Journal of AgriSearch, 9 (2): 145-148
An Open Access International Peer Reviewed Quarterly

ISSN : 2348-8808 (Print), 2348-8867 (Online)
https://doi.org/10.21921/jas.v9i02.10120

Onion Performance in Response to Zinc and Sulphur Application

RAJANEESH SINGH[1*], BIJENDRA K SINGH[2], AMAN SRIVASTAV[1], VIRENDRA KUMAR PATEL[1] AND AKHILESH RAWAT[1]

ABSTRACT

The experiment was conducted Jaunpur, U.P. to study the response of different doses of zinc and sulphur on growth and yield of onion. The experiment was arranged in a Randomized Block Design (RBD) with 12 treatments with three replicates each. Maximum plant height 60.53 (cm), number of leaves per plants 9.98, leaf length 54.74 (cm), leaf width 147(cm), leaf area 90.86 (cm), fresh weight of bulb 187.98 (g), dry weight of bulb117.36 (g), bulb length 6.85 (cm), thickness (bulb width) of bulb before curing 7.95 (cm), thickness (bulb width) of bulb after curing 7.16 (cm), dry matter of plant124.68 (g), bulb 230.44 yield/ha (q), net returns (Rs 227235 ha^{-1}) and B:C ratio (1:5:60) were obtained with the T_{12} *i.e.* RDF + 3 Kg Zn + 40 Kg S. Whereas, minimum plant growth, yield and net return and B:C ratio were recorded under treatment (T_1) control. Above result showed that T_{12} was best in all treatments, so farmers may be adopt it for cultivation.

Keywords: Nitrogen, Onion, Yield, Zinc, Sulphur, Plant height, Leaf area, Net returns.

ARTICLE INFO

Received on	:	24.03. 2022
Accepted	:	02.06. 2022
Published online	:	16.06.2022

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops cultivated extensively in India and it belongs to family Alliaceae. It is considered to be the second most important vegetable crop grown in the world after tomato. It is most widely grown and popular vegetable crop among the alliums as well as cash crops. Therefore, onion is popularly referred as "Queen of Kitchen." Onion is liked for its flavor and pungency which is due to the presence of a volatile oil "allyl propyl disulphide"- organic compound rich in sulphur. Onion has its own distinctive flavor and is used in soups, meat dishes, salads, and Sandwiches, and is cooked alone as a vegetable. Its pungency is due to the presence of a volatile oil (allyl propyl disulphide) (Malik 1994). A pound of onion contain Protein 6 g, Fats 0.9 g, Carbohydrate 44 g, Calcium 137 mg, Phosphorous 188 mg, Iron 2.1 mg, Thiamine 0.15mg, Riboflavin 0.1 mg, Niacin 0.6mg and Ascorbic acid 38 mg. (Thomson and Kelly 1982) Onions are day length sensitive, several onion types exist depending upon the latitude at which they grow. It is estimated that around the World, over 3,642,000 ha of onions are grown annually. On a worldwide scale, around 80 million metric tons of onions are produced per year. China is by far the top onion producing country in the world, accounting for approximately 28% of the world's onion production, followed by India, USA, Iran, Egypt, Turkey, Russia, Pakistan, Netherlands and Brazil. The worldwide onion exports are estimated at around 7 million Metric tons. The Netherlands is the world's largest onion exporter with a total of around 220,000 Metric tons followed at a distance by India (FAO, 2013). India is the second largest producer in the world. The major onion producing states in India are Maharashtra, Karnataka, Madhya Pradesh, Bihar, Gujarat and Rajasthan. In India, it is grown in 1181 lakh hectare area and its production is 18924 tone of bulb and productivity is 16 t/ha whereas in Madhya Pradesh, it is grown in 120.35 lakh hectares area and production is 2754.30 tone and productivity is 22.89 t/ha (Anonymous, 2014-15). Liberal application of nitrogen fertilizers can stimulate plant growth and increase zinc requirements beyond the available supply. The amount and properties of nitrogen source and its placement in relation to the zinc fertilizer has a notable effect on zinc availability. Nitrogen fertilizers that are acid forming will increase the uptake of both native and supplemental zinc. On the other hand, products with a neutral to basic effect are known to depress zinc uptake (Tisdale *et al.* 1985). Being a high yielding crop, onion utilizes large quantities of the nutrients from the soil, but onion per hectare yield is still low in Pakistan as compared to other countries. The best way to improve the yield and growth is to apply appropriate amount of fertilizer. Nitrogen, being a component of amino acids and chlorophyll, promotes rapid vegetative growth, protein content and yield of the crop. Among the macro and micronutrients, nitrogen, phosphorus, potassium and sulphur are pre-requisite. Onion responded to nitrogen and sulphur positively in terms of yield and quality of bulbs (Nasreen *et al.*, 2007).

