The Effect of Phosphorus Fertilization on Chemical Composition and Forms of Phosphorus in Mature Corn Crops

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Past studies have shown that the use of limestone and phosphate fertilizers has markedly affected the chemical composition of corn crops grown on the poorer soils in Kentucky (9). The effect of these limestone and phosphate treatments varied somewhat, depending on seasonal conditions, and in most cases was greater in stover than in grain. Based on a 5-year average of the plots on the Campbellsville Soil Experiment Field, the use of phosphate fertilizers showed an increase in the phosphorus content of grain of 25 to 50% and in stover of 30 to 93% over that from plots receiving no treatments. On the Campbellsville plots there was a fairly good correlation between available phosphorus in the soil and the phosphorus content of the crop (8). This was particularly true when some allowance was made for the fact that the use of phosphate fertilizers was discontinued on several of the treated plots some 8 to 10 years prior to sampling and that both superphosphate and rock phosphate were used in the comparisons.

Many studies have shown that increasing the level of available phosphorus in the soil by the use of phosphate fertilizers will often increase the concentration of this element in crops grown in the soil. Little work has been done, however, that would indicate the form in which this additional phosphorus is held or how the different forms might be related to other constituents in the plant. Whether these things are related to crop quality and nutrient value is not known at present and an answer to the question must depend on their effect on seed viability and the feeding value of the crop. These matters should be of considerable practical as well as scientific interest to agronomists and nutritionists in view of studies going forward on the relationship of soil composition to crop quality and nutritive value. DeTurk, et al. (1) have recently studied the form of phosphorus in the corn plant at different growth stages in two different hybrids grown on soils of two levels of fertility. The behavior of the two hybrids as to phosphorus content was very different on the soils of high and low fertility.

In spite of the fact that the seed is the vital and storage organ for a new crop and is not thought to be readily affected by environment as the vegetative parts of the plant, it seems to vary appreciably in phosphorus content with phosphorus concentration in the soil. Whether most of this variation occurs in the embryo or in the endosperm may affect the vitality of the seed. If most of it occurs in the endosperm (phytin fraction), its effect in aiding the development of the plant becomes of considerable importance. The feed value of hays grown on soils of high fertility (10, 11, 12) has been found to be due in part to an effect on coarseness of forage and a hardness of grain rather than the actual availability of phosphorus itself. It was the opinion of these workers that a chemical analysis in the ordinary chemical analysis. But they do show differences in total composition with treatments related oftentimes to form of a constituent present in plants as, for example, nitrate phosphorus. The continuation of studies of this kind along with other measures of quality, including trials, should eventually be a basis for establishing nutrient quality on a more nearly quantitative basis.

This investigation is an attempt to throw some light on these questions by determining in what way the form of phosphorus in corn crops and low concentration of phosphorus, and it is hoped, by determining also how these forms might be related to other chemical constituents in the soil and

MATERIALS AND METHODS