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Effects of Nitrogen and Zinc Fertilizers on Grain Yield and Some Yield Components of Pehlivan

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This research was performed to determine the effect of which wheat will have on yield and some yield components by applying two importants elements of which many researchers investigated only one of them (only N or only Zn). It was carried out on experimental areas of Uludag University Agricultural Faculty where Zn deficiency was present. As an experimental material, Pehlivan, an important bread wheat, was used for two cultivation periods. The experiment area was established in a randomized design with three replicates on 1.2×5 m = 6 m^2. In this experiment, five different zinc doses (Z_0: 0 g da^{-1}, Z_1:100 g da^{-1}, Z_2:150 g da^{-1}, Z_3:200 g da^{-1}, Z_4: 250 g da^{-1}) and four different nitrogen doses (N_0: 0 kg da^{-1}, N_5: 5 kg da^{-1}, N_{10}: 10 kg da^{-1}, N_{15}: 15 kg da^{-1}) were applied. As a result, it was determined that Zn is of no significant effect on plant height, seed number pers pike, 1000-seed weight and yield. However, extremely positive results were obtained in combinations in which Zn forms with nitrogen. The best results in terms of plant height were obtained in Zn_2N_3, seed number per spike in Zn_3N_{10}, 1000-seed weight in Zn_0N_{15}, respectively. As to yield, average Z_3N_{10}, Z_3N_{10}, Z_4N_5, Z_4N_{10} and Z_4N_{15} combinations were over 700 kg da^{-1}.

Key Words: Wheat, Nitrogen fertilizer, Zinc fertilizer, Plant height, yield.

INTRODUCTION

Wheat is one of the most important plants which has the most important position in terms of cultivation and production among culture plants used mainly in human nutrition and with its wide adaptation ability. Increasing world population presented inadequate nutrition and starvation. Firstly, production areas were enlarged in order to solve this problem but studies have been conducted to increase per unit field yield of products as this couldn't be sufficient.

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Nitrogen has been one of the most investigated factors in wheat production. Numerous studies[1-3] indicate that N fertilization can increase both wheat grain yield. Macas[4] reported that decreases of 5 % in yield were present in wheat production where N is not used. Borowczak *et al.*[5] reported that nitrogen fertilizer applied on wheat increases seed number per spike and seed weight. Ali *et al.*[6] reported that they obtained the highest seed yield by applying 125 kg da^{-1} and the lowest seed yield by applying 100 kg ha^{-1}. Bosak[7] reported that application of 60 + 30 kg ha^{-1} to wheat was the most effective for winter cereals. Fooladmand *et al.*[8] reported that different nitrogen fertilizer and irrigations levels provided only an increase of 1 % on wheat yield. Frant and Bujark[9] and Liu *et al.*[10] reported that N fertilizer increase plant height but decrease 1000-seed weight.

Rengel *et al.*[11] reported that seeds including high amounts of Zn produce bigger fruits and more grains and root and stem structures develop well. Cakmak *et al.*[12] reported that different Zn doses influence stem dry matter rate and seed yield in aestivum and durum wheat and due to Zn deficiency significant decreases in yield may occur. Yilmaz *et al.*[13] reported that Zn application increases yield compounds such as spike number per m^2, seed number per spike and 1000-seed weight and soil + leaf fertilizer is the best method.

Zubaidi *et al.*[14] reported that N, one of macro elements in soil and Zn, one of micro elements have more effective role in yielding maximum product than other nutrition elements (Mg, Mn, Cu, B). Kalayci *et al.*[15] reported that fertilizers applied with Zn increased 8-76 % of varieties of yields and average yield 30 %.

EXPERIMENTAL

This research was conducted in fields where Zn deficiency had already been determined on experimental areas of Uludag University Faculty of As an experimental material, Pehlivan, an important bread wheat and whose commonly cultivation has been done in Turkey, was used for two cultivation periods. The experiment area was established in a randomized design with three replicates on 1.2×5 m = 6 m^2. In this experiment, five different zinc doses (Zn_0: 0 g da^{-1}, Zn_1: 100 g da^{-1}, Zn_2: 150 g da^{-1}, Zn_3: 200 g da^{-1}, Zn_4: 250 g da^{-1}) and four different nitrogen doses (N_0: 0 kg da^{-1}, N_5: 5 kg da^{-1}, N_{10}: 10 kg da^{-1}, N_{15}: 15 kg da^{-1}) were applied. As a result, it was determined that Zn is of no significant effect on plant height, seed number pers pike, 1000-seed weight and yield. However, extremely positive results were obtained in combinations in which Zn forms with nitrogen. In two cultivation periods chelated (EDTA) form of Zn was applied just before spike period and *via* leaf. Half of nitrogen amount to be applied during vegetation period as pure dose nitrogen (33 % $NH_4NO_3^-$) was used in sowing and the remaining half just before spike and *via* soil.

