# Effect of Manganese and Zinc Foliar Application on Common Bean

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## INTRODUCTION

Zinc deficiency in Turkey is a widespread nutritional problem affecting yield and quality of crop plants. According to Cakmak et al. (1996), about 50% of the arable land in Turkey and 80% in the Central Anatolia Region, which is the most important cereals and legumes growing area, are Zn-deficient. Although there are only a few studies reporting yield and quality losses due to Mn deficiency in Turkey, 44% of Turkish soils have been reported as Mn-deficient (Eyupoglu et al. 1996). Widespread Mn deficiency exists in soils of the Central Anatolia Region (Kacar and Katkat 1998). The nutrient balance in plants is important for growth and yield of plants. Common bean (*Phaseolus vulgaris* L.) is an important legume crop and grown at the highest rate in the Central Anatolia Region (Sepetoglu 1994). The aim of this study was to investigate the effect of different Mn and Zn doses as foliar applications on some yield components and seed yield in two common bean cultivars.

## METHODS

The experiment was carried out under field conditions in Eskisehir in the Central Anatolia Region. Common bean cultivars, Yunus and Onceler, were sown in split plots in a randomized block design with three replicates on May, 27th in 2004. Basal fertilizers were applied at the rates of 40 kg N $ha^{-1}$, 80 kg $P_2O_5$ $ha^{-1}$ and 60 kg $K_2O$ $ha^{-1}$ as diamonium phosphate and potassium nitrate. Three doses of Mn as $MnSO_4.4H_2O$ (0, 300 and 600 g $ha^{-1}$; $Mn_0$, $Mn_1$ and $Mn_2$, respectively) and three doses of Zn as $ZnSO_4.7\ H_2O$ (0, 200, 400 g $ha^{-1}$; $Z_0$, $Zn_1$ and $Zn_2$, respectively) were sprayed onto leaves on the $39^{th}$ day after sowing in Onceler and on the $46^{th}$ day after sowing in Yunus (before flowering). Plants were harvested when pods matured in October. Ten mature plants were sampled from each plot and evaluated for the number of pods per plant, number of branches per plant, height of first pod, number of seeds per pod and seeds.

## RESULTS AND DISCUSSION

Application of different doses of Mn and Zn affected yield components and seed yield of two bean genotypes differently. The results are in Table 1. The number of pods per plant was significantly affected by G, A and GxA interaction. The number of pods per plant, a very important yield component, varied among genotypes. It has a tendency to increase with environmental improvements (Kruvadi and Sanchez 1993). The number of branches per plant was not affected by Zn and Mn applications and GxA interaction, but it differs among genotypes irrespective A and GxA. The highest heigth of the first pod was found in cv. Yunus under control conditions. Increased rates of Zn and Mn decreased the height of the first pod significantly in cv. Yunus, while cv. Onceler was not as affected. The number of seeds per pod were similar in both genotypes and not significantly affected by Zn and Mn applications. Seed yield of genotypes increased significantly with Mn application in cv. Yunus while seed yield of cv. Onceler was only increased with the $Mn_2$ application. While Mn application resulted in an increase in seed yield of genotypes, Zn application increased seed yield only significantly when it was applied in combination with Mn. Application of Zn in combination with Mn seemed to have a stronger effect on common bean yield.

**Table 1. Effect of different doses of Zn and Mn as foilar applications on pod and branch number per plant, height of first pod, seed number per pod and seed yield per plant in common bean.**

| Genotypes (G) | Application (A) | Pods number per plant | Branch number per plant | Height of first pod (cm) | Seeds number per pod | Seed yield (kg $ha^{-1}$) |
|---|---|---|---|---|---|---|
| | $Zn_0Mn_0$ | 19.75 | 2.63 | 18.54 | 3.25 | 2250 |
| | $Zn_0Mn_1$ | 23.29 | 2.67 | 12.96 | 3.23 | 2990 |
| Y | $Zn_0Mn_2$ | 25.71 | 2.88 | 15.88 | 3.24 | 3050 |
| U | $Zn_1Mn_0$ | 26.17 | 2.54 | 14.73 | 3.41 | 2260 |
| N | $Zn_1Mn_1$ | 26.79 | 3.25 | 16.46 | 3.18 | 1830 |
| U | $Zn_1Mn_2$ | 26.33 | 2.83 | 13.29 | 3.10 | 2550 |
| S | $Zn_2Mn_0$ | 24.54 | 3.13 | 13.85 | 3.01 | 1690 |
| | $Zn_2Mn_1$ | 25.63 | 2.96 | 13.63 | 3.09 | 3130 |
| | $Zn_2Mn_2$ | 29.67 | 3.29 | 14.17 | 3.05 | 3040 |
| | $Zn_0Mn_0$ | 18.42 | 3.13 | 14.75 | 3.55 | 1750 |
| Ö | $Zn_0Mn_1$ | 18.00 | 3.21 | 12.79 | 3.79 | 2100 |
| N | $Zn_0Mn_2$ | 26.46 | 3.17 | 10.54 | 4.00 | 2730 |
| C | $Zn_1Mn_0$ | 22.13 | 4.17 | 15.29 | 3.60 | 1910 |
| E | $Zn_1Mn_1$ | 19.62 | 3.21 | 14.19 | 3.37 | 1860 |
| L | $Zn_1Mn_2$ | 19.71 | 3.21 | 12.29 | 3.53 | 2180 |
| E | $Zn_2Mn_0$ | 17.33 | 3.04 | 14.10 | 3.61 | 1620 |
| R | $Zn_2Mn_1$ | 20.70 | 3.20 | 10.71 | 3.07 | 1850 |
| | $Zn_2Mn_2$ | 24.87 | 3.35 | 11.88 | 3.66 | 2110 |
| Mean | | 23.06 | 3.10 | 13.89 | 3.37 | 2270 |
| LSD (α=0.05) | | | | | | |
| Genotype | | 3.427* | 0.17* | 2.265ns | 1.658ns | 6.96ns |
| Application | | 2.226** | 0.503ns | 1.076** | 0.384ns | 7.55* |
| GxA | | 3.148* | 0.712ns | 1.521** | 0.543ns | 10.68ns |

ns. not significant; *. P<0.05; P<0.01.

## CONCLUSIONS

It was concluded that Zn and Mn deficiency should be considered together in common bean production in the Central Anatolia Region. There are genotypic differences in response to Zn and Mn application in common bean.


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## REFERENCES


Cakmak, I., Yilmaz, A., Ekiz, H., Torun, B., Erenoglu, B. and Braun, H.J. (1996) Zinc deficiency as a critical nutritional problem in wheat production in Central Anatolia. Plant and Soil 180: 165-72.

Eyupoglu, F., Kurucu, N. and Talaz, S. (1996) Status of some plant available micronutrinets in Turkish soils (in Turkish). In: Soil and Fertilizer Research Institute General Publication No: 217, Series No: R-133, Ankara. 72p.

Kacar B. and Katkat, A.V. (1998) Plant Nutrition (in Turkish). Uludag University Reinforcement Foundation Publication No:127, VIPAS Publications:3, Bursa. 595p.

Kruvadi S. and Sanchez, V. (1993) Range of Yield Components and Phenotypic Correlation in Tepary Beans (*Phaseolus acutifolus*) under Dryland Conditions. In: New Crops. J. Janick and J.E. Simon (eds.). Wiley, New York.p.594-596.

Sepetoglu, H. (1994) Edible Legumes (in Turkish). Ege University, Agricultural Faculty Publications, Coursebook No:24, Bornova-İzmir. 262p.