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Effect of nitrogen and sulphur levels on nutrient uptake and economics of *Rabi* onion (*Allium cepa* L.)

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Abstract
A field experimented was conducted at Horticulture Farm, MJRP College of Agriculture and Research, Achrol, Jaipur during *Rabi* season of 2017-18 to study the effect of nitrogen and sulphur levels on nutrient uptake and economics of *Rabi* onion. The results reveals that application of 150kg N ha^{-1} and 90 kg S ha^{-1} were significant improvement in nutrient concentrations their uptake and economics of *Rabi* onion under Rajasthan Conditions.

Keywords: Nitrogen, bulb, uptake, net returns and onion

Introduction

Onion (*Allium cepa* L. 2n=16) is an important vegetable belonging to the family *Alliaceae*. It is the most widely grown and popular crop among the *Alliums*. From the list of worldwide cultivated vegetable crops, onion ranks third, only preceded by tomatoes and potatoes (FAOSTAT, 2021) [6]. It is an indispensable item in every kitchen as a vegetable and condiment used to flavour many of the food stuffs. Therefore, onion is popularly referred to as "Queen of Kitchen" (Selvaraj, 1976) [11]. The edible portion is a modified stem, which is known as bulb and develops underground. It is a unique vegetable that is used throughout the year in the form of salad or condiments or for cooking with other vegetables. Onion is also used in preparing soups, sauces, curries, pickles and for flavouring or seasoning foods. Onion bulbs have many medicinal properties. It is recommended for the persons suffering from high cholesterol, weakness, lethargy and lack of vitality. It increases the appetite and suppresses the formation of gases. It's use against sunstroke is the best remedy during summer. It is also useful in fever, dropsy, catarrh and chronic bronchitis. The pungency in onion is due to sulphur bearing compound Allylpropyl Disulphide in the volatile oil. The yellow colour of the outer skin of onion bulb is due to Qurecetin.

Nutrients play a significant role in improving productivity and quality of crops. Therefore, increasing the productivity of onion with a good quality is an important target for the local market. Nitrogen is an essential element for both growth and productivity of all plants and onion crop. The beneficial effect of nitrogen application on onion yield was noted by (Tiwori *et al*., 2002; Devi *et al*., 2003; Abdel-Mawgoud *et al.*, 2005) [12, 4, 1]. In the past few years, there has been an increased concern about the role of sulphur application as a soil amendment and as a factor of increasing fertilizer efficiency. Sulphur as a macronutrient has a positive effect on onion and other crops (El-Shafie and El-Gamaily, 2002; Bloem *et al*., 2004) [2, 5]. Application of sulphur to the soil has several effects; such as reducing pH, improving soil-water relation and increasing availability of nutrients like P, Fe, Mn and Zn (Marschner, 1998) [9].

However, information regarding effect of nitrogen and sulphur levels on nutrient uptake and economics of *Rabi* onion in Rajasthan is lacking. Keeping in view the above discussed facts of sufficient information and space related research, the present investigation was undertaken to find out the effect of nitrogen and sulphur levels on nutrient uptake and economics of *rabi* onion.

Materials and Methods

An experiment was conducted during *rabi* season of 2017-18 at Horticulture Farm, MJRP College of Agriculture and Research, Achrol, Jaipur. The soil was loamy sand in texture, slightly alkaline in reaction, poor in organic carbon with low available nitrogen, phosphorus and sulphur and medium in potassium status.

The experiment was conducted in factorial randomized block design with replicate thrice consisted of sixteen treatment combinations. Nitrogen levels *viz*. (N_0) control, (N_{50}) 50 kg N ha^{-1}, (N_{100}) 100 kg N ha^{-1} and (N_{150}) 150 kg N ha^{-1} as first factor and sulphur levels comprising of (S_0) control, (S_{30}) 30 kg S ha^{-1}, (S_{60}) 60 kg S ha^{-1} and (S_{90}) 90 kg S ha^{-1} as second factor use as an experiment material. The treatments were allocated randomly to each plot. Urea, single super phosphate, murate of potash and elemental sulphur were used as a source of nitrogen, phosphorus, potassium and sulphur. The crop was uniformly fertilized with 50 kg P_2O_5 and 100 kg K_2O ha^{-1} giving a full dose of phosphorus, potassium and sulphur as basal and nitrogen applied as basal as well as top dressing. Puna Red Desi variety of onion was used as test crop. Nursery was raised on 25th October while, transplanting in main field on 22nd December, 2017. Other crop management methods were accompanied as per the recommendation of the area.

