

NEW ASPECTS OF VEGETATION CONTROL

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CONTROL OF VEGETATION IN DRAINS

Though a great deal of experimental work has been conducted, it appears that we have not reached complete agreement on the rate and timing of application of the currently used weedkillers. Despite this difference of opinion among those people who have independently or cooperatively participated in the development of drain cleaning by chemicals, it is realised that even at the highest rates of the weedicides recommended these chemicals have distinct advantages over manual or mechanical clearing in both efficiency and economy. Mechanical methods of drain cleaning alone do not provide a complete answer because of rapid regrowth, cost of removing and replacing fences, dumping of soil, widening of drains, and excessive deepening below piped culverts, etc.; such mechanical cleaning may amount up to £2 per chain or even more.

First, a few words about the combination of dalapon and amitrol.

Amitrol not only enhances the rate of kill of hard to control grass weeds with dalapon, but controls a wide range of plants not susceptible to dalapon. The combination of dalapon and amitrol, in particular at a ratio of 4:1, may indicate a synergistic effect and therefore the combination of these two materials appears to offer a far greater cost efficiency than either of these materials by themselves.

The rate of application of amitrol is largely determined by the control expected of it and therefore larger quantities must be used per acre to control the widest possible range of flat weeds and deep rooted perennials. Since in drains there is a tremendous variety of vegetation, some not susceptible at economic rates to amitrol, it has been often necessary to supplement the mixture of dalapon and amitrol with 2,4-D or other chemicals. If no 2,4-D is used in the mixture, it is considered that 2½ to 5 lb of amitrol are required per acre, resulting in good control of all flat weeds except a few such as buttercups (*Ranunculus* spp.), monkey musk (*Mimulus guttatus*), watercress (*Nasturtium officinale*), convolvulus (*Convolvulus arvensis*), willow weed (*Polygonum persicaria*), and various rushes (*Juncus* spp.). When 2,4-D is used in conjunction with the dalapon/amitrol mixture at a rate of 2 to 3 lb per acre, the rate of amitrol may be reduced to 1 to 2 lb per acre.

The rate of dalapon is largely determined by the monocotyledonous species comprising the bulk of the vegetation. If grasses such as paspalum (*Paspalum dilatatum*), water couch (*P. distichum*), tall fescue (*Festuca arundinacea*), reed sweetgrass (*Glyceria maxima*), purua grass (*Scirpus maritimus*), and raupo (*Typha angustifolia*) are present, it is advisable to use at least 10 and preferably 15 lb of dalapon per acre. In some instances lower rates have been found satisfactory, the minimum dosage rate being 5 lb of dalapon per acre in one area.

The timing of the application appears to be just as important as the correct application rate of the chemicals. The hard to control grass type weeds mentioned earlier should be treated for optimum results not earlier than February and not later than June; spring applications have proved to have much less effect. Because at least one or possibly most of the hard to kill weeds are likely to be present in the drains, the late summer or early autumn application seems an essential factor in the successful clearing of drains with mixtures of dalapon and amitrol.

If flooding in spring is likely, autumn application in many instances may not give a sufficient lasting effect to maintain the drain weed-free to the spring and it is therefore necessary to supplement the autumn application with a further treatment in August or September. For spring retreatment the rate of both dalapon and amitrol may be reduced, rates as low as 5 lb of dalapon and 1½ lb of amitrol per acre were found to be satisfactory in the Hauraki Plains district.

When the bottom of the drain is showing prolific growth it is advisable to incorporate with the dalapon/amitrol either simazine, monuron, or diuron for late summer or early autumn application provided that the drain at this time is reasonably dry, thus enabling the spray to reach the vegetation growing on the ditch bottom. Under such circumstances it is most economical to restrict the application just to the bottom of the drain. The quantity of these residual chemicals required to give up to a season's control varies from 10 to 16 lb of the active material per acre. Such treatment will result in extended control of the submerged water weeds which otherwise are very hard to control. Simazine, because of its low solubility in water, resistance to leaching, and slow rate of breakdown, is the preferred material to monuron.

