Native budworm outbreak

Department of Agriculture, Western Australia

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Dust storms cause yield losses

Soils Division
Farmers and research workers are well aware that heavy grazing during summer loosens and exposes soil to the action of strong winds and summer thunder storms. They also realise that dust storms mean soil loss from paddocks, but until now there has been little idea of the effect of these storms on crop yields in subsequent seasons. It was to determine the significance of soil loss and yield loss that a series of investigations was begun to find the quantities of soil likely to be lost, the effect the loss had on yield, and how long yield recovery was likely to take.

The officer responsible for the investigations is Mr. B. a'B. Marsh of the Soil Conservation Service Branch.

It was already known that yield recovery on an eroded soil takes decades. A study of wheat yield on areas from which soil had been scraped 16 years before, had indicated that where 76 mm (3 inches) of soil had been removed, yields were still depressed by about 30 per cent.

Direct measurements of soil lost from depths likely to be affected by dust storms are carried out using Department designed instruments. Depth losses of less than a millimetre can be measured and an investigation is to be carried out during the 1972-73 summer to find the amount of fine dust, organic matter and plant nutrients removed from paddocks during dust storms.

To find the immediate effect of soil loss on crop yield, soil was removed from experimental plots on many different soil types. As expected soil loss depths would be in the order of a millimetre or two, methods were devised to remove soil to similar depths. The Main Roads Department provided a mechanical road sweeper which could remove soil fairly uniformly from uneven surfaces to the desired very shallow depths.

Last summer the sweeper was used to remove 286 tonnes (280 tons) of soil from 22 separate experimental areas each of 0.5 hectares. The experiments were carried out between Mullewa and Jerramungup and soil was removed to depths of about 1, 2, 4 and 8 mm. The areas are being cropped to cereals and yields will be analysed when the crops are harvested.

The budworm caused serious losses in lupin crops and most crops in the northern agricultural areas were heavily infested and suffered economic damage. Four or five caterpillars per plant were not uncommon, and in some crops up to 50 per cent of seeds were destroyed. Damage to rapeseed was not as widespread or severe but a number of crops were treated for budworm in the southern agricultural areas.

About a dozen insecticides have been evaluated as DDT alternatives in a series of replicated field trials conducted during the last two

Native budworm outbreak

Biological Services Division
The outbreak of native budworm (Heliothis punctigera) during October and November was one of the most severe ever recorded in Western Australia. Accurate estimates of economic losses or acreage treated are not yet available but it is clear that tens of thousands of acres of lupins and rapeseed were severely damaged, and many thousands of acres were sprayed either from the air or with ground misters. The area treated would have been even greater had there not been a general shortage of DDT in the State and the high cost and short supply prevented DDT alternatives being widely used.

The budworm caused serious losses in lupin crops and most crops in the northern agricultural areas were heavily infested and suffered economic damage. Four
seasons by entomologist Mr. J. A. Button.

The materials were used at various rates on lupin, rapeseed and lucerne crops and the effectiveness against the various caterpillar stages was assessed. Dosage levels were in most cases selected with regard to cost and most treatments fell within the range of $1.50 to $2.50 per acre for the chemical.

The full range of materials was applied to small plots (0.02 ha) with a portable 1.8 m (6 ft.) boom spray having an output of 91 litres per hectare (8 gallons per acre) at 241 kilopascals (35 p.s.i.). The most promising materials were further evaluated under farm conditions with commercial misting equipment having an output of 22.7 litres per hectare (2 gallons per acre).

Ultra low volume formulations were applied with a commercial U.L.V. mister operating on a 40 m (44 yard) swathe.

Of all the materials tested carbaryl (Sevin, Dicarbam, Le-Baryl, etc.) at 1.42 kg of 80% wettable powder per hectare (20 oz. per acre) and methomyl (Lannate) at 0.14 to 0.21 kg per hectare (2 to 3 oz. per acre) have been most consistent in controlling all larval stages on a wide range of crops. Another spray which performed well but less consistently was endosulphan (Thiodan) at 1.42 to 2.13 litres of 35% E.C. per hectare (1 to 1½ pints per acre).

