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Short Communication

Effect of soil fertility and integrated plant nutrients on yield response and nutrient uptake of onion (*Allium Cepa* L.)

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Onion is one of the major vegetable crops grown worldwide. It is essential ingredient of variour dishes in Indian diet and also called as queen of kitchen. Its requirement is spread through the year as internal and exports demands. It is necessary to produce onions through the year for fulfilling the domestic and export markets. In onion production, nutrition is one of the most important factors. Application of organic, inorganic and bio-fertilizer would be the optimum integrated nutrient management practices for higher yield, nutrient uptake and fertility status of soil. Soil fertilization is the basic condition for adequate mineral supply to the plants (Sharma *et al.* 2000). Organic and biological routes of improving soil health and fertility for optimum crop production form the vital component of integrated plant nutrient supply system. The yields obtained with the use of fertilizers in combination with organic manure are higher than the use of inorganic fertilizer alone (Warade *et. al.* 1995). The soil status for crop and the uptake of nutrients by the crop is important for deciding the fertilizer requirement in integrated nutrient management system (Shanti *et al.* 2005). Growing of high value vegetables like onion, to obtain higher yields is important. Hence there is a need to study the nutrient uptake by onion under integrated nutrient management practices for medium black soils of western Maharashtra conditions. An attempt has therefore been made to investigate the suitable organic, inorganic and biofertilizers for onion to maximum the yield and improve the uptake of major nutrients.

The experiment was laid out in a Randomized Block Design with three replications having eleven treatments including absolute control and recommended dose of fertilizers at All India Coordinated Research Project on Vegetable Crops, Mahatma Phule Krishi Vidyapeeth, Rahuri during *rabi* season 2013-14. The onion variety N-2-4-1 was used for present investigation. The soil of the experimental plot was medium black with pH of 8.18, EC (d sm^{-1}) 0.26, $CaCO_3$ 8.37%, organic carbon 0.50% and available N, P_2O_5 and K_2O were 173.42, 16.31, 375.24 kg/ha respectively. The available sulphur was 7.91 mg/kg^{-1}. The details of treatments studied are T_1 – Absolute control, T_2 – 100:50:50 kg NPK ha^{-1}, T_3 – 100:50:50 kg NPK + 20 t FYM ha^{-1}, T_4 – 110:40:60:40 kg NPKS + 15 t FYM ha^{-1}, T_5 – 110:40:60 kg NPK + 7.5 t PM + 15 t FYM ha^{-1}, T_6 – 110:40:60:40 kg NPKS + 7.5 t PM ha^{-1}, T_7 – 110:40:60:40 kg NPKS + 7.5 t VC ha^{-1}, T_8 – 110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM ha^{-1}, T_9 – 110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t VC ha^{-1}, T_{10} – 110:40:60:40 kg NPKS + 3.5 t PM + 3.5 t VC ha^{-1}, and T_{11} – 110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC ha^{-1}. The bio-fertilizers 5 kg each of Azospirillum and Phosphobacteria (PSB) per hectare was applied to all treatment except T_1 and T_2 i.e. T_3 to T_{11}. The half dose of nitrogen and full dose of phosphorus, potassium, FYM (farm yard manure), PM (poultry manure), VC (vermicompost) and Sulpher were given at the time of transplanting and half of nitrogen was applied one month after transplanting i.e. top dressing with urea. The bio-fertilizers 5 kg each of Azospirillum and phosphobacteria was applied per hectare to all treatments except treatment T_1 and T_2. The root portion of the seedlings was dipped into the solution of Azospirillum + PSB for 15 minutes period as per treatment and then transplanted in flat beds. Recommended agronomic practices and plant protection measures were taken up to grow healthy crop. Five randomly selected plants were taken for recording the biometrical parameters like plant height (cm), number of leaves, neck thickness (cm), polar and equatorial diameter of bulb (cm), average weight of bulb (g), % A, B & C grade bulbs, bolting (%), twin bulb (%), total bulb yield (t/ha), marketable bulb yield (t/ha) and the total storage losses % as quality parameters. The data

