

EFFECT OF MINERAL FERTILIZATION ON THE MN, ZN, CU AND SR CONTENT OF WINTER WHEAT

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Introduction

Intensification of agricultural production pointed the view on the microelements. Beside the yield increase the high level fertilization doses may cause some negative effects because of changed mineral content (Györi 1963, Bergmann and Henning 1973). So nowadays the notion of quality includes the mineral element content and their adequate ratios (Pais, 1993), so in this respect it is important to examine the relations of plant cultivation technologies and element content. The element content is mainly determined by genetical (Peterson *et al.* 1983, Davis *et al.* 1984) and environmental factors (Dikeman *et al.* 1982), but the agricultural technology has an important role as well.

There are several known antagonisms between macro and micronutrients. E.g. the higher phosphorus doses decrease the plant available zinc in soils which leads to decreased plant zinc content (Györi 1971, Elek és Kádár 1975, Touchton *et al.* 1980). Syltje és Dahuke (1983) found same reaction to nitrogen fertilization also. The surplus Ca content decreases the Zn, Cu and Mn content as well (Tulin és Alekszeeva 1976). Another modifier factor is the soil humidity; in the case of optimal soil humidity the NPK fertilization increases both P and Zn content, but in dryer conditions the Ca content increases (Debreczeni és Tölgyesi 1975).

The Hungarian loamy chernozem soils have about 30 – 40 (Kádár és Szemes, 1994, Györi *et al.*, 1993) mg/kg total strontium content. Lásztity (1986) found that strontium content of wheat grains is 4,3 mg/kg, while in the case of straw this value is 11,4 mg/kg, and his additional examinations (1990) proved that the 90 % of strontium content in the upper ground parts of wheat plant is in straw and glume and the Sr-Ca rate in the vegetative and generative plant parts is nearly the same.

Methods

The analysed grain samples are from the National Long Term Field Trials (NLFTT) Experimental Stations between 2003 and 2004. The examined samples are from 1st, 5th, 14th, 16th and 20th treatments of the No. 17 experiment (the N, P₂O₅ and K₂O doses are 0/0/0; 150/0/0; 150/0/100; 150/120/100 and 250/180/100 kg/ha). The examined variety is Mv Csárdás.

Grain samples were prepared by wet digestion. 1g dried grain samples were digested. The digestion consisted of two stages: 1. Predigesting: 1g sample + 10 ml cc. HNO₃ at 60 °C for 30 minutes 2. Digestion: + 3 ml cc H₂O₂ at 120 °C for 1.5 hours. The volume of digested liquid was increased to 50 ml using deionized water and then filtered with MN (Macherey-Nagel) 640W filter paper (Kovács *et al.* 1996, 1998). The element content of wheat grain samples was determined by Labtam 8440M inductively coupled plasma atomic emission spectrometer after digestion.

Results and discussion

The Mn content of grain samples was increased as an effect of mineral fertilization (Figure 1.). The increase was not the same in the examined two years; in 2004 the increase was almost continuous (except at the first fertilization dose in Nagyhorcsök and Karcag), in 2003 it was continuous only in Iregszemcse and on the other examined sites the increase was only

tendencial. Multivariate analysis of variance proved only the effect of phosphorus fertilizer on the Mn content.

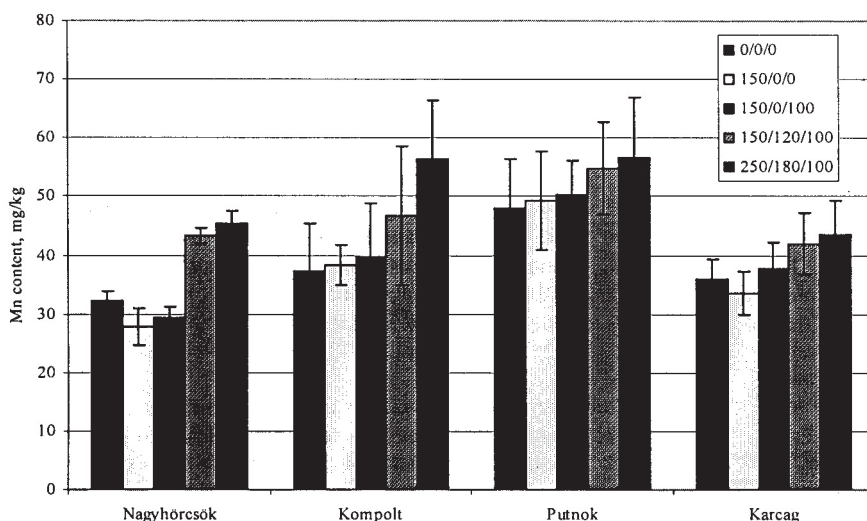


Figure 1.: Effect of mineral fertilization on the Mn content of wheat grains (2004)

The known antagonism between phosphorus and zinc was proved again by the results. The NLTFT trials give the possibility of the separated examination of the effect of macro fertilizers and I found that while the increasing N and K mineral fertilization decreases the Zn content of wheat grains, the decreasing effect of phosphorus fertilization is much more expressed; in some cases the 20th fertilization level resulted a half Zn content in grains.

In the case of Cu content I found similar tendencies; the phosphorus mineral fertilization decreased the Cu content. This decreasing effect is much higher in 2004 with its rainy maturing period, but it is recognizable in the drought 2003 as well. The increasing N levels results a small increase but potassium fertilization had no significant effect on the Cu content of winter wheat grains.

Statistical analyses proved the Sr content increasing effect of phosphorus fertilization as well, but the effect of other macronutrients are recognizable. The effect of cropping year is different in the cases of Karcag and Nagyhörsök; while the phosphorus fertilization effect is expressed in Nagyhörsök in both examined years, in Karcag this effect is realizable only in the rainy 2004; while in 2003 I measured the highest Sr level in wheat grains, the Sr content was not affected by the macrofertilizer application (Figure 2.).

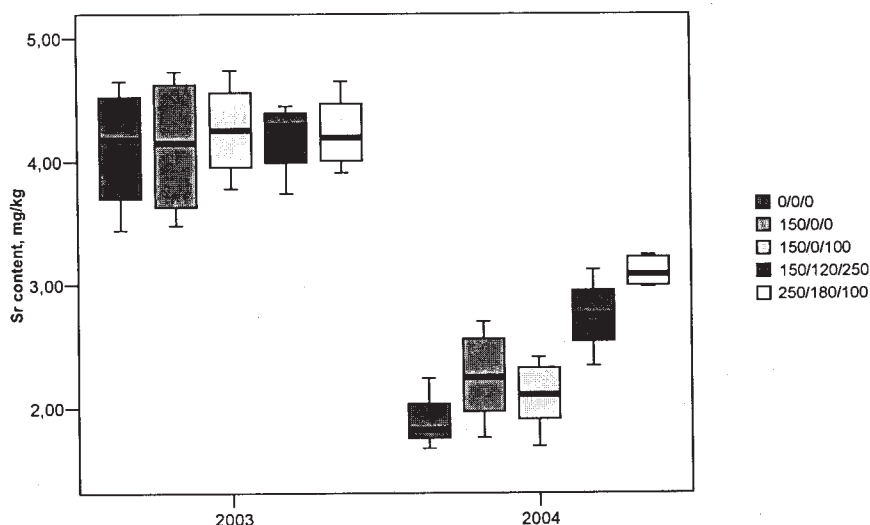


Figure 1.: Effect of mineral fertilization on the Sr content of wheat grains (Karcag, 2003-2004)

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