

Original Research Article

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Effect of Foliar Application of Zinc and Manganese on Growth Parameters and Yield of Potato (*Solanum tuberosum* L.)

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ABSTRACT

In order to study “(Effect of basal and foliar application of Zn and Mn on growth parameters and yield of Potato (*Solanum tuberosum* L.)” cv. Kufri Ashoka was carried out at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.), during rabi season in the year 2015-16. The soil of experimental field was sandy loam, with low in nitrogen and high in phosphorus and medium in potassium contents. The nine treatments T₁ – (N: P: K) 120 : 80 : 150 kg ha⁻¹ as basal, T₂ – 120:80:150:25 (N:P:K:Zn) kg ha⁻¹ as basal, T₃ – 120:80:150:25 (N:P:K:Mn) kg/ha⁻¹ as basal, T₄ – RDF + Zinc sulphate (ZnSO₄) 100 ppm as foliar, T₅ – RDF + Zinc sulphate (ZnSO₄) 200 ppm as foliar, T₆ – RDF + Zinc sulphate (ZnSO₄) 300 ppm as foliar, T₇ – RDF + Manganese sulphate (MnSO₄) 100 ppm as foliar, T₈ – RDF + Manganese sulphate (MnSO₄) 200 ppm Foliar, T₉ – RDF + Manganese sulphate (MnSO₄) 300 ppm as foliar were evaluated in Randomized Block Design with three replications. Observation on various parameters viz. Maximum emergence percentage (93.65), plant height (43.14cm), number of haulms per plant (6.40), number of leaves per plant (55.27), fresh weight of plant (340.23g), dry weight of plant (26.35g), Total number of tuber per plant (8.00), Weight of tuber per plant (435.12g), yield of tuber (26.98kg), during 2015-16 respectively, were noted maximum with the foliar application of T₆ – RDF + Zinc sulphate (ZnSO₄) 300 ppm as foliar. The experimental findings revealed that the treatment T₆- RDF + (ZnSO₄) 300 ppm as foliar showed better response on plant growth, yield attributes and quality. However, the maximum yield (26.98 kg) was obtained with the application of T₆- RDF + (ZnSO₄) 300 ppm as foliar.

Keywords

Foliar application, Zinc and Manganese, Growth parameters, Yield and Potato

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Introduction

Foliar application of zinc and manganese has become an efficient way to increase yield and quality of crops. Zinc (Zn) is known to have

an important role either as a metal component of enzymes or as a functional, structural or regulatory co-factor of a large number of enzymes (Grotz and Guerinot, 2006). Manganese (Mn) in turn, is regarded as an

activator of many different enzymatic reactions and takes part in photosynthesis. Manganese activates decarboxylase and dehydrogenase and is a constituent of complex PSII-protein, SOD and phosphatase. Several researches indicated a positive influence of micronutrient (Zn, Mn) application in increase of yield and quantitative parameters of crops (Mosavi *et al.*, 2007) on potato.

The aim of this study was to evaluate the effect of foliar application of Zinc and Manganese on growth parameters and yield of Potato (*Solanum tuberosum* L.) and select out of the best treatment doses in terms of yield and growth parameters.

Materials and Methods

The present investigation was carried out in Rabi season, during 2015-2016 at the Vegetable Research Station Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) India.

Details of the treatments

In order to facilitate their reference the symbol assigned to different treatments are given as under:

T₁: Recommended dose of N:P:K @120:80:150 kg ha⁻¹ as basal Control

T₂: R.D.F+ ZnSO₄ @ 25 kg ha⁻¹ as basal at the time of planting

T₃: R.D.F + MnSO₄ @ 25 kg ha⁻¹ as basal at the time of planting

T₄: R.D.F as basal + ZnSO₄, 100 ppm as foliar at 50 days after planting

T₅: R.D.F as basal + ZnSO₄, 200 ppm as foliar at 50 days after planting

T₆: R.D.F as basal + ZnSO₄, 300 ppm as foliar at 50 days after planting

T₇: R.D.F as basal + MnSO₄, 100 ppm as foliar at 50 days after planting

T₈: R.D.F as basal + MnSO₄, 200 ppm as foliar at 50 days after planting

T₉: R.D.F as basal + MnSO₄, 300 ppm as foliar at 50 days after planting

The different observations were recorded on Emergence percentage (%), Plant height (cm), Number of haulms per plant, Number of leaves per plant, Fresh weight of plant (g), Dry weight of plant (g), Total number of tubers per plant, Weight of tuber plant per plant (g) and Total yield of tubers per plot (kg q⁻¹). The various statistical techniques were used for calculation of the data as suggested by Fisher and Yates (1949). The experiment was conducted in randomized block design (RBD) for field experiment.

