Plant Studies with Radioactive Sodium

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DURING the past 2 years, studies concerned with the influence of Na on plant growth have been in progress at this Station. These consisted of sand culture, potted soil, and outdoor cylinder trials. In certain of these tests, Na\textsuperscript{22} was introduced for the purpose of studying the distribution of Na in various plant parts, its rate of absorption and translocation by different plants, and the influence of varying K and Na levels on the uptake of Na. This contribution presents some of the results obtained.

**Experimental Methods**

For the plants that were grown in sand culture, the technique of Robbins (5)\textsuperscript{1}, with some modifications, was employed.

Radioactive Na\textsuperscript{22} was added as the chloride at rates varying between 0.5 and 2.5 microcuries per pot or cylinder, the rate depending upon the specific purpose of the test.

The plants grown in the tests, when harvested, were fractionated into various parts, depending upon the species involved, dried at 70° C, and ground in a Wiley mill for analysis.

Assay of the content of Na\textsuperscript{22} in the plant was conducted on the ash of plant parts. From 100 to 500 mgms of oven-dried material, the quantity used depending upon the suspected activity, was ashed in a small pyrex planchet at 600° C, cooled, and the ash compressed into a layer of uniform thickness. The activity of the sample was counted using a Geiger-Muller-tube with a window thickness of 2.96 mgms per cm\textsuperscript{2} and a Tracerlab Autoscaler. The activities of all the samples reported in the tables are expressed in terms of the total number of disintegrations per minute per gram of oven-dried plant material.

Chemical analysis of the plants or plant parts was performed by the system suggested by Toth (8) et al.

**Results and Discussion**

**Absorption of Na\textsuperscript{22} by Various Plants**

The use of radioactive elements in plant studies is not a new technique (1, 2, 3, 6). Except in special cases (4, 6), the information gained by their use can be acquired by standard methods. But radioactive elements can be used to advantage to obtain supplementary information that cannot be arrived at by other methods and to reduce the time required for analysis.

One of the first problems in this study was the determination of the proper dosage of Na\textsuperscript{22} to obtain activities of measurable magnitude in the plant. Resistance from published tests was limited, since very few of the studies specifically listed the dosage of the radioisotope (6, 7).

Na\textsuperscript{22} has a half life of 3.0 years and emits beta and gamma radiations, the latter with an energy equivalent to 1.68 MEV. The first test consisted of an application of 0.5 microcurie of Na\textsuperscript{22} to a sand culture in which the effect of two K levels on alfalfa was being studied. The plants were mature at the time of application of the radioisotope. Later, the plants were harvested, fractionated into various parts, and the activities of these parts determined. The results of the test are given in Table 1.

The figures indicate that at the 0.5 microcurie level of application, the radioisotope could readily be detected in the various plant parts. The relation of Na\textsuperscript{22} in the various parts of the plant was related to the K level in the substrate. In the 19.5 ppm K series, the order of distribution was: roots > seeds > blossoms. With the 3.9 ppm K series, the order was: roots > stems > blossoms > seeds > leaves. Activities of all the plant parts, except the leaves, were greater in the 3.9 than the 19.5 ppm K series. Alfalfa plants have a low Na requirement. The results of this preliminary test were of great assistance in arriving at dosage rates of Na\textsuperscript{22} for other species.

Since the preliminary test indicated that the content of the substrate was the primary factor in the absorption of Na\textsuperscript{22}, the studies were extended to plants of several species grown at varying K levels in a complete nutrient solution.

Table beets, Detroit Dark Red variety, arrived at maturity in sand cultures at 19.5 ppm K and Na. Seven days before harvest, one of Na\textsuperscript{22} was added to the surface of the plant in with a small amount of nutrient solution.