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Effect of nitrogen and sulphur levels on growth and yield 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 growth and yield of *Rabi* onion. The results reveals that application of 150kg N ha^{-1} and 90kg S ha^{-1} were significant improvement in growth, yield attributes and yield of *Rabi* onion under Rajasthan Conditions.

Keywords: Nitrogen, bulb, volume, onion and edible

Introduction

Maximum yield and bulb weight uniformity are the two important characters in determining the marketable proportion of onion (*Allium cepa*, L.) performance (Krishnamuthy and Sharanappa, 2005) [9]. 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 flavourings 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) [15, 6, 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) [7, 3]. 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) [11].

However, information regarding effect of nitrogen and sulphur levels on growth and yield 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 growth and yield 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}) 50kg N ha^{-1}, (N_{100}) 100kg N ha^{-1} and (N_{150}) 150kg N ha^{-1} as first factor and sulphur levels comprising of (S_0) control, (S_{30}) 30kg S ha^{-1}, (S_{60}) 60kg S ha^{-1} and (S_{90}) 90kg 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 50kg P_2O_5 and 100kg 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) [8]. 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 and Discussions

The outcomes of the study showed that different nitrogen and sulphur levels caused significant effect on growth, yield attributing characters and yield of onion are presented in Table 1-4.

Table 1: Effect of nitrogen and sulphur levels on plant height, number and fresh weight of leaves plant^{-1} at harvest

Treatments	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight of leaves plant^{-1} (g)
Nitrogen (kg ha^{-1})			
Control	37.40	9.26	20.43
N_{50}	44.02	9.84	23.72
N_{100}	50.04	10.22	25.43
N_{150}	54.10	10.60	26.91
S.E (m) ±	0.83	0.13	0.43
CD (p = 0.05)	2.41	0.39	1.24
Sulphur (kg ha^{-1})			
Control	43.79	9.70	23.38
S_{30}	46.50	9.90	23.70
S_{60}	47.08	10.05	24.31
S_{90}	48.18	10.28	25.09
S.E (m) ±	0.83	0.13	0.43
CD (p = 0.05)	2.41	0.39	1.24

Table 2: Effect of nitrogen and sulphur on neck thickness and neck length of bulb

Treatments	Neck thickness of bulb (cm)	Neck length of bulb (cm)
Nitrogen (kg ha^{-1})		
Control	0.85	5.24
N_{50}	0.95	5.71
N_{100}	1.03	5.93
N_{150}	1.13	6.52
S.E (m) ±	0.006	0.08
CD (p = 0.05)	0.018	0.24
Sulphur (kg ha^{-1})		
Control	0.95	5.68
S_{30}	0.98	5.74
S_{60}	1.00	5.94
S_{90}	1.03	6.03
S.E (m) ±	0.006	0.08
CD (p = 0.05)	0.018	0.24

Table 3: Effect of nitrogen and sulphur on equatorial diameter, polar diameter and number of scales bulb^{-1}

Treatments	Equatorial diameter (cm)	Polar diameter (cm)	Number of scales bulb^{-1}
Nitrogen (kg ha^{-1})			
Control	5.12	4.00	5.95
N_{50}	5.50	4.71	6.61
N_{100}	5.82	5.46	7.19
N_{150}	6.24	6.13	7.99
S.E (m) ±	0.05	0.07	0.09
CD (p = 0.05)	0.14	0.20	0.26
Sulphur (kg ha^{-1})			
Control	5.42	4.88	6.73
S_{30}	5.62	4.94	6.85
S_{60}	5.81	5.11	6.97
S_{90}	5.83	5.37	7.20
S.E (m) ±	0.05	0.07	0.09
CD (p = 0.05)	0.14	0.20	0.26

Table 4: Effect of nitrogen and sulphur on fresh weight of bulb, volume of bulb and yield of bulb

