CROP DESICCATION TRIALS

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ALTHOUGH the object of this Conference is to discuss various aspects of weed control, the purpose of this paper is to consider the use of certain weedicides in a rather different role, that of crop desiccants. Crop desiccation implies the wilting and drying out of plant leaf and stem by restricting the flow of sap in the plant. As a consequence, this function enables crops to be more easily harvested. It has been established that certain of the contact types of weedicides at low rates of application can bring about desiccation without permanent damage to the treated plant. These contact chemicals are not translocated into the roots as with the hormone weedkillers and therefore do not kill the plants. They have been used successfully in both potato and maize crops, but their greatest application is possibly on clover seed crops. This paper will be confined to their use on red clover and lucerne seed crops and reference will be made to trials incorporating various of the desiccant materials.

In a normal season between 2000 and 3000 acres of Certified Montgomery red clover seed are harvested in South Canterbury. This area has been as high as 8000 acres. This crop is not only an important one for the district, but it also represents over half the New Zealand acreage.

Before discussing the merits of the various crop desiccant materials let me first explain why they are of particular use on these crops. To do this it will be necessary to say something about the normal ripening process of these seed crops. The standard methods of harvesting will also be the subject of discussion, as this has a definite bearing.

Montgomery red clover is essentially a late-flowering red clover and the New Zealand strain has been designed to give a long spread of seasonal production. As a consequence it tends to flower over a long period. Although the crop is usually in full flower in February, a number of plants will continue to flower through into March and April. Seed usually matures during late March and April, but few crops are harvested then owing to excessive green leaf and stem which interfere considerably with harvesting operations.

There are two methods of harvesting red clover. One is to direct head the crop with the header harvester and the other is to cut the crop and thresh from the windrow with the pick-up header. Undoubtedly, under ideal harvesting conditions the windrowing method is capable of giving highest yields, due largely to early harvesting. Nevertheless, the practice is looked on with disfavour by most seed producers. They claim that while the crop is left to condition in the windrow it is in a particularly vulnerable state. It can be lifted and blown away by strong winds, and wet weather can cause seed loss and greatly impair the seed quality. In addition, damp conditions are likely to cause considerable second growth which tends to grow through the windrowed crop, making harvesting virtually impossible. Unfortunately at this time of the year, direct heading is out of the question because of the excessive amount of leaf and stem present. Where direct heading is practised it is usual for the standing crops to be left until leaves and stems are cut back by the first frosts. This is often as late as June and July, a time of the year unsuitable for crop harvesting. Thus, the delay from seed maturity to actual time of harvest can be as long as 10 to 12 weeks. Much can happen to a crop over this period. For instance, early maturing seed heads tend to open up and shed their seed, strong winds can partially strip a crop, and continued wet weather may cause sprouting and general deterioration

of seed. In addition at this time of the year there is only a limited period of 4 to 5 hours of the day during which crops are fit for threshing. This fact, along with normal delays due to wet weather, can cause harvesting to drag over a long period. In spite of these obvious disadvantages farmers still prefer this method of harvesting. They claim that direct heading nearly always produces some seed, whereas with the windrowing method they may stand to lose the entire crop, should adverse weather intervene.

Where direct heading is practised it stands to reason that any process capable of promoting an early harvest should result in greater yields per acre and improved quality seed. Crop desiccants claim to do this and do it very effectively. By their use earlier harvesting is made possible, less seed is lost, and harvesting occurs at a more suitable time of the year. All these factors contribute to increased crop yields.

What has already been said applies also to lucerne seed crops. Lucerne tends to set its seed earlier and there is not always the same need for defoliation. In damp seasons, however, and on moisture-retentive soils rapid second growth will occur and this can interfere with harvesting operations. Desiccants, therefore, can play quite an important part in aiding the harvesting of lucerne seed.

Over the past two seasons trials have been conducted in which have been included a number of crop desiccant materials. Some of the most effective of these comprise the phenol preparations. These include DNBP, DNBP + DNAP, and DNOC. All these preparations are soluble in oil and the active ingredient is mixed with 10 to 20 gallons of dieselene, which can then be emulsified in water. PCP emulsified in creosote was also used. Other materials used were Oktone, an organic chemical soluble in oil, and Endothal, a water-soluble chemical. Atlacide completes the list of preparations used.

