of the septate fibre is to give mechanical strength and serve for storage of food material is not quite correct[5]. In tropical woods, non-septate and septate fibres, and even vessels, have been observed to serve as storage tissues in living trees (Chowdhury, K. A., unpublished work).

A detailed account of this investigation will be published elsewhere.

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[1] Govindarajalu, E., and Swamy, B. G. L., *Nature*, **176**, 315 (1955).
[2] Vestal, P. A., and Vestal, M. R., *Bot. Museum Leaflet, Harvard Univ.*, **8**, 16 (1940).
[3] Purkayastha, S. K., Proc. 40th Ind. Sci. Congr. (Abstracts), 98 (1953).
[4] Chowdhury, K. A., *J. Ind. Bot. Soc.*, **33**, 1 (1954); Proc. 8th Int. Bot. Congr. (in the press).
[5] Harrar, E. S., *Tropical Woods*, **85**, 1 (1946). Spackman, W., and Swamy, B. G. L., *Amer. J. Bot.*, **36**, 804 (1949).

## Effect of Hormone Herbicides on the Growth of *Rhizobium trifolii*

In view of the widespread use of hormone-type herbicides on mixed stands of crop plants containing clover as an essential constituent, it would appear to be of considerable importance to determine the effect of these substances on the growth of the clover nodule-forming organism. This is particularly true of the phenoxybutyric compounds which have been recommended for use as herbicides where clover is present, since they have been shown by Wain[1] and other workers to have no harmful effect on clover due to the latter's lack of the β-oxidizing enzyme system.

The substances investigated in this experiment were the sodium salts of 24*D* (2 : 4-dichlorophenoxyacetic acid), *M.C.P.A.* (2-methyl-4-chlorophenoxyacetic acid), 245*T* (2 : 4 : 5-trichlorophenoxyacetic acid), 24*DB* (γ-(2 : 4-dichlorophenoxy)butyric acid), and *M.C.P.B.* (γ-(2 methyl-4-chlorophenoxy)butyric acid). They were incorporated in a yeast–mannitol agar[2] in the appropriate concentration of acid equivalent. Two agar plates were prepared for each concentration. A standard suspension of a known effective strain of rhizobium (*Rh. trifolii* 157) was prepared in sterile distilled water and three loopfuls were streaked on each Petri dish of agar. The plates were incubated at 24° C. for four days.

From the results it is clear that the herbicides had no effect on the growth of *Rhizobium trifolii* at concentrations up to 25 p.p.m. Beyond this level, the growth was moderate to poor up to 500 p.p.m. The bacteriostatic point lies beyond 500 p.p.m. but has not yet been determined. It will be noted that the butyric-acid compounds 24*DB* and *M.C.P.B.* were slightly less toxic than the acetic-acid compounds 24*D*, *M.C.P.A.*, and 245*T*.

Table 1

| Substance / Conc. p.p.m.* | 24*D* | *M.C.P.A.* | 245*T* | *M.C.P.B.* | 24*DB* |
|---|---|---|---|---|---|
| 0 | +++ | +++ | +++ | +++ | +++ |
| 1·0 | +++ | +++ | +++ | +++ | +++ |
| 5·0 | +++ | +++ | +++ | +++ | +++ |
| 25·0 | +++ | +++ | +++ | +++ | +++ |
| 50·0 | ++ | ++ | ++ | +++ | ++ |
| 100·0 | + | + | + | ++ | ++ |
| 200·0 | + | + | + | ++ | ++ |
| 300·0 | + | + | + | + | + |
| 400·0 | + | + | + | + | + |
| 500·0 | + | + | + | + | + |

* Acid equivalent. + poor growth; ++ moderate growth; +++ good growth.

Relating these figures to soil conditions, 1 acre of topsoil to 8–9 in. depth contains approximately 3 million pounds of moist soil. This refers to 'mineral' soil with about 3–12 per cent of organic matter. A convenient figure for the weight of topsoil of an arable field to the deliberately vague specification of 'plough depth' would be 2¼ million pounds or 1,000 tons. If the actual content of active growth substance in an application, on reaching the soil, is as much as 1 lb., the momentary concentration in the topsoil (assuming even distribution) is 0·5 p.p.m. approximately.

These are the concentrations over the whole mass of soil. But the substance is effective against plants or microbes only to the extent that it dissolves in the soil water. Assuming no adsorption but complete solution, and a 20 per cent water content of soil, the concentrations become 2–2·5 p.p.m. = 1 lb./acre approximately. Since the growth of *Rhizobium trifolii* is unaffected by concentrations up to 25 p.p.m. (= 10 lb./acre), it can be assumed that the concentrations used in agricultural practice (usually 1 lb. of the acid equivalent per acre) will have no adverse effect on the growth of *Rhizobium trifolii* even assuming that all of it reaches the soil.

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[1] Wain, R. L., *Agric. Rev.*, 1 (1955).
[2] Fred, E. B., Baldwin, I. L., and McCoy, E., "Root Nodule Bacteria and Leguminous Plants" (Madison, 1932).

## Growth of Lettuce Seedlings

The methods of growth analysis[1] have been applied to comparatively few horticultural crops; yet, as stated by Gregory at the Thirteenth International Horticultural Congress in 1952 [2], these techniques open up a wide field in horticultural research and are an essential basis of any attempt to understand the control of growth by environmental factors.

The following results were obtained with lettuce (*Lactuca sativa*, Linn.), variety Cheshunt 5*b*, during the course of an investigation of the rate of recovery of seedlings from the check of transplanting, full results of which will be reported elsewhere. The study was confined to the first three or four weeks of growth; that is, up to or beyond the normal stage for planting out. Plants were raised at various seasons in growth rooms and also during mid-winter in a heated glasshouse. In the growth rooms, plants were grown at constant temperatures of 70°, 60° and 50° F., day-lengths of 16 and 9 hr., and light intensities, at plant-level, of approximately 650, 400 and 250 ft. candles, using fluorescent daylight tubes. Net assimilation-rates were obtained by the usual formula[3], leaf areas being calculated from length and breadth measurements, excluding the petiole. Good