Statistical analysis and interpretation of data

Data recorded on relative composition of weeds in the experiment was subjected to analysis by using Fisher's method of analysis of variance (ANOVA) and interpreted as outlined by Gomez and Gomez (1984) [7]. The levels of significance used in 'F' and 't' test was p = 0.05. Critical difference values were calculated where F test was found significant.

Results

The outcomes of the study showed that different nitrogen and sulphur levels caused significant effect on nutrient concentration (%) their uptake (kg ha^{-1}) and economics of *Rabi* onion (Rs. ha^{-1}) are presented in Table 1-3.

Table 1: Effect of nitrogen and sulphur on nitrogen, phosphorus and sulphur content (%) in bulb

Treatments	Nitrogen (%)	Phosphorus (%)	Sulphur (%)
Nitrogen (kg ha^{-1})			
Control	0.663	0.343	0.637
N_{50}	0.729	0.356	0.666
N_{100}	0.768	0.364	0.686
N_{150}	0.814	0.382	0.709
S.E (m) ±	0.004	0.002	0.002
CD (p = 0.05)	0.011	0.006	0.005
Sulphur (kg ha^{-1})			
Control	0.722	0.354	0.665
S_{30}	0.737	0.360	0.673
S_{60}	0.750	0.364	0.677
S_{90}	0.766	0.368	0.683
S.E (m) ±	0.004	0.002	0.002
CD (p = 0.05)	0.011	0.006	0.005

Table 2: Effect of nitrogen and sulphur on nitrogen, phosphorus and sulphur uptake (kg ha^{-1}) by onion bulb

Treatments	Nitrogen uptake (kg ha^{-1})	Phosphorus uptake (kg ha^{-1})	Sulphur uptake (kg ha^{-1})
Nitrogen (kg ha^{-1})			
Control	119.42	61.82	114.70
N_{50}	152.81	74.58	139.35
N_{100}	178.45	84.76	159.55
N_{150}	207.00	97.01	180.02
S.E (m) ±	3.051	1.473	2.563
CD (p = 0.05)	8.811	4.255	7.401
Sulphur (kg ha^{-1})			
Control	150.37	73.50	137.96
S_{30}	160.12	77.82	145.76
S_{60}	168.86	81.57	151.53
S_{90}	178.34	85.28	158.36
S.E (m) ±	3.051	1.473	2.563
CD (p = 0.05)	8.811	4.255	7.401

Table 3: Effect of nitrogen and sulphur on net return (Rs. ha^{-1}) and B:C ratio of *Rabi* onion

Treatments	Net return (Rs. ha^{-1})	B:C ratio
Nitrogen (kg ha^{-1})		
Control	95039	1.42
N_{50}	120417	1.77
N_{100}	140252	2.03
N_{150}	158337	2.26
S.E (m) ±	3399	0.049
CD (p = 0.05)	9816	0.142
Sulphur (kg ha^{-1})		
Control	118305	1.75
S_{30}	126118	1.85
S_{60}	131665	1.90
S_{90}	137956	1.97
S.E (m) ±	3339	0.049
CD (p = 0.05)	9816	0.142

Nutrient concentrations (%)

Nutrient content in bulb with respect of nitrogen, phosphorous and sulphur significantly influenced by nitrogen and sulphur levels (Table 1).

Nitrogen content in bulb (%): It is obvious from the data in Table 1 that nitrogen content of bulb increased significantly under the nitrogen and sulphur levels. The highest increase in nitrogen content of bulb was obtained under N_{150} followed by N_{100} and N_{50} treatments as compared to control (N_0). The application of nitrogen @ 50, 100 and 150 kg ha^{-1}, increased the nitrogen content of bulb to the extent of 9.95, 15.83 and 22.77 per cent, respectively, as compared to control. However, highest increase in nitrogen content in bulb was obtained under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). The application of sulphur @ 30, 60 and 90 kg ha^{-1} increased the nitrogen content of bulb to the extent of 2.08, 3.88 and 6.09 per cent, respectively as compared to control.

