Abies, of which I have seen few satisfactory specimens because of the dropping of leaves and cone scales on drying.

The tissue-killing effect of this solution also lightens immeasurably the burden of preparing material of such difficult plants as Crassulaceae, Portulacaceae, Aizoaceae, and other fleshy groups, even in a dry climate.

Direct Introduction of Chemical Substances Into Herbaceous Plants[1]

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During studies concerned with the effect of 2,4-D upon plants the need for a means of introducing chemicals into any desired part of herbaceous plants, without either injuring the plant itself or taking up too much of the experimenter's time, became obvious. The principal methods of treatment hitherto used have major drawbacks.

The solution to be tested is placed upon the upper surface of a leaf blade either in the form of a drop or in a small disk of filter paper (*2*, *3*). Also, pellets containing mixtures of a paste-like carrier and growth regulators have been used (*1*). Necessarily, these treatments are limited to those organs of the plant which, by virtue of their shape, support a drop of liquid or a disk of moist filter paper. They are not feasible for application to erect or inclined parts or to surfaces of a repellent or impermeable nature. The injection method (*4*) is not practicable with herbaceous plants in large-scale experiments because it is too time consuming; also, the inner turgor of the tissues usually prevents penetration of additional fluids from outside, and the cells are readily injured or ruptured when even a minimum of liquid is forced into them.

A good deal of knowledge is still lacking with regard to the fundamental facts about the mechanism of growth, metabolic systems, and correlations between physiological and morphological developments in plants. This ignorance may be due to inadequate means employed in tracing and analyzing various phases of reactions which take place in the intact growing plant.

Attention is called here to a technical device used by Winifred O. Roberts (*5*) in diagnosing mineral deficiencies in leaves, and also developed independently by the author for experiments with plant growth regulators. The fact that essentially the same method was conceived by researchers of different countries seems to confirm the need for, and the versatility of, the technique.

Needles formed from florist steel wire No. 30 are threaded with 2–3 inches of white mending cotton. The thread is soaked to saturation in the solution to be tested and drawn through the desired part of the plant. The needle is then severed from the thread, the latter being left inside the tissue (Fig. 1). If a continuous supply of a substance is desired, the end of a longer thread may be left immersed in the solution, thus serving as a wick. Powdered substances may be introduced similarly by making them adherent to a slightly moistened thread. If the exact amount of introduced substance is to be determined, the thread may be dried after soaking and the differences in weight of the treated and untreated threads calculated for any given length. It has been observed that a thread impregnated with a solution of 2,4-D, dried, and then introduced is equally effective.

There was no instance of a detectable effect from puncturing the tissues with the needle or introducing a thread soaked in distilled water. In order to avoid contact of the plant sap with metal, the wire may be replaced by a plastic or glass-fiber material. The time factor involved in using this method for experimental purposes is negligible. An unskilled worker can prepare 60–80 needles per hour, and the treatment of 150 plants requires about one hour.

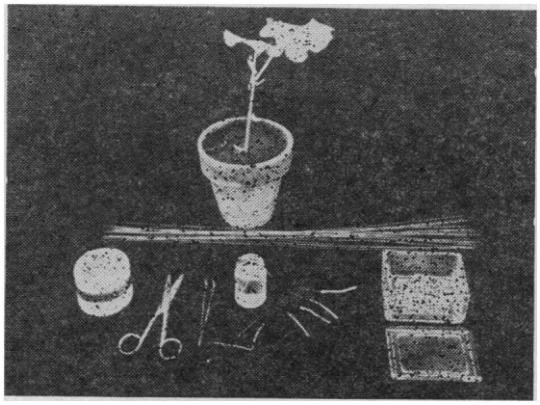

FIG. 1. Thread introduced in the first node of a bean seedling (above), and tools used in preparing threaded needles (below): wire, mending cotton, scissors, flat forceps, and glass bottle for soaking threads. Square glass jar (right) is used for storage of threaded needles.

The "thread method" already has been used successfully in experiments conducted to test (1) the responsiveness of specific morphological parts of bean plants to 2,4-D, (2) the transport of 2,4-D within the plant, (3) the effect of 2,4-D in relation to acid and alkaline systems of plants, and (4) the pH in the growing plant, by using threads impregnated with indicator solutions. In some of the experiments several thread tests involving various time intervals between the single treatments, have been used on the same plant. A detailed report of these studies will be published elsewhere.

This method seems to be useful in cases where (1) specific areas of a plant cannot be reached by applying a drop, (2) minimum amounts of a substance are to be introduced, and (3) the capacity of specific tissues is to be tested relative to absorption, accumulation, or transport of metabolic or artificially introduced substances. The method offers innumerable possibilities of experimental tests with normal and diseased plants and may facilitate new discoveries of both morphological and physiological correlations and the fundamental mechanism of growth.

References

1. BEAL, J. M. *Bot. Gaz.*, 1944, **106**, 165–178.
2. LUCAS, E. H., and HAMNER, C. L. *Mich. agric. exp. Sta. Quart. Bull.*, 1947, **29**, No. 3, 256–262.
3. MITCHELL, J. W., and HAMNER, C. L. *Bot. Gaz.*, 1944, **105**, 474.
4. ROACH, W. A. *Ann. Bot.*, 1939, **3**, 156–226.
5. ROBERTS, WINIFRED O. *J. Pomol. hort. Sci.*, 1946, **22**, 184–188.

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