A NOTE ON POT EXPERIMENTS WITH "GAMMEXANE"* (BENZENE HEXACHLORIDE) IN SOIL.

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SUMMARY.

Pot experiments with single eye sugar cane setts planted periodically in thoroughly mixed "Gammexane" and soil in proportions from 1 : 250 *to* 1 : 50,000 *were carried out. The "Gammexane" used was a commercial dust containing* 10% *BHC* (1·3% *gamma isomer*).

"Gammexane" damaged the roots in the series 1 : 250 *to* 1 : 10,000.

The proportion of root weight of a treated series to that from the corresponding check was taken as the root growth attainable in a particular "Gammexane"–soil mixture at a known time after mixing.

It was not practicable to evaluate the half-life of "Gammexane" in soil through its effects on root growth. This is due to a distinct change in the system about 16 *months (in this instance during the second summer) after the "Gammexane" and soil were mixed. Further long-term work is necessary to elucidate the basic reasons for this change.*

INTRODUCTION.

The persistence, phytotoxicity, and residual effects in soil of benzene hexachloride (BHC), particularly in crude commercial form such as "Gammexane," have been studied or mentioned by workers abroad and in Australia.

According to one of the earlier references (Stoker, 1948), "the manufacturers have issued a warning [in England] that for two years following the use of BHC dusts for wireworm control, potatoes grown on treated soil are liable to be tainted." There is now a considerable literature on off-flavour caused by BHC, and attempts to counteract this effect by soil treatments have been recorded (Turner, 1950). In small-scale experiments, Smith (1948) estimated from chloride analyses that 80-94 per cent. of BHC remains in the soil after 18 months, and Sakimura (1949) reported that the residual toxicity of hexachlorocyclohexane in the soil is remarkably high after 19 months, which is quite contrary to the findings in aerial applications.

* When these experiments were commenced "Gammexane" was the trade name of the only benzene hexachloride product available for commercial purposes in Queensland.

Wilson and Choudhri (1948) reported on the effect of BHC on soil organisms, and Ashby (1950) and Foster (1951) recorded phytotoxic effects and some plant responses to this insecticide. Petty (1951) remarked that the effect of BHC on soils has not been fully determined. Of these authors, only Foster, when dealing with one determination of greenhouse soil containing BHC for three years, approached the time period covered by somewhat similar work in Queensland.

Mungomery (1949) covered experiments with BHC to control "greyback" cane grub (*Dermolepida albohirtum* Waterh.) in North Queensland canefields, and also discussed large-scale commercial applications during 1947-49. The persistence of this material as a soil insecticide in the field was demonstrated effectively by the outstanding results obtained in protecting the crop for three years with a dressing of 75 lb. per acre of 20% BHC dust containing 2·6% gamma isomer applied in suitably placed bands.

Concurrent with the earlier field work with BHC in North Queensland, Buzacott (1948) studied BHC in pots. Similarly the pot experiments reported here and briefly mentioned earlier (McDougall, 1947) were undertaken as part of an investigation of BHC against wireworms in canefields. Although the control of these pests does not require an insecticide with a persistence of more than a few months (McDougall, 1948), the obvious effects of BHC on cane root development warranted a continuation of the work. The objective was to evaluate the half-life of BHC in the soil.

METHOD.

Series of seedling pots, four inches in diameter and six inches high, were filled with thoroughly mixed "Gammexane" and soil in proportions from 1 : 250 to 1 : 50,000. The "Gammexane" used was a 10% crude BHC in pyrophyllite containing 1·3% gamma isomer, and the greyish soil was typical of the wireworm country in the flat forest areas of the Mackay district (McDougall, 1934). There were 10 replicates of each treatment, and for checks the proportionate amounts of pyrophyllite only were mixed with soil.