During experimental period a number of physiological and yield components of which only plant height, seed number per spike, 1000-seed weight and yield were given importance in our study were examined. Variance analyses of obtained results were done by SPSS[12]. Differences among doses were examined in the level of LSD 5 %.

RESULTS AND DISCUSSION

Plant height: The height of Pehlivan increased 91.17 cm^{-1} 15.70 cm in the first year and 92.00 cm^{-1} 13.80 cm in the second year. The difference between obtained results was found about 5 % in each year. As can be seen in Fig. 1, it was determined that N doses also increased plant height in combinations were Zn_0 forms with N. These obtained results show similarities with those reported by researchers[9,10]. However, in plant height no increase was observed in combinations in which N_0 forms with increasing amounts of Zn. According to these results, it can be said that Zn itself is not an effective element for plant height. But in other combinations Zn_2N_{15}, Zn_3N_{15} and Zn_4N_{15} had the longest plant height value.

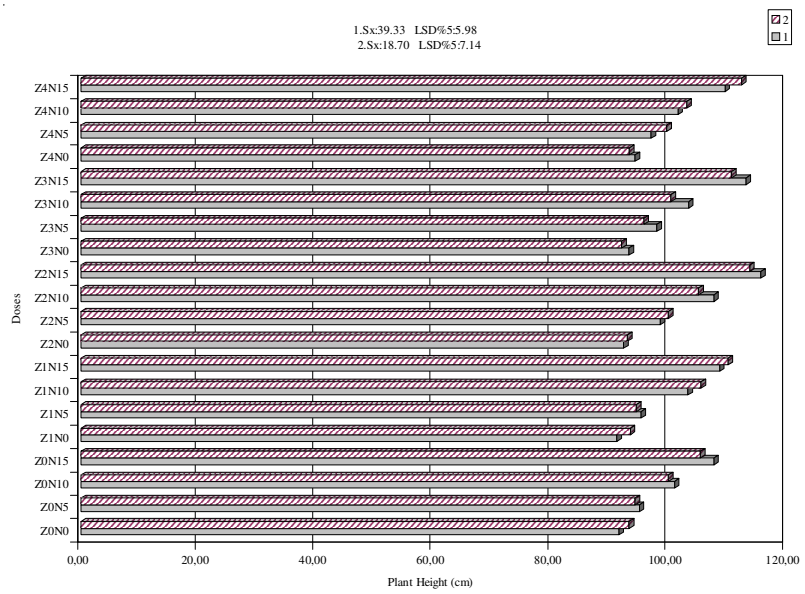

Fig. 1. Different doses of N and Zn applied in two years on plant height of Pehlivan

Seed number per spike: While seed number per spike ranged from 31.80 unit to 46.92 unit in the first year, from 30.00 unit to 48.53 unit in the second year. The differences between obtained results was found about 5 % in each year. As can be seen in Fig. 2, in combinations in which Zn_0 forms with N, increasing N doses showed superiority compared with Z_0N_0.

These obtained findings show similarities partly with those reported by Borowczak *et al.*[5]. It was determined that in combinations in which N_0 forms with increasing doses of Zn has no significant effect to increase in seed number per spike. These obtains results are not consistent with those reported by Rengel *et al.*[11] and Yilmaz *et al.*[13]. In terms of seed number per spike Zn_3N_{10} and Zn_3N_{15} combinations had the best results.

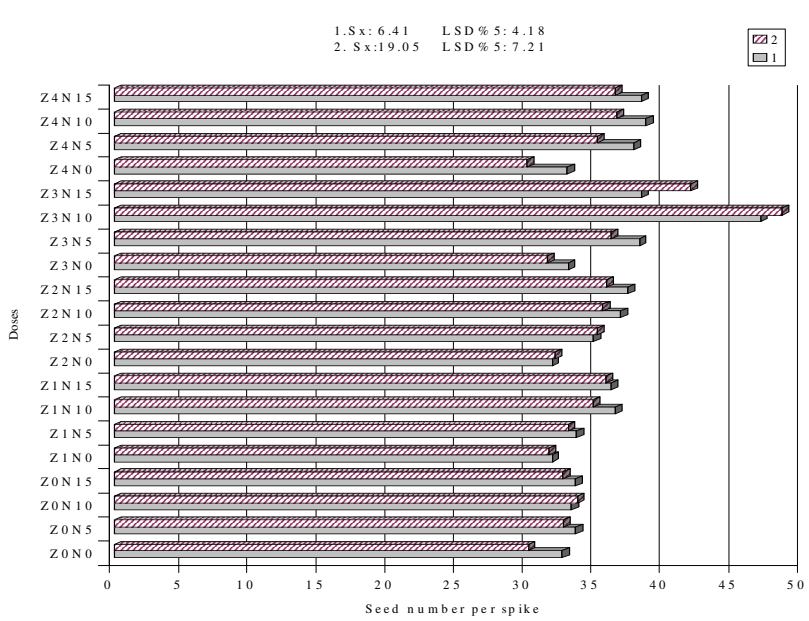

Fig. 2. Different doses of N and Zn applied in two years on seed number per spike of Pehlivan