MATERIALS AND METHODS

A Field experiment was conducted to observe the Response of NPK with different doses of zinc and sulphur on growth and yield of onion at Experimental Unit, Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur U.P. in 2018. Jaunpur district is situated in eastern part of Uttar Pradesh at latitude of 25º 44′ 05″ North and longitudes 82º 41′ 07″ East and an altitude of 82 meters above mean sea level. This region lies under 8th Eastern plain zone of Agro-climatic zone. The climate condition of Jaunpur is sub-tropical with three distinct seasons i.e., winter, summer and rainy. During the winter season (December-January) temperature fall, 5°C even low, while in summer season (May- June) it reaches as high as 45°C. Occasional spell of frost and precipitation may occur during winter. Most of the rainfall is received in the middle of July to end of September after which the intensity of rainfall decreases. The main annual rainfall is about 850-1100

[1] Department of Horticulture, T.D.P.G. College, Jaunpur, 222 002, Uttar Predesh, India
[2] Department of Fruit Science, CoH, BUA & T, Banda, Uttar Predesh, India
*Corresponding Author E-mail: rajaneeshhort@gmail.com

mm.

The experiment was arranged in a Randomized Block Design (RBD) with 12 treatments (T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 T_{10} T_{11} and T_{12}) of three replicates each. Zink levels under trail were 1, 2 and 3 kg per hectare, while sulphur levels were 15, 30, and 40 kg per hectare. T_1 - RDF(NPK), T_2 - RDF + 1kg Zn, T_3 - RDF + 2Kg Zn, T_4 - RDF + 3Kg Zn, T_5 - RDF + 30Kg S, T_6 - RDF + 40 Kg S, T_7 - RDF + 1 Kg Zn + 30 Kg S, T_8 - RDF + 2 Kg Zn + 30 Kg S, T_9 - RDF + 3 Kg Zn + 30 Kg S, T_{10} - RDF + 1 Kg Zn + 40 Kg S, T_{11} - RDF + 2 Kg Zn + 40 Kg S, T_{12} - RDF + 3 Kg Zn + 40 Kg S.

The calculated quantities of fertilizers were applied to the respective plot. The sources of nutrients were nitrogen (Urea) phosphorus (DAP), potash (MOP) Zinc and Sulphur (Elemental Sulphur). Half of nitrogen and whole of phosphorus@ 60 Kg/ha, potash@100 Kg/ha and Sulphur as per treatments were applied as basal dose prior to transplanting of onion seedlings. While the rest of nitrogen was given in 2 equal split doses in transplanted onion seedling, first at 30 and second 45 days of transplanting. Other cultural practices like weeding, hoeing, irrigation, insect pest and disease management were done as and when required. The observations were recorded from each treatment to assess the Response of NPK with different doses of zinc and sulphur on growth and yield of onion. The observed data were analyzed by analysis of variance (ANOVA) using the statistical program and the significance differences between the mean were tested against the critical difference at 5% probability level.

RESULTS AND DISCUSSION

Growth characters

The data (Table 1) showed that the maximum and significantly higher plant height (26.31, 55.13, 58.87 and 60.53 cm) was recorded in T_{12} (NPK + 3 Kg Zn + 40 Kg Su). Followed by T_{11} (26.05, 55.13, 58.28 and 60.51 cm). Whereas, the minimum plant height (23.44, 49.54, 54.11 and 55.11, cm) was recorded in T_1 (NPK) i.e. Control.

