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Effect of Zinc Compound (Teprosyn F-2498) on Wheat (*Triticum aestivum* L.)

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This research was carried out to determine the effect of zinc compound on grain yield and yield components of soft wheat cultivars. In this study, three doses of zinc compound (4, 8 and 12 kg Zn/1ton) were applied to seed of bread wheat cultivars before sowing. The effects of zinc compound on grain yield and yield components was found insignificant. Although there was no significant effect of zinc compound on yield it some doses caused numerical and partial increases in yield.

Key Words: Bread wheat, Zinc compound, Grain yield and Yield components.

INTRODUCTION

Plant nutrition is the most important practice for increasing quality and quantity in agricultural production. The growing and yields of the plants are negative influenced because of some of the plant nutrients aren't sufficient amount in the soil. Some researches indicated that there are 74 elements in structure of plants[1] and 20 of 74 elements which one of them is zinc is necessary in the growing of the plant[2]. The importance of zinc increased in recent years although its concentration is insufficient in the structure of the plant.

In Turkey, it is determined that zinc is insufficient in the 50 % (14 mil.ha) of agriculture soils[3]. Application to soil or seed of zinc is recommended in order to remove zinc efficiency. Kacar and Katkat[4] found that zinc concentrations applied from soil and seed increased 204 and 265 % the seed yield of bread and durum wheat, respectively. On the other hand study, Yilmaz *et al.*[5], reported that zinc concentrations applied to soil, leaf and seed or as these combinations increased significantly seed yield and zinc content. Zinc deficiency in the soil reduced production and causes to many diseases in health of animal and human[6]. Çavdar[7] determined deficiency of zinc in children, adults and pregnant women depend on feeding habit and socio-economic structure in Turkey.

Wheat has a very important place in the feeding of animal and human. Increasing of wheat yield may be obtained by removing of zinc deficiency in the soil[8]. This research was carried out to determine the effect of zinc compound on seed yield and yield components of bread wheat cultivars.

EXPERIMENTAL

Field experiments were done at the Applied and Research Centre of Agricultural Faculty of Uludag University in Southern Marmara Region, Turkey. The structure of the soil of the centre is clayey and neutral in reaction. It is poor in organic matter and zinc (0.42 ppm) and rich in available P and K[9]. But, some researchers reported that the critical limit of zinc range in soil was 0.5 ppm[10].

Bursa province in which the trials were carried out has a temperate climate. It is located in the Southern Marmara Region, with average annual rainfall of 616.8 mm and 12 ºC mean monthly temperature. Total monthly precipitation and mean air temperature values belonging to the years (1998-1999 and 1999-2000) in which the trials were carried out and long-term averages are presented in Table-1.

TABLE-1
TEMPERATURE AND RAINFALL VALUES OF INDIVIDUAL EXPERIMENTAL YEARS AND LONG-TERM PERIOD (1998-2000)

Month	1998-1999		1999-2000		Long-term mean	
	Temp. (°C)	Precipitation (mm)	Temp. (°C)	Precipitation (mm)	Temp. (°C)	Precipitation (mm)
October	15.8	138.5	16.1	55.3	15.6	56.2
November	11.6	94.0	10.9	89.9	12.5	75.4
December	6.8	84.9	10.2	60.9	7.6	101.8
January	6.8	35.4	3.3	29.0	5.3	94.4
February	6.5	167.8	5.2	104.6	6.2	77.5
March	8.9	63.9	7.6	95.6	8.3	68.8
April	14.5	32.9	15.0	108.8	12.9	60.0
May	19.0	4.5	17.7	48.9	17.7	52.4
June	22.6	74.2	21.8	16.1	22.1	30.3
Total	–	696.1	–	609.1	–	616.8
Mean	12.5	–	11.9	–	12.0	–

In first trial year (696.1 mm), total precipitation was higher than the second trial year (616.8 mm). But, especially precipitation in March, April and May 2000 (253.3 mm) were higher than those of both long-term (181.2 mm) and from first trial year (101.3 mm).

In this study, three bread wheat cultivars (Pehlivan, Gönen and Golia) were used in the experiments.

The trial was established with three replicates in plots with the dimensions of 1.2 m × 6 m according to randomized block design. Wheat was sown during the first two weeks of November at a rate of 550 seeds/m^2. Seeds were sown by Oyjord drill in plots, each consisting of eight rows. 150 kg N ha^{-1} (half at sowing stage and half at tillering stage) and 50 kg ha^{-1} P_2O_5 (once, at sowing) were applied. Three different dose (4, 8 and 12 kg Zn/1 ton) of zinc compound (Teprosyn F-2498) was treated with water and mixed with seeds just before sowing.

The plots (7.2 m^2) were harvested at maturity to obtain seed yields. Ten plants from each plot were collected randomly at harvest time of seed and plant height, number of seeds per spike, weight of seeds per spike, harvest index, hectoliter weight, 1000 kernel weight recorded.

All the data were subjected to analysis of variance for each character using MSTAT-C (version 2.1, Michigan State University, 1991) and MINITAB (University of Texas at Austin) software. Means were compared with the least significant difference test at ($p < 0.05$).

RESULTS AND DISCUSSION

The mean values belonging to yield and yield components of bread wheat cv. Pehlivan, Golia and Gönen which is growth in different concentrations of zinc is given in Table-2. According to analysis of variance, zinc concentrations didn't affect the yield of bread wheat. In addition, the differences between zinc concentrations were not found significantly in terms of all yield components. On the other hand, the differences between the years were statistically significant for plant height, seed weight/spike, harvest index and 1000 kernel weight. In the all characteristics observed variety-zinc and zinc-years interactions were also not significant.