1000-Seed weight: While 1000-seed weight values which Pehlivan investigated in present study had during the first year of trial ranged from 30.31-43.60 g, in the second year they were 33.00-43.50 g. The differences between obtained results was found about 5 % in each year. As can be seen in Fig. 3, in combinations in which Zn forms with N in both years, there was decrease in 1000-seed weight of other three combinations compared with Zn_0N_0 but no significant difference was present among themselves (Zn_0N_5, Zn_0N_{10}, Zn_0N_{15}). While these obtained results are consistent with those reported by Frant and Bujark[9] but not consistent with those of Yilmaz *et al.*[13]. It was determined that increasing Zn doses decreased 1000-seed weight in combinations Zn forms with N_0. However, this condition was different in other combinations *i.e.*, Zn_3N_5 and Zn_3N_{10} gave good results in combinations Zn forms with N_0.

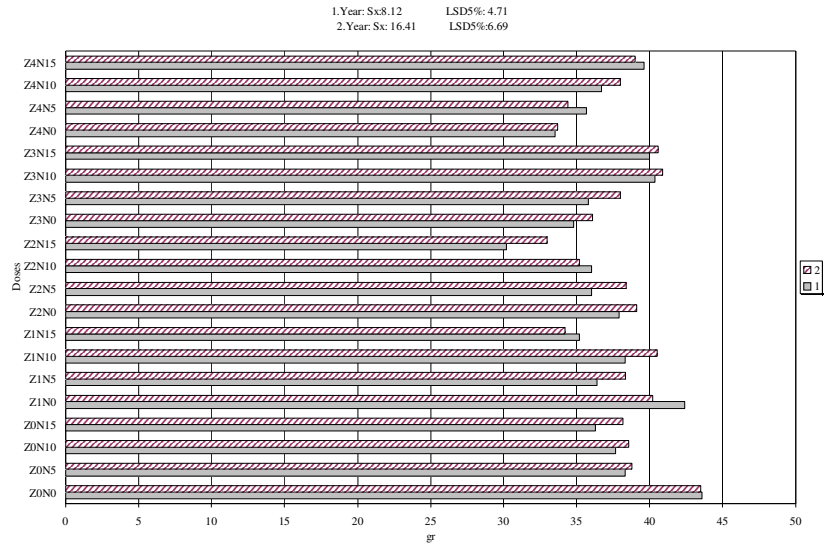

Fig. 3. Different doses of N and Zn applied in two years on 1000-seed weight of Pehlivan

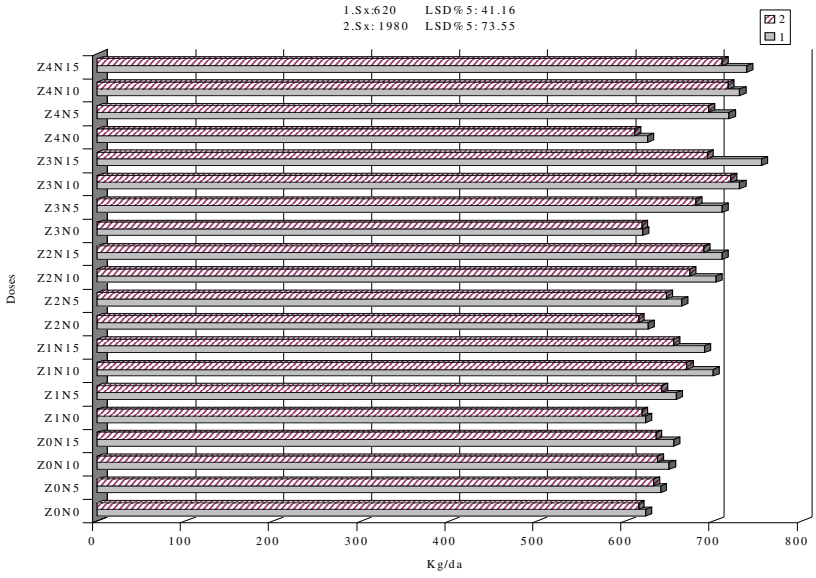

Fig. 4. Different doses of N and Zn applied in two years on yield of Pehlivan

Yield: The last characteristics examined in present trial is yield. While yield values which Pehlivan investigated in this study had during the first year of trial ranged from 620-755 kg da^{-1} while in the second year were 611-720 kg da^{-1}. The differences between obtained results were found about

5 % in each year. As can be seen in Fig. 4, it was observed that increasing N doses increased yield in combinations Zn_0 forms with increasing doses of N. However, in combinations where N_0 forms with increasing doses of Zn, no significant increase was observed in yield but positive results were obtained in other combinations *i.e.*, results over 700 kg da^{-1} were obtained in especially Z_3N_{15}, Z_3N_{10}, Z_4N_5, Z_4N_{10} and Z_4N_{15}, which shows that positive results can be obtained in certain combinations where Zn forms with N. These obtained results supported the other researchers reports[12,14,15].

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