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was analyzed by the method suggested 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 2014. The soil nutrient status was analyzed before the application of treatments and after the harvesting of the crop by adopting the methods suggested by AOAC (1990). For nutrient uptake plant samples were collected from each treatment separately at harvest and dried in differed sunlight and then in an oven at 60°C till constant weight. The over dry samples were grind and finely powdered in Wiley Mill into composite sample. The samples were fursher digested with 1:1 mixture of the concontrased sulphuric acid in Kjeldahl digestion unit at required temperature as suggested by Parkinson and Alien (1975). The acid extract was used for the analysis of N, P, K and S concentration by using standard method of analysis. The total uptake of N, P, K and S was calculated from concentrations of N, P, K and S and bulb yield was recorded and the data was analysed as method suggested by Panse and Sukhatme (1989).

The uptake of N, P, K and S was significantly influenced by all the treatments under study. As per the soil test, soil pH and EC after harvest were non significantly influenced by various treatments (Table 1) percentage of soil organic carbon was significantly influenced by various tremantes and it was maximum (0.62%) in treatment T_{11} 100: 40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC^{-1} along with biofertilizers. However, it was minimum in treatment T_1 (0.51%). Organic carbon was increased in soil in treatments with addition of FYM, PM, VC and bio-fertilizers. These results are in close agreement with those of Siag and Yadav (2004) and Shanti *et al.* (2005).

The quantitative assessment of crop productivity, growth characters and yield contributing characters influenced the total bulb yield significantly. Integrated nutrient management system increased both vegetative growth parameters and yield contributing characters which increased total bulb yield. The treatment receiving 110:40:60:40 kg NPKS + 7.5 t FYM + 2.5 t PM + 2.5 t VC^{-1} recorded the higest bulb yield (50.38 t ha^{-1}) and the T_1 recorded lowest yield of (20.57 t ha^{-1}) which is absolute control and T_3 recorded the yield of 28.49 t ha^{-1} which received only recommended dose of fertilizers i.e. 100:50:50 NPK kg/ha + 20 t FYM ha^{-1}. The use of bio-fertilizers in combination with inorganic fertilizers and organic manures offers a great opportunity to increase the production of onion. In onion combination of organic, inorganic and bio-fertilizers enhances the bulb yield production with better quality of bulbs as recorded earlier by Warade *et al.* (1995). In present investigation the maximum increase in total bulb yield (50.38 t ha^{-1}) was recorded in treatment T_{11} over treatment T_1 (20.57 t ha^{-1}) and T_3 (28.49 t ha^{-1}). These results are in close agreement with those reported by Khandelwal (2010).

The total nutrient uptake of N, P, K and S by onion crop was significantly influenced by various treatments. Total nitrogen uptake (97.19 kg ha^{-1}) by onion was maximum in treatment T_{11} and which was at par with T_{10} (92.76 kg ha^{-1}) and T_8 (87.15 kg ha^{-1}) and minimum in treatment T_1 (58.31 kg ha^{-1}) i.e. absolute control. The recommended dose of fertilizer recorded the Nitrogen uptake of 76.52 kg ha^{-1}. The total phosphrous uptake (15.54 kg ha^{-1}) were recorded in treatment T_1 (absolute control) and maximum (35.43 kg ha^{-1}) in treatment T_{11} followed by T_{10} (33.43 kg ha^{-1}) and T_9 (30.90 kg ha^{-1}). Minimum potassium uptake by onion was recorded in treatment T_1 (53.69 kg ha^{-1}) and it was maximum (91.36 kg ha^{-1}) in treatment T_{11}. This may be because of application of inorganic fertilizer with organic sources which are responsible for increasing nutrient use efficiency by the crops. Uptake of nutrients increased with increasing availability of nutrients and also with nitrogen use efficiency. Similar results were also

Table 1: Effect of different treatments of integrated nutrient management on total uptake of NPKS in onion

