SOME LIMITATIONS OF PLANT JUICE ANALYSES AS INDICATORS OF THE NUTRIENT NEEDS OF PLANTS

J. M. POEHLMAN

IN an investigation on the adaptation of Morse and Virginia varieties of soybeans to different soil types, studies were made of the concentrations of nitrates, phosphorous, and potassium in the expressed plant juice of the two varieties. If any differences in concentrations existed, it was thought that they might help to explain the yields of these varieties as manifested on different soil types in different seasons. In addition to the contribution to the problem of varietal differences, an analysis of the data shows many observations on and some limitations of the use of plant juice analyses as indicators of the nutrient needs of plants which are summarized and presented here.

REVIEW OF LITERATURE

Gilbert (4) determined the nitrogen, phosphorous, and potassium of plant extracts by colorimetric methods and found a relationship between the amounts of the elements present in the plant juice and the amounts of the corresponding fertilizing elements added to the soil. Gilbert, McLean, and Adams (6) found concentrations of nitrates, phosphates, and potassium in the plant juice influenced by factors which would limit or inhibit growth, such as deficient amounts of fertilizing elements, and unfavorable weather and cultural conditions. Critical concentrations of nitrates, phosphates, and potassium which should be maintained in the plant sap for optimum yields are suggested by Gilbert and Hardin (5) who found that the current amounts of these elements in plant extracts are influenced materially by the amounts supplied the crops in chemical fertilizers.

The lowering of the freezing point of cell sap by the application of fertilizers to the soil is reported by McCool (9). He suggests that a phosphorous deficiency in the soil may be detected by cell sap studies of crops grown on it. Austin (1) reports that soil type and the application of phosphorous and potassium fertilizer affects the phosphorous and potassium content of the cell sap of soybeans grown in the greenhouse. He believes the soil type to be a greater factor in determining the composition than the application of moderate amounts of fertilizers. McCool and Weldon (10) observed that the application of mineral nutrients to the soil as fertilizers generally resulted in increased concentrations of those elements in the juice and that if one element was limiting, the others would accumulate in the plant juice. Ponder (3) reports that variations were found in the potassium content of the expressed juice from stems and leaves of plants grown on different soil types, but these variations were not related to soil texture. Cook (2) studied the effect of soil type and fertilizer on the nitrate content of the expressed sap of small grains and reports the nitrate content of the sap to be increased by applications of nitrogen fertilizers, but to be decreased by the application of other fertilizers that

1Contribution from the Department of Botany, University of Missouri, Columbia, Mo. Received for publication December 15, 1934.
2Instructor in Field Crops, formerly Graduate Assistant in Botany. The author expresses his appreciation to Dr. W. J. Robbins under whose direction the investigation was carried out.