

SOIL DEPLETION REDUCES FEEDING VALUE OF CROPS

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It has long been known that a large portion of the soils in Illinois are deficient in available phosphorus. This deficiency was originally discovered by the fact that applications of phosphatic fertilizers to the land were often accompanied by substantial increases in crop yields. There are, however, some soils where there is no crop response to added phosphate, and such soils as a rule are well supplied with available phosphorus. Phosphate fertilizers in various forms have been and are still recommended and sold to the farmer solely on the basis that such fertilizers are profitable because of the resulting increased crop yield. Apparently up to recent years, there has been only limited emphasis placed on the desirability of adding additional phosphorus to the soil so that this in turn would add more of this important mineral to the feed of farm animals.

There is an increasing interest in the phosphorus content of crops grown on various soils. It has been discovered that some very serious livestock diseases may be traced directly to a phosphorus deficiency in their ration, and this in turn has been traced directly to a phosphorus deficiency in the soils over which the animals grazed or from which was collected a large part of their feed. The seriousness of this problem may best be illustrated by statements from men who are in close touch with various phases of agricultural problems.

Mr. G. C. Smith, Farm Adviser in Pope-Hardin counties in extreme southern Illinois, in his 1942 annual report states: "We have fewer reports of cattle breaking down in their backs since we have so many limed and phosphated pastures. Several years ago Doctor Walker had dozens of cases of cattle that went down in their backs. They were cured by an injection of calcium gluconate. The trouble was a lack of mineral in the feed, according to the veterinarian."

In an address before the 28th (1942) Annual Meeting of the Illinois Agricultural Association, Dr. W. L. Burlison said, "Chemical analysis indicates that the phosphorus content of crops grown on many of our light colored soils is now so low as to induce serious nutritional diseases in man and animals. It is a very significant fact that this phosphorus deficiency does not occur in forage crops grown on land which has received liberal applications of either rock phosphate or superphosphate."

Dr. T. S. Hamilton, who is engaged in animal nutrition research at the University of Illinois, has made some very pertinent statements regarding the function of phosphorus in the nutrition of farm animals. In an address before the Western Phosphate Conference, September, 1940, Doctor Hamilton said: "When animals subsist for long periods of time on forages which contain less than about 0.15 per cent (3 pounds per ton) phosphorus on the dry basis, aphosphorosis is a possibility, although there is usually no consistent and serious damage until the phosphorus content drops below 0.12 or 0.13 per cent (2.4 or 2.6 pounds per ton)." He explained that aphosphorosis is primarily a disease associated with phosphorus-deficient soils and consequently phosphorus-deficient forage crops.

These statements are quite definitely agreed on the serious possibilities of phosphorus deficiency in our soils and in our crops. The fact that a considerable portion of Illinois croplands have been found deficient in available phosphorus, along with the finding of a corresponding deficiency of phosphorus in forage crops grown on these lands, and the establishment of a limit value for desired amounts of phosphorus in these crops represent significant progress in research work on this particular problem.

Probably the largest areas of phosphorus-deficient soils are in southern Illinois and especially in the Ozark hill

TABLE 1.—PHOSPHORUS CONTENT IN POUNDS PER TON FOUND IN LEGUMES AND GRASSES FROM FOUR SOUTHERN ILLINOIS EXPERIMENT FIELDS

Soil Treatment	Ewing	Raleigh	Sparta		Elizabethtown			
	Alfalfa	Red clover	Lespedeza	Corn Stover	Timothy	Redtop	Bluegrass	Orchard grass
Phosphate added....	3.4	4.8	6.0	2.4	2.6	3.2	3.6	4.4
No phosphate.....	2.2	2.6	2.0	1.0	1.8	2.0	1.8	1.8

region of the extreme southern part of the State. In this hill region is located the Elizabethtown (Hardin County) experiment field from which some of the data in Table 1 were obtained.

The amounts of phosphorus found in timothy, redtop, bluegrass, and orchard grass (Table 1) from unphosphated land on the Elizabethtown field are far below the 3 pounds-a-ton limit given by Doctor Hamilton. Also from this field red clover and alfalfa hay on unphosphated land was found to be far below the 3 pounds-a-ton limit. Also in Table 1, alfalfa, red clover, lespedeza, and corn stover from unphosphated land on the Ewing, Raleigh, and Sparta fields had a phosphorus content far below the 3-pound limit. The experiment fields at Ewing, Raleigh, and Sparta are also located in southern Illinois and represent the more level to gently rolling farm lands.

As pointed out by Doctor Burlison, when forage crops are treated with liberal amounts of either rock phosphate or superphosphate the deficiency of phosphorus in the forage is largely overcome. This is apparent from the results in Table 1. When phosphate was added to the soil, the amounts of phosphorus in the forage were increased in most cases above the 3 pounds-a-ton limit. The exception to this were timothy hay and corn stover. Corn stover from the most fertile soils is seldom found to contain as high as 3 pounds of phosphorus per

ton. The average is more nearly 2 pounds of phosphorus in a ton which includes stalks, leaves, sheaths, and husks. The amount of phosphorus in timothy hay may be brought up to and above 3 pounds a ton on these soils by the addition of phosphate alone, however, timothy responds to a more general improvement of the soil, that is legumes, residues, manure, and potash are usually needed in addition to the phosphate. In some cases lespedeza has been found to have requirements similar to timothy in this respect.

Phosphorus deficiencies in soils and crops are not confined to southern Illinois. Forage crops from experiment fields in both central and northern Illinois show some very decided deficiencies in phosphorus content. The Morrow plots in central Illinois produced red clover hay from untreated land with a phosphorus content of 2.2 pounds per ton of hay (1942). Red clover hay from limed land on the Joliet experiment field in northern Illinois had a phosphorus content of 1.8 pounds per ton of hay. Kentucky bluegrass from untreated soils on the Joliet field (1942) was found to contain 2.2 pounds of phosphorus per ton of hay. These values were considerably below the 3 pounds-a-ton limit. The use of phosphate in various forms on these central and northern Illinois soils has as a rule increased the phosphorus content of the forage crops to considerably above the 3 pounds-a-ton limit.