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Effect of Sources and Levels of Sulphur on Bolter and Doubles Percent in Onion (*Allium cepa* L.)

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A B S T R A C T

An experiment was conducted to study the effect of different sources and levels of sulphur on growth, yield and quality parameters of onion at ICAR-National Institute On Abiotic Stress Management, Baramati, Pune, Maharashtra. The treatments made up of three incremental doses of sulphur application (30, 45 and 60 kg S ha^{-1}) and no sulphur application (control, 0 kg S ha^{-1}). Sources of sulphur (Elemental sulphur-Bentonite clay, Potassium schoenite and ammonium sulphate). The experiment was laid out in RBD design with three replications and fourteen treatments. Other fertilizers were applied according to recommended doses. The results showed that the double and bolter percentage was significantly higher in RDF + sulphur @ 30 kg ha^{-1} as elemental sulphur soil application (2.96 and 1.14%) and statistically on par with absolute control (2.64 and 1.52%). The treatment RDF + sulphur @ 45 and 60 kg ha^{-1} as potassium schoenite-Nutripellet pack recorded significantly less per cent doubles (0.99 and 1.29 %) followed by RDF + 45 and 60 kg ha^{-1} as potassium schoenite soil application (1.44 and 1.48%).

Introduction

Onion (*Allium cepa* L. 2n=16), is an important vegetable belonging to family Alliaceae. It is most widely grown and popular crop among the alliums. Onion is considered to be the second most important vegetable crop grown in the world after tomato. It is an indispensible item in every kitchen as vegetable and condiment used to flavour many of the food stuffs. Therefore, onion is popularly referred as “Queen of Kitchen.” In addition, onion is used as salad and pickle. Recently onion is being used by processing industry to greater extent for preparing dehydrated forms like powder and flakes.

The area under onion in world is 39.71 lakh hectare with a total production of 760 lakh MT and average productivity of 19.1 MT ha^{-1}. India is the second largest producer of onion in the world, next to China, accounting for 22.18 per cent of the world production. In India, onion is grown over an area of 12.20 lakh hactare with a production of 228.1 lakh MT and a productivity of 18.70 tonnes per hactare (FAOSTAT, 2019). The *rabi* crop harvested in

April-May is stored all over the country and slowly made available for domestic supply as well as export up to October-November. There is critical gap in supply in the country from October-December and as a result the prices shoot up. The good harvest in *kharif* season tries to bridge the gap. If there is failure of *kharif* crop due to vagaries of monsoon further it leads to rise in the prices. The *kharif* crop therefore is more sensitive and vulnerable. Sulphur requirement of crop is almost similar to that of phosphorus. Sulphur is a constituent of secondary compounds viz. allin, cycloallin and thiopropanol which not only influence the taste pungency and medicinal properties of onion besides inducing resistance against pests and diseases. Sulphur deficiency is known to effect nitrogen metabolism in plants when sulphur is limiting, protein synthesis decreases the nitrogen is not fully utilized resulting in accumulation of non protein nitrogen in the plant. The critical N: S ratio varied with the crop and there is a strong relationship between total nitrogen total sulphur and N-protein sulphur ratio. Sulphur is one of the important nutrients receiving greater attention due to its proven deficiency in commercial crops all over the world causing 10 to 34 percent yield reduction. Sulphur deficiencies are widespread in Indian soils and reports are coming regularly that many areas are found to be deficient in sulphur more than 40% soil samples are found to be deficient by Tandon and Messick (2007). Sulphur deficient plants had poor utilization of nitrogen, phosphorus and potash and a significant reduction of catalase activities at all age. Severe sulphur deficiency during bulb development has detrimental effect on yields and quality of onion. Sulphur fertilization is required for increasing the dry matter production. In the recent years there has been an increased concern about the role of sulphur application as a soil amendment and as a factor of increasing fertilizer use efficiency. Sulphur has a positive effect on onion and other crops.

