CHEMICALS AS AN AID TO OVERSOWING AND CROP ESTABLISHMENT

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SUMMARY

AN attempt is made to evaluate the chemically treated sward as a seed-bed for pasture renovation and establishment. A review is given of how far present chemicals measure up to what is thought to be their ideal uses. Emphasis is laid on the fact that where new species are introduced it is important to correct factors which would otherwise result in quick deterioration. A description of the eight trials carried out in Southern Hawke's Bay, including a trial on the overdrilling of crops, is outlined. It is considered that the application of chemical methods of pasture establishment to hill country could have far-reaching possibilities.

The prime purpose of chemicals in pasture work in the past has been for the control of weeds. Their use as an aid to the oversowing and establishment of pastures and crops is a comparatively new concept and one which in my opinion has a great future.

Leonard has shown that good establishment of oversown pasture species has occurred when nassella tussock (*Nassella trichotoma*) is destroyed by chemicals. Trial work near Wellington and in Southern Hawke's Bay carried out in the autumn of 1956 has clearly established that both grasses and clovers can be successfully introduced into browntop (*Agrostis tenuis*) and browntop dominant swards by pre-spraying with chemicals.

To determine whether the results obtained in small trials were applicable to larger areas and also to try to work out suitable techniques a number of large-scale trials were laid down in Southern Hawke's Bay last autumn.

CHEMICALLY TREATED SWARD AS SEED-BED

In attempting to assess the value of the chemically treated sward as a seed-bed we must ask this question: What are the objects of cultivation, and how far does the new method fulfil these? The three main objectives in cultivating soil are:—

1. **To kill the existing vegetation:** This can be satisfactorily achieved by chemical means.
2. **Mobilise plant nutrients through organic matter breakdown:** Because it is desirable to sow the seed as soon after chemical treatment as is considered safe to do so (and this may be a matter of 10 to 14 days), there is an insufficient time lag for turf rotting to have proceeded far enough to supply nutrients from decomposition. The availability of plant nutrients will therefore depend on the fertility level of the soil medium itself. Under low-fertility conditions such as would be found on a browntop dominant cloverless sward the nitrogen level of the soil would naturally be very low. Under such conditions the necessary nitrogen for supporting introduced grasses must await the establishment of the clovers. It is felt that artificially applied nitrogen is necessary here to speed up establishment and even for survival. In a trial on steep hill country laid down this autumn a good nitrogen response was obtained from 1cwt. of sulphate of ammonia applied at sowing.

Under higher-fertility conditions on a browntop dominant sward containing a fair proportion of clover a nitrogen response was obtained from a pasture mixture sown on a chemically treated sward, whereas no response was obtained on the cultivated portion of the same

paddock. It would appear therefore that an induced nitrogen deficiency had occurred as a result of accelerated bacterial activity associated with turf rotting.

It has been observed that after a period of 6 weeks or longer there is a noticeable improvement in the quality of the establishing pasture, an improvement which is thought to be quite separate from any nitrogen supplied by the clovers. The reason is probably a delayed action boost associated with the breakdown of the original turf mass.

3. **Prepare a suitable seed-bed, usually described as fine and firm with enough free soil on top to cover the seed effectively:** Such a seed-bed is required to ensure a good strike and establishment of the seed. In the chemically treated sward consolidation to a degree not normally possible with cultivation is already present, and the dying herbage provides a very effective cover. In fact it has a micro-climatic effect which seems to favour a good seed strike. The cover so provided results in high humidity, good moisture retention, and shelter from drying and cold winds. Also rilling, scouring, and wind blowing are reduced or practically eliminated. Other advantages are that the surface layer (0in. to 3in.) is more fertile in respect to organic matter and applied phosphate. The number of fresh weeds that strike is also greatly reduced, or practically eliminated in the case of annuals such as fat-hen (*Chenopodium album*), spurrey (*Spergula arvensis*), etc.

Along with the many advantages must be mentioned an important disadvantage. Pests, particularly slugs, in the original sward may play havoc with the young seedlings. A relatively small number of slugs may do great damage once their main feed supply has been removed.

