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Short communication

Effect of integrated nutrient management on content and uptake of N, P, K and S of onion

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Onion is being cultivated in an area of about 0.42 million ha with a production of 4.21 million tonnes (Anonymous, 2004). The productivity of onion in India is, however, quite low compared to many other countries. Application of fertilizers is imperative to maintain the desired pace of crop production. Continuous use of inorganic fertilizers has depleted soil organic matter, resulting into inherent loss of native soil N, available P, available K and ultimately lowered the productions. Balanced fertilization has to be made for different crops based on soil testing for attaining maximum yield and nutrient content of crop. The balanced use of chemical fertilizers with FYM and biofertilizers for onion crop improve the nutrient availability and uptake to the plants.

The investigation was carried out at Horticulture Farm, S.K.N. College of Agriculture, Jobner during rabi season 2002-03 and 2003-04 to study the effect of integrated nutrient management on content and uptake of N, P, K and S of onion. The treatments consisted of four levels of NPK (control, 50% of recommended dose of NPK, 75% of recommended dose of NPK and 100% of recommended dose of NPK), two levels of FYM (without FYM and with FYM @ 25 t ha^{-1}) and four levels of biofertilizers (no inoculation, N_2 fixer *Azatobactor,* PSB inoculation and N_2 fixer *Azatobactor* + PSB inoculation) making thereby 32 treatment combinations, which were replicated three times in the split plot design. Levels of fertilizers and FYM were taken in main plots and levels of biofertilizers in sub-plots. Plot size was kept 3.0 m x 1.5 m with a row to row and plant to plant distance of 15 cm x 10 cm. Recommended dose of NPK for onion in this zone is 100:50:100 kg ha^{-1}. Nitrogen was applied as per treatment through urea, half as basal dose and remaining half in two equal splits at 30 and 50 days after transplanting. Phosphorus and potassium was applied through single super phosphate and muriate of potash, respectively just before transplanting. Well rotten farm yard manure was incorporated in the soil at the time of field preparation as per treatment @ 25 t ha^{-1}. *Azatobactor* and PSB @ 2 kg ha^{-1} were mixed with 20 kg FYM ha^{-1}. This mixture was applied in soil after the transplanting of seedling.

Nitrogen was estimated by digesting plant samples with sulphuric acid using hydrogen peroxide for removing black colour. Estimation of nitrogen was done by colorimeteric method using Spectronic-20 after development of colour with Nesseler's reagent (Snell and Snell, 1939). Nitrogen was calculated and expressed in percentage. Phosphorus was estimated by digesting plant sample with Tri-acid mixture of HNO_3 : H_2SO_4 : $HClO_4$ and was estimated by Vanadomolybdo phosphate yellow colour method (Jackson, 1967). Potassium was determined by digesting plant samples with tri-acid mixture of HNO_3 : H_2SO_4 : $HClO_4$ and was estimated by flame photometric method (Jackson, 1967).Sulphur was estimated by turbidmetric method (Tabatabi and Bremner, 1970). Plant samples were digested with tri-acid mixture (Nitric acid, perchloric acid and hydrochloric acid) using gelatin barium chloride solution for development of turbidity. The resultant turbidity was measured by colorimeter and sulphur content was expressed in percentage on dry weight basis.

Uptake of nitrogen, phosphorus, potassium and sulphur was computed from nitrogen, phosphorus, potassium and sulphur content in bulb and leaves and yield of bulb and leaves by using the following relationship.

$$\text{Total uptake of NPKS (kg ha}^{-1}\text{)} = \frac{\text{\% NPKS content in bulb x Bulb yield (kg ha}^{-1}\text{)} + \text{\% NPKS content in leaves x Leaves yield (kg ha}^{-1}\text{)}}{100}$$

The data revealed that there was clear cut effect of different levels of fertility. FYM and biofertilizers significantly influenced the content of N, P, K and S (Table 1), yield and uptake of nutrients (Table 2). Progressive increase in levels of fertility from control to 100 % RDF brought about significant improvement in nutrient content of onion over preceding levels. The significant increase in N, P, K and S uptake in onion with the increasing levels of fertility was due to the effect of higher yield along with higher N, P, K and S content in bulb. The content and

