furic acid added, and the material heated in a glycerine bath at 150° C for 1½–2 min. If the material is overheated, a charring occurs which interferes with the results of the test. The color develops quite rapidly while heating, going through the stage of pink to purple to a very deep wine-purple color.

Attempts were made to employ a standard liquid reagent by dissolving the chromotropic acid in concentrated sulfuric acid, but this proved unsatisfactory since the reagent (chromotropic acid) decomposed upon standing with the sulfuric acid. An excess of chromotropic acid is needed for maximum color development.

Because of the extreme sensitivity of the reaction, it is of the utmost importance that the glassware used be absolutely free of the 2,4-D. The author has encountered difficulty in running blank reactions with test tubes that had been washed thoroughly with soap and hot water and put through rinses of clean water because of the trace of 2,4-D left in the reaction vessel.

TABLE 1

Acid	H_2SO_4	+ Chromotropic acid
Acetic	No color	Purple
Chloroacetic	" "	Weak pink
β-Brompropionic	Brown	Brown
Butyric	Pinkish-brown	Brown-reddish-pink cast
Maleic	No color	Brownish-yellow
Malic	" "	Yellow
Tartaric	Yellow	Yellow changing to bright green, finally to brown
Lactic	"	Yellow
Oxalic	No color	Light pink
Dinheptylacetic	Brown	Brown
Phenylacetic	Yellow	Yellow
2,4-Dichlorophenylacetic	No color	Pink
o-Chlorophenoxyacetic	Pink	Wine-purple
p-Chlorophenoxyacetic	No color	Reddish-pink
2,4-Dichlorophenoxyacetic	" "	Wine-purple
2,4-Dibromophenoxyacetic	" "	" "
Benzoic	" "	Brown
2,4-Dichlorobenzoic	Pink	Dark pink
4-Chloro-2-methylphenoxyacetic	No color	Brownish cast
2,4,5-Trichlorophenoxyacetic	" "	Wine-purple
Pentachlorophenoxyacetic	" "	" "
Indole acetic	Light pink	Light pink
Naphthalene acetic	No color	Pinkish-brown
Salicylic	Brown	Brown
Stearic acid	Yellow	Yellow
Phenylethyl acetate	"	"

This test is not entirely specific for the 2,4-D, as other organic acids will also give this color. However, it is sufficiently characteristic to make its use feasible in the identification of the 2,4-D, even when it is extracted from plant material.

Table 1 gives the characteristic reaction of a number of organic acids and one ester with both sulfuric acid and the sulfuric acid-chromotropic acid mixture.

It is interesting to note that, in the aromatic acids, only the halogen derivatives of these acids react to give a characteristic color. An example of this is the phenylacetic acid and the 2,4-dichlorophenylacetic acid. Some difference is noted also in the position of substitution. For example, the *o*-chlorophenoxyacetic acid gives a much deeper color with the reagent than the *p*-chlorophenoxyacetic acid.

While the mechanism of this reaction has not been determined—and so far we have used it only as a qualitative method—there does appear to be a possibility that the reaction could be put on a quantitative basis. We have found that, by employing varying quantities of 2,4-D, a more intense color results as the quantity of 2,4-D is increased. However, the technique is not sufficiently refined to enable one to determine the differences consistently between runs, and occasionally the relationship does not appear to be linear in the same run. This is probably due to the failure of the technique employed in carrying out the reaction.

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Proposed Method for Measuring the Movement of Soluble Fertilizer Salts in the Soil

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During the past 17 years the author has had an opportunity to use various types of lysimeters in studying the movement of soluble salts in the soil during the growing season. One of the uses made of the data collected from these lysimeters was to advise growers concerning the extent of leaching of plant nutrients from the soil. The installation of lysimeters and the collection and analyses of the leaching therefrom requires rather elaborate installation costs and detailed procedures.

In the past few years a simple system of measuring the movement of soluble salts in the soil has been under study and has been very valuable from the standpoint of recommending fertilization practices for different soil types. The system consists of sinking 10′ × 10′ frames of 12″ boards about 6″ in the soil. To the soil in these frames a definite amount of chloride ion is added by dissolving it in a given amount of water and sprinkling it uniformly over the soil. As many different conditions as desired can be established, and frames can be placed on as many different types of soil as conditions warrant.

