Current Journal of Applied Science and Technology

33(2): 1-4, 2019; Article no.CJAST.46410
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Effect of Sulphur Sources and Levels on Growth, Yield and Quality of Onion (*Allium cepa* L.)

Sanjay Kumar Singh[1*], Manish Kumar[1], Seema[1], P. K. Singh[1] and L. M. Yadav[2]

[1]Nalanda College of Horticulture, Noorsarai (Nalanda), Bihar Agricultural University, Sabour, Bhagalpur, India.
[2]Department of Horticulture, Tirhut College of Agriculture, Dholi, India.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2019/v33i230053
Editor(s):
(1) Dr. Bishun Deo Prasad, Department of Molecular Biology and Genetic Engineering, Bihar Agricultural University, Sabour, Bhagalpur-813210, Bihar, India.
Reviewers:
(1) Nusret Ozbay, Bingöol University, Turkey.
(2) Olfa Ben Braïek, University of Monastir, Tunisia.
Complete Peer review History: http://www.sdiarticle3.com/review-history/46410

Original Research Article

Received 21 December 2018
Accepted 11 January 2019
Published 05 March 2019

ABSTRACT

A field experiment was conducted during rabi season at Trihut college of Agriculture Dholi, Muzaffarpur to evaluate the response of sources (Elemental sulphur and gypsum) and different doses (15, 30 and 45 kg S ha^{-1}) of sulphur growth yield and quality of onion. Bulb yield, nutrient content in onion and nutrient uptake were significantly improved by the application of sulphur by gypsum over elenmental sulphur. Amongst sulphur doses, the application of sulphur at 40 kg/ha showed significant superiority over others, however it was at par to sulphur at 30 kg/ha.

Keywords: Allium cepa; Sulphur; growth and yield.

1. INTRODUCTION

Onion (*Allium cepa* L.) is an important vegetable crop grown in 2.6 lakh ha with a productivity level of 14.2 t ha^{-1}. Low productivity in country is mainly due to grow in poor soil conditions and inadequate use of fertilizers. Among the major nutrients sulphur plays an important role in onion, which are almost insufficient in most of the Indian soil. According to Tandon [1] widespread sulphur deficiency has been observed in crops and soils in 120 districts of India irrespective of soil texture

**Corresponding author: E-mail: sanjay_singh2005@yahoo.com, sanjay.singhhorti@gmail.com;*
Note: This paper was presented in National Conference on Biotechnological Initiatives for Crop Improvement (BICI 2018), December 08-09, 2018, Organized by Bihar Agricultural University, Sabour, Bhagalpur - 813210 (Bihar), India. Conference organizing committee and Guest Editorial Board completed peer-review of this manuscript.

and cropping pattern, including Varanasi and Mirjapur districts of eastern Uttar Pradesh. Coarse textured soils which have low sulphur retention capacity, application of 20-50 kg S/ha is recommended (Tandon, 1990). Balance nutrition not only improves productivity but also enhance quality of onion crop. Role of sulphur become particularly more important in onion as it is constituent of allin, cycloallin and thiopropanol [2]. Bell [3] also reported sulphur containing secondary compounds was not only of importance for nutritive value and flavors, but also for resistance against pest and disease. Probably for these reasons onion crop needs comparatively higher amounts of sulphur for proper growth, development and higher yield of bulbs. Considering these points, an experiment was conducted to find out the efficiency of sulphur source and it doses in onion crop for increasing the bulb yield and quality of onion.

2. MATERIALS AND METHODS

The experiment site, Tirhut College of Agriculture, Dholi, Muzafferpur is situated at 25˚10' latitude, 82˚37' longitude and at altitude of 146 metres above mean sea level. It falls under agro-climatic zone IIIA (semi arid eastern plain zone) of *Vindhyan* region of India. Vidhyan soil comes under rainfed and invariably poor fertility status. The climate of the region is semi-arid to sub humid with hot dry summer and cold winters. The experimental top soil (0-15 cm) initially was well leveled sandy loam, having good irrigation facility and alkaline in reaction (pH:8.51), electrical conductivity (0.22 $ds^{-1}m$) and poor in organic carbon 0.43%, available nitrogen (), available phosphorus () as well as available sulphur () and moderate in potash (). The experiment was laid out in factorial randomized block design with six treatments and four replications in addition to control plot. The treatments consist of three level of sulphur with two sources *viz.* Gypsum and elemental sulphur (15,30 and 45 kg S /ha) and treatment symboled as T_1 (Control), T_2 (15 kg S /ha through Gypsum), T_3 (30 kg S/ha through Gypsum), T_4 (45 kg S/ha through Gypsum), T_5 (15 kg S/ha through Elemental Sulphur), T_6 (30 kg S/ha through Elemental Sulphur), T_7 (45 kg S/ha through Elemental Sulphur). Onion var. 'Agrifound light red' (52 days old seedling) was transplanted in (Plot size-6.0 m x 2.0 m) at a spacing of 15 cm x 10 cm apart on December 14, 17 and 19 during 2009, 2010 and 2011 respectively. A well decomposed FYM at the rate of 10 t/ha was applied uniformly at the time of field preparation and crop was fertilized with 100:80:80 kg NPK per hectare. Observations on Vegetative growth, yield parameters and bulb yield were taken at harvest stage of onion crop. The crop was harvested on April 28, May 01 and May 02 in the year 2010, 2011 and 2012, respectively. The bulbs were harvested from net plot and yield was recorded after grading.

