The Influence of Acid-forming and Neutralized Fertilizers on the Soil Reaction and Nutrient Level in the Irish Potato Row During the Growing Season

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A LARGE percentage of the potato fertilizer used in eastern Virginia is applied at time of planting, in bands approximately 2 inches to the side of and from one half to 1 inch below the seed piece. Much of this fertilizer material is labelled neutral, and, as shown by previous work at this station (2), its continued use does not cause a permanent acidifying influence in the soil. On the other hand, the “acid-forming” fertilizers, which are still used to some extent, have been shown by work conducted on the Eastern Shore of Virginia (3) to exert a permanent acidifying influence on the soil when used continuously for a number of years. Blume and others (1) at this station have shown that band placement of fertilizer influences the salt concentration at various locations in the potato row.

This investigation was started as a result of a question raised by several potato growers in this section as to what fertilizing procedure should be followed with potatoes when the soil reaction was favorable for scab development. It was suggested that an acid-forming fertilizer be used in place of the neutral fertilizers commonly used. In view of the lack of information on the effect of these fertilizers on the soil reaction during a single growing season, an experiment was set up on a Woodstown sandy loam at the Experiment Station in Norfolk to determine whether the acid forming material would lower the pH of the soil in the potato row during the growing season.

Materials and Methods

The fertilizer material used was a commercial 5–10–5 and was 10% acid-forming, requiring 200 pounds of limestone per ton to render it neutral. The nitrogen in the fertilizer was supplied by ammonia solution (2.25 units), ammonium sulfate (2.4 units), and organic material (0.35 units). The phosphorus was supplied by 20% superphosphate and the potassium by 62% muriate of potash. The fertilizer carried 1.66% MgO in the form of dolomitic limestone. Three treatments or variables were used. Treatment 1 consisted of the commercial 5–10–5 fertilizer, treatment 2 of the same material with 200 pounds of fine dolomitic limestone (80% through a 200 mesh screen) added per ton to render the fertilizer neutral, and treatment 3 was the same as treatment 1 with 500 pounds of the limestone added per ton. The mixtures were applied in bands at time of planting, 2 inches to the side of and slightly below the seed piece, with a top delivery hopper at the rate of 2,000 pounds of 5–10–5 fertilizer. In order to allow for the added limestone, the rates for treatments 2 and 3 were 2,200 and 2,500 pounds per acre.

For treatments 2 and 3 were 2,200 and 2,500 pounds per acre, in Onley to check their location with reference to the fertilizer bands. Here the pH was lowered as much as 1.0 to 1.5 units at the 2–mon. and 3 mon. after the fertilizer had been applied and before harvest. In taking the soil samples a shank was cut a cross section in the row from the surface to 4 inches below the fertilizer band. From three locations or sampling locations in each 275-foot row, samples were taken for the composite. Cork borer (2 inches in diameter) were used to take the samples pushed into the soil 2 to 3 inches and parallel. Two such borings were made at each of the locations for each composite.

There were two 275-foot rows, 40 inches apart, and the composite samples were taken from:

A. 2 inches above the fertilizer bands.
B. 2 inches to the side of the fertilizer bands.
C. 2 inches below the fertilizer bands.
D. in the fertilizer bands.
E. between the fertilizer bands.
F. along the edge of row away from the fertilizer influence.
G. 2 inches to the side of and between A.

The samples were air dried and screened through a 2-mm screen. pH determinations were made with a Beckman pH meter using a soil-water ratio of 1:1. Potassium, and calcium were extracted with the Morgan universal extracting solution (4) and the determinations run according to a procedure similar to that described by Pech and English (5). The exact procedure will be described in detail in bulletin at a later date. The nitrate tests were run according to the AOAC procedure for soils.

Samples were also taken from two potato rows, the 10% acid-forming fertilizer at the Onley station. The samples were taken to check the influence of the material on a lighter soil, Sassafras sandy loam. Season from the middle of March to the last day for potatoes at both locations. Thirteen and 25 lb. of rain fell during this period at Onley and 20
ton at a later date. The nitrate tests were run according to the AOAC procedure for soils.

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Ten to twelve days before digging the potatoes root weights were determined at one place in Norfolk and at three places at Onley to check their location with the fertilizer band.

Discussion of Results

INFLUENCE ON SOIL REACTION

From the data in Table 1 it is evident that there was a wide range in the soil reaction in 1948 during the 1948 growing season. There was a lowering of the pH in the row as the growing season progressed while the soil reaction between the rows (sample F), largely away from the fertilizer influence, did not change appreciably during the growing season.