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Survey of Insect Pests at Rothamsted and Woburn

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soil, tend to accumulate. The loss of carbon and nitrogen from the soil probably depresses productiveness.

It is not yet clear whether other crops such as market garden crops would suffer the same kind of deterioration, though observations on certain market gardens on the same kind of soil and not far away from Woburn suggest that this may be so. No method of recuperation has yet been tested. This of course brings us back to the old problem of soil sickness, which formerly received much attention at Rothamsted. The earlier investigations were with horticultural soils and the treatment adopted was partial sterilisation, which has now become general. For farm land, however, this method is unsuitable.

It seems evident that the subject should be re-investigated. One special aspect, clover sickness, has been studied in conjunction with T. Goodey of the Institute of Helminthology, St. Albans; this work is still continuing.

(5) Although light soils are notoriously susceptible to drought we cannot find that either the wheat or the barley has suffered through lack of actual rainfall. A dry spell at a critical time may of course do harm, but over the fifty years there was no evidence of any uniform injury caused by dry weather. In 1933 in spite of the record drought, the annual rainfall being 17.8 inches only, we obtained on the light land at Woburn over 60 bushels of barley, 30 bushels of wheat, 14 tons of sugar beet and 8 tons of potatoes without excessive manurial treatment.

(6) The experiments show the conditions under which malting barley may be produced on a light soil.

(7) The acid plots have enabled us to study in detail the effects of acidity on plant growth, with the purpose of recognising the symptoms that appear before yields begin to suffer, and when therefore dressings of lime would be most advantageous and economical.

INSECT PESTS AT ROTHAMSTED AND WOBURN, 1932-3

H. C. F. NEWTON

GENERAL. The year was notable for very severe attacks: (1) on sugar beet by the Bean aphid, *Aphis rumicis* L. (plentiful also on the surrounding beans), (2) on kale by Flea-beetles (*Phyllotreta* spp.) in numbers sufficient to necessitate resowing, for the first time since 1930, (3) on barley by the Gout Fly, *Chlorops taeniopus* Meig. Damage by pigeons is increasing, and a large area of kale on Great Knott was stripped of its foliage when the plants were some six to eight inches high.

BROADBALK. *Wheat*. There was no winter attack by Frit Fly but some loss of plant by soil insects occurred during the winter months. Wheat Bulb Fly (*Hylemyia coarctata* Fall.) did not cause appreciable damage, though many tillers were destroyed; the attacked tillers on the fallowed plot were about twenty times more numerous than those on the unfallowed. Wheat Leaf Miner (*Agromyza (Domomyza) ambigua* Fall.) was rare; Wheat Midges (*Contarinia tritici* Kirby, *Sitodiplosis mosellana* Géhin) were notably less abundant, the figures for the last seven years being:

Year ..	..	..	1927	1928	1929	1930	1931	1932	1933
Percentage grain attack ..	..	..	3.2	6.5	7.7	17.6	21.4	15.4	2.1

HOOS FIELD. FOUR COURSE ROTATION. *Barley* suffered an unusually severe attack of Gout Fly ; Wheat Bulb Fly was generally present on the wheat, but the Leaf Miner was rare. The classical barley plots were fallowed.

BARNFIELD. *Mangolds*. An attack by *Atomaria linearis* Steph. the Pigmy Mangold Beetle, reduced the plant on certain areas, notably the 4N, 5N, 6N, 5A and 6A plots. *Bourletiella hortensis* Fitch, the Mangold Springtail, was also responsible for some loss of seedlings, especially on the northern side of the field. Damage by birds again occurred in a semi-circular area around the poultry experiment (chiefly plot 1AC) extending outwards some twelve rows. The damage consists in the loss of both cotyledons at an early stage before the second leaf appears, so that such as survive remain stunted. *Plectroscelis concinna* Marsh and *Pegomyia hyoscyami* Panz. were not seen.