Treatments	Fresh weight of bulb (g)	Volume of bulb (cc)	Yield of bulb (q ha^{-1})
Nitrogen (kg ha^{-1})			
Control	50.55	49.09	179.72
N_{50}	58.46	55.13	209.34
N_{100}	65.46	60.51	232.57
N_{150}	71.44	64.29	253.86
S.E (m) ±	1.26	0.47	3.78
CD (p = 0.05)	3.63	1.35	10.91
Sulphur (kg ha^{-1})			
Control	58.02	55.50	206.11
S_{30}	60.54	56.84	215.46
S_{60}	62.76	57.73	222.96
S_{90}	64.60	58.94	230.95
S.E (m) ±	1.26	0.47	3.78
CD (p = 0.05)	3.63	1.35	10.91

Plant height (cm): Plant height of *Rabi* onion at harvest was significantly increased with the application of nitrogen (Table 1). The highest increase in plant height 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 150kg ha^{-1}, increased the plant height to the extent of 17.70, 33.80 and 44.65 per cent respectively, as compared to control. In case of sulphur significant increase in plant height at harvest under S_{90} followed by S_{60} and S_{30} treatments as compared to control S_0. However, the increase in plant height with S_{90} treatment was statistically at par with S_{60} and S_{30} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1}, increased the plant height to the extent of 6.19, 7.51 and 10.02 per cent respectively, as compared to control. In line with this, Chattoo *et al*. (2019) [5] reported that the application of nitrogen at the rate of 150kg ha^{-1} and sulphur at the rate of 90kg ha^{-1} produced the highest value for plant height of onion.

Number of leaves plant^{-1}: Perusal of data (Table 1) advocated that significantly higher number of leaves plant^{-1} was recorded under N_{150} followed by N_{100} and N_{50} treatments as compared to control (N_0). However, the increase in number of leaves plant^{-1} with N_{150} treatment was statistically at par with N_{100}. In case of sulphur, a significant increase in number of leaves plant^{-1} was recorded under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in number of leaves plant^{-1} with S_{90} treatment was statistically at par with S_{60} and S_{30} treatment. These results are in conformity with Al-Fraihat *et al.* (2009) [2], who reported that the highest number of leaves plant^{-1} was obtained by the application of 150kg N ha^{-1} and 90kg S ha^{-1}. Rizk *et al.* (2012) [14] also reported that the application of 150kg N ha^{-1} and 90kg S ha^{-1} showed a significant effect on the number of leaves of onion.

Fresh weight of leaves plant^{-1}: It is obvious from the data in Table 1 that the fresh weight of leaves plant^{-1} at harvest increased significantly with the application of nitrogen and sulphur. The highest fresh weight of leaves plant^{-1} at harvest was recorded under N_{150} followed by N_{100} and N_{50} treatments in comparison to control (N_0). The application of nitrogen @ 50, 100 and 150kg ha^{-1}, increased the fresh weight of leaves plant^{-1} at harvest to the extent of 16.10, 24.47 and 31.72 per cent respectively, as compared to control. However, the increase in fresh weight of leaves per plant at harvest with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1} increased the fresh weight of leaves plant^{-1} at harvest to the extent of 1.37, 3.98 and 7.31 per cent respectively, as compare to control. The increase in fresh weight of leaves plant^{-1} might be due to the impact of nitrogen and sulphur application on improving the vegetative growth, which led to the increment in leaf length and leaf diameter and resulted in an increased fresh weight of leaves plant^{-1}. Similarly, Nawange *et al*. (2011) [13] reported that the fresh weight of leaves plant^{-1} of the garlic plant increased significantly as a result of the applied 150kg N ha^{-1} and 90kg S ha^{-1} fertilizers.

Neck thickness: The data presented in Table 2 revealed that the neck thickness of bulbs increased significantly with the application of nitrogen and sulphur. The highest increase in neck thickness of bulbs 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 150kg ha^{-1}, increased the neck thickness of bulbs to the extent of 11.76, 21.18 and 32.94 per cent respectively, as compared to control. Application of sulphur there was a significant increase in neck thickness of bulb under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). The application of sulphur @ 30, 60 and 90kg ha^{-1}, increased the neck thickness of bulbs to the extent of 3.16, 5.26 and 8.42 per cent respectively, as compared to control. In line with the present finding, Zaman *et al*. (2011) [17] reported the highest neck thickness of bulbs with the application of 150kg N ha^{-1} with 90kg S ha^{-1}.