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Table 1. Effect of N, P, K, FYM and bio-fertilizers on N, P, K and S nutrient content in onion bulbs

Treatment	N (%)	P (%)	K (%)	S (%)
Fertilizers				
F_0 = Control	0.703	0.212	1.033	0.635
F_1 = 50 % RDF	0.799	0.267	1.075	0.665
F_2 = 75 % RDF	0.876	0.310	1.092	0.690
F_3 = 100 % RDF	0.910	0.336	1.103	0.693
C D at 5%	0.025	0.011	0.028	0.015
Manures				
M_0 = Control	0.775	0.273	1.057	0.659
M_1 = 25 t ha^{-1}	0.870	0.290	1.095	0.682
SEm±	0.006	0.003	0.007	0.004
CD (p=0.05)	0.018	0.008	0.020	0.011
Biofertilizers				
B_0 = Control	0.737	0.264	1.051	0.654
B_1 = *Azatobactor*	0.842	0.278	1.077	0.673
B_2 = PSB	0.833	0.282	1.075	0.670
B_3 = *Azatobactor* + PSB	0.877	0.302	1.100	0.686
C D at 5%	0.019	0.011	0.023	0.014

RDF= Recommended dose of fertilizers

uptake of any nutrient in the plant is directly related to the availability in the feeding zone and growth of plant. The increased uptake of nutrient with increasing fertility level was due to added supply of nutrients and an account of proliferous root system developed under balanced nutrient application which resulted in better absorption of water and nutrients. Thus, increasing doses of N, P, K and S might have resulted in higher content and uptake of these nutrients in onion. The result were in close agreement with the findings of Patel *et al.* (1992) and Soni (2005) in onion crops. Miller *et al.* (1987) also reported significant improvement in the uptake of nitrogen with the application of mineral nutrient in conjunction with FYM under different soils, crops and climatic conditions. Yadav *et al.* (2002) reported an increase in potassium uptake in kharif onion with increase in number of nutrient in a mineral mixture. Further, the application of 100% fertility level significantly increase N, P and K availability in soil. The probable explanation of this result is better utilization of N, P and K with increase in rate of fertility levels (Table 3).

Addition of 25 t ha^{-1} FYM increased the N, P, K and S uptake by onion. The favorable and significant influence of organic manure (FYM) might be due to enhanced growth characters, increasing rate of NPK and micro nutrient availability. Application of organic manure not only increased the uptake of nutrients through mineralization but also reduced the loses of N which other wise occurs through leaching and volatilization (Shanmugam and Veeraputtiram, 2000 and Shreelatha *et al.*, 2000). The increase in uptake of N, P and K due to application of organic matter could be attributed to higher availability of these nutrients and increased utilization of native P due to organic acids produced during decomposition of organic matter, Vachhani and Patel (1993).

Inoculation with biofertilizers (*Azatobactor* and PSB) significantly increased the NPK and S uptake by onion whether alone or in combination. Inoculation significantly increased the uptake of nutrients by crop, which could be

Table 2. Effect of NPK, FYM and bio-fertilizers on nutrient uptake of N, P, K and S and yield of onion

Treatment	Bulb yield (q ha-1)	Nitrogen uptake (kg ha-1)	Phosphorus uptake (kg ha-1)	Potassium uptake (kg ha-1)	Sulphur uptake (kg ha-1)
Fertilizers					
F_0 = Control	153.75	109.38	32.80	159.41	97.98
F_1 = 50 % RDF	200.14	161.83	53.86	215.91	133.55
F_2 = 75 % RDF	236.02	209.31	73.63	258.55	163.32
F_3 = 100 % RDF	244.21	224.81	82.67	270.31	169.82
CD at 5%	7.69	9.30	4.00	9.77	6.56
Manures					
M_0 = Control	173.61	136.98	48.74	184.32	115.18
M_1 = 25 t ha^{-1}	243.45	215.68	72.73	267.77	167.16
SEm±	1.88	2.27	0.98	2.38	1.60
CD (p=0.05)	5.44	6.58	2.83	6.91	4.64
Biofertilizers					
B_0 = Control	196.45	148.59	53.50	207.96	129.62
B_1 = *Azatobactor*	211.54	182.68	60.80	229.46	143.62
B_2 = PSB	208.88	178.44	60.91	226.06	141.18
B_3 = *Azatobactor* + PSB	217.25	195.61	67.75	240.71	150.25
C D at 5%	4.91	7.85	2.78	6.82	3.42

