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Research Article

Effects of Zinc, Manganese, and Sulphur on the Growth and Quality of Onion (*Allium cepa* L.) cv. Nasik Red

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ABSTRACT

Optimistic and sustainable supply of nutrients to soil affects crop productivity and crop quality. In the present investigation, effects of Zinc (Zn), Sulphur (S), and Manganese (Mn) was observed on growth and quality attributes of onion (Allium cepa L. cv. NasikRed), belongs to family Alliaceae. For this, micronutrients were applied to soil in 8 combinations including 1 control (having no micronutrient). soil application of micronutrients ZnSO 4@ 10 kg/ha + CuSO 4 10 kg/ha + MnSO 4 @ 10 kg/ha in combination with 50 kg N, 40 kg P 2 O 5 and 40 kg K 2 O per hectare before transplanting the onion crop is the most beneficial treatment for obtaining higher vegetative growth and quality of onion bulbs resulted high net income and maximum benefit of per rupee invested. However, for low input technology soil application of ZnSO 4 @ 10kg/ha + recommended dose of NPK can also be followed.

Keywords: *Onion, Zinc, Sulphur, Manganese.*

INTRODUCTION

Allium cepa L. (Onion), belongs to family Alliaceae, is bulb crop which has importance of a cash crop in recent years due to high export potential throughout the world. Major onion producing countries are China, India, USA, Pakistan, turkey, Russia, Iran, Brazil, Mexico, and Spain (Choudhary, 2018).

Quality of onions can be measured by Sulphur content in it. S is important element in onion. It influences growth functions (nitrogen metabolism, enzyme activity, and protein and oil synthesis), yield and quality of bulbs of onions positively (Judita, et al., 2014). Besides S, total soluble solids, and dry matter content are indicator of quality of onions. Total soluble solids (TSS) are positively corelated with dry matter content (DMC) (Jongtae, et al., 2016).

Physical and biochemical properties of any crop depend upon fertility of soil. Various essential macronutrients along with micronutrients present in soil play important roles in production of a good quality crop (Tripathi, et al., 2015).

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Nitrogen (N), Phosphorus (P), Potassium (K) are important macronutrients which have various roles in plant growth and development (Barita, et al., 2018). Zinc (Zn), Sulphur (S), and Manganese (Mn) are important micronutrients which are involved in growth, development, and metabolism of plants (Vadlamudi, et al., 2020; & Santiago, et al., 2020).

In the present study, we worked to observe effects of Sulphur (S), Zinc (Zn), Manganese (Mn) in different combinations along with N, P, and K in soil on the growth and quality attributes of *Allium cepa* L. cv. NasikRed.

MATERIALS AND METHODS

The present investigation, & quot; Effect of Zinc, Manganese and Sulphur on growth, and quality of onion (Allium cepa L.) cv. Nasik red was conducted during rabi season 2015-16 at the Horticultural Research Farm, R.B. (P.G.) College, Agra U.P. The experiment was laid out in a Randomized Block Design with three replications. There were eight treatments comprised of NPK alone (T 1) NPK+ ZnSO 4 @10 kg/ha (T 2), NPK+MnSO 4 @ 10 kg/ha (T 3), NPK+ sulphur @ 10 kg/ha (T 4), NPK+ZnSO 4 @ 10 kg/ha + MnSO 4, @ 10 kg/ha (T 5), NPK+ ZnSO 4 @ 10 kg/ha + sulphur @ 10 kg/ha (T 6), NPK+ MnSO 4 @ 10kg/ha + sulphur @ 10 kg/ha (T 7) and NPK+ ZnSO 4 @ 10 kg/ha +MnSO 4 @ 10 kg/ha + sulphur @ 10 kg/ha (T 8).

RESULTS AND DISCUSSION

The progressive data on the growth in terms of plants height and number of leaves as influenced by application of various treatments are presented in Table 1.

(i) Plant height (cm)

It was observed that maximum plant height was recorded in T_3 plants at 45 DAT (50.65±1.15 cm), in T_8 at 60 DAT (55.83±0.71 cm), and in T_8 at 75 days after transplantation (62.95±0.34 cm).

The minimum plant height was observed in control T_1 at 45 DAT (47.00±0.23 cm), 60 DAT (49.50±1.12 cm), and 75 DAT (53.10±0.49 cm).

It was observed that the difference in plant height due to all micro-nutrient treatments was marginal and could not cross the level of significance. But the difference in plant height between control T_1 with rest of the treatments were significantly different.

(ii). Number of leaves per plant

It was observed from data that the differences in number of leaves per plant by the application of Zinc, Manganese and Sulphur application at were found statistically non-significant at all the stages of crop growth.