All the spraying should be carried out with a minimum of 150 gallons of water per acre, particularly where the stand of vegetation is dense.

The cost per chain with a 3 ft width of drain treated will be about 9d. to 1s. 4d., or per acre between £8 5s. to £14 10s. for the chemicals. On the basis of the average rate of treatment of 1½ miles per hour at a cost of £3 per hour the application cost will, on an average, amount to 6d. per chain. The total cost of chemical cleaning of drains 9 ft wide would amount to 2s. 9d. to 4s. 6d. per chain for the autumn spraying and 2s. to 2s. 6d. per chain for the spring spraying. When simazine, diuron, or monuron are used for the autumn application the cost of treatment will be increased to 7s. per chain when only the bottom 3 ft strip is treated.

Because of the distinct advantages of clearing drains by the use of chemicals, this method has become an established practice. Though very economical at present, with the advent of further chemicals it will no doubt become even more efficient.

The newer chemicals such as fenac and trichlorobenzoic acids are holding sufficient promise to control resistant weeds such as willow weed (*Polygonum persicaria*) and starwort (*Callitriche verna*).

Acknowledgment is made to the work of Mr G. L. Banfield, Farm Advisory Officer, Thames, and Mr P. Anderson, contractor, Palmerston North.

2. Control of Vegetation on Roadsides and Industrial Sites

An ideal material for the treatment of such areas is simazine for the following reasons:

- (a) It is resistant to leaching.
- (b) It is not decomposed by soil organisms (an important consideration for the treatment of soil with a high organic matter content and high microbiological activity).
- (c) It is resistant to decomposition by ultra-violet light.
- (d) It is nearly water insoluble.

The application rate of simazine active at 10 to 16 lb per acre will ensure at least a seasonal protection against reinfestation by most weed species. Diuron may be comparable to simazine, though it may not be as lasting in soils with a high humus content. This deficiency is compensated for by its greater efficacy on some hard-to-kill grass species, paspalum and tall fescue. Though monuron is effective at the same rate of application as simazine, it suffers from the same disadvantages as diuron, but these may be even more pronounced. Monuron being significantly more soluble in water is subject to leaching and care must be taken on sloping ground to obviate damage to neighbouring areas.

For the control of weeds growing on roadsides and industrial sites it is necessary to employ foliage absorbed materials to ensure a quick knockdown of the existing vegetation. Root absorbed materials such as simazine, monuron, and diuron are slow acting and most unspectacular in the initial action. The combination of amitrol and dalapon discussed under chemical clearing of drains is ideal for this purpose, and to maintain residual effect can be combined with the residual type of root absorbed chemical. The rate of application of dalapon and amitrol depends largely on the composition of the vegetation in the area. Should this be composed principally of hard-to-kill grass weeds such as paspalum and tall fescue, the rate of dala-

pon must be increased to at least 10 lb and preferably to 15 lb per acre and the amitrol to 2½ to 5 lb per acre. The 5 lb per acre rate of amitrol gives wider control of the flat weeds, but the 2½ lb rate is satisfactory if 2,4-D is used in conjunction. The rate of simazine, monuron, or diuron in conjunction with dalapon/amitrol mixtures is largely dependent on the length of control required from the treatment. In some cases it may be considered uneconomic to apply quantities which would provide control for more than one growing season. A quantity from 10 to 16 lb per acre of one of the three materials should be satisfactory for seasonal control under a wide range of conditions.

Annual weeds can usually be readily controlled in spring, but perennial weeds are more susceptible to the application of these chemicals in autumn. In any case, the timing of the spraying, whether spring or autumn, should be carried out to ensure the destruction of all seedlings germinating at this stage.