Phosphorous content in bulb (%): The critical examination of data in Table 1 revealed that phosphorus content in onion bulb increased significantly with the application of nitrogen and sulphur levels. The highest increase in phosphorus content of bulb was obtained under N_{150} followed by N_{100} and N_{50} treatment as compared to control (N_0). The application of nitrogen @ 50, 100 and 150 kg ha^{-1}, increase the phosphorus content of onion bulb to the extent of 3.79, 6.12 and 11.37 per cent, respectively, as compared to control. The highest increase in phosphorus content in bulbs was obtained S_{90} followed by S_{60} and S_{30} treatment as compared to control (S_0). However, the increase in phosphorus content of onion bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90 kg ha^{-1}, increased the phosphorus content of onion bulb to the extent of 1.69, 2.82 and 3.95 per cent, respectively as compared to control.

Sulphur content in bulb (%): It is evident from the data summarized in Table 1 that the sulphur content in onion bulb was significantly increased by nitrogen and sulphur levels. The highest increase in sulphur content of bulb was recorded under N_{150} followed by N_{100} and N_{50} treatments as compared to control (N_0). The application of nitrogen @ 50, 100 and 150 kg ha^{-1} increased the sulphur content of grain to the extent of 4.55, 7.69 and 11.30 per cent, respectively, as compared to control. However, significantly higher increase in sulphur content of bulb was obtained under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). The application of sulphur @ 30, 60 and 90 kg ha^{-1} increased the sulphur content of onion bulb to the extent of 1.20, 1.80 and 2.71 per cent, respectively as compared to control.

Nutrient uptake (kg ha^{-1})

Nutrient uptake by bulb with respect of nitrogen, phosphorous and sulphur significantly influenced by nitrogen and sulphur levels (Table 2).

Nitrogen uptake (kg ha^{-1}): It is evident from the data in Table 2 that nitrogen uptake of onion bulb increased significantly with the increase in the level of applied nitrogen and sulphur. The highest increase in nitrogen uptake of bulb was obtained under N_{150} followed by N_{100} and N_{50} treatments as compared to control (N_0). The application of nitrogen @ 50, 100 and 150 kg ha^{-1}, increase the nitrogen uptake of bulb to the extent of 27.96, 49.43 and 73.33 per cent, respectively, as compared to control. However, highest increase in nitrogen uptake of bulb was obtained under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). The application of sulphur @ 30, 60 and 90 kg ha^{-1}, increased the nitrogen uptake of onion bulb to the extent of 6.48, 12.29 and 18.60 per cent, respectively, as compared to control.

Phosphorous uptake (kg ha^{-1}): It is clear from the data in Table 2 that application of nitrogen and sulphur caused significant effect on phosphorus uptake. The highest increase in phosphorus uptake of bulb was obtained under N_{150} followed by N_{100} and N_{50} treatments as compared to control (N_0). The application of nitrogen @ 50, 100 and 150 kg ha^{-1}, increased the phosphorus uptake of onion bulb to the extent of 20.64, 37.10 and 56.92 per cent, respectively as compared to control. However, highest increase in phosphorus uptake of bulb and tops was obtained under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in phosphorus uptake of onion bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90 kg ha^{-1}, increased the phosphorus uptake of bulb to the extent of 5.87, 10.97 and 16.02 per cent, respectively, as compared to control.

Sulphur uptake (kg ha^{-1}): It is evident from the data summarized in Table 2 that sulphur uptake of onion bulb was significantly increased by nitrogen and sulphur levels. The highest increase in sulphur uptake of onion bulb was recorded under N_{150} followed by N_{100} and N_{50} treatment as compared to control (N_0). The application of nitrogen @ 50, 100 and 150 kg ha^{-1} increased the sulphur uptake of onion bulb to the extent of 21.49, 39.10 and 56.94 per cent, respectively, as compared to control. However, highest increase in sulphur uptake of bulb was obtained under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However the increase in sulphur uptake of onion bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90 kg ha^{-1} increased the sulphur uptake of bulb to the extent of 5.65, 9.83 and 14.78 per cent, respectively, as compared to control.

Economics (Rs ha^{-1}): A critical examination of data in Table 3 revealed that the effect of nitrogen on net return and B:C ratio was found to be significant. The maximum net return (Rs. 158337 ha^{-1}) and B:C ratio (2.26) was obtained under the N_{150} treatment over rest of the treatments. The application of nitrogen @ 50, 100 and 150 kg ha^{-1} increased the net return and B:C ratio to the extent of 26.70, 47.57 and 66.60 per cent and 24.64, 42.95 and 59.15 per cent, respectively as compared to control (N_0). In case of sulphur, maximum net return (Rs. 137956 ha^{-1}) and B:C ratio (1.97) was obtained under the S_{90} treatment over rest of the treatments. However, the increase in net return and B:C ratio with S_{90} treatment was statistically at par with S_{60} and B:C ratio S_{60} and S_{30} treatment. The application of sulphur @ 30, 60 and 90 kg ha^{-1}, the increased net return and B:C ratio to the extent of 6.60, 11.29 and 16.61 per cent and 5.71, 8.57 and 12.57 per cent, respectively as compared to control (S_0).

