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Aphid control in beets by means of aircraft

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The selection of a chemical for aphid control in beets is, when applied by tractor sprayers, quite dependent on the object aimed at. In order to check immediate sucking damage, the aphid population must, in a relatively short time, be reduced to a low level. If, however, infestation by virus-yellow has to be avoided, the plants must be free from virus-carriers and, for some time, be protected against infected aphids which come flying along. The aphids must not be given the opportunity to multiply on the beets, as the degree of infestation by virus-yellow is closely connected with the number of aphids on the crop. Besides, the number of infected winged aphids, coming on the crop from elsewhere, is of importance here. A mass action of these winged aphids may have general infestation of the crop as a result.

Sucking damage can very well be controlled with chemicals such as parathion, malathion and isolan, which give excellent results. Weather conditions must be favourable, however, (a temperature of not less than 10° C., high air humidity), while a large quantity of liquid (800—1,000 litres per ha) must be sprayed. For the control of virus yellow in sugar beets the systemically working chemicals, such as thiometon, demeton-methyl and phosphamidon are first of all considered. Besides a direct contact-kill of the aphids sprayed, the hidden aphids can also be reached and killed as the chemical is absorbed and translocated through the plant. The effect of these chemicals is greater than that of parathion. Chemicals, the effect of which is greatest, protect the crop for about 12 days.

Experiments made with aircraft in the Netherlands, a broad survey of which is given in this article, revealed that the selection of chemicals for aerial control of aphids in beets is more restricted than when tractor sprayers are used, which have a spraying capacity of 800 litres of water per ha.

The experiments have mostly been made with the Piper PA18A, which is equipped with the conventional spraying apparatus with Spraying System nozzles nr. D 6 and D 8 – 45. The total quantity of sprays amounted to 35 – 45 litres per ha.

Beets grown from seed

The control with parathion of the black aphid *(Aphis fabae scab.)* in beets grown from seed is mostly insufficient. Only the aphids in the highest stems were killed. Spraying on lower side-shoots had no or hardly any result. In a single experiment, during which 3 litres of parathion emulsion 25 % were applied under highly favourable weather conditions (high relative air humidity) the result was reasonable. In the plots treated with 2 litres of Isolan 20 %, about 80 per cent. of the aphids was killed.

Generally, however, the results of the sprayings were not such that for black aphid control in beets grown from seed, aerial application of these chemicals could be advised.

The results of aerial control with systemic chemicals are, if sprayed with great air humidity, very good.

Under these conditions the effect of the following chemicals in black aphid control was excellent

thiometon 1 and 1.5 litres per ha
demeton-methyl-thiolisomer
0.5and 0.75 litres per ha
phosphamidon 1 and 1.5 litres per ha

The greatest dosages have been given when heavy infestation in dense crops had to be *controlled.*

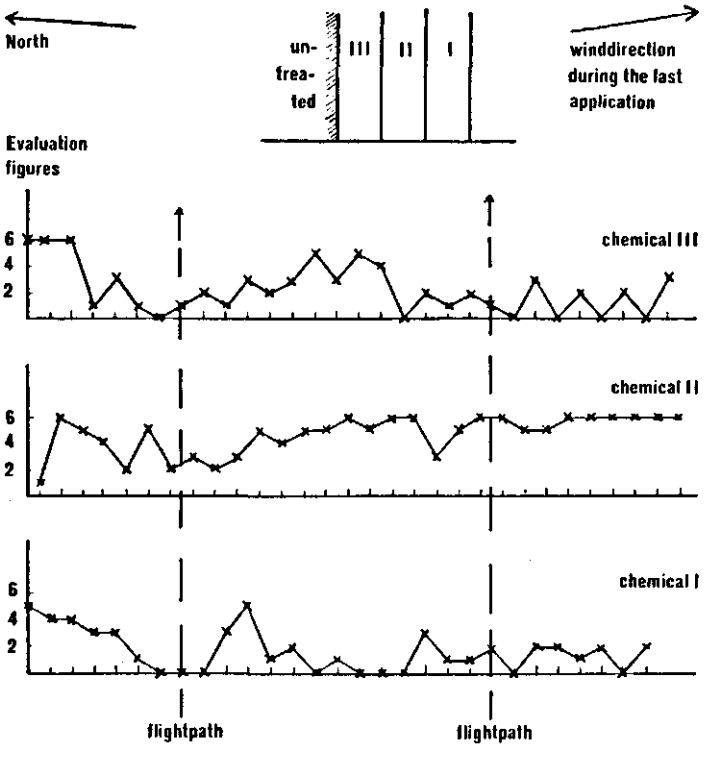
The great importance of the application of a systemically working chemical by aircraft equipped with the conventional spraying equipment, was clearly shown in experiments with Rogor, a chemical with a great penetrating effect, which, when applied by a tractor sprayer gives a high aphid-killing percentage in a large quantity of water. It has no systemic effect, however. In one experiment comparisons were made between spraying with 1 litre of Rogor per ha. and 1 litre of thiometon per ha.

The plants were heavily attacked by the black aphid. Weather conditions were, during the experiment (towards evening) particularly favourable. The final inspection took place four days after spraying. In the plots treated with Rogor, only about 40 per cent. of the aphids in the upper part of the plants, were killed. In the lower parts less than 10 per cent. was killed. In the plot sprayed with thiometon, all the aphids were killed in the entire plant. The result of an experiment with a double quantity of Rogor, was insufficient.

