may be limited by the rate at which energy becomes available from the products of respiration, at least between 5° and 30° C.

In the present experiments, the temperatures of the root and of the meristematic region were found to act and interact in the regulation of leaf expansion. Other experiments, to be reported elsewhere, will show that changes in shoot temperature also produce specific responses independently of root and meristem temperatures. The expansion of young maize leaves is therefore sensitive to (*a*) the temperature of the leaf tissue, (*b*) the rate of transpiration, (*c*) the meristem ambient temperature, (*d*) the temperature of the root system in transpiring plants, and (*e*) the water status of the tissue in the meristematic regions when the root zone is cooled below 5° C.

If the behaviour of other species is equally complex, conventional phytotron experiments relating plant growth to temperature will yield little information relevant to field conditions, for most phytotrons are designed to keep the whole plant at the same temperature. To understand how plants respond to natural microclimates, growth must clearly be studied in relation to differences in temperature between different plant organs.

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Long Term Persistence of Parathion in Soil

PARATHION, an early organophosphorus insecticide introduced commercially in 1947, is, like most other compounds in this group, considered to be relatively non-persistent on plants and in soil. West[1] reported its persistence to be 5–12 days on plants, and Lichtenstein[2] showed that 97% of a soil application disappeared within three months.

Field plots, established at Kentville, Nova Scotia, in 1949 to study the persistence of parathion in soil and its uptake by plants, received annual spring applications of 31.4 lb per acre (15.7 p.p.m. soil concentration) of parathion from 1949 to 1953 inclusive. The compound was thoroughly incorporated to a depth of 6 inches with a rotary cultivator and various crops have been grown each year up to the present.

Parathion residues were at first determined by the relatively non-specific colorimetric method of Averell–Norris[3]. Chisholm *et al.*[4] found that parathion disappeared rapidly from the soil, the concentration after five annual spring applications of 15.7 p.p.m. being only 0.5 p.p.m. in the autumn of 1953. By 1964 the soil concentration had fallen to 0.2 p.p.m. The Averell–Norris method, however, does not distinguish between parathion and degradation products containing aromatic nitro or amino groups.

The acquisition of a flame photometric detector[5] prompted a reinvestigation of these plots in an attempt to identify the compound or compounds in the soil responsible for the characteristic magenta colour produced by the Averell–Norris reagent. Soil samples representative of the 0–4, 4–8, 8–12 and 12–16 inch depths were collected from each of four plots in the spring of 1969. After air-drying at room temperature the soils were extracted with hexane–acetone (1 : 1) in a Soxhlet extraction apparatus, and the extracts concentrated to 2 cm^3/g of soil. Preliminary observations, using a Tracor MT-220 gas chromatograph with a Melpar flame photometric detector and 3% OV–17 column, indicated that a substance containing phosphorus and sulphur, with a retention time identical with that of parathion, was present in the soil at a concentration of about 0.1 p.p.m. Further work using a 2% DEGS column and a 10% DC–200 column confirmed that this substance was indistinguishable from parathion by gas–liquid chromatography. No other sulphur or phosphorus-containing compound was detected in the extracts.

The relative phosphorus–sulphur response given by this substance in the flame photometric detector was the same as that of parathion. Its distribution coefficients[6] in three solvent systems (hexane–acetonitrile; heptane–90% ethanol; iso-octane–80% acetone) were also identical with those of parathion. Finally, the presence of parathion in this soil was confirmed by thin layer chromatography of soil extracts on silica gel plates using several solvent systems. Parathion was detected on the plates by an esterase inhibition technique[7] and the flame photometric response of material eluted from the appropriate position on the chromatogram. Several solvent systems acetone; hexane–acetone (1 : 1); methanol–chloroform (1 : 1) extracted almost identical amounts of parathion from the soil. Methanol extracted smaller amounts. Addition of one part water to nine parts air-dry soil before Soxhlet extraction did not improve extraction yields.

During the period 1949–69 there was little downward movement of parathion in this sandy loam soil (sand 57%, silt 15%, clay 28%, organic matter 3.7%, *p*H 6.2) even though the average precipitation was 42 inches per year (Table 1). Samples taken outside the perimeters of the plots indicated a small amount of lateral movement which appeared to be a result of cultivation.

Table 1 Parathion Residues in Experimental Plots (1969)

Depth (inch)	p.p.m. Parathion*
0–4	0.060
4–8	0.063
8–12	0.008
12–16	Trace

* Average of four replicates.

About 0.1% of the total parathion applied to the plots remained in 1969, 16 years after the last application. The reason for this long persistence in soil, hitherto unreported for an organophosphorus pesticide, is unknown. It is possible that parathion may be dissolved in lipids of the soil organic matter and thus be protected from bacterial degradation and hydrolysis.

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