EFFECT OF SOIL CHARACTERISTICS AND FERTILIZATION ON POTATOES AS REGARDS YIELD AND TISSUE COMPOSITION

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A CONSIDERABLE portion of the Red River Valley of northwestern Minnesota produces the Irish potato as a principal cultivated crop. The soils of this region belong to the chernozem-like group and are developed on material filling the basin of glacial Lake Agassiz, forming one of the most extensive areas of level land in the world. The high organic matter content of the soil imparts a black color to a depth varying from 10 to 20 inches. The subsoil is highly calcareous, the principal carbonates being those of calcium and magnesium deposited in a gray or olive gray clay. The productivity of the land is somewhat limited by hot, dry summers characteristic of the region, the average rainfall during the six warm season months (April to September) being approximately 16 inches.

Potato growers of the area have used commercial fertilizer on the potato crop for many years. The natural fertility of the soil, coupled with limited precipitation, is not conducive to heavy applications of plant food. A 3-year rotation is usually practiced, consisting of potatoes (fertilized in the row) and small grain in which sweetclover is sown. The sweetclover is plowed down the following June and the land fallowed for the remainder of the year. Potatoes or sugar beets are planted on the land in the following spring.

EXPERIMENTAL METHODS

Early in 1941, 12 experimental fields were selected as being representative of the potato-growing area. Three soil types were represented as follows: Three fields of Ulen loamy sand, three of Bearden silt loam, with the remaining six fields being Fargo silty clay loam. Previous experiments with nitrogen, both alone and in combinations, had shown little increase in yield after applying this element. The plan followed was to cooperate with potato growers who were interested in determining the value of phosphate and potash fertilizers on these soils. All of the fields were 80 rods or more in length and were planted by the grower using his own seed stock and equipment. It was not practical to plant all 12 fields with the same variety, and therefore, the three varieties, Early Ohio, Early Triumph, and Irish Cobbler were planted. The investigators noted little indication that potato variety effects were of significance in this study, and hence, such effects were disregarded.

A 12-row section was selected near the center of each of the 12 fields. Four of these rows received no fertilizer, and the remaining eight rows received superphosphate (43% P₂O₅) at the rate of 125 pounds per acre applied with an attachment to the planter. Four of the phosphated rows were then top-dressed with muriate of potash (60% K₂O) at the approximate rate of 200 pounds per acre. The plots were cultivated and the potatoes were sprayed regularly by the growers at the same time as the remainder of the field.

The lower stems of the growing plants were tested for soluble nitrate, phosphate, potash, and chlorine in July and again as the plants neared maturity in September. The method used for the first three elements has been outlined by Thornton, Conner, and Fraser (4). The nitrate content of the plants was shown to be...