As an aircraft equipped with an apparatus for the atomisation of a quantity of 35 litres per ha, was not at our disposal, we could not investigate whether, if the crop would have been covered with a residue consisting of a larger number of finer drops than had hitherto been applied, better results would have been obtained with a non – systemically working chemical.

Sugar beets

It has become clear that, just as with beets grown from seed, aerial application of parathion gives an insufficient killing percentage of the black aphid. The aphids under the curled leaves hardly came into contact with this chemical. Here, too,



1. Survey of the aphid infestation on 29th June 1959 (0 = no or only winged aphids, 6 = colonies). Above: map of the trial

systemic chemicals gave much better results. In order to check infestation by virus-yellow, the first spray against the black aphid, and the green peach aphid *(Myzus persicae* Sulz) in particular, must be applied early to prevent the aphids from multiplying. In years when the weather conditions are favourable for the aphid to develop, such as the past season, sprayings must be repeated. That a second, and, if necessary, a third spraying is desirable before first treatment has ceased to have any effect and the aphids can multiply, became clear from an experiment made for a comparison of the effect between three systemic chemicals, – not to be named in this article – applied from the air. The chemicals have been indicated by I, II and III.

Three experimental spraying runs of 550 m long and 30 m wide were made in the middle of a field with beets; these runs were treated by plane. The rest of the field was treated by a tractor sprayer. Because of any possible drift of the sprays of the tractor sprayer, 10 m. on the upper wind part of the plots remained untreated.

The spraying apparatus of the plane was equipped with 26 Spraying System nozzles D 8—45. The quantity of liquid sprayed was 35 litres per ha.

Sprayings were applied on 25th May and on the 5th and 23rd June. The following details refer to the black aphid population as the green peach aphid was only found in small numbers.

On 22nd May, three days before the first spray, hardly any aphids could be found in the experimental plot. Only a few small colonies were found in an edge of the field next to the experimental plots.

Three days after had been sprayed, only a few living winged black aphids were found; this was about 2 per cent. of all the plants examined in the plots. Five days later, not a single living aphid was found.

On the 10th June, so five days after the second spray, there had just been a new flight of the black aphid. Living winged aphids were found on about half the number of plants in all the plots concerned. On the 16th June, too, only winged aphids were found; the number had fallen to about ¼. During this period of 11 days after the spray, the chemicals had been so effective as to prevent the formation of an aphid population.

On 23rd June, before the last spray, the plants were examined again. It now appeared, however, that in the weeks before, the winged insects had been able to multiply. Not any of the chemicals used had still sufficiently protected the crop. Colony formation had already started on the large leaves of the plant, and small colonies had already developed in their hearts.

The result of the third spray became clear during the examination on 29th June. Owing to the great number of aphids it was difficult to make exact countings. Another method has therefore been followed. At right angles to the rows (in this case also to the flying direction), three plants are alternately examined on the presence of aphids. Plants on which no or only winged aphids were found were given an 0 as valuation mark; those on which wingless aphids were scattered, were given a 1, and the plants with colonies a 2.

A survey of the aphid populations in the three experimental spray runs is given in graph 1, the totals of the valuation marks having been given per row. It is also shown in this graph how the wind can alter the spraying runs.

On the 29th June large aphid colonies had developed on the beet plants in the untreated part windward of the areas treated by planes.

In the mathematical working up of valuation marks, 15 rows at the upper wind side of the plots were every time ignored, to avoid the influence of drift. The sum of the valuation marks per object could be 0 in the most favourable circumstances (so only winged aphids), and 132 in the most unfavourable circumstances, which means colonies on every plant.

The totals of the valuation marks were:

untreated	132
chemical I:	29
chemical II:	113
chemical III:	44

This experiment revealed that, though dif-

ferences were found between the effects of chemicals, aphids could not entirely be killed on in the meantime fully developed plants in neither of the plots. This was also the case in parts treated with the tractor sprayer (600 litres of liquid per ha).
In this experiment the effect of the sprayings on the appearance of virus yellow was not so good. In about the middle of July beets infected with virus yellow were found all over the plot.
Visual differences between the relative experimental spraying runs and between the parts of the plot which were treated by aircraft and by the tractor sprayer, could not be observed. There were a few differences between the outcome of the sugar content-stipulations in beet in various experimental spraying runs, though they were not reliable (maximum difference 0.6 %).
The general infestation in all experimental plots with virus yellow has probably mainly been caused by the great aphid flights in June. Though the crop has been sprayed with systemic chemicals, aphids who come flying along from elsewhere may carry the virus as they only get into contact with the killing agent by sucking. Besides, according to the observations of the Institute for Rational Sugar Production at Bergen op Zoom, the sprayings for the control of the green peach aphid should have taken place on 20th May and 8th and 22nd June. The period between the second and third spraying in our experiment was 18 days, so that, in the latter part of this period, the green peach aphid, just as the black aphid, may still have had the opportunity to infest the beet plants via the wingless aphids.
Early in July there was a rather rapid decrease in the aphid population, which reduced the possibility of infestation of the already tall plants. On the whole, the beets in the entire area in which the experimental plot is situated, had to a rather high degree been infested by virus yellow.