Treatments	Bulb yield (tha^{-1})	Soil pH (1:2.5)	EC (d Sm^{-1})	Organic carbon (%)	$CaCO_3$ (%)	N uptake (kg ha^{-1})	P uptake (kg ha^{-1})	K uptake (kg ha^{-1})	S uptake (mg kg^{-1})
T_1	20.57	8.20	0.28	0.51	8.41	58.31	15.54	53.69	19.19
T_2	25.44	8.18	0.30	0.52	8.44	65.50	19.08	58.46	19.90
T_3	28.49	8.16	0.34	0.56	8.53	76.52	24.98	61.45	21.29
T_4	27.20	8.17	0.33	0.54	8.49	73.33	21.13	60.58	20.68
T_5	31.18	8.16	0.36	0.55	8.51	81.17	25.33	70.60	20.04
T_6	35.55	8.15	0.34	0.54	8.57	82.56	26.49	71.49	23.22
T_7	39.26	8.14	0.38	0.56	8.63	80.61	27.33	74.85	25.83
T_8	42.76	8.13	0.39	0.58	8.65	87.15	30.11	80.70	25.35
T_9	40.15	8.11	0.39	0.56	8.58	85.29	30.90	78.17	24.79
T_{10}	46.17	8.09	0.36	0.59	8.68	92.76	33.43	85.39	26.76
T_{11}	50.38	8.07	0.41	0.62	8.74	97.19	35.31	91.36	27.46
S.E.±	1.52	0.03	0.03	0.01	0.02	3.79	1.46	2.69	0.97
CD at 5%	4.48	NS	NS	0.05	0.08	11.17	4.31	7.94	2.87

reported by Sharma *et al.* (2000) and Shanti *et al.* (2005).

The maximum (27.46 mg kg^{-1}) sulphur uptake by onion was recorded in treatment T_{11} and minimum (19.19 mg kg^{-1}) in treatment T_1. The treatment T_{10} (26.76 mg kg^{-1}), T_9 (24.79 mg kg^{-1}), T_8 (25.35 mg kg^{-1}) and T_7 (25.83 mg kg^{-1}) were at par with treatment T_{11} for sulphur uptake. From these studies it was seen that uptake of sulphur increased with application of organic, inorganic and bio-fertilizers in combinations. These results are in close agreement with those of Siag and Yadav (2004). It is evident from the present studies that judicious use of organic, inorganic and bio-fertilizers as integrated nutrient management system would be useful for enhancing the yield and uptake of various nutrients in onion, as it is major crop in western Maharashtra. The integrated use of macronutrients and organic source for other elements is essential for obtaining maximum yields in onion.

References

AOAC (1990) Official methods of analysis. association of agricultural chemicals, Washington DC.

Khandelwal RB (2010) Effect of integrated nutrient management on yield and quality of onion (*Allium cepa* L.) cv. N-2-4-1 (ARS Durgapura, Annual Report 2010, pp 50-54.

Panse VG and Sukhatme PV (1989) Statistical methods for agricultural workers. ICAR, New Delhi, pp 158-162.

Parkinson JA and Allen SE (1975) A wet oxidation proced use suitable for the determination of nitrogen and mineral nutrients in biological material. Commun Soil Sci Plant Anal 6(1): 1-11.

Shanti R, Natesan R and Selvakumari (2005) Effect of soil fertility and integrated plant nutrient on yield response and nutrient uptake of aggregatum onion. Indian J Agril Res 39(3): 213-216.

Sharma RP, Datta N and Pritam K (2000) Effect of combined application of nitrogen, phosphrous, potassium and FYM on onion under high hills, dry temperature conditions of North Western Himalayas. Indian J Agric Sci 73(3): 225-227.

Siag RK and Yadav BS (2004) Effect of vermicompost and fertilizers on productivity of onion and soil fertility. Indian J Agric Sci 77(11): 613-615.

Warade SD, Desale SB and Shinde KG (1995) Effect of organic, inorganic and bio-fertilizer on yield of onion bulbs cv. B-780. J Maharashtra Agric Univ 20(3): 467-68.