USE OF CHEMICALS

Though it is realised that the results we can get from chemicals at present are entirely dependent on the materials at our disposal, it is also important to have a clear picture of just what we would like our chemicals to do for us.

Ideally then they should assist with the following:—

1. Pasture Renewal

Kill all vegetation present and have little or no residual effect. Judged from this angle dalapon goes a long way. Dalapon is absorbed and translocated by living grass foliage and provided it is applied at a suitable time (that is, to an actively growing dense grass dominant sward) then the material is very effective. Rain causing run-off within 24 hours will render the result less effective. Under good conditions in trials as little as 2½lb. of dalapon plus ½lb. of ATA has given an almost complete kill of grasses and existing clovers. However, it is considered that no less than 5lb. of dalapon should be used under most conditions to allow a margin of safety. Though there is no doubt that ATA increases the effectiveness of dalapon, the residual effects are also greatly increased, especially where a prolonged dry spell follows application.

Clovers appear to be affected most. For this reason it is considered that the wisdom of including ATA is questionable.

2. Pasture Renovation

(a) **Arresting growth of the sward** temporarily only, without materially affecting composition. These effects may need to last only 3 weeks or perhaps more, during which time the introduced species establish themselves to the stage where they can fend for themselves. Where broadcasting is being done quantities of dalapon from 2lb. to 2½lb. should be sufficient. Where overdrilling is concerned the possibility of eliminating the competition immediately adjacent to each drill by attaching a single spray nozzle

immediately in front of each coulter with the object of seeing if the rates of dalapon can be reduced to as little as $\frac{1}{2}$ lb. to $\frac{1}{4}$ lb. per acre is being investigated. It must be pointed out that dalapon even at comparatively low rates affects clover vigour.

(b) **Selectively killing undesirable species within the sward;** for example, annual grasses such as barley grass, browntop, etc., and at the same time arresting pasture growth if necessary for the purpose of ensuring the successful establishment of the introduced species. This concept of periodically purging pastures is an important one and in my opinion ranks in importance with pasture renewal. The aim here is to arrest deterioration by the removal of undesirable species and to introduce desirable species in their place by oversowing. Trials in Southern Hawke's Bay have shown that browntop can be removed from a pasture with little or no harm to white clover, ryegrass, or cocksfoot if TCA is applied at 20 lb. per acre. With browntop would go annual grasses such as barley grass (*Hordeum murinum*), *Poa annua*, etc. Though such a treatment would be costly, I have mentioned it because of the remarkable result obtained. TCA at 20 lb. was applied on 13/3/57 and oversown on 11/4/57. As a result there has been a very noticeable lift in the pasture.

RECTIFYING THE CAUSES OF DETERIORATION

We cannot expect to hold the new species introduced if one or more factors are operating to bring about quick deterioration. These factors may be poor drainage, grass-grub infestation, poor utilisation, a soil deficiency, etc. For instance, the establishment of a new pasture in a potash-deficient paddock will result in rapid deterioration toward the level of the original pasture.

Again, if a new pasture is to be established on a low-fertility area by chemical means, the land should receive manurial treatment comparable with that which would be given a pasture laid down by conventional methods.

EXPERIMENTS IN SOUTHERN HAWKE'S BAY

Over the past 15 months eight trials have been laid down; two in the autumn of 1956, one in spring of the same year, and five last autumn. The trials laid down last autumn involve an area of over 10 acres, and have been designed so that they can be satisfactorily grazed with stock.

1956 TRIALS

1. Overdrilling and Broadcasting of a Run-out Browntop-dominant Sheep Pasture Following Partial to Complete Sward Destruction with Chemicals and other Treatments

The object of this trial was to include as many treatments as possible in order to obtain a range of effects from a slight setback of the pasture to a complete kill, if this were possible. The trial was sprayed on 3 March 1956 and sown with a 30 lb. pasture mixture 4 days later. Included in the experiment were the following per acre treatments: the sodium salt of MH 8 lb. (MH equivalent), dalapon $3\frac{1}{2}$ lb., $7\frac{1}{2}$ lb., and 15 lb., TCA at 10 lb. and 20 lb., dieselene at 40 gallons, surface cultivation, and control. Across these treatments the seed was sown in three ways: broadcast, overdrilled with Grassland tips, and also with Australian sod-seeder.