The first of these trials laid down in the district was in the autumn of 1955 on a dense crop of Montgomery red clover in the Fairlie district. Seed was mature, but the crop contained a prolific growth of green leaf and stem which prevented it from being direct headed. Eight treatments were used on plots measuring 4 chains in length. They were sprayed with tractor-mounted 8ft. spray boom offset to enable plots to be sprayed on either side of the tractor without incurring wheel damage on treated plots. After plots had been sprayed the buffer plots along which the tractor operated were also treated to ascertain whether wheel damage had caused any reduction in yield. For the purpose of yield determinations there were 3 main treatments replicated 3 times. In addition 5 further treatments were included purely for observation purposes. Each plot received the same quantity of total spray, namely 40 gallons. This included the active ingredient along with the filler, which consisted of dieselene or water according to the nature of the preparation.

Plots were sprayed on 7 April and inspected 5 days later. In listing the order of preference I shall quote the treatments and rates of application as equivalents per acre. The order of preference from the point of view of visual inspection, therefore, is as follows:—

- Amine DNOC, 5.84lb. + 20 gallons dieselene + water.
- Endothal, 8lb. + water.
- Ammonium DNBP, 0.75lb. + 10 gallons dieselene + water.
- Amine DNOC, 1.46lb. + 20 gallons dieselene + water.
- Na PCP, 2lb. + water.
- Atlacide, 14lb. chlorate.
- Endothal, 2lb. + water.
- Oktone, 2lb. + 20 gallons dieselene + water.

On inspection the outstanding treatments appeared to be the high rates per acre of DNOC, Endothal and DNBP, all of which were extremely effective in drying off the crop. Atlacide, on the other hand, was disappointing in its action. Owing to damp conditions over the following fortnight it was not possible to harvest the trial until approximately 3 weeks after treatment. The control plots were harvested a further 3 weeks later, but even at this stage they were not in a condition really fit for threshing, as frosts had not brought about sufficient defoliation. The farmer, however, was loathe to leave the crop any longer, as some seed had already been lost due to strong winds. Plot yields indicated that all treatments on those plots subject to yield determination gave significantly higher yields than the untreated plots. Actual yields in lb. per acre are as follows:—

Na PCP at 2lb.	=	130.4
DNBP at 0.75lb.	=	119.3
Atlacide at 14lb.	=	112.5
Control	=	97.8

The treated plots were harvested on 26 April and the control plots on 10 May.

Yields from the sprayed buffer plots along which the tractor operated in spraying the plots indicated that wheel damage was not of any great consequence. Although tractor wheels had pressed down the crop, it was possible to thresh this portion of the crop without additional loss of seed.

Germination tests of seed from treated plots indicated a considerably reduced percentage of hard seeds compared with seeds from control plots.

Na PCP	gave 76 per cent. germination and 14 per cent. hard seeds.
DNBP	gave 70 per cent. germination and 23 per cent. hard seeds.
Atlacide	gave 68 per cent. germination and 22 per cent. hard seeds.
Control	gave 53 per cent. germination and 38 per cent. hard seeds.

The only conclusion that can be drawn from these tests is that treatments may have had some effect on the seed coats of a proportion of the hard seeds. The matter is one requiring further investigation.

In summarising the results of this trial I would say that:—

- (1) Crop desiccants result in higher crop yields. This must be attributed to easier and earlier harvesting of the crops.
- (2) Crop desiccants cause no subsequent damage to the crop. In the trial described recovery growth was normal.
- (3) Crop desiccants may result in crops being harvested with fewer hard seeds in the sample.
- (4) Crop desiccants can bring the crop in earlier by 6 to 10 weeks.
- (5) The earlier harvesting of crops enables recovery growth to come away earlier before winter sets in. A good recovery is of value in restoring the vitality of the crop as well as of value to the grazier.
- (6) Wheel damage does not appear to affect crop yields adversely. This is important in that reliance does not have to be placed entirely on aircraft for spraying crops. The tractor-mounted spray equipment would in my opinion give better plant cover and more efficient desiccation.
- (7) Although crops are ready to harvest within several days of spraying, yet a delay of 2 to 3 weeks due to adverse weather conditions does not appear to have any adverse effect on seed yield.

Brief reference will now be made to further observational trials carried out this year, along with results of spraying of two crops.

It was hoped to undertake further yield trials during the 1956 harvest. Owing to drought conditions in the district most crops had to be used

for grazing and very few were harvested. Those that did come to maturity were short in growth and were harvested early. For this reason they did not lend themselves to the use of crop desiccants.