The maximum number of leaves at 45 days after transplanting were observed in T_5 (5.67±0.74) and minimum (5.00±0.76) in control (T_1). At 60 days after transplanting maximum number of leaves were recorded in T_8 (6.12±0.28) and minimum in control T_1 (5.69±0.58). The maximum number of leaves per plant were recorded in T_8 (7.65±0.28) while minimum was recorded with the control T_1 (6.10±0.15).

It was analysed that T_8 produced maximum number of leaves at 75 DAT among all the plants. It was also observed that number of leaves increased in plants at 75 DAT as compared to 45 and 60 DAT.

The difference in number of leaves in all the treated plants was not significant but these were significantly different when compared to control T_1 plants.

Table 1: Effects of Zinc, Manganese, and Sulphur on the growth and quality of onion (*Allium cepa* L.) cv. Nasik red

Plant	Treatment	Plant height (cm)			Number of leaves		
		45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT
T_1	Control	47.00±0.23	49.50±1.12	53.10±0.49	5.00±0.76	5.69±0.58	6.10±0.15
T_2	Zn	48.23±0.46	54.97±0.28	57.17±1.03	5.42±0.54	5.95±1.06	6.75±0.64
T_3	Mn	50.65±1.15	53.72±0.48	56.81±0.78	5.20±0.28	5.65±1.14	6.45±0.25
T_4	S	48.58±1.75	53.00±1.78	55.90±0.37	4.95±0.18	5.75±0..76	6.25±0.17
T_5	Zn + Mn	49.20±0.92	55.57±0.88	61.22±0.87	5.67±0.74	5.98±0.20	6.65±1.16
T_6	Zn + S	48.78±0.38	53.56±0.39	56.75±1.21	4.95±0.35	5.78±0.27	6.55±0.26
T_7	S + Mn	47.85±0.89	53.35±0.97	57.10±0.47	5.29±0.17	5.75±0.67	6.54±0.64
T_8	Zn + Mn+S	48.85±0.67	55.83±0.71	62.95±0.34	5.85±1.08	6.12±0.28	7.65±0.28

Note*: DAT- Day after transplantation

3. Quality Attributes

The results pertaining to the qualitative attributes of onion as affected by micronutrients (Zn, Mn and Sulphur) application are given below. These results are shown in Table 1.

(i). Total soluble solids (%)

The maximum total soluble solids were found in T_8 (15.92 ±0.37 %) followed by T_2>T_5 >T_7 >T6 >T3 >T4 >T1. The minimum TSS were found in control T_1 (11.62 ±0.24 %).

Results showed that the effect of micronutrients application on the total soluble solids of onion bulbs were observed significant. In treated plants, TSS were found significantly higher when compared with control.

(ii). Dry matter content (%)

The maximum dry matter content (%) was recorded with the combined application of Zn, Mn and S in T_8 (14.95±0.47 %) followed by T_5 >T_3 >T_6 >T_7 >T_4 >T_2 >T_1. The minimum dry matter content was found in T_1 (12.15±1.13 %) which was control.

In treated plants, dry matter content was significantly higher than that in control plants.

(iii) Sulphur content (%)

The maximum sulphur contents were found in T_8 plants (0.46±0.85 %) followed by T_2 >T_5 >T_6 >T_7 >T_3 >T_4 > T_1. The minimum sulphur contents were found in T_1 plants (0.26±0.75%) which were control.

Results revealed that the micronutrients application had significant effect on sulphur content in onion bulbs. The magnitude of increase in sulphur content with the combined application of Zn, Mn and Sulphur (T_8) was to the tune of 15.0 to 76.9 % over all other treatments. The variation in sulphur content with the treatments T_2 to T_7 was not appreciable and these treatments were statistically at par among themselves but had significantly higher sulphur content as compared to control T_1.

Table 2: Effects of Zinc, Manganese, and Sulphur on the growth and quality of onion (*Allium cepa* L.) cv. Nasik red

Plant	Treatment	Total soluble solids	Dry matter	Sulphur
T_1	Control	11.62±0.24	12.15±1.13	0.26±0.75
T_2	Zn	15.75±0.18	12.95±0.33	0.40±0.26
T_3	Mn	13.72±0.56	13.65±0.54	0.37±0.22
T_4	S	13.26±0.26	13.40±0.24	0.36±0.62
T_5	Zn + Mn	15.02±1.04	14.26±0.21	0.38±1.17
T_6	Zn + S	14.26±0.58	13.45±0.67	0.37±0.46
T_7	Mn+S	14.50±0.11	13.42±1.54	0.37±0.27
T_8	Zn + Mn+S	15.92±0.37	14.95±0.47	0.46±0.85

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