NUTRIENT STATUS OF SOILS IN COMMERCIAL POTATO-PRODUCING AREAS OF THE ATLANTIC AND GULF COAST: III. PLANT RESPONSES TO FERTILIZATION

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Field experiments were conducted during 1945 in Aroostook County, Maine, and in Beaufort County, N. C., to determine the effect of rates of phosphorus applied to potatoes grown on soils having a wide range of readily soluble phosphorus. In addition, in Maine field experiments with rates of potash applied to potatoes were conducted on soils having a wide range of exchangeable potash. Principles suggested by an interstate committee were followed in conducting the field experiments.

MATERIALS AND METHODS

The chemical data from the soil samples collected in 1944 enabled the selection of locations for the fertilizer tests on soils having a wide range of readily soluble phosphorus. The locations selected in Maine were used also for a study of potash response.

In five experiments conducted in Richland township of Beaufort County, N. C., five rates of phosphorus were applied, namely, 0, 40, 80, 120, and 160 pounds of $\text{P}_2\text{O}_5$ per acre. A 5 x 5 Latin square design was used. At the Tidewater Station three additional treatments were added and four replications were used in a randomized block arrangement. The plot size was $\frac{1}{10}$ acre; six-row plots $21 \times 32$ feet were used at the first five locations and six-row plots $18 \times 37.3$ feet at the Tidewater Station. At harvest 2 feet were discarded at each end of each plot before yields were taken. Treble superphosphate was used as the source of $\text{P}_2\text{O}_5$. The amount of calcium applied with each treatment was kept constant by adding enough gypsum in each mixture to equal the calcium supplied with the highest rate of treble superphosphate. The mixtures were prepared so that a uniform amount of calcium applied with each treatment was kept constant by adding enough gypsum in each mixture to equal the calcium supplied with the highest rate of treble superphosphate. The mixtures were prepared so that all plots received the same amount of nitrogen and potash (100 pounds of N and 200 pounds of K$_2$O per acre). The sources of nitrogen were as follows: one fifth from ammonium sulfate, one fifth of one half from nitrate of soda, and one eighth from blood. Potash was supplied as muriate (60% K$_2$O). The fertilizer was applied with a potato planter having two bands, each one 2 inches to the side of and on a level with the lower plane of the seed piece. The variety planted at each location is indicated in Table 3.

The potash rate tests were located adjacent to the phosphorus rate tests. In each of these tests, potash was applied at the following rates: 100, 150, 200, 250, and 300 pounds of K$_2$O per acre. A 5 x 5 Latin square design was used. The dimensions of the plots and the method of applying the fertilizer were the same as those used in the rate of phosphorus tests. All plots received the same amount of nitrogen and phosphorus (100 pounds of N and 160 pounds of P$_2$O$_5$ per acre). The fertilizer mixtures were made up as indicated above.

The growing season in Maine was favorable for potatoes until about the first week in August; however, this was followed by a dry period of nearly three weeks in mid-August. The amount of rainfall that occurred when normally under Aroostook County conditions is very rapid. The period of dry weather was especially favorable for the development of aphids and flea beetles, resulting in high populations of these insects which soon seriously damaged or killed the potato plants. Particularly low yields were produced at location No. 1, where an early variety was planted on relatively gravelly soil.

RATE OF PHOSPHORUS TESTS

The yield data from the six phosphorus experiments conducted in North Carolina are summarized in Table 1. Increases in yield obtained from treatment at all locations. However, increases from individual increments of 40 pounds of P$_2$O$_5$ were not large enough to be statistically significant in any case, except at the location where the soil contained a very low amount of readily soluble phosphorus (48 pounds P$_2$O$_5$ per acre). Significant linear treatment effects were obtained at four of the locations. The yields, as illustrated in Figure 1, are expressed as increases of total yield from individual increments of 40 pounds of P$_2$O$_5$ per acre.