GREAT KNOTT. *Kale* (second sowing). The first serious outbreak of Flea-beetles (*Phyllotreta* spp.) since 1930 destroyed the entire plant of the second sowing of kale. The species concerned were *P. undulata* Kuts. 50 per cent., *P. nemorum* L. 20 per cent., *P. atra* 14 per cent., *P. diademata* Foudr. 11 per cent., *P. vittula* Redt. 4 per cent., *P. nigripes* F. 1 per cent. The kale was sown on May 16th and was attacked during the last week in May and the first week in June ; the Flea-beetles spread across the field from the direction of Knott Wood—from south to north. Areas were sprayed with a hand atomizer using (1) paraffin and (2) a paraffin—pyrethrum extract, at a rate of one gallon to the acre. Two sprayings were given, but without ultimate effect. Atomized paraffin has been claimed in the past to be very successful as a repellent for these beetles. A difficulty with small areas is that the wind tends to drift the atomized spray, and it is possible that the complete treatment of the field would be more successful. No marked benefit resulted from the addition of the pyrethrum extract.

The kale was resown on 26th June. Except for slight damage on the most southerly rows it was untouched ; and in spite of the drought a reasonable crop was obtained.

First Sowing. On part of the field the kale had been sown earlier (26th April). This area escaped serious damage as the plants were well established in the cotyledon stage when the Flea-beetles appeared. *During the year the field was an excellent illustration of the importance of early sowing in connection with Flea-beetle attack.* This plot was later subject to severe damage by pigeons, the majority of the plants, when about 6 ins. high, being stripped of their assimilating tissue.

LONG HOOS. SIX COURSE ROTATION. *Sugar-beet*. A good "plant" was not seriously affected either by Springtails or the occasional *Plectroscelis concinna* Marsh that were present. The gappiness occurring later which necessitated some transplantation was only partly due to wireworm attack. Bad growing conditions were chiefly responsible and the plants "went off" with a blackening of the root resembling "Black Leg" symptoms. A heavy infestation of *Aphis rumicis* L., the Bean Aphis, followed, which together with the drought, brought growth to a standstill. On 17th August the whole plot had a yellowed appearance due to the effects of the aphid on the outer leaves. These leaves were now encrusted on their under-

sides with dead aphides and a mould-like fungus—the latter probably being instrumental in bringing the infestation to an end.

Barley. Considerable gapping of the plant at the end of April was caused by wireworm, but there was less Gout Fly than elsewhere.

Wheat and Forage Mixture suffered from wireworm attack in the early spring. *Sitona lineata* L. attacked the few beans left in the forage mixture; some of the oats were affected with a kind of "whitehead" due to the stem being ringed by an unidentified agent.

THREE COURSE ROTATION. *Sugar beet* suffered from Bean Aphis, but less so than the Six Course Rotation; rabbits destroyed occasional plants.

Barley. Wireworm attack continued during April and May, and was followed by an infestation of Gout Fly considerably above the normal.

Oats. Wireworm caused many bare patches in the oats in series III and II.

PASTURES. The barley experiment was attacked by wireworm in April-May, causing an uneven plant; on the wheat experiments the damage done by this insect was not significant.

Sugar Beet. No serious damage to the "plant" was caused by insects though an occasional wireworm was found. As in the rotation experiment, however, a large number of seedlings showed a blackening of the root and remained stunted—many eventually dying off. The striking difference in size between such plants and those unaffected was to be seen over the whole experiment. The symptoms could not be ascribed to insect attack, and though resembling those of Black Leg, were probably a drought effect. An attack of *Aphis rumicis*, less severe than on Long Hoos, followed.

