
WEEDKILLERS AS AN AID TO PASTURE AND CROP ESTABLISHMENT

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Most agriculturists are familiar with the use of selective weedkillers for the control of weeds in crops and newly sown pasture established in conjunction with conventional methods of cultivation. For cultivation mechanical aids are used to reduce inter-plant competition and to prepare a seed-bed. In this paper I ~~propose to establish the concept of using weedkillers as a method~~ of reducing inter-plant competition in place of mechanical aids. The concept is based on using one or two specific weedkilling chemicals to kill the existing vegetation *in situ*. Pasture mixtures are then sown into the dead turf or crops are drilled directly into the chemically destroyed turf. The paper is based on the work of the Extension Division of the Department of Agriculture.

Pasture Establishment

The successful use of weedkilling chemicals to destroy existing grasslike vegetation before oversowing pasture mixtures was first demonstrated by J. P. Beggs and W. F. Leonard in 1953-54 in northern Marlborough. These two workers showed that if nassella tussock (*Nassella trichotoma*) was first destroyed with TCA, a balanced pasture mixture could be established by oversowing. Previous work showed that grazing and oversowing or firing and oversowing increased the incidence of nassella tussock. In later years a block of 55 acres of nassella tussock has been replaced successfully by this method and several larger blocks are now under development. A fair balance of cocksfoot, ryegrass, and red, white, and subterranean clover has been obtained. This sward has proved of sufficient density to arrest almost completely the germination of further nassella tussock. This method of reducing inter-plant competition has proved so successful that in future it should be used as the main line of attack in the control of nassella tussock.

Over the past two years this method has been extended to aid the oversowing of low fertility swards and to purge pastures of inferior grass species such as browntop (*Agrostis tenuis*) by reducing inter-plant competition. The method appears most

applicable to browntop-dominant swards. The work done to date by L. Blackmore and S. M. Maclean and others indicates that high fertility species such as ryegrass and cocksfoot and the various clovers can be introduced successfully into low fertility swards and swards of intermediate fertility by prior treating of turf with dalapon or other chemicals. The effect of dalapon in particular is to kill the browntop, while broadleaved weeds, ryegrass, cocksfoot, and existing clovers are merely checked in growth, a factor also favouring the establishment of sown species.

The following factors affect the efficiency of the method:

1. Manurial Requirements: If high fertility species are to be introduced and maintained, the correct manurial requirements of the particular soil type must be met. In many areas molybdenum has determined whether or not the high fertility species will survive. Further work is required to determine if there are any advantages in building up the fertility of an area before chemical treatment and oversowing.

2. Rate of Application of Weedkiller: Rates of as low as 1lb. per acre of dalapon have improved the take of oversown species. In general the rate of 3lb. of dalapon per acre is necessary for browntop control and rates up to 5lb. per acre for danthonia and chewings fescue control (*Festuca rubra* var. *fallax*). The addition of 2,4-D, 2,4,5-T, or ATA at rates of 1 to 2lb. per acre ensures that all broadleaved species are killed or severely affected, but the competitive effect of broadleaved species such as flat weeds appears small in comparison with the low fertility grass species and the addition of these materials in most cases is not warranted. If bryophytes are prevalent the addition of sodium PCP has proved worthwhile.

3. Interval between Spraying and Sowing: This depends on many factors. If the low fertility grass species are closely grazed, good establishment can be obtained if the weedkiller, seed, and fertiliser are all applied on the same day. If the herbage is rank, it must either be removed by grazing after spraying or by natural decomposition. Removal by grazing is feasible because the stock prefer sprayed to unsprayed material. If grazing is to be practised, the grass should turn brown before grazing is attempted. This usually takes two to three weeks. The seed and fertiliser should be applied before the area is grazed. On low fertility areas if the seed is sown shortly after spraying, the addition of a neutral nitrogenous fertiliser has proved beneficial in some cases but would not be a recommended practice.

4. Time of Sowing: Three times appear satisfactory. Dalapon applied just before the autumn rains begin so that the seed strikes

with the first rain has proved satisfactory, although a heavier rate of dalapon is required to ensure a kill. A more satisfactory period is early autumn after the autumn rains begin. At this period the low fertility grasses are intermediate in tolerance to dalapon. The grass appears most susceptible to dalapon when the material is applied in May or June. Oversowing is then best delayed until early spring.