Fenitrothion has shown considerable promise but further evaluation of this product is required.

From this work it is clear that satisfactory control can be achieved with a number of DDT substitutes but that the cost of an equivalent level of control to that obtained with DDT will be much greater—in most cases at least twice as much.

Satisfactory control of native budworm was obtained by most growers with 2.27 litres of 25% DDT per hectare (1.6 pints per acre) this season at a chemical cost of approximately $1.50 per hectare (60 cents per acre).

Superphosphate boosts irrigated lucerne yields

Dairy Division
The deep loams of the Darling Scarp produce successful lucerne stands and Hunter River lucerne can remain productive for 10 years or more with sound cutting management. In one demonstration at Donnybrook a good stand has produced hay equivalent to 13.8 tonnes per hectare (5.5 tons per acre) on dry land and 20.1 tonnes per hectare (8 tons per acre) with irrigation.

The value of irrigation is shown clearly in such demonstrations where irrigated crops may yield 45 per cent. more fodder during the five dry and hot months of the year. This trial was done to demonstrate the possibility of increasing production still further with additional superphosphate.

The trial was done with a two-year-old stand of irrigated Hunter River lucerne grown on Donnybrook loam with an annual rainfall of 8,075 mm (3,179 pts.). Sprinkler irrigation of 4,826 mm (1,900 pts.) was supplied between December and May, and the stand was given a basal dressing of 1 tonne per hectare (8 cwt. per acre) of muriate of potash in four split
dressings applied in April, July, October and January. Copper, zinc and molybdenum had been applied as a mixed dressing three years previously.

Various superphosphate treatments were applied as four split dressings, also in April, July, October and January, and yield increases measured as hay equivalents. Total figures for superphosphate applications and production are summarised in the table.

The results clearly indicate the value of the added superphosphate and work is to continue to examine the superphosphate requirements of dry land lucerne and the potassium requirements of irrigated and dry land stands. The work is being supervised by Dairy Adviser R. Sprivulis, of the Bunbury District Office of the Department.

Different pasture plants have different grazing values

Plant Research Division
Observations of winter pasture growth on grazing trials at North Bannister and Chowerup have shown that grazing values of the commonly used subterranean clover cultivars differ greatly. Even where one cultivar produces a greater bulk of material than another cultivar, it may be of lower grazing value because it is less palatable. Both trials are in areas receiving about 630 mm rainfall annually.

Trials to test grazing value are conducted by Research Officer D. A. Nicholas and include the cultivars Dinninup, Dwalganup, Geraldton, Woogenellup, Daliak, Uniwager, Seaton Park, Midland B and mixtures of these, and in some areas also include medics and serradellas. Sheep grazing the trials are weighed monthly and their wool production is measured annually. Pasture production is measured by sampling the continuously grazed pastures at intervals throughout the year.

Besides examining grazing value, the trials examine those agronomic characteristics of the plants which make them productive. Characteristics examined include plant density, seedling size, seed production and seasonal growth pattern. The trials are large and use Merino wethers at stocking rates ranging from 7.4 to 13.4 sheep per hectare.

The 30.4 hectare trial at North Bannister, now four years old, includes seven subterranean clover cultivars each grazed by eight sheep at two stocking rates, 7.4 and 9.9 sheep per hectare. There are two replications of each treatment. Table 1 shows the cultivars involved and indicates that body weight loss on Dinninup during June and July, 1971, was higher than on other cultivars, even though more Dinninup was available to the sheep than on all cultivars except Dwalganup. The same type of relationship, but to a lesser extent, applied to Dwalganup and Geraldton.

A similar result was obtained in a 16.2 hectare trial at Chowerup (Table 2), where Dinninup was compared with other clover cultivars of about the same maturity.