The cost of the chemical should be related to the expected period of protection. The dalapon/amitrol combinations are not expected to give long residual effects, the control being about three months, though slightly greater under the more arid conditions in some of the South Island districts. Application of this mixture with simazine, monuron, or diuron at rates of 10 to 16 lb per acre will ensure control from six to 12 months, depending on the rainfall and soil conditions. Simazine definitely appears to be the most lasting under the varying soil conditions. The combination of simazine or monuron with amitrol has been very popular in this country, but the limitation is that they do not provide complete control of the hard-to-kill perennial grasses, such as paspalum and tall fescue and must be fortified by other chemicals where these species are present.

3. *Control of Weeds on Railway Lines*

Weedkillers used on railway lines apart from satisfactory vegetation control should be safe and free of undesirable side effects. By this I mean any effect the weedkiller may have on the applicator, grazing animals, automatic signalling systems, slipping of trains on the track sprayed, and corrosion of the application equipment used. Generally, the present weedkillers of organic chemical origin are free of these undesirable properties. The determination of their cost efficiency should therefore be carried out on this basis rather than by strict comparison of weedkilling cost efficiency with the inorganic chemical type of weedkillers suffering usually from the above quoted disadvantages.

Further considerations are:

- (a) The capacity of the weedkiller to perform its task unaided by manual or mechanical cleaning of track.
- (b) Protection against reinfestation.
- (c) To work independent of weather conditions and ease of application.

Weedkilling preparations of organic origin which largely comply with the main requirements are:

1. *DALAPON/AMITROL MIXTURES*

(a) *Advantages*

1. Capable of destroying most existing grass and broad-leaved plants.
2. Good knockdown.
3. No detrimental effect on automatic signalling systems.
4. Do not induce the slipping of trains.
5. Less affected by adverse weather than weedkillers of inorganic origin.
6. Capable of low volume application thus saving labour, time, and inconvenience by blocking track to normal traffic.

(b) *Disadvantages*

1. Offer temporary control only (under average conditions, two treatments a year are required).

2. Physical character of mixture not entirely satisfactory. (Inclined to cake on storage nearly as much as the inorganic type weed-killer.)

2. SIMAZINE, MONURON, DIURON

(a) Advantages

1. Safe to use.
2. No detrimental effect on automatic signalling systems.
3. Do not induce slipping.
4. Not affected by weather.
5. Capable of low volume applications.
6. Residual.

(b) Disadvantages

1. Little knockdown of existing vegetation.
2. Insufficiently wide spectrum of efficacy at economic rates of application.
3. Form suspensions in water requiring agitation during application.

By a combination of the two groups of compounds the disadvantages of the individual materials can be largely overcome, but if necessary such mixtures can be fortified by weedkillers such as 2,4-D and fenac.

CONCLUSION

In the last 20 years a large number of herbicides have been evaluated in field usage. The advantages and disadvantages of individual materials have been realised and it has become increasingly evident that no one compound can give total vegetation control.

DISCUSSION

Q.—What detailed evidence have you of synergistic effects of amitrol when combined with dalapon?

A.—You get a quicker knockdown, but it is doubtful if the final result is any better.

Comment: If it were not for amitrol, when combined with dalapon on railway work, the rates of dalapon would have to be increased considerably to control paspalum and tall fescue.

Q.—Was the ratio of dalapon to amitrol 4:1?

A.—Yes.

Q.—What experimental evidence have you that simazine will outlast monuron or diuron?

A.—Experiments at New Plymouth would indicate that simazine is better.

Comment: In soils of high organic content simazine seemed to check seedling growth longer.

Comment: Amitrol and dalapon are additive not synergistic. What does the speaker think of amitrol and dalapon mixtures as compared with 2,4-D and dalapon mixtures?

A.—No experience myself, but I think amitrol and 2,4-D would not be as good. Consider better kills of grass obtained with amitrol and dalapon.

Q.—What is the persistency of chemicals in rhizomatous grasses?

A.—Dalapon is considered to have a more residual effect than amitrol in the plant, but though amitrol persists for a shorter period it shows up as pink discolouration for some time after application.