Neck length: It is evident from the data in Table 2 that the neck length was also increased significantly with the application of nitrogen and sulphur. The highest increase in neck length 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 150kg ha^{-1}, increased the neck length to the extent of 8.97, 13.17 and 24.43 per cent respectively, as compared to control. Application of sulphur there was significant increase in neck length under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in neck length with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1}, increased the neck length to the extent of 1.06, 4.58 and 6.16 per cent respectively, as compared to control. In line with the present finding, Zaman *et al*. (2011) [17] reported the highest neck length of bulbs with the application of 150kg N ha^{-1} with 90kg S ha^{-1}.

Equatorial diameter (cm): It is evident from the data in Table 3 that the equatorial diameter of bulb increased significantly with the application of nitrogen and sulphur. The highest increase in equatorial diameter 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 150kg ha^{-1}, increased the equatorial diameter of bulb to the extent of 7.42, 13.67 and 21.87 per cent respectively, as compared to control. Significant increase in equatorial diameter of bulb by sulphur application was obtained under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in equatorial diameter of bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg S ha^{-1}, increased the equatorial diameter of bulb to the extent of 3.69, 7.19 and 7.56 per cent respectively, as compared to control. The results was in line with this result of Tripathy *et al.* (2013) [16]. Cecilio *et al*. (2015) [4] also indicated that the positive relation of S with nutrients such as N might promote the yield attributes of onion.

Polar diameter (cm): It is evident from the data in Table 3 that the polar diameter of bulb increased significantly with the application of nitrogen and sulphur. The highest increase in polar diameter 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 150kg ha^{-1}, increased the polar diameter of bulb to the extent of 17.75, 36.50 and 53.25 per cent respectively, as compared to control. Application of sulphur was recorded significant increase in polar diameter of bulb under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in polar diameter of bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1}, increased the polar diameter to the extent of 1.22, 4.71 and 10.04 per cent respectively, as compared to control. The results was in line with this result of Tripathy *et al.* (2013) [16]. Cecilio *et al.* (2015) [4] also indicated that the positive relation of S with nutrients such as N might promote the yield attributes of onion.

Number of scales bulb^{-1}: The data presented in Table 3 indicate that the number of scales bulb^{-1} increased significantly with the application of nitrogen and sulphur. The highest number of scales bulb^{-1} 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 150kg N ha^{-1}, increased the number of scales to the extent of 11.09, 20.84 and 34.28 per cent respectively, as compared to control. In case of sulphur, a significant increase in number of scales bulb^{-1} was recorded under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in number of scales with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg S ha^{-1}, increased the number of scale to bulb^{-1} the extent of 1.78, 3.57 and 6.98 per cent respectively, as compared to control. The results was in line with this result of Tripathy *et al.* (2013) [16]. Cecilio *et al.* (2015) [4] also indicated that the positive relation of S with nutrients such as N might promote the yield attributes of onion.

Fresh weight of bulb: An examination of data in Table 4 that the fresh weight of bulb increased significantly with the application of nitrogen and sulphur. The highest increase in fresh weight 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 150kg ha^{-1}, increased the fresh weight of bulb to the extent of 15.64, 29.49 and 41.32 per cent respectively, as compared to control. Application of sulphur a significant increase in fresh weight of bulb was recorded under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in fresh weight of bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1}, increased the fresh weight of bulb to the extent of 4.34, 8.17 and 11.34 per cent respectively, as compared to control. This might be due to the role of N and S in improving the vegetative growth and accelerating the photosynthesis in storage organs of bulbs, ultimately resulting in an increased bulb fresh weight. These results are in agreement with those of Mishu *et al.* (2013) [12] and Zaman *et al*. (2011) [17], who reported that an increased level of N and S fertilizer rate resulted in increased bulb fresh weight.