Materials and Methods

The incubation and field experiments were conducted at Pune district of Maharashtra with the variety, Bhima Kiran during *rabi,* 2018 at National Institute on Abiotic Stress Management (ICAR-NIASM), Malegaon Khurd, Baramati. The experimental field was clay loam in texture, The alkaline (pH 8.2) soil of low in organic carbon 3.2 g kg^{-1} and available N, P, K, content were 110, 15, 220 kg ha^{-1} respectively for secondary nutrients for Ca, Mg, and sulphur content were 611, 53, 6.3 ppm respectively. The experiment was laid out in randomized block design consisted with three replications. Panse and Sukhatme, 1989. There were fourteen treatments including control along with four doses of sulphur i.e. 0, 30, 45 and 60 kg ha^{-1} from three sources (Elemental sulphur- Bentonite clay, Potassium schoenite and ammonium sulphate). Individual plot size was 3 x 4 m and plant spacing was 15 x 10 cm. a uniform recommended dose of N: P_2O_5: K_2O (110:40:60 kg ha^{-1}) was applied to all the plots except control. The sources of nitrogen, phosphorus and potassium were Urea, Dia ammonium phosphate and Murate of potash respectively. The sources of sulphur were elemental sulphur contain 80% sulphur (Bentonite Clay), potassium schoenite contain 21.5% sulphur and ammonium sulphate contain 24% sulphur. Full dose of phosphorus and potassium and $1_{/3}$ dose of nitrogen was also applied before transplanting. The remaining $2_{/3}$ dose of nitrogen was applied in two equal splits at 30 and 45 days after transplanting. Transplanting of onion was done on 20th January, 2018. The crop was harvested at 120 days after transplanting on 20th May, 2018. The doubled bulb were counted from each treatment and expressed in percentage. Flowering plants from each plot are counted and average was worked out computed. It was expressed in percentage. The data on double and bolter studies were tabulated and subject to statistical analysis. The total variation of different treatments was tested for significance by “F” test using analysis of variance technique.

Results and Discussion

The data on yield attributing and quality parameters is influenced by different sources and levels of sulphur in onion variety Bhima Kiran. The double and bolter per cent of bellary onion are significantly influenced by the RDF, sources and levels of sulphur with *Thiobacillus thiooxidans* soil application and *Thiobacillus thiooxidans*-Nutripellet pack. The periodical double of bellary onion was significantly influenced by the sources, levels of sulphur and *Thiobacillus thiooxidans* and the results are reported in (Table 1 and 2). It ranged from 0.24 to 0.66% at 30 DAH, 0.49 to 1.48% at 60 DAH, 0.68 to 1.87% at 90 DAH and 0.99 to 2.96% at 120 DAH. It was significantly the lowest in the treatment RDF + S @ 45 kg ha^{-1} as potassium schoenite-Nutripellet pack (0.24, 0.49, 0.68 and 0.99% respectively). The treatment RDF + S @ 60 kg ha^{-1} as elemental S + *Thiobacillus thiooxidans*-Nutripellet pack (T_6) recorded significantly the lowest per cent bolter in bellary onion at 30, 60, 90 and 120 DAH (0.09, 0.20, 0.36 and 0.40% respectively). The double and bolter percentage was significantly higher in RDF + sulphur @ 30 kg ha^{-1} as elemental sulphur soil application (2.96 and 1.14%) and statistically on par with absolute control (2.64 and 1.52%). The treatment RDF + sulphur @ 45 and 60 kg ha^{-1} as potassium schoenite-Nutripellet pack recorded significantly less per cent doubles (0.99 and 1.29 %) followed by RDF + 45 and 60 kg ha^{-1} as potassium schoenite soil application (1.44 and 1.48%).

