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38

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## Residual Effects of Phosphorus on Dryland Grain Sorghum (Milo)<sup>1</sup>

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When phosphorus fertilizer is broadcast, it stays within 2 or 3 inches of the topsoil unless mixed deeper with tillage implements. So phosphorus can be stored in the soil without being leached from the root zone by rainfall. Residual phosphate, therefore, is still available for succeeding crops, although a certain portion becomes fixed in unavailable form over time so it can not be used by plants.

Residual P compared with continued applications of P were studied at the Southeast Kansas Branch Experiment Station (Parsons Field) from 1974 through 1977 to see if heavy, first-year applications (200 pounds P<sub>2</sub>O<sub>5</sub> acre) would be as effective for grain sorghum as 100 pounds P<sub>2</sub>O<sub>5</sub> per acre applied every other year, or as effective as annual applications of 50 pounds P<sub>2</sub>O<sub>5</sub> per acre.

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After 4 years all plots had received the same total amount of P. Phosphorus was broadcast on the soil surface before planting then incorporated with a springtooth.

The two P sources used were diammonium orthophosphate (AOP, 18-46-0) and solid ammonium polyphosphate (APP, 15-62-0). APP was obtained from the Tennessee Valley Authority and contained 80% of the P in the APP form, with the remainder as AOP.

Initial soil P levels were very low (6 pounds of available P per acre). Soil series was a Parsons silt loam with 2.3% organic matter.

#### Results and Discussion

Results of the 4-year investigation indicated good P response despite moisture limitations in 1974 and 1976. As expected, first-year yields were highest from 100 or 200 pounds of P per acre.

The second year, yields were good from the initial 200-pound application and the annual 50-pound applications. The 100-pound application, only residual in the second year (1975), gave a significantly lower yield than either of the other two.

Third-year data (1976) indicated that the initial 200-pound P application was starting to become fixed in the soil. The 50-pound annual treatments and the

100-pound treatments (applied in 1974 and 1976) were both significantly more effective than the first-year 200-pound application.

The fourth year showed annual 50-pound applications slightly superior to 100-pounds every other year, and 13 bushels per acre superior to 200 pounds the first year only.

Means for the 4 years indicate no significant differences because of first-year (1974) yields.

Yield differences between P sources were non-significant throughout the 4-year study.

Soil test values at the end of the study indicated that the P treatments had essentially doubled the available soil P during the study. Soil pH at the end of the study was 6.1.

#### Conclusion

Results indicate that heavy, one-time P applications for grain sorghum are not so effective as annual applications. Biennial applications were more effective than applications once in four years.

For maximum efficiency, phosphorus should be applied annually because phosphorus fixation is quite likely in the acid soils of southeastern Kansas.

Comparisons of ortho- and polyphosphate materials indicate no significant difference.

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Table 1. Residual effects of phosphorus on dryland grain sorghum yields, 1974-1977.

P <sub>2</sub> O <sub>5</sub> rate lbs./A	Application time	Yield, bu/A				
		1974	1975	1976	1977	Mean
Control	- - - -	28	51	26	63	42
50	Annual	40	70	42	79	58
100	1974 & 76	45	65	48	76	59
200	1974	48	77	38	66	58
LSD .05		4	4	2	5	n.s.