Results and Discussion

The application of foliar and basal doses of zinc sulphate and manganese sulphate, time of application and its combination with recommended dose of fertilizers N, P and K @ 120:80:150 kg ha⁻¹ at the time of planting and foliar application of ZnSO₄ & MnSO₄ as foliar at 50 days after planting *i.e.* T₁ - (RDF) as basal at the time of planting; T₂ - (RDF and 25 kg ha⁻¹ ZnSO₄ as a basal) at time of planting; T₃ - (RDF and 25 kg ha⁻¹ MnSO₄ as basal) at the time of planting; T₄ - (RDF and 100 ppm ZnSO₄ as foliar); T₅ - (RDF and 200 ppm ZnSO₄ as foliar); T₆ - (RDF and 300 ppm ZnSO₄ as foliar); T₇ - (RDF and 100 ppm MnSO₄ as foliar); T₈ - (RDF and 200 ppm MnSO₄ as foliar) and T₉ - (RDF and 300 ppm MnSO₄ as foliar).

Foliar application of ZnSO₄ and MnSO₄ along with recommended dose of N: P: K @ 120:80:150 kg ha⁻¹ significantly increase the emergence percent of potato plant. Increase in concentration of these chemicals showed linear increase in plant emergence. Maximum emergence percent *i.e.* 93.65 and 93.35 were obtained at 300 ppm concentration of ZnSO₄ and MnSO₄ applied as foliar at 50 days after planting.

Table.1 Effect of basal and foliar application of Zn and Mn on growth parameters and yield of potato (*Solanum tuberosum* L.)

Treatments	Emergence Percentage	Plant height (cm)				Total no. of tuber per plant (g)	Weight of tuber per plant (g)	Yield of tuber per plot (kg.)
		30 DAS	45 DAS	60 DAS	75 DAS			
T ₁	74.53	24.80	29.64	31.39	36.41	4.33	336.79	17.46
T ₂	75.91	25.23	31.36	33.06	38.52	5.67	352.02	21.39
T ₃	77.06	24.94	30.98	32.89	37.27	5.33	341.87	19.37
T ₄	85.65	25.22	33.75	36.42	38.59	6.33	380.22	22.57
T ₅	93.20	26.47	34.39	39.61	40.55	7.00	391.77	25.25
T ₆	93.65	29.53	35.05	42.07	43.14	8.00	435.12	26.98
T ₇	78.85	25.80	31.85	34.73	40.28	6.00	360.01	23.54
T ₈	88.35	25.88	33.62	38.97	40.33	6.67	384.90	24.37
T ₉	93.35	26.49	34.60	40.27	41.09	7.33	418.64	26.32
C.D.(p=0.05)	2.82	2.653	2.201	3.425	3.674	1.466	39.353	2.652

Fig.1 Effect of basal and foliar application of Zn and Mn on number of haulms per plant of Potato (*Solanum tuberosum* L.)

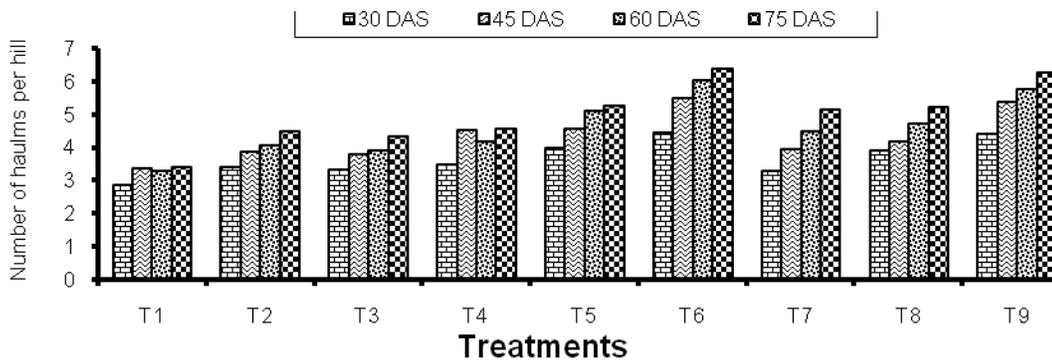


Fig.2 Effect on fresh weight of plant (g) at various stages as influenced by basal and foliar application of ZnSO₄ and MnSO₄