As seen in Table-2 according to mean of 2 years, the plant height ranged from 75.0 to 79.8 cm and was not influenced from different zinc concentrations. In addition, the differences between years are significant for plant height. In the second experimental year, the precipitations in March, April and May was much more from the first experimental year. Therefore, the second experimental year gave higher plant height (respectively; 66.9 and 87.4 cm).

Seed number spike was not significantly effected by zinc concentrations and years. In this connection, the seed number/spike was determined as 28.1 in 1999 and 30.5 in 2000 experimental year. According to mean of 2 years, although there was non significant effect of zinc on concentrations on the seed weight/spike some doses caused numerical and partial increases in the seed weight/spike. The differences between years was found significant in terms of seed weight/spike. Therefore, in the first experimental year, the mean of the seed weight/spike was high value than that of second experimental year (respectively; 1.88 and 1.28 g).

TABLE-2
EFFECT OF SEED–APPLIED OF ZINC COMPOUND (TEPROSYN F-2498) IN DIFFERENT DOSE ON YIELD AND YIELD COMPONENTS OF BREAD WHEAT (ACCORDING TO MEAN OF THREE CULTIVARS)

Dose	Plant height (cm)			Number of seed/spike			Weight of seeds/spike (g)			Harvest index (%)		
KgZn/ton	1999	2000	Mean	1999	2000	Mean	1999	2000	Mean	1999	2000	Mean
0	67.9	82.1	75.0	28.7	25.1	26.9	1.85	1.09	1.47	36	33	35.0
4	65.7	87.5	76.6	28.0	31.2	29.6	1.91	1.26	1.59	36	34	35.1
8	68.3	85.8	77.0	28.1	31.1	29.6	1.84	1.26	1.55	36	34	34.5
12	65.6	94.1	79.8	27.7	34.4	31.1	1.93	1.53	1.73	38	36	36.2
Mean	66.9 b	87.4 a	–	28.1	30.5	–	1.88 a	1.28 b	–	36 a	34 b	–

Dose	Hectoliter weight (kg/100 lt)			1000 kernel weight (g)			Seed yield (kg ha^{-1})		
KgZn/ton	1999	2000	Mean	1999	2000	Mean	1999	2000	Mean
0	83.4	83.4	83.4	46.1	42.6	44.4	5991	6049	6020
4	83.4	83.4	83.4	47.8	43.9	45.8	5933	6078	6006
8	83.4	83.6	83.5	46.0	43.6	44.8	6359	6027	6193
12	83.5	83.4	83.4	47.9	45.3	46.6	5747	5836	5791
Mean	83.4	83.4	–	47.0 a	43.8 b	–	6008	5998	–

TABLE-3
MEAN VALUES RELATED TO THE YIELD OF
BREAD WHEAT CULTIVARS

Cultivars	1998-1999	1999-2000	Mean of two year
Pehlivan	6449 a	5942	6196
Gönen	5847 b	5873	5860
Golia	5725 bc	6378	6051
Mean	6008	5998	–

The harvest index is positively associated with seed yield[11,12]. The concentrations of zinc were not provided an increasing in the harvest index, but it was determined that harvest index was significantly different according to years. Although harvest index was not significantly effected by different zinc concentrations its some doses caused numerical and partial increases in the harvest index (Table-1). Zinc concentrations didn't significantly affected hectoliter weight in each experimental year.

According to mean of 2 years, 1000 kernel weight was not influenced by the different doses of zinc, but the differences in between year for this characters were determined as significantly. For that reason the mean of the first experimental years was more than that of second year (respectively; 47.0 and 43.8 g).

In the research, the effect of zinc concentrations was not found significantly on seed yield too. According to results of 2 years, the mean values of seed yield ranged from 5791 to 6193 kg ha^{-1}. Yilmaz *et al.*[5] reported that the treatment to seed of zinc increased the seed yield in wheat. The present finding indicate that zinc concentrations over 8 kg decreased significantly seed yield of bread wheat although significant differences in terms of seed yield was not among years. The seed yield was determined as 6008 kg ha^{-1} in the first experimental year and 5998 hg ha^{-1} in the second experimental year.

Conclusion

According to results of the soil analysis of experiment, the content of zinc was lower than from extant limit values. Consequently, the different doses of Teprosyn F-2498 compound didn't effected significantly on both the seed yield and yield components in wheat.

The wheat is a sensitive plant to micro element deficiency (especially, to zinc). Therefore, the fertilizer program is necessary in order to obtain more yield from wheat. On the other hand, zinc concentrations of 8 kg Zn/ 1 ton gave higher seed yield in the first experimental year and of 4 kg Zn/ 1 ton in the second experimental year, although differences between zinc concentrations were not statistically significant in both experimental years.

Present study and previous reports indicated that genotype, environmental, climatic and soil factors had an important effect on benefit from zinc of plant. In present studies, it is found that higher zinc concentrations than 8 kg Zn/1 ton could decrease the seed yield (Table-2). In this research, it was determined that decrease of zinc is result from high of absorption rates of soil and is not insufficiency of normal total zinc on soil. The negative soil characteristics, such as high pH and higher clay rate, lower organic matter and insufficiency of soil moisture depend on high lime rate are due to insufficiency zinc content of the soils[13]. Zinc applied to areas having negative soil characteristics decreased the soil pH and increased micro element uptake by plant[3]. In this research and other research are emphasized that cultivars, climate, environment conditions and soil characteristics have an important influence to benefit from zinc of plants.

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