RDF= Recommended dose of fertilizers

Table 3. Effect of NPK, FYM and bio-fertilizers on post harvest available N, P, and K (kg ha^{-1})

Treatment	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
Fertilizers			
F_0 = Control	102.88	14.50	113.74
F_1 = 50 % RDF	14.48	15.99	125.23
F_2 = 75 % RDF	124.64	16.49	132.53
F_3 = 100 % RDF	130.20	17.34	137.18
C D at 5%	6.74	0.73	5.71
Manures			
M_0 = Control	112.49	15.27	124.57
M_1 = 25 t ha^{-1}	123.62	16.90	129.77
C D at 5%	4.77	0.51	4.04
Biofertilizers			
B_0 = Control	114.44	15.36	123.08
B_1 = *Azatobactor*	117.85	16.02	127.12
B_2 = PSB	117.10	16.04	126.91
B_3 = *Azatobactor + PSB*	122.82	16.90	131.58
C D at 5%	3.74	0.52	2.80

RDF= Recommended dose of fertilizers

attributed to the fixation of nitrogen, better root growth due to increased availability of P by PSB besides secretion of growth promoting substances especially by *Azatobactor* (Totawat *et al.*, 2000).

Reference

Anonymous, 2004. Agricultural Statistics, pp. 93-94.

Jackson, M.L. 1967. Soil Chemical analysis. Prentice Hall of India Pvt. Ltd. New Delhi.

Miller, M.H., Mitchell, W.A., Stypa, M. and Barry, P.A. 1987. Effect of nutrient availability and sub soil bulk density on corn yield and nutrient absorption. *Canadian Journal of Soil Science.* 67: 281-292.

Patel, K.P., Patel, J.C., Patel, B.S. and Sadaria, S.G. 1992. Yield and nutrient uptake by onion (*Allium cepa)* as influenced by irrigation, nitrogen and phosphorus. *Indian Journal of Agronomy.* 37: 395-396

Shanmugam, P. M. and Veeraputtiram, R. 2000. Effect of integrated nitrogen management and zinc application on growth and yield of winter rice. In: Proceeding of International Conference on *Managing Natural Resources for Sustainable Agricultural Production in the 21st Century*, New Delhi. 3: 1243-1244.

Shreelatha, T., Sreenivasa Raju, A. and Padma Raju, A. 2000. Integrated nitrogen management in mesta-horsegram sequence grown on alfisol. In: *Proceeding International Conference on Managing Natural Resources for Sustainable Agricultural Production in the 21st Century*, New Delhi. 3: 1186-1187.

Snell, F.D. and Snell, C.T. 1939. Calorimetric methods of Analysis, 3rd Ed. 11 Van Nostrand Co. Inc., New York.

Soni, A.K. 2005. Effect of crop geometry and fertility levels on growth, yield and quality of kharif onion (*Allium cepa* L.) cv. N-53 in semi-arid conditions. Ph. D. Thesis, RAU, Bikaner.

Tabatabi, M.A. and Bremner, J.M. 1970. A simple turbidimetric method of determining total sulphur in plant material. *Agronomy Journal.* 62: 805-806.

Totawat, K.L., Somani,L.L., Singh, R. and Singh, G. 2000. Integrated nitrogen management in maize-wheat cropping sequence on haplustalfs of sub-humid Southern plains of Rajasthan. In: *Proceedings of International Conference on Managing Natural Resources for Sustainable Agricultural Production in the 21st Century*, New Delhi. 3: 923-924.

Vachhani, M.U. and Patel, Z.G. 1993. Effect of nitrogen, phosphorus and potash on bulb yield and quality of onion (*Allium cepa). Indian Journal of Agronomy.* 38 (2): 333-334.

Yadav, G.L., Sharma, P.K. and Kumar, S. (2002). Response of *kharif* onion to nitrogen and potash fertilization. In: *Proceeding International conference on vegetables, held during* 11-14 November, 2002 at Bangalore, p. 193.