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Comparison of Phosphorus Recommendation Based on Average Soil Test and on Spatial Variability Maps[1]

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[1]Projeto Embrapa SEP 12.099.021.01: Utilização de Instrumentos e Técnicas de Agricultura de Precisão para o Aumento de Eficiência dos Processos de Produção Agrícola.

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The fertility level of the soil varies as a function of the soil type, soil managment, deficiencies in the methods of fertilizers application, and of other factors. The recommendations of fertilizers have been made traditionally, based on field average soil test. This approach generally over- or under-estimate the amount of fertilizer being applied to part of the field. Recent studies (Wibawa et al., 1993 and Wollenhaupt et al., 1994) making use of techniques of global positioning systems (GPS), have indicated that the the crop pruduction and the efficiency of the fertilizers can be improved, by adjusting the application of the fertilizers based on spatial variability of the soil.

The present work compares the method of phosphorus appliaction based on the field average soil test with soil spatial variability map. The area in study is irrigated by a center pivot of 38 ha, in a LEd soil, clayey texture, cultivated in the last years with corn and bean in rotation, part in minimum till and part in conventional till. The area was sampled (0 to 20 cm

Table 1. Relative distribution of soil phosphorus per class of soil test.

Soil test classes[1] Mehlich, mg dm^{-3}	Quadrant Average (%)				
	1st	2nd	3rd	4th	5th
0 – 5	9	18	33	19	20
5 – 10	28	32	37	41	35
> 10	63	50	30	40	40

[1] *CFSMG (1989)*

and efficiency of fertilizer to be applied, being an indication of the need of differentiated application rate. Grid sampling increased the rate of P recommended in three out of four quadrant (Figure 1); the differece was 23%.

GRIDING AND YIELD

The existing variability understimate the rate of fertilizer recommended using field average soil test levels. The P response curve for a Dark Red Latosol soil, clayey texture,

Table 2. Rate of P recommended and yield losses.

Quadrant	Base of recommendation (P_2O_5 kg ha^{-1})		Estimated yield losses using field avg. soil test (%)
	Field avg. soil test	Field variability	
1st	50	63	10.1
2nd	50	69	15.1
3rd	50	78	22.9
4th	80	72	8.5
Average	57.5	70.5	14

layer) for phosphorus analysis in a 25mx25m grid. A total of 731 georeferenced points were used to make a phosphorus spatial variability map. The field average soil test was obtained by dividing the area in four quadrants, with twenty random samples being taken for each quadrant and bucking them in a composed sample.

SOIL PHOSPHORUS VARIABILITY

Soil fertility sometimes is more variable than it is expected. In this study variability was visible when the field was grid sampled (Table 01). The preliminary results indicated differences between the methods for phosphorus soil test classes. While the map of spatial variability indicated three distinct classes of soil phosphorus (low, medium and high), comprising 20%, 35% and 46% of the area,respectively, the field average soil phosphorus was condensed into two classes: in 75% of the area soil phosphorus tested high and in the 25% remaining, phosphorus was medium. This difference affects the amount

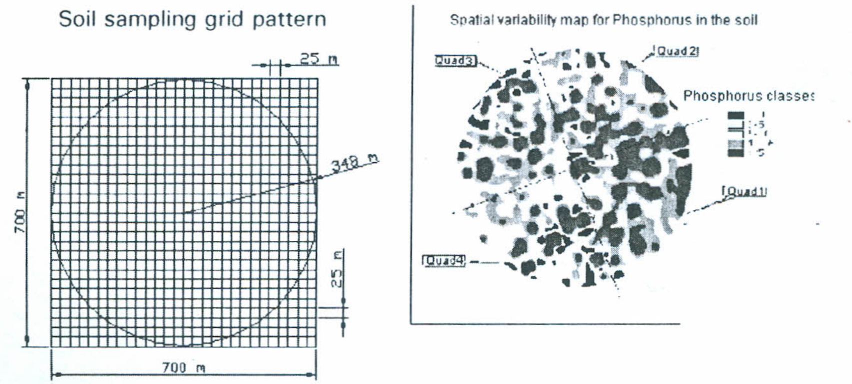

Figure 1. Soil sampling grid pattern and spacial variability map for Phosphorus in the soil.

was used to calculate yield losses when using average soil test for P. The data obtained (Table 02) suggested that the field yield is currentely at 85.7% of its potential, with 14.3% of losses. Taking into account corn yield and phosphorus fertilizer price, 12.7:1 ratio was obtained for variable application rate.

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