5. **Rate of Seeding:** Trial work shows that if the existing sward is destroyed with chemicals, a fairly high rate of seed is required to replace it. A high seeding rate of 25 to 30 lb. provides quicker ground cover than a seeding rate of 15 to 25lb., but there is little difference in the end results. Other factors such as time of sowing, grazing, and fertiliser application appear more important.

6. **Seed Mixtures:** Initial work indicates that there is no advantage in establishing clovers and then introducing grass later. Both grasses and clovers should be sown together.

Disadvantages of the Method

1. The effectiveness of dalapon may be reduced if rain falls within 12 hours of application.

2. Slugs and other insects deprived overnight of their food supply can cause serious damage to the germinating seedlings of the sown species. A material such as sodium salt of PCP can be used for the two-fold purpose of destroying slugs and killing bryophytes.

3. Species such as paspalum offer too much resistance to dalapon to warrant using the method.

Advantages of the Method

1. It allows the direct introduction of higher fertility demanding grasses into grass by oversowing and a better and quicker establishment of clovers, particularly large seeded clovers.

2. It is applicable to all types of country, as weedkiller, seed, and fertiliser can all be applied from the air, except perhaps where inoculated seed is required.

3. Only the sown species are fostered. On country too steep to be cultivated the normal practice has been to aerial topdress. Particularly in the North Island the first response is usually to appear in suckling, striated, and other annual species. In subsequent years subterranean and poor strains of white clover have dominated. Only after several years of topdressing is it possible to attempt the introduction of higher fertility demanding grasses. Even at this stage inter-plant competition from Yorkshire fog and vigorous growing browntop is a major factor limiting the successful introduction of higher producing strains of grasses.

4. It is probably better than overdrilling, as slower establishing

species such as cocksfoot, perennial ryegrass, and clovers have been successfully oversown. In a trial where overdrilling was compared with and without weedkiller and normal cultivation, oversowing of the chemically treated turf gave the best results.

5. On country that can only be giant disced the chemical method has given much better control of browntop and other *Agrostis* species than giant discing. Few, if any troublesome weeds strike, whereas they may be a problem on cultivated land.

6. Consolidation is not a problem, particularly on light land.

7. Because bare ground is not exposed, the method is applicable to light sand country or country that tends to erode after cultivation and the germinating seedlings are protected by a microclimate and do not suffer from wind blow and rain wash.

8. The method is applicable to land infested with weeds such as tall fescue, sedges, or nassella.

9. The method is cheaper than normal methods of cultivation, even at the present price of dalapon, and the land is out of production for a minimum period.

Crop Establishment

A limited number of trials conducted to date indicate that crops may be successfully drilled into turf destroyed by chemicals. The crops that appear most satisfactory are field brassicas, cereals, and lucerne. The method is most applicable to high fertility areas. A rate of 5lb. per acre is required to control the ryegrass and up to 2lb. acid equivalent per acre of 2,4,5-T is necessary for clover destruction. Ten days or more should elapse after spraying before the crops are drilled into the dead turf. Penetrating narrow coulters should be employed. Heavy stocking after drilling serves both to help cover the seed and to remove the dead litter of vegetation. Stock prefer sprayed litter to unsprayed litter. Interim results indicate that the disadvantages of the methods are:

1. Crops cannot usually be established in fields which contain species such as paspalum which are tolerant to dalapon at low rates.

2. Non-edible resistant broadleaved species such as docks, if present, would limit the use of the method.

3. In compact soils adequate depth of seeding is difficult. To facilitate drilling the soil preferably should be moist. Interim results show that the advantages of the methods are:

(a) The method is cheaper than conventional methods of crop establishment and the land is out of production for a minimum period.

(b) The crops establish virtually weed free. The factor of bare

ground is not introduced, so that weed seeds do not have the same chance of striking as the sown species.

(c) Surface nitrogen from animal excreta and also that supplied by the dead clover is available to the sown crops. Nitrogen is probably not lost to the same extent by leaching.

(d) There is less disturbance of the soil flora and the worm population is not reduced as much as with conventional methods. This may be an advantage in the case of the worm population.

(e) Consolidation is not a problem, particularly for light land. The problem on some soil types may be over-consolidation.