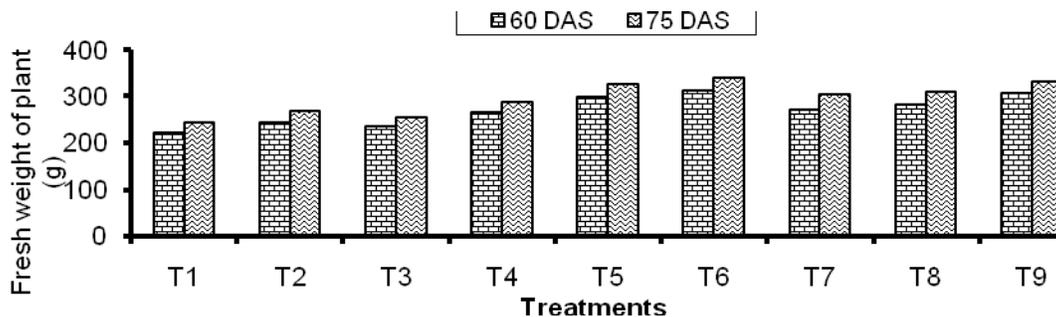
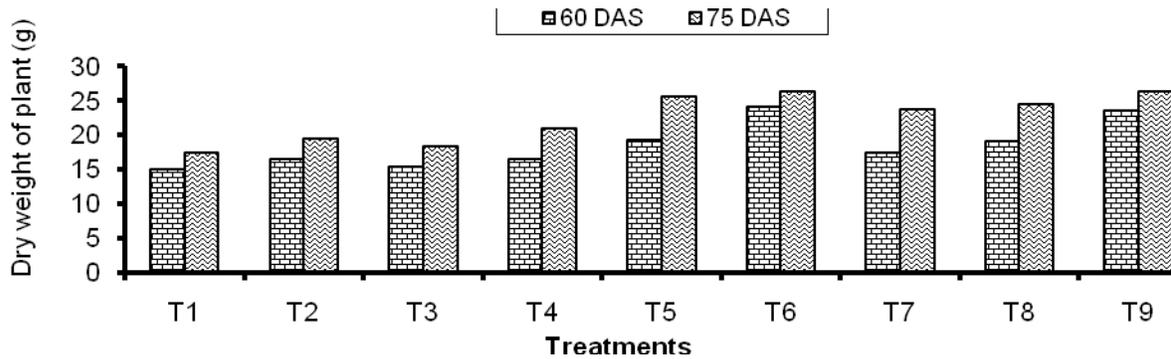


Fig.3 Effect on dry weight of plant (g) at various stages as influenced by basal and foliar application of ZnSO₄ and MnSO₄



Basal application of ZnSO₄ and MnSO₄ did not showed significant effect on emergence.

Maximum plant height were increases (18.48%) in T₆ (RDF and 300 ppm ZnSO₄ as foliar) at 50 days after planting as compared with T₁ (control) similarly number of haulms were increases (88.23%) in T₆ as compared with T₁ (control) and maximum number of leaves per plant were increase (27.93%) in T₆ at par with T₉ as compared with T₁ (control). Plant height, number of haulms and number of leaves are morphological phenomenon which mainly control by hormonal balance towards a substantial increase in the cytokinin content and cytokinin/ABA ratio which lead to the cell division and cell elongation at and growing region of the plant, Barben *et al.*, (2007) also investigated the plant height, number of hauls and number of leaves. The above result is similar to finding of Sayed Rohella *et al.*, (2007). Different parameters are given in table 1 and Figure 1, 2 & 3.

The zinc and manganese basal and foliar application markedly increased the number of tubers per plant. Maximum percent increase (84.75) number of tubers per plant was observed in T₆ followed by in T₉ over control (T₁). Similarly, weight of tuber per plant was increases (29.19%) in T₆ followed by T₉ as

compared with T₁ (control). Maximum yield of potato tuber per plot increases (54.52%) in T₆ followed by T₉ as compared with T₁ (control). Moreover, foliar application of zinc and manganese sulphate increases all plant characteristics relating to yield and quality of potato crop. Similar findings were also reported Alloway *et al.*, (2004) and Hashemy *et al.*, (1998).

On the present investigation we concluded that these micronutrients (Zn & Mn) are very necessary to improve the yield and quality of potato tuber crop. Further, linear increase an all parameters traits were observed with increase of concentration of these elements, thus its need further validation to include more concentration.

Maximum plant emergence percentage, plant height, number of haulms per hill and number of green leaves per plant was obtained in T₆; RDF and ZnSO₄ 300 ppm as foliar), followed by T₉; (RDF and MnSO₄ applied as foliar) at after 50 days after planting respectively. Fresh and dry weight of plant was significantly increased in the T₆; RDF and ZnSO₄ 300 ppm as foliar, followed by T₉; RDF and MnSO₄ 300 ppm as foliar) at 50 days after planting respectively. The above results similar to findings of (Mosavi *et al.*, 2007) and Parmar *et al.*, (2016).

Fresh and dry weight of plant was significantly increased in the T₆; RDF and ZnSO₄ 300 ppm as foliar, followed by T₉; RDF and MnSO₄ 300 ppm as foliar) at 50 days after planting respectively Rest the treatment did not showed significant effect on chlorophyll content at all crop growth stages. Foliar application of ZnSO₄ and MnSO₄ @ 300 ppm along with RDF applied as basal significantly increased T₆; RDF and ZnSO₄ 300 ppm as foliar) at 50 days after planting.

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