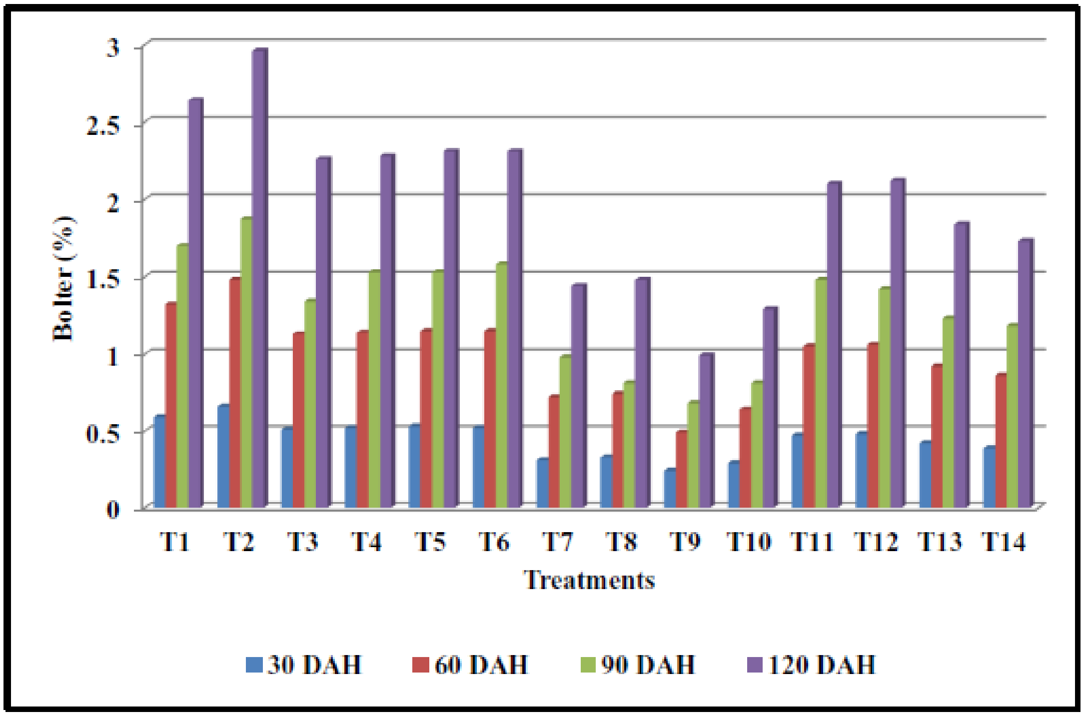
Table.1 Effect of sources and levels of sulphur on bolter (%) in bellary onion (Mean of three replications)

Treatments		DAH			
		30	60	90	120
T_1	Control	0.34	0.76	1.81	1.52
T_2	RDF + elemental S @ 30 kg ha^{-1} soil application + FYM @15 t ha^{-1}	0.26	0.57	0.96	1.14
T_3	RDF +S@45kg ha^{-1} as elemental S+ *Thiobacillus thiooxidans* -Soil application	0.17	0.26	0.51	0.52
T_4	RDF +S@ 60kg ha^{-1} as elemental S + *Thiobacillus thiooxidans*- Soil application	0.18	0.30	0.39	0.60
T_5	RDF +S@ 45kg ha^{-1} as elemental S + *Thiobacillusthiooxidans*–Nutripellet Pack	0.20	0.22	0.54	0.45
T_6	RDF +S@ 60kg ha^{-1} as elemental S+ *Thiobacillus thiooxidans*–Nutripellet Pack	0.09	0.20	0.36	0.40
T_7	RDF +S@ 45 kg ha^{-1} as Potassium schoenite-Soil application	0.14	0.31	0.44	0.62
T_8	RDF +S@ 60 kg ha^{-1} as Potassium schoenite-Soil application	0.19	0.27	0.45	0.82
T_9	RDF +S@ 45 kg ha^{-1} as Potassium schoenite – Nutripellet Pack	0.13	0.30	0.86	0.55
T_{10}	RDF +S@ 60 kg ha^{-1} as Potassium schoenite – Nutripellet Pack	0.14	0.40	0.46	0.61
T_{11}	RDF +S@ 45 kg ha^{-1} as Ammonium sulphate – Soil application	0.15	0.40	0.58	0.80
T_{12}	RDF +S@ 60 kg ha^{-1} as Ammonium sulphate – Soil application	0.16	0.37	0.53	0.81
T_{13}	RDF +S@ 45 kg ha^{-1} as Ammonium sulphate – Nutripellet Pack	0.17	0.35	0.44	0.74
T_{14}	RDF +S@ 60 kg ha^{-1} as Ammonium sulphate – Nutripellet Pack	0.18	0.34	0.48	0.70
	SEd	**0.08**	**0.07**	**0.07**	**0.013**
	CD (p = 0.05)	**0.17**	**0.14**	**0.16**	**0.029**