Table 1—Winter grazing results, North Bannister (Average of 7.4 and 9.9 sh/ha treatments)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Bodyweight increase</th>
<th>Herbage yield</th>
<th>Yield greasy wool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June 1-Aug. 8, 71 kg per head</td>
<td>Aug. 3, 71 kg per ha</td>
<td>Mar. 25-Oct. 14, 71 kg per head</td>
</tr>
<tr>
<td>Dinninup</td>
<td>— 3.9</td>
<td>1,357</td>
<td>3.66</td>
</tr>
<tr>
<td>Dwalganup</td>
<td>— 2.5</td>
<td>1,974</td>
<td>3.70</td>
</tr>
<tr>
<td>Geraldton</td>
<td>— 2.3</td>
<td>1,298</td>
<td>3.41</td>
</tr>
<tr>
<td>Woogenellup</td>
<td>— 1.4</td>
<td>991</td>
<td>3.96</td>
</tr>
<tr>
<td>Daliak</td>
<td>+ 0.3</td>
<td>869</td>
<td>4.05</td>
</tr>
<tr>
<td>Uniwager</td>
<td>+ 0.9</td>
<td>900</td>
<td>3.75</td>
</tr>
<tr>
<td>Seaton Park</td>
<td>+ 0.9</td>
<td>939</td>
<td>3.84</td>
</tr>
</tbody>
</table>

Table 2—Winter grazing results, Chowerup (Average of 7.4 and 9.9 sh/ha treatments)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Bodyweight increase</th>
<th>Herbage yield</th>
<th>Yield clean wool</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>July 20-Sept. 30, 71 kg per head</td>
<td>Oct. 26, 71 kg per ha</td>
<td>Nov. 30, 71 kg per head</td>
</tr>
<tr>
<td>Dinninup</td>
<td>— 0.4</td>
<td>2.966</td>
<td>4.12</td>
</tr>
<tr>
<td>Woogenellup</td>
<td>+ 7.0</td>
<td>2.304</td>
<td>4.46</td>
</tr>
<tr>
<td>Seaton Park</td>
<td>+ 8.6</td>
<td>2.356</td>
<td>4.29</td>
</tr>
<tr>
<td>Mixture</td>
<td>+ 9.5</td>
<td>2.382</td>
<td>4.50</td>
</tr>
<tr>
<td>Midland B</td>
<td>+10.9</td>
<td>1.836</td>
<td>4.21</td>
</tr>
</tbody>
</table>
During the period mid-July to the end of September, sheep grazing Dinninup lost weight while on other cultivars sheep gained weight rapidly. At the end of winter more feed was available on Dinninup than on other cultivars but wool production for the 12 months ended November showed that Dinninup gave a lower wool production than the other cultivars. The Chowerup trial, now three years old, includes two replications of three stocking rates; 7.4, 9.9 and 13.4 sheep per hectare.

Top-dressing of superphosphate on the trials is carried out annually and totals 2,000 kg per hectare at North Bannister and 1,200 kg per hectare at Chowerup.

Pastures on both trials are markedly clover dominant. At Chowerup they contain 100 per cent. clover and at North Bannister only the Uniwager treatment contains less than 95 per cent clover.

Post-slaughter examination of wethers from the North Bannister experiment showed that sheep grazing Dinninup had bulbo-urethral gland abnormalities, probably caused by the high formononetin content and it may be this material which is reducing intake and lowering animal production during the winter green period.

Grit for broilers

Animal Division

Research workers and Western Australian broiler growers are equally divided on the question of whether feeding grit to broilers is economic. Benefit in body weight gain and feed conversion rates are claimed by some growers and research workers but others claim no particular advantage. However, there are also practical considerations involved. Grit is claimed to cause excessive wear on metal parts of chain-type automatic feeders, and some processors have expressed concern over the effect of grit on knives and mechanical gizzard cleaning machines.

This trial was conducted at the poultry research station, Woodlands, to gain information on the benefits or otherwise of feeding grit to broilers under Western Australian conditions. The trial was supervised by broiler research officer P. Smetana and poultry technician B. R. Vale.

Six treatments including a control were carried out to find whether grit had any influence on ration performance, to find whether soluble grit was different from insoluble grit, to find whether grit incorporated in the feed was different from grit fed in separate containers, and to find the effect of removing grit from the ration a week or so before marketing.

The grits used were granite chips screened to 1.66 mm for 4 weeks, then to 3.2 mm until marketing. Soluble shell grit (Nor-West shell) was crushed to 3.2 mm for feeding to 4 weeks, then to 6.4 mm until marketing. The rations supplied included starter crumbles, finisher crumbles and finisher pellets, and were a standard commercial broiler feed.