A summary of the main results is as follows:—

(a) In the control area overdrilling and broadcasting alone were practically a complete failure. That is the competition from the existing sward was too great for the seedlings to survive.

(b) The establishment of the introduced species was in proportion to the extent to which the particular treatment weakened the existing sward.

(c) Both dalapon at 7½lb. and 15lb. gave a virtually complete kill of the sward (including clover as well as the grasses). Though the strike and establishment on the overdrilled plots were noticeably more rapid, the broadcast sections are at least equal if not better at present.

(d) TCA at 20lb. selectively killed most of the browntop, leaving the clovers, ryegrass, and cocksfoot practically unaffected. The introduced grasses and clovers ultimately established well in this plot.

2. Oversowing Browntop-dominant, Virtually Cloverless Steep Uncultivable Hillside with a Pasture Mixture Following Chemical Treatment

The trial was sprayed on 29 September 1956 and oversown with a 32lb. pasture mixture 10 days later. The treatments per acre were dalapon 5lb., dalapon 10lb., dalapon 10lb. plus the sodium salt of PCP 8lb., and control. The PCP was included to kill the moss, which it did most effectively. The dalapon plus PCP was outstanding from the start, and this was due to a practically complete kill of the grasses (including chewings fescue (*Festuca rubra* var. *fallax*)), a much higher percentage kill of flatweeds, and practically a complete kill of the moss present. A considerably better strike was obtained in the PCP plot than in control.

1957 TRIALS

3. Oversowing of Browntop-dominant Virtually Cloverless Steep Hill Country After Chemical Treatment

This trial which is of 2 acres was laid down in the autumn of 1957. A standard spray treatment was used consisting of 5lb. dalapon plus 1lb. ATA per acre, and was applied by a hand boom covering a 7ft. strip, operated by a knapsack with pressure gauge. Using 32 nozzles, a forward speed of 2 m.p.h. (1yd. per second) and a pressure of 25lb. per sq. in. the outfit delivered 18½ gallons of spray per acre. Spraying was done at two different times, 4 March, at the end of the drought, and on 22 March after the pasture had recovered with the autumn rains.

It is too soon to assess the value of this trial, but the following points are worth noting:—

Early spraying during the autumn drought period when the pasture was making little or no growth gave a much poorer kill of grasses than the later spraying on autumn flush pasture. Also the residual effect of the chemicals was much greater with the earlier spraying, and appeared to be particularly harmful to the germinating clovers, though some slug damage was suspected. A further point against the earlier spraying was the thick strike of volunteer grasses which came after the first autumn rains. With the later spraying this volunteer growth was killed.

A good response was obtained to nitrogen applied at sowing at 1cwt. per acre. The survival of clovers and the establishment of both clovers and grasses have been greatly improved as a result.

4. Oversowing of a Browntop-dominant Discable Hill Country Pasture Following Chemical Treatment

There were two times of spraying. The first (15/2/57) was done on a rank sward with very dry conditions following application. Half the area was burnt after the first autumn rains and a surprisingly clean burn was obtained. Both areas were sown with a 32lb. pasture mixture on 26 March. Burning resulted in a kill of volunteer seedling growth, and a superior strike was obtained on the ash.

Late spraying after the autumn flush (25/3/57) resulted in an almost complete kill of the existing sward. However, resowing of this area has been necessary, largely it is thought because of slug damage. Portion of the trial is to be treated with metaldehyde.

5. Spraying of Rough Browntop-dominant Sidelings on a Dairy Farm with Chemicals before Oversowing with a Full Pasture Mixture

The treatments were burning only, burning followed by spraying of the regrowth, and spraying followed by burning.

The last mentioned treatment is showing the most promise at present.

