**NUTRIENT STATUS OF SOILS IN COMMERCIAL POTATO PRODUCING AREAS OF THE ATLANTIC AND GULF COAST: I. BACKGROUND AND ORGANIZATION OF THE STUDY**

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The Atlantic and Gulf Coast states have been heavy users of fertilizers for many years. Recent studies (8) have shown that farmers in the southeastern states have averaged spending about 14 cents and the New England farmer about 5 cents out of each dollar of cash income for fertilizer.

In 1943, farmers in North Carolina returned in fertilizers about 60% as much nitrogen, 430% as much phosphoric acid, and 158% as much potash as was removed in the crops harvested. The nitrogen supplied in the fertilizers in North Carolina was just about equivalent to that contained in the nonlegume crops. The relative balance between phosphoric acid added as fertilizer and that removed by crops harvested in the various states is shown in Table 1 and Fig. 1. This does not take into account the quantities returned in manure. The geographic distribution of the fertilizer has been by no means uniform within these areas. Potatoes and truck crops usually receive large amounts of fertilizer, 1 ton or more per acre being the common practice. Tobacco is also fertilized rather heavily with cotton ordinarily receiving a moderate application. The cereals, hay crops, and pastures generally receive relatively small applications.

Examination of the cropping pattern discloses the fact that the heavily fertilized crops, such as potatoes, truck crops, and tobacco, tend to be concentrated in certain areas and even on a given farm the heavily fertilized crops will recur more frequently on certain fields best adapted to them.

Analyses of the mineral content of crops show consistently lower contents of phosphoric acid than of nitrogen or potash, whereas the ratios of mixed fertilizers used with few exceptions show a higher content of phosphoric acid than of nitrogen and potash. The average ratio of all fertilizers used in the nation in 1941 was 1-2.6-1.7. This ratio in fertilizers has been justified on the basis of the fact that phosphorus is often the first limiting factor on soils not previously fertilized and that a portion of the phosphorus added in fertilizers is fixed in unavailable forms. On soils of high fixing capacity fertilized at low rates of application this justification may continue to be valid for some considerable period. It might be questioned, however, where heavy rates of application are repeated annually for long periods of time. Very little phosphorus is lost by leaching while nitrogen and potash are lost more readily in this manner, especially on the lighter textured soils. Is it possible that the capacity of soils for rapid fixation of soluble phosphate might eventually become saturated? What is the value to succeeding crops of the residues left in the soil from heavy phosphate fertilization? We have seen many studies showing soil deterioration under prevailing management systems. May there not be other situations in which the soils are improving in some respects?

The fact that considerable accumulation has occurred is supported by reports of several published investigations (1, 2, 4, 5, 6, and 11) and by extensive unpublished data from the various experiment stations. In addition to numerous unpublished reports on the crop value of these residues, some of the published studies include those of Anderson, Morgan, and Nelson (1), Brown (3), Morgan and Jacobson (9), Bushnell (5), Odland and Crandall (10), Volk (14), Ware (15), and Hester, et al. (7). Considerably more evidence seemed necessary before extensive changes in fertilizer practice could be safely recommended.

Early in 1944, representatives from several eastern seaboard states met with some members of the Division of Soils, Fertilizers, and Irrigation, U. S. Dept. of Agriculture, at Beltsville, Md., in a seminar to review some of the evidence on the extent of accumulation and the crop value of soil residues from phosphate fertilization.

Following this discussion plans were initiated for a more critical study of this problem. After due consideration potato-producing areas were selected as a starting point. This is a crop which is grown in all states from the Gulf Coast to Maine and is fertilized heavily. While initial plans were directed toward a study of the phosphorus residues, it was decided rather early to include other nutrients. At the outset, Alabama, North Carolina, Virginia, Maryland, New Jersey, New York, and Maine expressed interest in participating in the study.

The problem logically divided itself into two parts, namely, (a) sampling and analysis of the soils in commercial potato culture as well as comparable virgin soils of the same areas to determine the extent of accumulation of fertilizer residues, and (b) field experiments involving rates of application of plant nutrients to determine the crop-producing value of varying amounts of the residues. The results of these studies are reported in other papers of this series.

The approach was somewhat unique in that the farming system was the basic unit of study rather than the experimental plot. Attempts were made to...