Volume of bulb: A close examination of the data in Table 4 indicates that the volume of bulb increased significantly with the application of nitrogen and sulphur. The highest increase in volume 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 150kg ha^{-1}, increased the volume of bulb to the extent of 12.30, 23.26 and 30.96 per cent respectively, as compared to control. Application of sulphur there was significant increase in volume of bulb under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in volume of bulb with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1} increased the volume of bulb to the extent of 2.41, 4.02 and 6.19 per cent respectively, as compared to control. The increased volume of bulb with N and S fertilization in the current study could be attributed to the increase in plant height, the number of leaves produced, leaf length, and neck diameter, which may have increased assimilate production and allocation to the bulb. In line with this, Mishu *et al.* (2013) [12] reported that the application of N and S increased volume of bulb. Magray *et al*. (2017) [10] also reported that a higher volume of bulb was observed by the application of 150kg N with 60kg S ha^{-1}.

Bulb yield ha^{-1}: It is obvious from the data in Table 4 that the bulb yield increased significantly with the application of nitrogen and sulphur. The highest bulb yield was recorded under N_{150} followed by N_{100} and N_{50} treatments in comparison to control (N_0). The application of nitrogen @ 50, 100 and 150kg ha^{-1}, increased the bulb yield to the extent of 16.48, 29.40 and 41.25 per cent respectively, as compared to control. Application of sulphur the significant increase in bulb yield was recorded under S_{90} followed by S_{60} and S_{30} treatments as compared to control (S_0). However, the increase in bulb yield with S_{90} treatment was statistically at par with S_{60} treatment. The application of sulphur @ 30, 60 and 90kg ha^{-1} increased the bulb yield to the extent of 4.54, 8.18 and 12.05 per cent respectively, as compare to control. Similarly, Zaman *et al.* (2011) [17] indicated that 150kg N ha^{-1} with S at the rate of 90kg ha^{-1} produced 54.5% and 54.9% higher yield over control treatment on two consecutive years.

Conclusion

From data presented it might reasonably be argued that the application of 150kg N ha^{-1} and 90kg S ha^{-1} were significant improvement in growth, yield attributes and yield of *rabi* onion under Rajasthan Conditions.

References

1. Abdel-Mawgoud AR, Abou-Hussein SR and 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. Al-Fraihat AH. Effect of different nitrogen and sulphur fertilizer levels on growth, yield and quality of onion (*Allium cepa* L.). Jordan Journal of Agriculture Sciences. 2009;5(2):155-66.
3. Bloem ES, Haneklaus, Schnug E. Influence of nitrogen and sulfur fertilization on the alliin content of onions and garlic. Journal of Plant Nutrition. 2004 Jan 1;27(10):1827-1839.
4. 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.
5. Chattoo M, Mudasir Magray, Ajaz Ah Malik, Shah MD, Chisti J. Effect of Sources and Levels of Sulphur on Growth, Yield and Quality of Onion (*Allium cepa* L). 2019;8(3):2319-7706.
6. 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.
7. 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.
8. Gomez AK, Gomez AA. Statistical Procedures for Agriculture Res. Awiley-Inter Sci. Publication. Johan Wiley and Sons, New York; c1984. p. 680.
9. Krishnamuthy D, Sharanappa. Effect of sole and integrated use of improved composts and NPK fertilizers on the quality, productivity and shelf life of Bangalore rose red onion (*Allium cepa* L.). Mysore Journal of Agricultural Sciences. 2005;39(3):355-361.
10. 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.
11. Marschner H. Mineral nutrition in higher plants. Academic Press, Harcourt Brace Jovanovich Publisher; c1998. p. 674.
12. Mishu HM, Ahmed F, Rafii MY, Faru G, Latif MA. Effect of sulfur on growth, yield and yield attributes in onion (*Allium cepa* L.). Australian Journal of Crop Sciences. 2013 Aug 1;7(9):1416-22.
13. 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.
14. Rizk FA, Shaheen AM, Abd El-Samad EH, Sawan, OM. Effect of different nitrogen plus phosphorus and sulphur fertilizer levels on growth, yield and quality of onion (*Allium cepa* L.). Journal of Applied Science Research. 2012 Jul;8(7):3353-61.
15. 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.
16. 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):641-4.
17. Zaman MS, Hashem MA, Jahiruddin M, Rahim MA. Effect of sulfur fertilization on the growth and yield of garlic (*Allium sativum* L.). Bangladesh Journal of Agricultural Research. 2011;36(4):69.