6. Grass to Grass: Comparing Normal Cultivation, Pre-spraying Followed By Surface Cultivation, and Pre-spraying Followed by Broadcasting and Overdrilling

The sward is on a dairy farm and is browntop dominant.

This is a large-scale trial of approximately 5 acres, in which the various treatments can be separately grazed as required. This trial is very promising and some results to date are:—

(a) Pre-spraying with dalapon at 5lb. per acre and ATA at 1lb., followed by broadcasting, is quite promising, the strike and establishment comparing very favourably with the pasture sown by conventional methods.

(b) Surface cultivation following spraying resulted in a very trashy and costly seed-bed to prepare.

(c) Overdrilling on the chemically treated sward has resulted in quicker establishment than for broadcasting. It is considered, however, that broadcasting is superior to drilling in 7in. rows because of the cover factor.

(d) A nitrogen response was obtained on the uncultivated treatment (sprayed only), but not on either of the cultivation treatments.

7. As for Trial 6 but no Overdrilling Was Done

Two interesting results from this trial are:—

(a) Chemical treatment of the sward allowed an excellent burn of the rather rank growth in this trial (2in. to 4in.) and this resulted in a surprisingly good seed-bed.

(b) Where the tractor wheels pressed down the grass in the spray treatment (dalapon 5lb. plus ATA 1lb.) the kill of browntop was equivalent to double this rate.

8. Overdrilling of Crops Directly into a Pasture Sward after Chemical Treatment

The chemicals were applied on 26 November and the crops sown 6 days later. The crops sown were turnips, chou moellier, collard kale, and lucerne.

There was an unfortunate choice of paddock. Apparently yarrow (*Achillea millefolium*) had originally been sown on this land, and, though not very evident in the pasture, as soon as the grasses were killed, it took charge in some of the treatments. The chou moellier, collard kale, and lucerne were a failure. However, patches of the trial where the turnips were able to compete successfully with the yarrow resulted in a surprisingly good take. The following points of this trial are worth noting:—

(a) Where the turnips grew well there was a complete smother and rotting of previous vegetation.

(b) The turnips in these patches grew surprisingly good bulbs up to 6in. in diameter.

(c) The bulbs were practically sitting on the surface, an important utilisation factor.

(d) The bulbs grew and kept well over a longer period than normally expected.

(e) In spite of the fact that the farmer has been unable to grow turnips on the flat successfully because of land being heavily infested with fat-hen, not one fat-hen plant was found on the experimental area.

CONCLUSIONS

In conclusion it can be said that the use of chemicals offers considerable hope from the following angles:—

1. Assisting with the establishment of introduced species into aggressive swards (either by oversowing or overdrilling).
2. Maintaining older pastures at a level of production approaching that of new grass; for example, replacing browntop with ryegrass. This is an important point, and would be of great significance in increasing production.
3. As an alternative method of pasture establishment.
4. Establishing pasture where this has not hitherto been possible by ordinary mechanical means.
5. The sowing of crops directly into pasture, especially on weedy land.

That chemicals can do all these things has already been demonstrated. How well and consistently they can do them remains to be seen.

On the better-class land where the farmer already has his own cultivation equipment the proposition of chemical pasture renewal is less attractive. The future on this class of country will depend largely on the quality and consistency of results and the cost of the chemicals.

On the other hand, on the basis of present costs alone, pasture establishment on discable hill country by chemical means even with dalapon at its present price would compare more than favourably with cultivation done by contract. The cost of producing a seed-bed would in fact be about half.

On the spectacular side, pasture establishment by air on hill country could be achieved at the rate of about 1 acre every 5 minutes.

REFERENCES

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- (3) Foreman, M. S. (1956) "Recent Research Work With Dalapon". Ninth Annual Conference of the N.Z. Weed Control Council.
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DISCUSSION

Q.—Which coulters was used to introduce the oversown species?

A.—Grassland tip.

Q.—Was there any evidence of slug control when using the sodium salt of PCP?

A.—A reduction of slug population was noticed in these areas.