	4.66	6.14	68.28	12.16	73.38	13.69	0.16	0.61	41.66	39.66
T4	60.00	10.26	1.16	4.43	5.93	68.46	13.46	69.57	15.79	0.51	0.67	41.75	38.62
T5	63.66	12.03	1.26	5.83	7.47	71.26	13.28	69.39	16.34	0.33	0.66	50.30	48.54
T6	61.46	11.84	1.33	5.59	7.31	69.47	12.31	74.09	12.23	0.35	1.02	45.54	43.36
T7	64.09	12.51	1.46	5.80	7.70	73.60	17.34	66.38	14.52	0.75	1.01	52.59	51.39
T8	61.46	11.62	1.15	6.04	7.72	70.30	14.33	75.10	9.29	0.25	1.03	47.54	45.46
T9	65.49	13.21	1.62	6.15	7.82	77.75	14.84	70.79	11.56	0.85	1.78	54.26	53.59
T10	68.52	14.10	1.64	6.22	7.87	78.41	17.34	75.60	5.38	0.08	1.60	57.61	54.00
S.E.±	1.74	0.78	0.15	0.49	0.63	1.84	2.26	2.89	2.04	0.15	0.25	2.46	3.09
C.D. at 5%	5.17	2.32	0.46	1.47	1.87	5.47	NS	NS	NS	0.46	0.76	7.32	9.17

AGB-A grade bulbs, BGB-B grade bulbs, CGB-C grade bulbs.

Table 3: Soil nutrient status as influenced by INM in Onion

Treatment	pH (1:2.5)	EC (d sm^{-1})	Organic carbon (%)	$CaCO_3$ (%)	Available N (kg/ha)	Available P_2O_5 (kg/ha)	Available K_2O (kg/ha)	Available Sulphur (mg/kg)	Available zinc (mg/kg)	Available boron (mg/kg)
T1	8.16	0.21	0.46	4.36	179.68	18.38	379.23	7.67	0.49	0.51
T2	8.05	0.27	0.48	4.30	179.94	19.24	395.90	8.91	0.56	0.53
T3	7.99	0.30	0.49	4.40	179.74	19.35	399.90	10.63	0.66	0.53
T4	8.01	0.27	0.52	4.33	179.79	20.32	407.67	8.99	0.61	0.56
T5	8.06	0.27	0.50	4.30	181.62	21.63	413.97	10.83	0.75	0.64
T6	7.99	0.27	0.53	4.20	180.84	20.06	419.90	12.58	0.85	0.69
T7	8.00	0.28	0.52	4.40	185.02	22.64	421.47	11.80	1.76	0.83
T8	8.01	0.28	0.54	4.36	182.93	21.06	427.27	11.20	1.15	0.75
T9	8.08	0.30	0.52	4.20	181.88	22.19	424.39	13.54	1.46	0.77
T10	8.08	0.27	0.56	4.46	187.11	22.99	430.60	16.82	1.90	0.97
S.E.±	0.14	0.08	0.02	0.07	1.46	0.98	0.74	0.97	0.25	0.09
C.D. at 5%	NS	NS	0.06	NS	4.35	2.87	2.20	2.90	0.73	0.26

The analysis of soil nutrient status (Table 3) before the treatment application and also after the harvest of the crop revealed that the organic carbon and available N was found significantly more in poultry manure treated plot alone or in combination with RDF. Very low organic carbon and available N content was observed in RDF. Similar trend was observed with available P_2O_5, K_2O, Sulphur, Zinc and Boron. The PH of the RDF treated plot was maximum (8.16) as compared to other treatments. The EC was minimum in RDF treated plot (0.21) as compared to T_9 treatment (0.30). The % $CaCO_3$ also maximum in T_{10} (4.26) and minimum in T6 (4.20). From these studies it is clearly seen that use of inorganic fertilizers along with FYM, PM, VC and Bio-fertilizers result in significant improvement in available N, P, K and S status of the soil. Similar findings were also reported by Siag and Yadav (2004).

Considering the yield contributing characters, storage losses and soil nutrient status, it can be concluded that for obtaining higher yield through the use of integrated nutrient management system, application of 100:40:60:40 NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC ha^{-1} + bio-fertilizers (5 kg each of Azospirillum and Phosphobactoria) should be given to onion crop.

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