The installation in this study consists of frames established on three different soil types: (1) Evesboro sand, (2) Woodstown sandy loam, and (3) Sassafras loam (clay subsoil). Part of the frames are kept clean cultivated and the others are in sod. After thoroughly sampling the soil, 500 gm of potassium chloride is added at the beginning of the growing season. Soil samples are taken periodically, usually at monthly intervals, from the 0–9″ and 9–18″ depths. The samples are carefully screened and 50 gm placed inside of a collodion bag in an extraction flask (Fig. 1) with 50 ml of water on the inside and 50 ml on the outside of the bag. After allowing the chlorides to come to an equilibrium (usually a period of 24 hr), a portion of the clear solution on the outside of the bag is titrated with silver nitrate using potassium chromate as an indicator.

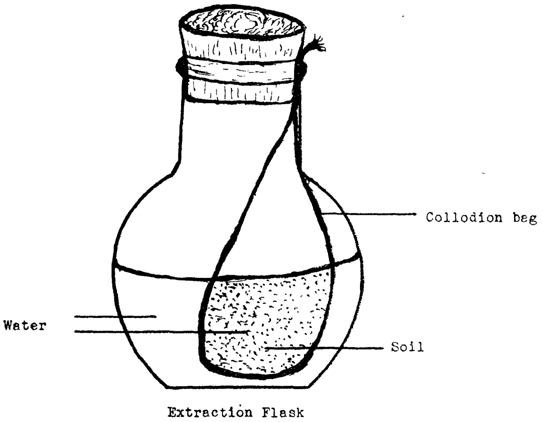

FIG. 1. Dialysis through collodion bag to insure clear extract.

The correlation of the movement of the chloride ion with rainfall is shown in Fig. 2.

In 1946 and 1947 the percentage of the chlorides that have moved through 18 inches of the soil has been calculated periodically, and the growers of this section have been advised of their loss. In other words, after a period of heavy rainfall the samples can be drawn, the chlorides determined, and, from the previous analyses, the amount of soluble chlorides lost can be calculated. Therefore, interpolations in terms of soluble plant nutrients such as nitrates and accompanying cations can be made. This information has proved very valuable to the growers from the standpoint of furnishing them additional knowledge regarding the amount of fertilizer to use in sidedressing operations. From the standpoint of final yields, the system has been extremely valuable, and for this reason this preliminary information is being presented.

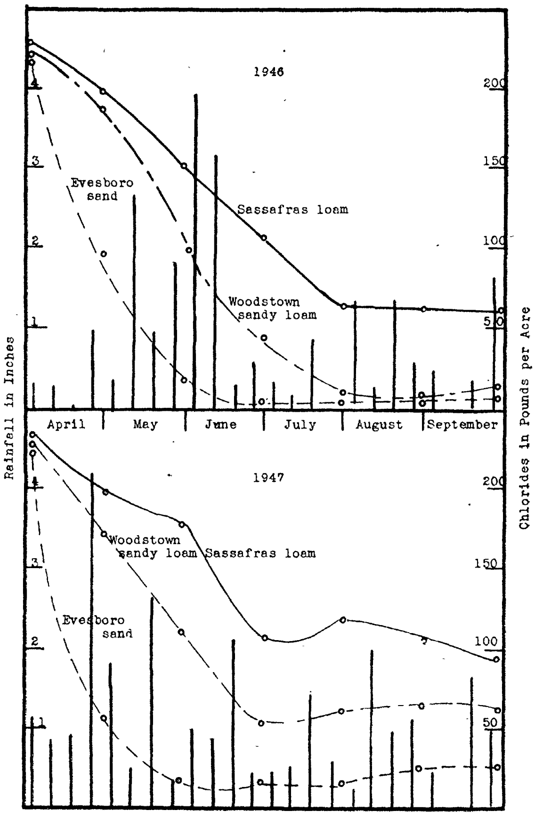

FIG. 2. Leaching of chlorides through 18″ of soil.

It is believed that after accumulation of these data for a number of years the loss can be calculated from the rainfall records without actual analyses.