A single bud sett of one of the sugar cane varieties HQ426 and Q50 was planted in each pot four or five times a year. The selection of the variety for a particular planting depended on availability, and only buds from the top third of the stalks were used. Six to nine weeks after planting the setts were lifted, washed in water, and their roots removed carefully. After further washing in industrial alcohol for one or two minutes, the roots were pressed gently between sheets of blotting paper, and then weighed. The proportion, expressed as a percentage, of root weight of a treated series to that of the corresponding check was taken as the root growth attainable in a particular "Gammexane" and soil mixture at a known time after mixing.

The original series were set out in early June 1946, and the last root weights were taken on October 19, 1948. During December 1947, a second series of freshly-mixed checks were added. All the pots were kept in the open on concrete tables at the Central Sugar Experiment Station, Mackay, and as well as the watering necessary to promote growth in pots, they were subjected to 138·24 inches of rain.

RESULTS.

It was not possible to separate the different treatments and checks by the appearance of shoots. This could be expected, as "Gammexane" does not affect the bud or eye, and even under field conditions primary shoots may develop and exist without root development for some months.

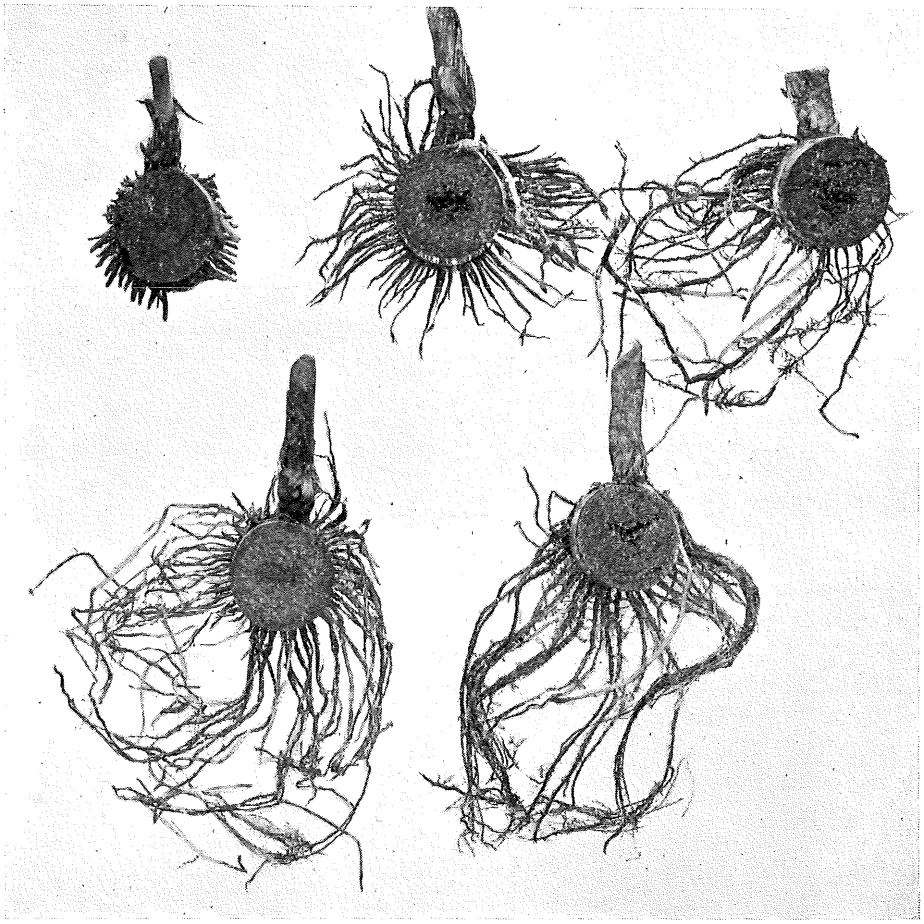

Fig. 1.

Root Development Associated with Single-eye Setts of Sugar Cane from BHC-treated Soil 400 Days after Mixing. A 10% "Gammexane" dust (1·3% gamma isomer) was used, and the mixture strengths were from top left, 1:500, 1:1,500, 1:2,000, 1:10,000 and check (soil-pyrophyllite only). Setts were taken from the soil six weeks after planting.