After harvesting the bulbs are stored in open plastic crates for six month thereafter, Percent weight loss (PWL), sprouting, rotting and total weight loss was calculated and converted it in percentage. The Total Soluble Solid (TSS) was also measured by hand refrectometer for quality standard.

3. RESULTS AND DISCUSSION

3.1 Effect of Sources of Sulphur

There were significant variation found on the vegetative growth and yield attributes due to sources of sulphur (Table 1). Gypsum recorded higher plant height, neck thickness equatorial diameter and polar diameter than application of elemental sulphur as source. However, application of elemental sulphur produced relatively higher number of leaves per plant than gypsum, but both were statistically non-significant. No significant differences were observed due to different sources of sulphur for yield and yield attributing parameters (Table 1). The result indicated that between the sources of sulphur, significant differences were recorded only with the average bulb and a grade bulb weight. Significantly highest average bulb weight of 43.37 g was recorded by application of gypsum than elemental sulphur (37.48 g), as source of sulphur. Gypsum as a source indicated better efficacy towards reduction of both bulbs of doubles (0.04%) as well as bolter (1.41%) than the elemental sulphur. In onion minimum number of double and bolter bulbs are essential for producing higher marketable bulb yield. Significant higher total and marketable yield were recorded with gypsum as compared to elemental sulphur. The better B:C ratio was recorded with 30 kg S/ha through gypsum was recorded more effective for higher marketable yield (31.40 t/ha) and better for B: C ratio (1: 2.59).

Keeping quality and TSS of onion bulbs not significantly influenced by different sources of sulphur. However, application of gypsum

Table 1. The vegetative growth and yield attributed as influenced by different treatments.

Treatment	Plant height (cm)	number of leaves	Equatorial diameter (cm)	Polar diameter (cm)	Neck thickness (cm)	Average bulb weight (g)	A grade bulb %	B grade bulbs %	C Grade bulb %	Bolter bulb (%)	double bulb (%)	marketable bulb yield (t/ha)	total bulb yield (t/ha)
Gypsum	53.0	7.7	4.79	4.71	0.85	58.8	33.18	37.86	27.43	0.64	0.60	28.5	30.1
Elemental Sulphur	52.0	8.7	4.66	4.57	0.73	55.4	36.97	36.06	25.71	0.86	0.83	25.6	27.3
LSD (5%) S	NS	0.6	NS	NS	0.11	4.5	4.58	4.78	2.39	0.33	0.25	1.17	1.1
Sulphur 0 kg/ha	50.0	7.4	4.56	4.49	0.74	49.1	26.11	41.83	29.38	1.41	1.27	23.7	25.4
Sulphur 15 kg/ha	55.2	8.8	4.76	4.68	0.78	56.4	35.40	36.39	27.05	0.60	0.61	27.8	29.3
Sulphur 30 kg/ha	52.7	8.7	4.75	4.75	0.81	63.2	41.12	34.46	23.56	0.42	0.42	28.9	30.6
Sulphur 45 kg/ha	52.0	8.0	4.83	4.66	0.84	59.7	37.68	34.93	26.28	0.57	0.56	27.9	29.4
L	5.1	0.8	NS	NS	NS	6.4	6.48	6.76	3.38	0.47	0.35	1.65	1.5
S x L	NS	1.1	NS	NS	0.22	9.0	9.16	9.56	4.79	0.67	0.50	2.34	2.1

Table 2 (a; b). Storage of bulb quality of onion

Treatment	Commulative storage loss after 4 months			
	PLW%	Sprouting	Rotting	Total wt loss %
Gypsum	23.05	7.8	13.3	44.7
Elemental Sulphur	23.48	8.1	13.4	44.9
LSD (5%) S	NS	NS	NS	NS
Sulphur 0 kg/ha	24.03	8.7	13.8	46.8
Sulphur 15 kg/ha	23.85	8.4	13.4	45.6
Sulphur 30 kg/ha	22.06	7.8	13.1	42.9
Sulphur 45 kg/ha	23.11	6.9	13.3	43.7
L	NS	NS	NS	NS
S x L	NS	NS	NS	NS