The maximum and significantly number of leaves per plant (4.91, 7.90, 9.75 and 9.98 cm) was recorded in T_{12}. Followed by T_{11} (4.83, 8.86, 9.62 and 9.98 cm). Whereas, the minimum number of leaves per plant (4.33, 6.56, 8.33 and 8.46 cm) was recorded in T_1 i.e. Control.

The maximum and significantly leaf length (cm), (23.85, 46.86, 52.86 and 54.74 cm) was recorded in T_{12}. Followed by T_{11} (23.73, 46.07, 52.67 and 54.56 cm). Whereas, the minimum number of leaves per plant (20.65, 41.61, 46.64 and 48.85 cm) was recorded in T_1 i.e. Control.

The maximum and significantly leaf width (cm), (0.44, 1.04,1.26 and 1.47 cm) was recorded in T_{12}. Followed by T_{11} (0.43, 1.06, 1.23 and 1.46 cm). Whereas, the minimum number of leaves per plant (0.35, 0.91, 1.04 and 1.16 cm) was recorded in T_1 i.e. Control.

The maximum and significantly leaf Area, (37.79, 54.63, 68.77 and 90.86 cm) was recorded in T_{12}. Followed by T_{11} (37.49, 54.48, 68.46 and 90.55 cm). Whereas, the minimum number of leaves per plant (35.22, 51.62, 65.60 and 88.57 cm) was recorded in T_1 i.e. Control.

The growth characters i.e. plant height, number of leaves per plant, number of leaves per plant, leaf length (cm), leaf width (cm), and leaf Area were at 20, 40, 60, 80 days after transplanting i.e. denoted significant influence of nitrogen levels as well as zinc and sulphur levels.

It showed that application of nitrogen exerted the positive effect on plant height, number of leaves per plant, fresh weight of shoot, fresh weight of bulb, dry weight of shoot and dry weight of bulb which may be due to the role of nitrogen in chlorophyll structure with increasing dose of Zinc & sulphur which is responsible for photosynthesis and manufacture of food material in the plants. These findings are in line with findings of Tiwari *et al.* (2002), Haque *et al.* (2004) and Nasreen *et al.* (2007).

Yield Characters

The data (Table 2) showed that the maximum and significantly different fresh weight of bulb (187.98 g) was recorded in T_{12}. Followed by T_{11} (186.32 g) and T_{10} (181.28 g). Whereas, the minimum fresh weight of bulb (170.78 g) was recorded in T_1 i.e. Control.

The maximum and significantly better dry weight of bulb (117.36 g) was recorded in T_{12} Followed by T_{11} (116.48 g) and T_{10} (115.63 g). Whereas, the minimum dry weight of bulb (107.81 g) was recorded in T_1 i.e. Control.

The maximum and significantly higher bulb length (6.853 cm) was recorded in T_{12} .Followed by T_{11} (6.753 cm) and T_{10} (6.677 cm). Whereas, the minimum bulb length (5.830 cm) was recorded in T_1 i.e. Control.

The maximum and significantly different thickness (bulb width) of bulb before curing (7.957 cm) was recorded in T_{12}. Followed by T11 (7.853 cm) and T10 (7.760 cm). Whereas the minimum thickness (bulb width) of bulb before curing (6.857 cm) was recorded in T1 i.e. Control.

The maximum and significantly different thickness (bulb width) of bulb after curing (7.163 cm) was recorded in T_{12}. Followed by T_{11} (7.127 cm) and T_{10} (7.063 cm). Whereas, the minimum thickness (bulb width) of bulb after curing (5.830 cm) was recorded in T_1 i.e. Control.

The maximum and significantly better dry matter of plant (124.68 g) was recorded in T_{12}. Followed by T_{11} (123.87g) and T_{10} (122.79 g). Whereas, the minimum dry matter of plant (113.86 g) was recorded in T_1 i.e. Control.

The maximum and highly significantly higher bulb yield (230.44 q/ha) was recorded in T_{12} Followed by T_{11} (223.67 q/ha) and T_{10} (182.83 q/ha). Whereas, the minimum bulb yield (107.52 q/ha) was recorded in T_1 i.e. Control.

