P2-14

[IDS3] Soil Information and Food Security

Effect of Phosphorus Uptake Efficiency on Micronutrients Content in Grains of Wheat and Soybean Cultivars

Alinne Silva[1], Isabeli Bruno[2], Nericlenes Marcante[3], Vinicius Franzini[4], Leticia Benitiz[3] and Takashi Muraoka[5]

[1] *Soil Fertility, CENA/USP, Brazil*

[2] *Soil Fertility, IAPAR, Brazil*

[3] *Soil Fertility, Esalq/USP, Brazil*

[4] *Soil Fertility, Embrapa, Brazil*

[5] *Soil Fertility, Esalq/CENA/USP, Brazil*

Brazil is one of the largest producers of soybean (Glycine max) in world, around 80.0 million tons on the crop season 2012/2013, on the other hand, is one of the top three importers of wheat (Triticum aestivum), due the small domestic acreage (around 2 million ha) and low production (5.78 million tons). Low phosphorus (P) availability is a primary constraint to plant yield in Brazilian soil, so it is necessary to apply large quantities of P fertilizer. In addition to fertilizers, it is possible identify cultivars that have a greater ability of P uptake, since, crop genotypes differ in phosphorus acquisition (Lynch, 2001).

However, application of P fertilizers may also cause detrimental effects on grain quality, in particular the concentration and bioavailability of micronutrients (Buerkert et al. 1998), as well, selecting cultivars with higher P uptake efficiency may reduce uptake of Zn or Zn concentrations in the plant (Zhu et al. 2001).

Using a 32P isotope technique, this study evaluated P uptake efficiency by wheat and soybeans cultivars and, if the P uptake efficiency affects the content of the micronutrient in the grain.

The experiment was carried out in a greenhouse. The study was performed in plastic pots, lined with polyethylene bags, holding 2.0 kg of air dried soil taken from topsoil of Typic Haplustox. Phosphorus fertilization was accomplished by applying a mixture of triple superphosphate (20 mg kg-1 of P) and Patos de Minas phosphate rock (150 mg kg-1 of P). The soil was labeled with 32P in solution applied at 9.62 MBq and 2 mg kg-1 P carrier.

Were evaluated 42 wheat and 57 soybean cultivars. The experimental design was a completely randomized with three replications. Part of the grains was used in seeding and the other part was used to determine the content of micronutrient. The shoot of wheat and soybean was collected 40 days after emergence and dried at 60 ºC. Phosphorus content in the shoot tissue and grain was determined by colorimetric method. The activity of ^{32}P in the shoot tissue was determined in a liquid scintillation counter by Cerenkov effect and L-value was calculated according to the following equation, where: L-value (mg kg-1 of P); SA0 is specific activity of applied solution (dpm µg P-1); SAp is specific activity of plant (dpm µg P-1); x is amount of applied P.

L-value = x(SAO/SAp -1)

The results indicated that there were substantial variations for P uptake among the 42 wheat and 57 soybean cultivars evaluated. The overall average of L-value was 8.19 and 14.78 mg kg-1 for wheat and soybean cultivars, respectively. The highest value of L-value for wheat was 12.13 mg kg-1 (cultivar IPR 136) and the lowest was 5.33 mg kg-1 (cultivar BRS 220). For the soybean, the highest and lowest were 19.90 and 10.92 mg kg-1, cultivar BRS Nova Savana and Sambaiba, respectively.

There were not significant correlation among L-value (P uptake efficiency) and micronutrient content in the grain both for wheat and soybean cultivars.

The means of 42 cultivars of wheat were 4.73, 37.26, 36.68, 33.47 mg kg-1, and means of 57 cultivars of soybean were 12.01, 213.27, 90.91, 102.91 mg kg-1 of Cu, Fe, Mn and Zn, respectively.

Although cultivars with high P uptake efficiency may reduce uptake of micronutrients, particularly Zn, in the plant, it does not necessary follow that all cultivars with high P uptake also produce grain with lower content of micronutrient, which was confirmed by the lack of significant correlation between variables L-value and content of micronutrient in the cultivars of soybeans and wheat.

Buerkert, A., Haake, C., Ruckwied, M., Marschner, H. Phosphorus application affects the nutritional quality of millet grain in the Sahel. Field Crops Research, v. 57, p. 223-235, 1998.

Lynch, J.P., Brown, K.M. Topsoil foraging – an architectural adaptation of plants to low phosphorus availability. Plant and Soil, v. 237, p. 225-237, 2001.

Zhu, Y.G., SMITH, S.E., SMITH, F.A. Plant growth and cation composition in
two cultivars of wheat (Triticum aestivum L.) differing in uptake efficiency.
Journal of Experimental Botany, v. 52, p. 1277-1282, 2001.

Keywords：*32P, radioisotope, L-value*