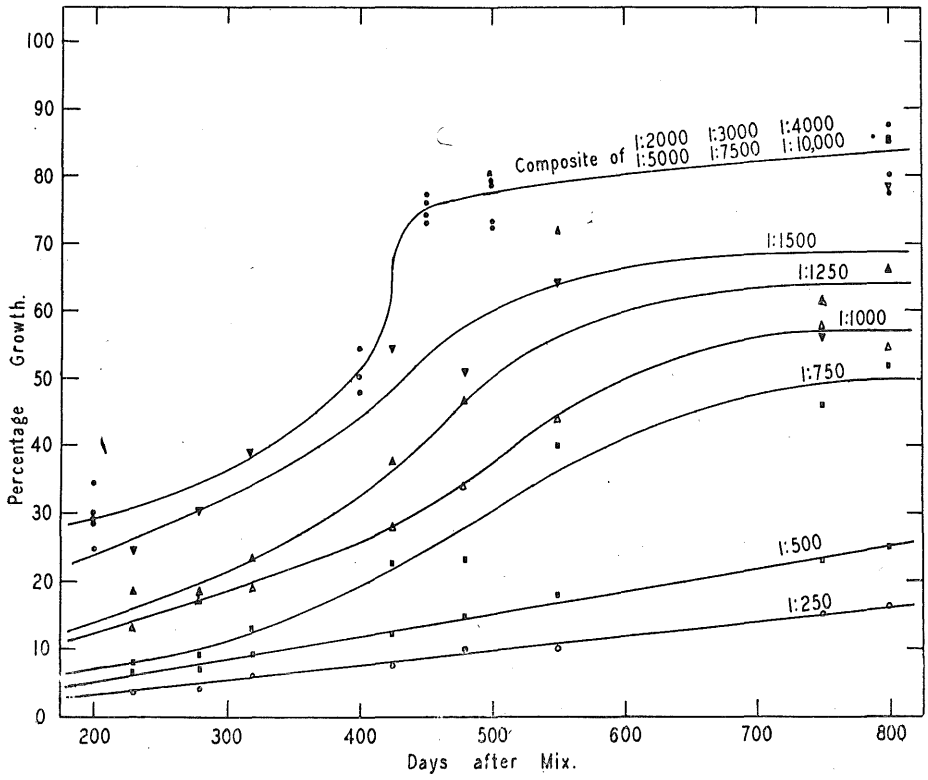

Fig. 2.

Graph Showing Percentage Root Growth 6-7 Weeks after Planting in BHC-soil Mixtures of Various Strengths. A 10% "Gammexane" dust (1·3% gamma isomer) was used.

In the series with mixture strengths of 1:20,000 to 1:50,000 there was only an indication of slight occasional interference with root growth during the first six weeks after mixing, but the differences between treatments and checks were not significant. Typical root damage by "Gammexane" in the series 1:250 to 1:10,000 is illustrated in Fig. 1, and results are presented in Fig. 2. The use of root weights from the newer checks during the last 10 months of this work did not alter materially the slopes of the curves.

DISCUSSION.

The insertion of further points for the curves in Fig. 2 does not interfere with their validity, and the publication of the tabulated data from which this figure was drafted would not help in the interpretation of results. Furthermore, the use of half log. graph paper does not clarify the issue. From inspection of Fig. 2 it is not practicable to evaluate the half-life of "Gammexane" in the soil, through its effects on root growth. This is due to a distinct change in the system which becomes apparent about 16 months after the "Gammexane" is thoroughly mixed with soil. A point of interest

is that the change coincides with the second summer after mixing. Further long-term work is necessary to decide if this change marks the beginning of BHC breakdown into products which are more potent root growth inhibitors, the slow accumulation of such products to effective concentrations or the inter-reaction of "Gammexane" and soil.

The practical aspects of this project concern the fact that for wireworm control in canefields (McDougall, 1947, 1948, 1949) "Gammexane" is applied in a band, which allows a concentration well above 1:10,000. This will be discussed further when the author's major field work on wireworm control with "Gammexane" is reported.

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