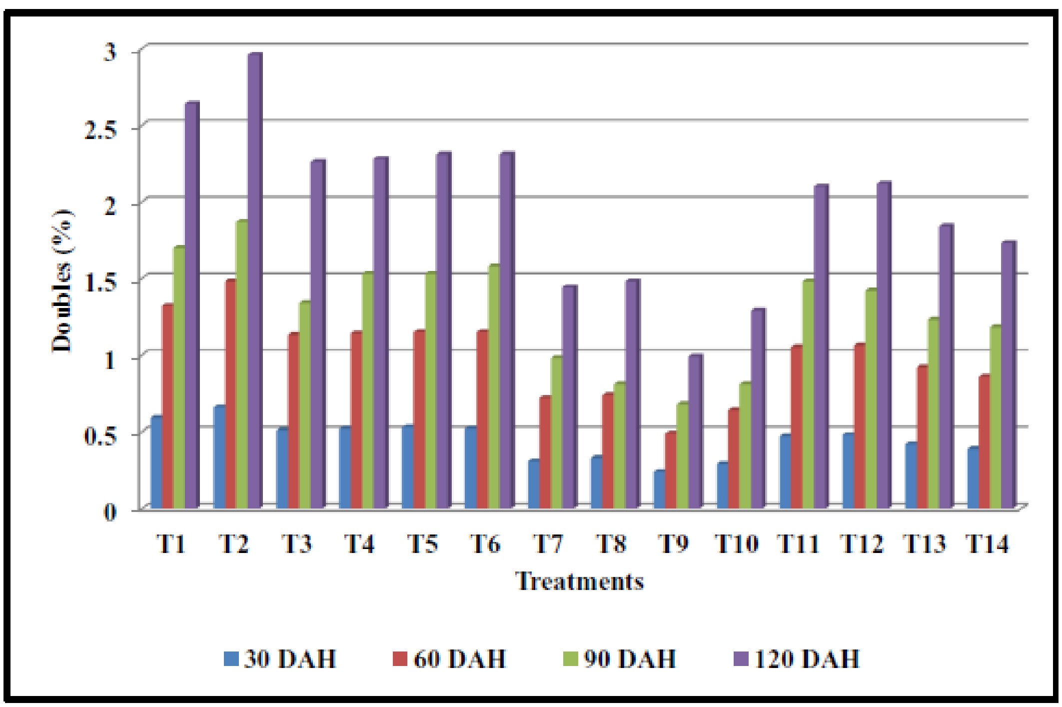
Table.2 Effect of sources and levels of sulphur on doubles (%) in bellary onion (Mean of three replications)

Treatments		DAH			
		30	**60**	**90**	**120**
T_1	Control	0.59	1.32	1.7	2.64
T_2	RDF + elemental S @ 30 kg ha^{-1} soil application + FYM @15 t ha^{-1}	0.66	1.48	1.87	2.96
T_3	RDF +S@45kg ha^{-1} as elemental S+ *Thiobacillus thiooxidans* -Soil application	0.51	1.13	1.34	2.26
T_4	RDF +S@ 60kg ha^{-1} as elemental S + *Thiobacillus thiooxidans*- Soil application	0.52	1.14	1.53	2.28
T_5	RDF +S@ 45kg ha^{-1} as elemental S + *Thiobacillusthiooxidans*–Nutripellet Pack	0.53	1.15	1.53	2.31
T_6	RDF +S@ 60kg ha^{-1} as elemental S+ *Thiobacillus thiooxidans*–Nutripellet Pack	0.52	1.15	1.58	2.31
T_7	RDF +S@ 45 kg ha^{-1} as Potassium schoenite-Soil application	0.31	0.72	0.98	1.44
T_8	RDF +S@ 60 kg ha^{-1} as Potassium schoenite-Soil application	0.33	0.74	0.81	1.48
T_9	RDF +S@ 45 kg ha^{-1} as Potassium schoenite – Nutripellet Pack	0.24	0.49	0.68	0.99
T_{10}	RDF +S@ 60 kg ha^{-1} as Potassium schoenite – Nutripellet Pack	0.29	0.64	0.81	1.29
T_{11}	RDF +S@ 45 kg ha^{-1} as Ammonium sulphate – Soil application	0.47	1.05	1.48	2.10
T_{12}	RDF +S@ 60 kg ha^{-1} as Ammonium sulphate – Soil application	0.48	1.06	1.42	2.12
T_{13}	RDF +S@ 45 kg ha^{-1} as Ammonium sulphate – NutripelletPack	0.42	0.92	1.23	1.84
T_{14}	RDF +S@ 60 kg ha^{-1} as Ammonium sulphate – Nutripellet Pack	0.39	0.86	1.18	1.73
	SEd	**0.07**	**0.08**	**0.07**	**0.015**
	CD (p = 0.05)	**0.15**	**0.16**	**0.14**	**0.035**

Graph.1 Effect of sources and levels of sulphur on bolter (%) in bellary onion



Graph.2 Effect of sources and levels of sulphur on doubles (%) in bellary onion



This might be because of balance nutrition to bellary onion and potassium nutrition governs the metabolic activity. Hence, there was less percentage of double. Similar trend was observed in per cent bolter of bellary onion. These observations are similar to that of results of Mukesh *et al.*, (2000).

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