During the eight-week feeding period the chickens were placed in pens measuring 4.9 m x 1.8 m with a hot water brooder providing heat during brooding. Feed was available from plastic tube feeders and running water was supplied in a "V" trough through each pen, and from water fonts for the first week.

Mortality, body weight, food consumption and food conversion are summarised in the table for all six treatments.

<table>
<thead>
<tr>
<th>Effect on broiler growth of grit in normal ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Ration</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Mortality (%)</td>
</tr>
<tr>
<td>Body weight at 8 weeks (g)</td>
</tr>
<tr>
<td>Food consumption (g)</td>
</tr>
<tr>
<td>Food conversion</td>
</tr>
</tbody>
</table>

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Figures in the table indicate that no growth advantage was gained by feeding either insoluble or soluble grit to broilers when compared with similar groups of birds not fed grit. This indicates that feeding soluble or insoluble grit to broilers, in association with the diets used in this experiment, whether continually during the eight-week growing period or for part of that period, does not affect live body weight.

However, the results indicate that soluble shell grit fed *ad lib* gave significantly lower feed conversion than insoluble grit.

It should be noted that the commercial crumbles and pellets used in the ration contained an analysed fibre content ranging from 2.6 to 3.4 per cent.

**Grain moisture and atmospheric humidity**

*Wheat and Sheep Division, and Plant Research Division*

Most Western Australian grain producing areas are fortunate in having atmospheric conditions at harvest which allow crops to dry quickly. The conditions allow the crop to be harvested easily and grain to be stored without deterioration. Moisture content of the grain is usually well below receival limits.

In contrast, in some coastal areas, especially on the south coast, atmospheric humidity stays high well into the harvesting period. The humidity also varies widely each day and grain in standing crops loses moisture during the day but then absorbs moisture at night. Under these conditions it is possible that the harvested grain will have a moisture level too high for safe storage.

Little information is available on the relationship between grain moisture level and changes in atmospheric humidity but there have certainly been problems with grain moisture levels at receival points in recent seasons. Because of these problems experimental work is being carried out this year to define the relationship between humidity and grain moisture, and to provide background information to enable harvesting recommendations to be made to farmers. The aims of the work are to—

- Determine the hours during which harvesting will produce grain at a suitable moisture level for storage.
- Determine methods whereby farmers can tell if their product is dry enough for harvest and delivery.
- Supply farmers with recommendations as to what harvesting periods are likely to be suitable in various areas, on the basis of readily available long term climatic records.

Measurements are being made with wheat, barley and rape crops over a wide range of climatic conditions.

Results of preliminary work done in 1971 (see figure) show a considerable time lag before grain reaches equilibrium with the moisture content of the surrounding atmosphere. However, it is not known, for example, what happens when dew forms, although water uptake by the grain would probably be rapid under these circumstances. Whether the incidence of dew is more important than a high atmospheric humidity in encouraging moisture uptake by the grain is one of the questions which could be answered by the 1972 results.
New training and research centre

Agriculture Protection Board

The Agriculture Protection Board's new centre at Forrestfield, opened in August, 1972, will greatly assist the Board in its function of protecting Western Australian agriculture from economic losses caused by vermin and noxious weeds. The centre, at the foot of the Darling Scarp near Perth, includes offices, staff training facilities, a laboratory block and animal pens, a poison bait factory, vehicle workshop and other support facilities.

Though the centre has been in operation for only nine months it has already made a significant contribution to wild dog control in pastoral areas. To extend control to remote and inaccessible places, the Board recently conducted an extensive aerial baiting campaign using a new type of 1080 (sodium fluoroacetate) bait developed by its research staff. The 640,000 baits used were manufactured in the new centre's bait factory, which also produces rabbit baits for use in W.A. and some eastern States.

Twenty years ago, few people would have believed that the seemingly irresistible rabbit plague would ever be controlled. That this objective has been achieved was made possible largely as a result of the development of the highly successful 1080 “one-shot” baiting method by the Board's research section. Since then the research programme has been expanded and, while investigations into the behaviour and control of rabbits are being continued, new projects have been initiated to study the population status and control of other vermin, including the dingo and some species of parrots.