GREAT HARPENDEN. *Brussels sprouts.* Early in the season some loss of plant was caused by hares or rabbits and by *Chortophila* (*Hylemyia*) *brassicae* Bché, the Cabbage Root Maggot. In the autumn and winter months a general but not severe attack of the Mealy Cabbage Aphis, *Brevicoryne brassicae* L. occurred. Only about 10 per cent. of the plants were infested to any extent, and of these only a third were badly infested. Syrphid larvae and Hymenopterous parasites were present, but the parasitisation was low. Three parasites were bred out. They were the Braconid *Aphidius brassicae* Hal, the Chalcid, *Asaphes vulgaris* Nees (= *aeneus* Walk.) the Cynpid, *Allotria brassicae* Ashm., the figures relative to Aphid numbers being 15 per cent., 8 per cent., 1 per cent., respectively. Of these the first is the only effective figure, as the two other insects are probably hyperparasites. These figures are extremely low—as the aphid is often parasitized 100 per cent.

Cabbage White Fly (*Aleurodes brassicae* Walk.) was plentiful during the same period.

Barley. Gout Fly severely attacked the crop, every third tiller of a number of plants examined being affected.

FOSTERS. *Wheat.* Wheat Bulb Fly was generally present. Thrips were unusually plentiful in the summer here, as on the other cereals.

LITTLE HOOS AND LONG HOOS. *Beans.* Attack by *Aphis rumicis* L.

WOBURN

The farm at Woburn was inspected on June 16th, but no serious insect damage was seen.

FUNGUS DISEASES AT ROTHAMSTED AND WOBURN, 1932-33

MARY D. GLYNNE

WHEAT

Mildew (*Erysiphe graminis* DC.) was slight by July on most of the wheat crops under observation. It was moderate on some plots of Broadbalk and on the Woburn Six Course Rotation, and varied from absent to plentiful on different parts of the Six Course Rotation on Long Hoos and the Commercial Wheat on Fosters.

Whiteheads (Take-All) (*Ophiobolus graminis* Sacc.) was found on wheat grown continuously or in alternate years on the same land, and was much more plentiful on the light land at Woburn than on the heavier land at Rothamsted. On wheat grown alternately with green manure on Stackyard and Lansome fields at Woburn the disease was moderate, reaching a maximum of about 13 per cent. plants infected. On certain plots of the Continuous Wheat, Stackyard field, as many as 43 per cent. of the plants were infected at harvest. Plots with a high soil acidity (pH below 5) were practically free from the disease. A detailed survey carried out since 1931 showed an increase in percentage diseased plants from 1931 to 1932 on all plots affected by the disease. In the following year there was an increase in infection in all plots numbering seven which, in 1932 had less than 35 per cent. infected and a decrease in infection in the seven plots which had 35 per cent. or more of their plants infected in 1932. The significance of this observation is not yet clear.

Loose Smut. (*Ustilago Tritici* (Pers.) Jens.) was rare except on certain blocks of the Precision Wheat on Lansome field at Woburn.

Brown Rust (*Puccinia triticina* Erikss.) was slight in July on most of the Wheat and was moderate on the Commercial Wheat on Fosters field and the Cultivation experiment on Pastures.

Yellow Rust (*Puccinia glumarum* (Schm.) Erikss. and Henn.) appeared in June and varied from slight and moderate to plentiful at Rothamsted, while at Woburn it was never more than slight.

Foot Rot (*Fusarium* sp.) was occasional on Broadbalk, slight on the Alternate Wheat and Green Manure experiment on Stackyard and a little more plentiful on the Green Manuring experiment on Lansome field, Woburn.

Leaf Spot (*Septoria Tritici* Desm.) of little if any economic importance, was found occasionally.

OATS

Mildew (*Erysiphe graminis* DC.) was generally slight except on the Forage oats grown on Pastures field, where it was plentiful.

Leaf Spot (*Helminthosporium Avenae* (Bri. and Cav.) Eid.) was slight on all oat crops grown at Rothamsted. None was grown at Woburn.

BARLEY

Mildew (*Erysiphe graminis* DC.) varied from slight to plentiful on different crops at Rothamsted, and was rare at Woburn.