REVIEW OF WEED CONTROL IN NEW ZEALAND

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SUMMARY

THIS paper reviews the use of weedkilling chemicals for agricultural purposes. Weedkillers are of direct value for the control of high-fertility and climatic weeds of pastures and plant establishment, for crops, newly sown pastures, and pasture establishment in low-fertility areas, and for drainage and irrigation canals and dangerous aquatic weeds. Their biggest use in the future appears as indirect aids to agricultural practices, to assist cultivation practices by prior killing of the weeds or turf, and as a replacement for cultivation on unploughable country by reducing plant competition and allowing direct seeding. Direct seeding of crops may also be practised on flat land. Other uses are as crop desiccants and to assist farm management practices.

I propose to review the present use and attempt to look into the future use of weedkilling chemicals, particularly for agricultural purposes. Possibly, no subject in the whole field of agricultural technology has advanced as rapidly in recent years as has that of chemicals for weed control.

DIRECT USE OF WEEDKILLERS

Pasture weeds: The most important direct use of chemicals is for the control of high-fertility weeds of pastures. No pasture is completely weed-free, but with increasing fertility the prostrate-growing low-fertility weeds, flatweeds (*Plantago* spp, *Taraxacum officinale*, etc.), field daisy (*Bellis perennis*), sorrel (*Rumex acetosella*, etc), have largely disappeared and have been replaced by weeds that could be classed as high-fertility weeds. The commonest high-fertility weeds are docks (*Rumex* spp), buttercups (*Ranunculus* spp), scotch thistle (*Cirsium lanceolatum*), and other thistles and barley grass (*Hordeum murinum*). The introduction of upright-growing grasses, rotational grazing, high rates of fertilising, all factors aimed at increasing production, have favoured the establishment and increase of high-fertility weeds. In addition, grass-grub attacks and adverse climatic conditions favour weed establishment; a wet season favours buttercup establishment and a dry season, thistle, dock, and barley grass establishment.

Some external factor completely unrelated to normal farm management practices is necessary to control the incidence of high-fertility weeds, particularly if production per acre is to be raised. Selective weedkillers offer the best means of control.

Climatic weeds: Weeds more typical of hill pastures particularly in lighter soil prone to summer droughts are winged (*Carduus tenuiflorus*), variegated (*Silybum marianum*), and nodding (*Carduus nutans*) thistles. If these thistles are not checked early after entry into the pasture by progressive pasture smother, they can spread rapidly. The aerial application of hormone weedkillers not only limits the spread of these thistles, but offers a ready means of controlling them after the dry weather and allows the re-establishment of pastures.

Low-fertility weeds: Many weeds will not compete with a good pasture. Numerous examples could be cited: the various flatweeds, cresses (*Coronopus didymus*, etc.), various daisies (*Anthemis cotula*, *Matricaria* spp, etc.), and most scrub weeds. The control of this type of weed with chemical weedkillers is not warranted. Such control measures would only be temporary, as the cause is not removed and reinfestation quickly

re-occurs. Furthermore, many low-fertility weeds are edible and their suppression leads to a temporary loss in pasture production which may be serious if accompanied by clover damage.

Clover damage: The successful use of MCPA and 2,4-D depends on the extent of clover damage. White clover, the most dominant species, is most readily damaged by MCPA and to a less extent by 2,4-D in early spring and again in late autumn. In a pasture where the balance is in favour of clover dominance a check in clover growth in spring may not lead to a drop in pasture production; it may even be beneficial as an agent in reducing the incidence of bloat. The control of susceptible species such as buttercup and thistles under these conditions is a worthwhile operation.

In a pasture where clover growth is not excessive, nitrogen could be the limiting factor, particularly in early spring. It is at this period that grass grows at the expense of clover and is dependent on sufficient nitrogen for growth. Under these conditions clover damage is important and a check to clover with either MCPA or 2,4-D in a dry season may last from one spring to the next. Similarly, the effect of a check to clover in the late autumn will carry over to the following spring with subsequent loss in pasture production. In both cases the incidence of weed growth should be such that its control is more important than clover damage before weedkillers are used, and measures to re-introduce clover should follow spraying.

In a low-fertility pasture supporting introduced grasses or in a pasture where clover growth is not adequate, clover damage at periods that will result in reduced spring growth of grasses is serious. In such circumstances the use of MCPA or 2,4-D to control weeds such as ragwort (*Senecio jacobaea*) may be successful, but with pasture deterioration as a result of clover suppression. In contrast, a reduction in competition from clover and the control of weeds in a high-fertility pasture usually leads to extra grass growth, hence the use of MCPA and 2,4-D in pastures where clover is not growing strongly at periods that cause clover damage is not recommended. The use of these weedkillers appears limited in swards where clover growth is inadequate.