Discussions

Significant increase in nutrient content by application of 150 kg N and 90 kg S ha^{-1} might be higher nutrient levels. However, application of 150 kg N and 90 kg S ha^{-1} recorded significantly higher nutrient uptake. In line with this result, Tripathy *et al.* (2013) [13] showed that the application of 150 kg N ha^{-1} with 90 kg S ha^{-1} resulted in a higher N and S uptake. The increase in N uptake might be due to the vital role of S that increased the availability of N to plant, which promotes the production of higher weight of bulbs that could have led to the higher acquisition of nutrients, ultimately resulting in higher total N and S uptake (Nawange *et al*., 2011) [10]. Cecilio *et al*. (2015) [3] also indicated that the positive relation of S with nutrients such as N might promote the uptake of other essential nutrients. Economically, application of 150 kg N and 90 kg S ha^{-1} recorded significantly higher net returns and B:C ratio over rest of the treatments. This might be due to higher bulb yield in respective treatments. The results are in line with the results of Magray *et al*. (2017) [8].

Conclusion

From data presented it might reasonably be argued that the application of 150 kg N ha^{-1} and 90 kg S ha^{-1} were significant improvement in nutrient concentration, their uptake and economics of *Rabi* onion under Rajasthan Conditions.

References

1. Abdel-Mawgoud AR, Abou-Hussein SR, El-Nemr MA. Interactive effects of zinc and different nitrogen sources on yield and quality of onion. Arab-Universities Journal of Agricultural Sciences. 2005 Sep 1;13(3):863-875.
2. Bloem ES, Haneklaus, Schnug E. Influence of nitrogen and sulfur fertilization on the alliin content of onions and garlic. Journal of Plant Nutrition. 2004 Jun 2;27(10):1827-1839.
3. Cecilio ABC, Souza LFG, Tulio FA, Nowaki RHD. Effect of Sulfur dose on the productivity and quality of onions. Australian Journal of Crop Science. 2015;2(3):7-28
4. Devi AK, Limi-Ado, Singh NG. Effects of inorganic and biofertilizers on bulb yield and economics of multiplier onion (*Allium cepa* L. var. Aggregatum Don). News-Letter National. Horticultural Research and Development Foundation. 2003;23(3):1-3.
5. El-Shafie, Fattma S, El-Gamaily E. Effect of organic manure, sulphur and microelements on growth, bulb yield, storability and chemical composition of onion plants. Minufiya Journal of Agricultural Research. 2002;27(2):407-424.
6. FAOSTAT. Food and Agricultural Organization Statistics. Food and Agricultural Organization, United Nations. http://faostat.fao.org/, accessed on June 20; c2021.
7. Gomez AK, Gomez AA. Statistical Procedures for Agriculture Res. Awiley-Inter Sci. Publication. Johan Wiley and Sons, New York; c1984. p. 680.
8. Magray M, Mudasir Chattoo MA, Narayan S, Najar GR, Jabeen N, Ahmad T. Effect of sulphur and potassium applications on growth and chemical characteristics of garlic. Bioscan. 2017;12(1):471-5.
9. Marschner H. Mineral nutrition in higher plants. Academic Press, Harcourt Brace Jovanovich Publisher; c1998. p. 674.
10. Nawange DD, Yadav AS, Singh RV. Effect of phosphorus and sulfur application on growth, yields attributes and yields of chickpea (*Cicer arietinum* L.). Legume Research. 2011;34(1):48-50.
11. Selvaraj S. Onion: Queen of the kitchen. Kisan World. 1976;3(12):32-34.
12. Tiwori RS, Ankur A, Sengar SC. Effect of doses and methods of nitrogen application on growth, bulb yield and quality of “Pusa Red” onion (*Allium cepa*). Indian Journal of Agricultural Sciences. 2002;72(1):23-25.
13. Tripathy P, Sahoo BB, Priyadarshini A, Das SK, Dash DK. Effect of sources and levels of sulfur on growth, yield and bulb quality in onion (*Allium cepa* L.). International Journal of Bio-Resources and Stress Management. 2013 Dec 1;4(4):641-644.