The laboratories at Forrestfield are some of the most modern and well equipped biological laboratories in W.A. Air-conditioned animal houses have been built underground beneath the laboratory block and these will be used in the current study of rabbit immunity to myxomatosis as well as for general research. The investigations into myxomatosis are part of an Australia-wide programme of research with the C.S.I.R.O. and other State vermin control authorities.

In conjunction with the work on rabbit immunity the Board is also studying the establishment and effectiveness of the European rabbit flea as a vector of the myxoma virus.

Other research facilities include animal paddocks to house rabbits, kangaroos, sheep and dingoes. The rabbit pens will be used to investigate the environmental factors which influence the onset, maintenance and cessation of breeding, and also the effect of rabbits on pastures and pastures on rabbits. It is hoped that this work may lead to improvements in cost and effectiveness of control.

The dingo pens will play an important role in the present study of dingo breeding, growth and behaviour. This work is being done with a view to assessing and improving the effectiveness of present dingo control methods.

Effect of calcium nitrate sprays on superficial scald

Horticulture Division

Observations in 1970 showed the development of superficial scald in stored apples to be significantly reduced by pre-harvest sprays of calcium nitrate. In one trial, a single calcium nitrate spray a few hours before picking produced a scald level of 8 per cent. for treated fruit compared with 18 per cent. for untreated fruit.

The beneficial effects of calcium nitrate added to post-harvest applications of D.P.A. and ethoxyquin for scald control were well known and it was decided to extend the results of a bitter pit experiment to include the effects of pre-harvest calcium nitrate applications on subsequent incidence of superficial scald during short term storage of Granny Smith apples.

The trials were carried out in 1970-71 using 60 trees (10 replicates of 6 trees each) at a Newlands property 200 km south of Perth. The harvested apples were stored at about 0°C in cool stores at Robbs Jetty and checked for scald after two months cold storage and an additional week of common storage. The work was supervised by Fruit Adviser Mr. S. E. Hardisty.

Besides the calcium nitrate treatments shown in the table, half the trees were given two sprays of Lefingwell's "Nutraphos" shortly after petal fall. The Nutraphos is a foliar nutrient spray high in phosphorus, calcium and trace elements, and was reputed to give adequate control of bitter pit. Its effect on superficial scald development is shown in the table, along with results for the calcium nitrate treatments.

Although the harvesting dates were somewhat earlier than desirable for an experiment on superficial scald, the results clearly indicate the advantage of applying calcium nitrate before harvest. All calcium nitrate treatments significantly reduced the amount of superficial scald developing in the stored fruit. Conversely, for two of the harvest dates, the Nutraphos treatments significantly increased the per cent. of fruit developing scald.

<table>
<thead>
<tr>
<th>Treatments†</th>
<th>Harvested on 10/3/71</th>
<th>Harvested on 17/3/71</th>
<th>Harvested on 24/3/71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (No Ca(NO₃)₂)</td>
<td>37</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>1 pre-harvest Ca(NO₃)₂ spray on 17/3/71</td>
<td>Not applied</td>
<td>5-8*</td>
<td>3***</td>
</tr>
<tr>
<td>3 Ca(NO₃)₂ sprays in Dec-Jan</td>
<td>31 n.s.</td>
<td>9*</td>
<td>3***</td>
</tr>
<tr>
<td>3 Ca(NO₃)₂ sprays in Feb-March</td>
<td>17*</td>
<td>6**</td>
<td>4***</td>
</tr>
<tr>
<td>3 Ca(NO₃)₂ sprays in Dec-Jan + 1 pre-harvest spray on 17/3/71</td>
<td>Not applied</td>
<td>6**</td>
<td>3***</td>
</tr>
<tr>
<td>Treatments above + Nutraphos</td>
<td>+***</td>
<td>n.s.</td>
<td></td>
</tr>
</tbody>
</table>

† Calcium nitrate was applied at 8 g/l and Nutraphos at 15 g/l.
* ** *** Significant change. n.s. No significant change.
+ Increase in scald but measurements not available.