

Evaluation of Zinc Micronutrient Effects on Yield and Some Characteristics of Two Potato Cultivars

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INTRODUCTION

Maximizing yield without the application of fertilizers is impossible today. Fertilizers can increase yield and enhance crop resistance to pest and the quality of yield, and can help to maintain human and livestock health. Despite the key-role of micronutrients in essential compounds such as enzymes, the use of micronutrients is unfortunately low in Iran. In soils devoted to potato production in the Ardebil province that have heavy soil textures, high pHs and high P applications, Zn deficiency has occurred frequently. Research showed that ZnSO₄ applications can increase potato yield by 37%. Spraying and inoculating tubers with Zn increased also potato yield (Divide 1991). The application of 20 ppm Zn increased the dry weight of stem, root and main stolon (Langille and Batteese 1974). Spraying Zn on shoots had a positive effect on the carbohydrate metabolism and increased the starch content of tubers.

METHODS

To determine the effects of Zn on morphological traits and tuber yield of potato, a factorial experiment was conducted at the Agricultural Research Center of the Ardebil province, Iran in 2003. Experimental factors included two potato cultivars (Ceaser, Agria) and four Zn concentrations (0.001, 0.003, 0.005) with three replicates.

The soil was a clay-silt-loam (EC 0.45 dsm⁻¹, pH 7.8). Sprouted tubers were sown on loamy soils. The spacing between rows and plants in rows were 75 and 25 cm, respectively. Phosphorus fertilizer was applied at 200 kg ha⁻¹ as ammonium phosphate. Nitrogen was applied at sowing and 75 kg N ha⁻¹ at 60 days after sowing. The soil K level was 450 ppm. Zinc was sprayed 15 days before and 15 days after flowering. Weeds were controlled by hand.

Morphological traits, such as the number of main stems and branches, leaves, stolones, plant height, and yield components, including tuber mean weight, tuber number, tuber diameter, number of eyes on tubers, bark thickness of tuber were recorded. Data were subjected to analyses of variance with SAS software, and means were tested with the multiplicate range test of Duncan.

RESULTS AND DISCUSSION

Cultivars showed significant differences for all of traits, except for bark thickness. The effects of ZnSO₄ on the number of tubers per plant, bark thickness, tuber fresh weight, number of stolons per plant, yield, branches and tuber diameter were significant. The effect of the interaction of cultivars and Zn levels on the number of leaves, ears and stolens per plant was significant. Ceaser had higher plant heights and stem diameters in comparison to Agria, which is consistent with other findings. A high number of branches and a small tuber number are essential for achieving a higher yield (Khan and Zende 1977). The number of leaves was greater in Agria than in Ceaser, but Zn did not have an effect on leaf number. Fonseka and Asanema (1996) obtained similar results earlier. Agria that had more shoots and

leaves produced larger tubers. Zinc application affected bark thickness. The Zn content of Agria and Ceaser tubers were 41.39 and 33.02%, respectively.

The application of Zn reduced *Phytophthora* sp. damage in both cultivars and benefited Agria more. Relative resistance of Agria to this disease and 0.005 concentration of Zinc resulted in yield higher than that of Ceaser.

Table 1. Effects of different levels of ZnSO₄ on yield, compound yield and other parameters of two potato cultivars.

		Means squares								
	treatment	Height	Branches Per plant	Leaves Per plant	Tuber Diameter	Bark Thickness	Yield	Tuber wet weight	Tuber No.	Stolen No.
		cm			mm	mm	t ha ⁻¹	gr		
Variety	Ceaser	31 ^a	5.7 ^b	46.15 ^b	44.52 ^a	-	15.92 ^b	298.5 ^b	5.0 ^b	5.42 ^a
	Agria	27.4 ^b	10.3 ^a	67.7 ^a	41.17 ^b	-	19.32 ^a	362.1 ^a	6.3 ^a	3.42 ^b
Zinc sulfate	Control	-	7.8 ^{ab}		42.48 ^{ab}	0.503 ^b	15.12 ^b	283.5 ^b	-	1.92 ^b
	0.001	-	5.2 ^b		39.85 ^b	0.520 ^{ab}	16.24 ^b	304.5 ^b	-	4.33 ^a
	0.003	-	7.2 ^{ab}		42.94 ^{ab}	.0595 ^a	18.45 ^b	346.0 ^b	-	5.67 ^a
	0.005	-	11.6 ^a		45.1 ^a	0.592 ^a	20.66 ^a	387.0 ^a	-	5.75 ^a

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