There was a linear increase in yield attributes and yield in all treatments from T_1 to T_{12}. Bulb yield were recorded highest with application of T_{12} which was significantly superior over other doses at all the stages. The Combined responses of zinc and sulphur recorded significant influence. Similar results have been found by Joshi *et al.* (2005) and Mozumder *et al.* (2007). It is revealed form the data obtained that a highly significantly maximum bulb yield/ha of (230.00 q) was obtained in onion treatment. The net return/ha of Rs (227235) and with cost benefit ratio of (Rs 1:5.60) .was obtain under treatment T_{12} followed by treatment T_{11} gave yield/ha (223.67q) and net return/ha of Rs (219311) with cost benefit ratio of (Rs 1:5:46) While, lowest bulb yield/ha (107.52 q) and net return/ha of Rs (83531) along with cost benefit ratio (1:2.83) was observed in the treatment T_1.

Highest benefit cost ratio was recorded with T_{12} followed by T_{11} these results may be due to increase in economic yield with increasing dose of Zinc and sulphur also reported by Nagaich *et al.* (1999) and Ullah *et al.* (2008).

Table 1. Response of NPK with different doses of Zinc and Sulphur on growth of onion

Treatments	Plant height (cm)	Numbers leaves/plant	Leaf length (cm)	Leaf width (cm)	Leaf area (cm²)
T_1	55.11	8.46	48.85	1.16	88.57
T_2	55.19	8.59	50.48	1.19	88.79
T_3	56.46	8.7	50.67	1.25	88.92
T_4	56.65	8.79	51.58	1.27	89.25
T_5	58.59	9.44	52.73	1.42	89.79
T_6	58.65	9.50	53.46	1.43	89.89
T_7	57.17	8.88	51.96	1.30	89.38
T_8	57.59	8.98	52.30	1.31	89.52
T_9	58.37	9.34	52.51	1.34	89.67
T_{10}	59.41	9.64	53.65	1.44	90.12
T_{11}	60.51	9.84	54.56	1.46	90.55
T_{12}	60.53	9.98	54.74	1.47	90.86
C.D.at 5%	**0.751**	**0.115**	**0.255**	**0.01**	**0.122**
SEm±	**0.254**	**0.039**	**0.086**	**0**	**0.041**

Table 2. Response of NPK with different doses of Zinc and Sulphur on yield of onion

Treatments	Fresh weight of bulb (gm)	Dry weight of bulb (gm)	Bulb length (cm)	Thickness (bulb width) of bulb before curing (gm)	Thickness (bulb width) of bulb after curing (cm)	Dry Matter of Plant(gm)	Bulb yield (q/ha)
T_1	170.78	107.81	5.83	6.85	5.83	113.86	107.52
T_2	171.33	108.85	5.94	7.14	5.94	115.49	143.89
T_3	172.76	109.76	6.18	7.27	6.27	116.54	152.46
T_4	173.15	110.17	6.27	7.31	6.38	117.61	152.62
T_5	177.41	113.60	6.43	7.67	6.92	121.73	173.54
T_6	180.50	114.73	6.60	7.7	7.01	122.57	182.59
T_7	174.63	110.92	6.30	7.38	6.61	119.66	153.68
T_8	175.65	111.83	6.34	7.42	6.89	120.47	172.68
T_9	176.48	112.67	6.38	7.6	6.98	121.51	173.37
T_{10}	181.28	115.63	6.67	7.76	7.06	122.79	182.83
T_{11}	186.32	116.48	6.75	7.85	7.12	123.87	223.67
T_{12}	187.98	117.36	6.85	7.95	7.16	124.68	230.44
C.D.at 5%	**0.731**	**0.238**	**0.111**	**0.15**	**0.278**	**0.127**	**2.653**
SEm±	**0.248**	**0.081**	**0.038**	**0.051**	**0.094**	**0.043**	**0.899**

Table. 3: Response of NPK with different doses of zinc and Sulphur on Economics of different treatments.