(f) The loss of soil moisture is probably less than with conventional methods of cultivation.

(g) On steeper country the crops are less likely to suffer from rain wash and wind blow.

Discussion

The concept of aiding pasture establishment by prior destruction of the turf with chemicals as described has probably a wide field of use in New Zealand. Browntop, chewings fescue, and danthonia probably constitute the most widely distributed grass species in New Zealand pastures. While it is most applicable to browntop and other *Agrostis* species, chemicals may be successfully employed for the control of nassella tussock, sedge and scrub, Spanish heath, gorse, and secondary growth. One of the main governing principles is that of raising the fertility quickly enough to support the maintenance of high fertility grasses. If the concept can be established of measuring fertility responses to high fertility species ~~oversown~~ after chemical destruction of the sward, then the principle of oversowing species consistent with the soil fertility level is no longer valid.

In crop establishment the success of the method will depend largely on local conditions and appears to be more applicable to high fertility conditions than to low fertility conditions. It is doubtful if the method will be applicable to heavy soils that tend to pack. With the likely development of newer, more efficient chemicals the method may be extended into areas where resistant species such as paspalum now dominate.

DISCUSSION

Q. Is it possible to eliminate Ratstail and rushes by chemical means prior to oversowing?

A. Ratstail can be eliminated by 10-15lb. of dalapon per acre. The soft rush *Juncus effusus* may be killed by hormones. If the rushes are dense, you should wait for decomposition before sowing seed. It is doubtful if the surface trash area from rushes should be burnt.

Mr Hamblyn: We have gone a little further with chemical turf destruction and have treated areas of about 4 acres from the air by means of the

helicopter, and have proved that this is a feasible method. However, the first use of the helicopter has shown that it is very easy to get uneven distribution and incomplete kill in parts of the area treated. More work is required on dilution rates and number of flights on a given area. I think that this technique will put the plough in the hands of the hill country man, will enable more efficient use of fertiliser and will enable crops to be grown on hill country.

- Q. Would Mr Matthews elaborate on his statement about the burning of surface trash?
- A. Where all the species present can be killed with chemicals, burning should not be resorted to. Unless the cover is burnt with a wet bottom, humus is destroyed. Humus, when present, favours the introduced species. The only two cases where burning is advantageous are:
1. *Carex longifolia* which cannot be killed completely with chemicals, and
 2. Gorse, where other farm management practices should be used first, including burning.

After burning a chemically treated browntop sward, a mass of browntop seedlings usually results.

- Q. When an old pasture is ploughed, there is a release of plant food from the decaying material. Is follow-up work to be done to see to what extent decaying roots affect establishment?
- A. We have as yet not much evidence on this point. Where the seed has been sown late in autumn and has resulted in poor clover establishment, pure stands of ryegrass usually result. In such cases, we have not observed the yellow herbage characteristics of pure ryegrass stands established from seed, and this may be due to the nitrogen released in the top soil layers. We think that we are getting a phosphate response for the ryegrass. In one case where 8 year's growth of browntop was treated, the turf decomposed within weeks of treatment and nitrogen was almost certainly released. We are using sensitive crops like chou moellier to assess the release of nitrogen from decomposing turfs.
- Mr Lynch: The nitrogen aspect is important. A main factor is the interval between spraying and oversowing as far as release of nitrogen is concerned. There is likely to be nitrogen starvation in the cycle when sowing follows closely after chemical treatments. In such cases, there is likely to be benefit from applied nitrogen. The deficiency is only a short term one however. On the other hand, we cannot treat nitrogen deficient browntop dominant swards and expect good results immediately after oversowing.

- Q. Would Mr Matthews comment on the interval between spraying and sowing in relation to the residual effects of dalapon in the soil? In trials, depression in seed establishment has been noted on plots receiving 10lb. of dalapon to the acre. Does weather affect these results?
- A. Effects of the chemical in the soil could reduce germination. We do not yet know what the interval should be for complete safety. There is an advantage in applying both the chemical and the seed together in that the helicopter or contractor can be called in and the whole job done in one day.

- Mr Leonard: Mr Lynch referred to the importance of the chemical following before sowing. For nassella tussock control dalapon is more effective in the hot months of the year. It therefore seems probable that we can use dalapon to advantage in hot seasons and then sow the seed later at the most favourable time in the autumn.