with Eureka 2, and in each case the resistant progeny will be back-crossed to Eureka 2 until sufficient of its genotype has been recovered. These recovered lines should all be morphologically similar, but during the course of the selection it may be possible to include a marker gene so that at a glance one can tell from which source the resistance has been added. At present, it is not known whether all the resistant varieties given above have different genes for rust resistance. In at least certain of them, the genes appear to be allelic. Despite the absence of this information the programme will not be affected, for should a new rust arise, then all those recovered lines that prove susceptible will be discarded. It is most unlikely that all resistant progenies obtained from such a diverse collection of parents will succumb at one time to the same rust. One or more of the surviving ones will, of course, be released for cultivation.

Preparing Gabo for the occurrence of a new strain of stem rust has not proved so simple, as this variety is already resistant to the Australian races. Continuous back-crossing to Gabo, using, say, Kenya 117*A* as the non-recurrent parent, would probably only recover the present Gabo resistance, unless there was available for test a specific race to which Gabo was susceptible. As such is not present here, and it seems unwise to introduce it, the programme is being carried out in two steps. The progeny of the Gabo × Eureka 2 cross mentioned above has been back-crossed twice to Gabo and selection has been for stem-rust susceptibility. After one more back-crossing, probably sufficient of the Gabo genotype will have been recovered. To this susceptible strain of Gabo will be added in turn the resistance of those varieties of the above collection. These recovered, resistant strains of Gabo, together with the resistant Gabo now being cultivated, should give some hope that even if a new race of rust does arise, one or more varieties will be immediately available capable of resisting it.

This programme is not being complicated by leaf-rust resistance at present, as this latter is a separate project. It is proposed to combine leaf- and stem-rust resistance as soon as practicable. A method closely resembling the one outlined for Gabo and Eureka 2 is being followed in breeding for rust resistance in linseed. Punjab is taken as the standard susceptible high-yielding variety. The resistance of several carefully selected parents is being added by the usual method of back-crossing.

I. A. WATSON

Faculty of Agriculture,
University of Sydney.
Nov. 4.

Effect of Crude Benzene Hexachloride on Wheat Seedlings

THERE are numerous published references to the unfortunate effects of benzene hexachloride on the development of plants, both from seed[1–3] and from the tuber[4]. In only one of these reports, however, is any reference made to the question of the exact identity of the constituent of the crude material which is responsible for these effects[3]. Of the many isomers and impurities present in the crude material, only the gamma isomer is recognized as important as an insecticide. If the effects of benzene hexachloride on plants are due to some other constituent, the potentialities of the material as an agricultural insecticide may be greatly extended. To settle this question, experiments were begun in March 1948 by treating seed wheat with various preparations and constituents of benzene hexachloride, and observing the effects on germination and development.

The evidence indicates that plant deformation is not due to the gamma isomer. A mixture of trichlorobenzenes prepared by alkaline breakdown of alpha benzene hexachloride possesses this activity in far higher degree, relatively small doses causing the ultimate symptom, inhibition of germination. The material is active in the vapour phase. Possibly this active material is 1,3,5-trichlorobenzene, which has been shown to have this property[5], possibly another trichlorobenzene or some other volatile breakdown product of benzene hexachloride. Under natural conditions it is produced most rapidly by the breakdown of the gamma isomer, more slowly by the alpha isomer and at a quite unimportant rate, if at all, by the beta isomer. The material is effective in such low concentration that it may well have applications in the field of selective weed-killers. The exact nature of the material is still under investigation and detailed results will be published shortly.

Benzene hexachloride preparations for wheat-seed treatment against wireworms should be materials of high gamma content, applied at the minimum practical rate for control. The hazards accompanying their use are likely to be increased by storage after treatment, especially if ventilation is inadequate, by exposure to sunlight and by deficient moisture or high *p*H of the soil.

I am indebted to Dr. J. H. Whyte, of the Department of Botany, University of Alberta, for his help on botanical aspects of this work; also to Prof. D. L. Garmaise, of the Department of Chemistry, University of New Brunswick, and to Messrs. Canadian Industries, Ltd., who kindly provided many of the chemicals used.

B. HOCKING

Department of Entomology,
University of Alberta,
Edmonton.
March 12.

[1] Kostoff, D., *Nature*, **162**, 845 (1948).
[2] McLeod, W. S., *J. Econ. Ent.*, **39**, 815 (1947).
[3] Stoker, R. I., *Ann. App. Biol.*, **35**, 110 (1948).
[4] Arnason, A. P., Fox, W. C., and Glen, R., *Can. Ent.*, **79**, 174 (1947).
[5] Gavaudan, P., and Gavaudan, N., *C.R. Soc. Biol.*, **133**, 348 (1940).

Persistence of Pyrethrins and Gamma Isomer of Benzene Hexachloride

IN view of Beckley's advocacy of pyrethrum dust for weevil control in bagged grain[1], the following comparison with the gamma isomer of benzene hexachloride is of interest.

Laboratory tests were made against *Sitophilus granarius* using wheat dusted with 0·5 and 1·0 p.p.m. gamma benzene hexachloride from a commercial benzene hexachloride dust diluted with kaolin, and with 5, 10, 20 and 27 p.p.m. pyrethrins from powdered pyrethrum flowers. The treated grain was kept in open jars for 2–16 weeks at 28° C. and 70 per cent relative humidity before introducing the insects, and the jars were then closed. Mortality counts were taken at intervals up to 28 days. The tests were run in quadruplicate and the usual precautions observed.