

Effect of the soil-solution ratio on the sensibility of the P extractor Mehlich-1 to discriminate the differences in productivity of maize hybrids contrasting for phosphorus efficiency

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The differences in performance among maize hybrids contrasting for phosphorus efficiency could be due to the interaction between the plants sensibility to acquire P and the soil P adsorption capacity. Also, the chemical extractors (Mehlich, Bray and Olsen) used for soil P analysis have sensibility to soil P adsorption capacity, and this sensibility is affected by the soil/solution ratio of the extractor. One hypothesis to verify these differences and its relationship with plant growth and development is to modify the soil/solution ratio of the extractor. An experiment was conducted in Sete Lagoas, MG, Brazil on a dark red latosol, clay texture, fertilized with three rates of P (0, 500 and 1,000 kg P₂O₅/ha) and cultivated with 12 single cross maize hybrids contrasting for phosphorus efficiency developed at Embrapa Maize and Sorghum. Soil samples were taken at 0 to 20 cm depth from each plot during the growing season and analyzed for "available P" content in the soil with the Mehlich-1 extractor using different soil/solution ratios: 10:50, 10:100; 10:150 and 10:200 [soil volume (dm³)/solution extractor volume (ml)]. Modifications in the soil solution ratios of the Mehlich-1 extractor, significantly changed the values of extracted P for all level of P applied (Table 1). The maximum values of P for zero P were observed for the large soil solution ratios (10:150 and 10:200) with significant difference from the others ratios. The maximum values of P for the P treatments were obtained with a soil solution ratio of 10:100. The improvement in the P values from 2 to 7 mg/dm³, under natural conditions without P application (Table 1), with the modifications in the soil solution ratios of the Mehlich-1 extractor, show that the capability of the soil in supplying P to the plants can be improved and consequently improve the understanding of corn response to P. Although there was a great response of the corn hybrids to P application (Figure 1), the average grain yield for the 12 corn hybrids, in the treatment control, without P application, was 6 t/ha and one genotype produced 8 t/ha. Results of experiments, conducted in the past on this type of soil, have demonstrated that the observed average grain yield of 6.0 t/ha would not be observed if the true value of "available P" is only 2 mg/dm³, obtained when the soil solution ratio of 10:50 was used for Mehlich-1 extractor (Table 1). The simple correlation coefficients analysis between phosphorus extracted by Mehlich-1 with different soil-solution ratios and grain yield of corn hybrids (Table 2) shows that the correlation for only two hybrids, one classified as efficient (hybrid 5) and the other inefficient (hybrid 11) for phosphorus acquisition, were statistically significant. Although it was possible to improve the sensibility of the Mehlich-1 extractor by modifying its soil solution ratios, the observed correlation coefficient (Table 2) is not sufficient enough to demonstrate the relationship between corn hybrids sensibility to phosphorus acquisition and "available P" in soil. Since the yield is affected by others factor, besides the available P in soil extracted by Mehlich-1, the variable grain yield may not be a good parameter to demonstrate this relationship. Thus, other variables such as biomass, P concentration in the leaves and P uptake in the vegetative and physiological maturity stages, should be used to better understand this relationship.

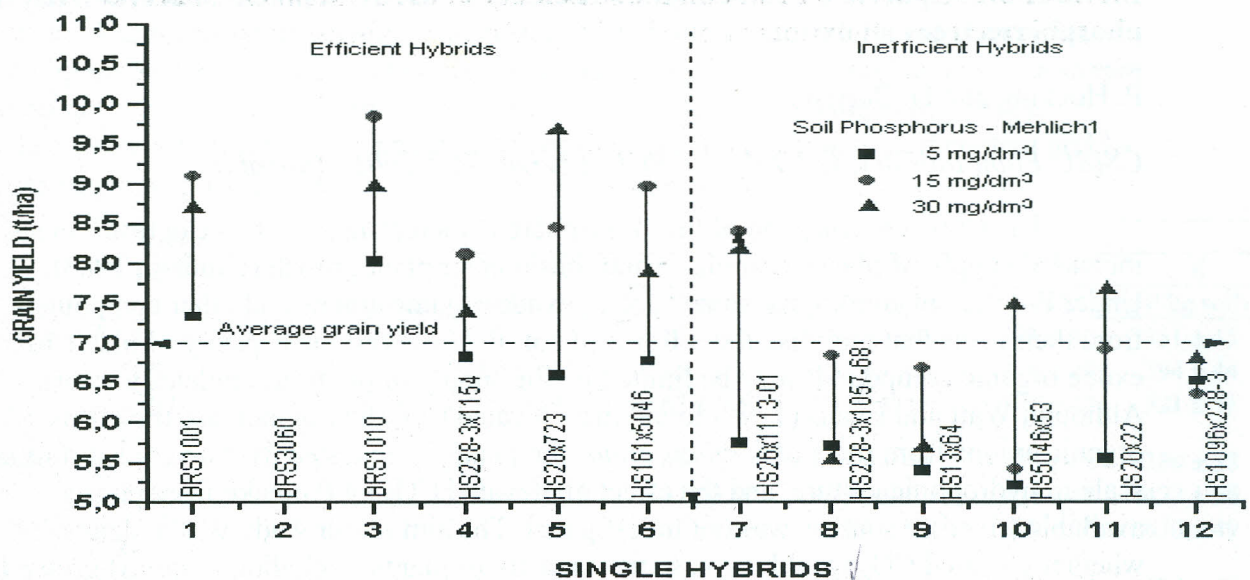


Figure 1. Grain yield of 12 singlecross corn hybrids cultivated on a soil with three level of phosphorus.

Table 1. Phosphorus extracted by Mehlich1 with different soil-solution ratios.

Soil solution ratios	Level of P ₂ O ₅ – kg/ha		
	0	500	1000
Soil (dm ³)/solution (ml) ^{1/}	----- Extracted P – mg/dm ³ -----		
10 : 50	2.07c ^{1/}	8.63b	18.16b
10 : 100	5.34b	20.49a	39.69a
10 : 150	7.59a	16.86a	35.40a
10 : 200	7.12a	18.13a	31.34a
CV (%)	9.14	13.64	18.44

^{1/} Brazilian soil analysis labs routinely use the 10: 100 soil solution ratio. ^{2/} Within columns, means followed by the same letter are not significantly different from each other at the 0.05 probability level.

Table 2. Simple correlation coefficients analysis between phosphorus extracted by Mehlich1 with different ratios soil-solution and grain yield (data are average of level of P)

Maize hybrids	Soil solution ratios (soil/solution extractor)			
	10 : 50	10 : 100	10 : 150	10 : 200
1	0.28	0.29	0.21	0.28
3	0.30	0.26	0.28	0.21
4	0.06	0.08	-0.04	0.10
5	0.57**	0.59*	0.50**	0.55**
6	0.13	0.18	0.07	0.20
7	0.34	0.38	0.19	0.41
8	-0.16	-0.18	-0.17	-0.21
9	0.08	0.10	0.02	0.13
10	0.40	0.43	0.34	0.39
11	0.52*	0.58**	0.45	0.61*
12	-0.08	-0.04	-0.13	0.00

* ** Correlation's are significant at the 0.05 and 0.10 probability level respectively.