Two observational trials, however, were conducted. One was on a small portion of a red clover seed crop where irrigation water had accumulated. The extra growth obtained made it suitable for a trial. The other was on a lucerne seed crop. Five treatments were used and spraying was done with a knapsack sprayer. In the red clover crop, first in order of preference was DNBP + DNAP at 1.25lb. per acre, then DNBP at .75lb. per acre. Endothal at 4lb. per acre was next, followed by sodium PCP with the 10 per cent. solution of Atlacide (28lb. chlorate) per acre the least effective of all treatments. The DNBP products were mixed with 10 gallons of dieselene and water and the others with water only. The procedure was rather similar to that of the trial previously mentioned. Results were rather similar except for the relatively poor efficiency of Endothal, which, however, was applied at only half the recommended rate. It was obvious that the 4lb. per acre was not sufficient for adequate defoliation. Atlacide again was not efficient even at the more concentrated solution of 10 per cent. In the lucerne trial, however, the 10 per cent. solution of Atlacide was the best treatment. This was followed in order of preference by Endothal at 8lb., DNBP + DNAP, DNBP, and finally sodium PCP. The interesting feature of this trial is the apparent superiority in lucerne of Atlacide compared with other treatments. Surprisingly, the DNBP products which were outstanding in all the red clover trials were relatively poor in effectiveness in the lucerne. Weather following the treatment of these areas was damp and dull, but this did not appear to have any adverse effect on treatments.

The crop containing the lucerne trial was sprayed with a 7 per cent. solution of Atlacide with excellent results. The crop was a reasonably good one. Seed had set well, but owing to a considerable quantity of green leaf and stem it could not be direct headed. The farmer was undecided whether to cut and pick up the crop from the windrow or leave it for direct heading later in the season. The crop was eventually sprayed on 5 April with a tractor-mounted spray boom. A 7 per cent. solution of Atlacide was applied at 20 gallons per acre. Within 4 days of treatment the crop was fit for heading. Owing to damp weather, however, it was not harvested until 3 weeks after treatment. Some second growth started to make its appearance at this stage, but was not sufficient to interfere with harvesting. Had the farmer elected to cut the crop and pick up from the windrow as was his first intention, it is doubtful if he would have harvested much of the crop due to second growth, which would have grown through the windrow. Had the crop been left to die-back naturally, a considerable quantity of seed would have been lost through shattering. Tractor wheel marks in the crop were obvious where the crop has been pressed down, but these portions went through the header quite satisfactorily. In harvesting the crop it was found advantageous to operate the header in the direction opposite to that in which the crop was sprayed. In this way the header was able to head into the leaning crop where it had been pressed down by wheel marks. It is doubtful if any seed was lost. The crop ultimately yielded approximately 150lb. per acre.

Finally, let me make brief reference to a Montgomery red clover crop which was sprayed with DNBP + DNAP. This crop in the Peel Forest area contained considerable leaf and second growth, making it impossible to harvest by direct heading. Seed was mature and a small proportion was even starting to sprout. The crop was sprayed with

DNBP + DNAP at the rate of 1.5lb. per acre in 10 gallons of dieselene. No water was used as a filler. Desiccation was excellent and in addition grass in the crop was dried off very effectively. Again the crop was ready for harvest within 4 days of treatment and was actually harvested within a week of spraying.

In conclusion I would say that in the future the spraying of red clover and lucerne seed crops with crop desiccants is likely to become an accepted practice in seed-producing areas. Not only does it give a greater assurance of a seed harvest but it can quite conceivably result in the harvesting of crops in higher-rainfall areas, localities hitherto considered unsuitable for seed production.

DISCUSSION

Q.—Did treatments actually affect the percentages of hard seeds?

A.—That is not definitely known yet.

Q.—In the tables given what was the missing 10 per cent?

A.—Abnormal seed.

Q.—Were costs taken into account in trials?

A.—Costs were as follows:—Atlacide 17s. per acre, PCP 25s. per acre, DNBP 34s. to 37s. per acre, DNBP+DNAP 47s. per acre.

Q.—On red clovers Atlacide was considered to be disappointing. Considering it to be $\frac{1}{2}$ the cost was this a fair criticism?

A.—I consider it a fair criticism, as it was not very effective.

Q.—Would you agree that observational trials are misleading compared with yield trials?

A.—Observational trials in obvious cases are fairly accurate.

Q.—Were the results statistically analysed?

A.—No.