Treatments	Treatment Cost (Rs)	Total cost (Rs)	Yield/ha (qu)	Gross Income (Rs)	Net Income (Rs)	B:C Ratio
T_1	8693	45493	107.52	129024	83531	1:2:83
T_2	8893	45693	143.89	172668	126975	1:3:77
T_3	9093	45893	152.46	182952	137059	1:3:98
T_4	9293	46093	152.62	183144	137051	1:3:97
T_5	11093	47893	173.54	208248	160355	1:4:34
T_6	11893	48693	182.59	219108	170415	1:4:49
T_7	11293	48093	153.68	148416	100323	1:3:08
T_8	11493	48293	172.68	207216	150923	1:4:29
T_9	11693	48493	173.37	208044	159551	1:4:27
T_{10}	12093	48893	182.83	219396	170503	1:4:48
T_{11}	12293	49093	223.67	268404	219311	1:5:46
T_{12}	12493	49293	230.44	276528	227235	1:5:60

CONCLUSION

Several attempts have been made in the past to increase the yield potential of bulb crops, but they are primarily concerned with the use of chemical fertilizers. Almost negligible attention has been given to the basic physiological processes, which limit the crop productivity. The role of micronutrients in enhancing the growth characters is well known and they have a positive relationship with growth.

In India, the deficiency of micronutrients has been observed in many types of soils. With the introduction of high yielding varieties, hybrids and intensive cropping system, micronutrient deficiency is becoming more and more acute.

Keeping this in view, the investigation was undertaken to find out the role of NPK and micronutrients on growth and yield of onion.

REFERENCES

Anonymous. 2015. National Horticulture Board.2014-15. Gurgaon (Haryana), India. Website: *www.nhb.gov.in*

FAO.2010. Globle Forest Resources Assessment 2010. Food and Agriculture Organization of the United Nations. Rome, Italy.

Haque M I, Zaman M M, Hasan M K, Mahfuza, Begum and Pervin F.2004. Growth and yield of onion as influenced by nitrogen and irrigation. *Journal of Agriculture and Rural Development* **2**(1): 151-153.

Joshi R P, Rajoria U K and Bose US.2005. Influence of nitrogen and sulphur application on growth and yield of onion. National seminar on agro technology, quality, processing and export of spices held from at College of Horticulture, Mandsaur, March, 20-21, p 64.

Malik M N.1994. Bulb crops, Onion. In: Horticulture. pp. 500-501. National Book Foundation, Islamabad, Pakistan.

Mozumder S N, Moniruzzaman M and Halim GMA.2007. Effect of N, K and S on the yield and storability of transplanted onion (*Allium cepa)* in the hilly region. *Journal of Agricultural and Rural Development* **5** (1): 58-63.

Nagaich K N and Singh V B.1998. Response of onion to potash and sulphur, National seminar on opportunities and potentials of spices for crop diversification, January 19-21 held at College of Horticulture, Mandsaur, pp: 112-113.

Nasreen S, Haque M M, Hossain M A and Farid ATM.2007. Nutrient uptake and yield of onion as influenced by nitrogen and sulphur fertilization. Bangladesh. *Journal of Agricultural Research* **32**(3): 413 - 420.

Thomson H C and Kelly W C. 1982. Bulb crops vegetable crops. Ta Ta Mc Grew-Hill publishing company Limited, New York. Reprinted at Pakistan printing Works, Lahore. pp. 611.

Tisdale S L, Nelson W L and Beaton J D. 1985. Micronutrients and other beneficial elements in soils and fertilizers. In soil fertility and fertilizers, Zinc, pp. 387-388. Macmillan Publishing Company 866 third avenue, New York, 10022.

Tiwari R S, Agarwal A, Sengar S C and Agarwal A.2002. 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* **72** (1): 23-25.

Ullah M H, Huq S M I, Alam M D U and Rahman M A. 2008. Impacts of sulphur levels on yield, storability and economic return of onion. *Bangladesh Journal of Agricultural Research* **33** (3): 539 – 548.

Citation:

Singh R, Singh BK, Srivastav A, Patel VK and Rawat A. 2022. Onion performance in response to zinc and sulphur application. *Journal of AgriSearch* **9** (2):145-148