Treatment	Nutrient uptake by onion				Available soil nutrients after harvest (kg ha^{-1})			
	Nitrogen	Phosphorus	Potassium	Sulphur	Nitrogen	Phosphorus	Potassium	Sulphur
Gypsum	58.2	17.1	50.1	24.1	239.5	14.2	97.2	16.7
Elemental Sulphur	47.1	13.4	34.2	15.7	241.2	14.8	97.8	17.2
LSD (5%) S	NS	3.1	9.5	7.0	18.9	0.2	NS	0.2
Sulphur 0 kg/ha	44.9	11.8	34.8	14.4	212.6	15.7	91.3	17.6
Sulphur 15 kg/ha	53.2	16.2	44.6	21.3	249.0	15.4	91.9	15.7
Sulphur 30 kg/ha	55.4	16.7	46.0	20.7	240.0	12.8	105.3	16.4
Sulphur 45 kg/ha	57.1	16.1	43.1	23.0	259.0	13.9	101.6	18.1
L	NS	4.4	13.6	9.8	26.8	0.3	18.6	0.3
S x L	NS	6.2	19.3	13.9	37.9	0.4	26.3	0.4

indicated higher bulb TSS and better keeping quality parameters such as PLW, rotting and sprouting in comparison to elemental sulphur after four month of storage of onion bulbs (Table 2 a). The present study thus indicated the better efficacy of gypsum as a source of sulphur for vegetative growth, yield and yield attributing parameters as well as keeping quality of onion than elemental sulphur.

3.2 Effect of Levels of Sulphur

Different doses of sulphur significantly influenced the vegetative growth and yield parameters. Application of sulphur at 45 kg/ha at par with 30 kg/ha recorded significantly higher plant height and number of leaves/ plant than others (Table 1).

The results on yield and yield attributing parameter revealed significant variations due to different levels of sulphur except in doubles and bolters. Among the levels of sulphur, irrespective of sources, sulphur @ 30 kg /ha recorded significantly heaviest bulb (60.83 g) and total bulb yield (211.23 q/ha) than other levels. However, statistically parity was observed with the application of sulphur @15 and 45 kg/ha. Relatively lower doubles and bolters were recorded by application of sulphur @ 30 kg/ha than other levels, although all were statistically non-significantly. Hence, by considering yield and other parameters application of sulphur @ 30 kg /ha showed better results in onion. These results confirm the earlier results of Kumar and Singh [4] and Channagouda et al. [5] in onion. Significantly highest TSS of 11.90% was recorded with application of sulphur @ 30 kg/ha than the control (10.32%) However, statistically parity was observed among the levels of sulphur @ 15 or 45 kg/ha (Table 2 b). Similar result was also reported by Channagonda et al. [5]. Although no significant variations were observed among the treatment with respect to shelf life such as PLW (%), rotting (%) and Sprouting (%) after four month of storage, irrespective of sources of sulphur,

4. CONCLUSION

The elemental source response of sulphur and gypsum at different doses (15, 30 and 45 kg S ha^{-1}) on yield and quality of onion showed significant variation. Bulb yield, nutrient content in onion and nutrient uptake were significantly improved by the application of sulphur by gypsum over elenmental sulphur. Sulphur dose at 40 kg/ha showed significant superiority and dose of sulphur at 30 kg/ha was normal. Any significant variations were not noticed among the treatment with respect to shelf life such as PLW (%), rotting (%) and Sprouting (%) after four month of storage, irrespective of sources of sulphur

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Tandon HLS. Fertilizer recommendation for horticultural crops. Aguide book fertilizer development and consultation organization New Delhi; 1987.
2. Schung E. Physiological functions and environmental relevance of sulphur containing secondary metabolites in sulphur nutrition and assimilation in higher plants(Ed L.Dekok) the hagne the netherland SPB Academic Publishing. 1990;179-90.
3. Bell AA. Biochemical mechanism of disease resistant. Annu Rev Plant Physiol. 1981;32:21-81.
4. Kumar A. Singh(o). Effect of sulphur deficiency on plant growth and yield of onionInd. J. Agric Res. 1995;29:127-130.
5. Changouda RF, AD Janawade. Water use studies in onion (*Allium cepa* L) as influenced by irrigation schedules and nutrition in alfisols of northern transitional tract of Kernataka. Kernataka Journal Agric Sci. 2006;19(3):737-739.

© 2019 Singh et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle3.com/review-history/46410