At periods other than early spring and late autumn clover is more resistant and a slight check does not necessarily lead to a loss in pasture production. In the warmer months clover growth is stronger than most high-fertility grasses and a response to grasses has been noted if toxic preparations such as 2,4,5-T have been used to check the clover. Clover damage may also be reduced at the susceptible stages of clover growth by hard grazing before weedkiller application. This reduction in damage is apparent only at the susceptible stages of clover growth.

As aids to plant establishment: As one of the main purposes of cultivation is to reduce plant competition, any factor that will aid desirable plants to establish after cultivation is of value. Selective weedkillers have proved worth while in the following cases:—

Crops: In annual crops weedkillers are necessary only to allow crop establishment. This usually means weed suppression is necessary for a short period, particularly if the crop forms a complete ground cover. For perennial crops, particularly those that do not form a complete ground cover, weed control is difficult. Chemicals aid the suppression of weeds, but in very few instances could be claimed to be wholly successful. No chemical is specific enough to allow only one species to establish weed-free. A combination of chemicals and/or cultivation is required to keep perennial crops weed-free.

Spring sown pastures: In many areas the sowing of pastures in spring is desirable, but is not commonly practised due to greater establishment of weeds than in autumn sowings. If annual weeds and low-fertility edible

perennials are dominant, the use of chemicals is probably not warranted, because effective weed control can be obtained with the first grazing, except under adverse conditions. If high-fertility perennial weeds are present, particularly docks, their early control is worth while. The quicker-establishing ryegrass and docks suppress the clovers in the first season. The ryegrass then dies out through lack of nitrogen in the second season, leaving a clover-dock dominant sward.

Pasture establishment in low-fertility areas: In many newly developed areas good pastures cannot be obtained until the fertility status is raised. This process usually takes several years. Low-fertility weeds and scrub weeds such as gorse (*Ulex europaeus*) often prove troublesome in the establishing stages. Weedkillers have been used extensively to check such weeds until the pasture improves sufficiently to control the weeds by plant competition aided by grazing.

Weeds of waste areas: The use of temporary or long-term weedkillers for control of weeds in drains or irrigation canals is worth while. The conditions that allow weeds to establish cannot be altered, so that chemical control has proved to be of value. Dangerous aquatic weeds such as water hyacinth and even willow fall into the same category. Poisonous weeds such as cape tulip survive in pastures, because they cannot be grazed. This type of weed is also best controlled with weedkillers.

INDIRECT USE OF WEEDKILLERS

The main use of weedkillers in the past and at present is to maintain an ecological balance such as control of high-fertility weeds in pastures or restricting the spread of undesirable weeds. In future, weedkillers will be used more and more to aid other agricultural practices.

AS AIDS TO CULTIVATION

Weed control in conjunction with seed-bed preparation is a sound practice, but cultivation for weed control alone is not warranted. For annual weed control, if suitable climatic conditions are obtained, a summer fallow will reduce seed population in the soil, but the same results can be obtained by the application of a suitable chemical to the growing crop, thus allowing full utilisation of the land. For perennial weed control of species such as couch (*Agropyron repens*) in a suitable season by hustling, the soil is usually so depleted of moisture to the depth of cultivation that the subsequent crop suffers and also the land is out of production for a period. Equal or better control has been obtained by the sowing of a resistant crop and treating the couch in the crop or by the application of a weedicide to the soil after rotary hoeing or similar cultivation. In either case the soil is not depleted of moisture and the land is fully utilised.

In dry areas 12 months is often required to rot down the existing turf mat before a suitable seed-bed can be prepared. Chemicals have aided the process, allowing the seed-bed to be prepared in the one season. On hill country suitable for giant discing, the number of cuts with the discs has been reduced by pre-killing the existing turf with chemicals. This not only facilitates cultivation, but allows a better strike of oversown species due to reduced plant competition.

AS A REPLACEMENT FOR CULTIVATION

Large areas of New Zealand are too steep to be cultivated even with tracklaying equipment, but even where cultivation can be practised weedkillers appear satisfactory alternatives. There are about 13,000,000 acres of browntop (*Agrostis tenuis*) country in New Zealand, much of

which is too steep to be cultivated with tracklaying equipment. The over-sowing of browntop swards is not over-successful; clovers establish, but the introduction of grasses is difficult. The addition of fertilisers to such areas usually results in a response to low-fertility annual clovers and low-producing strains of white clover. If the existing turf is killed with chemicals, grasses establish successfully and an even better establishment of clovers is obtained. If dalapon is used alone, the rate of application does not destroy existing clover, cocksfoot, or ryegrass. This method should receive widespread acceptance, as the weedkiller, seed, and fertiliser can all be applied aerially. If the dead turf is excessive, it could also be removed by firing, but this would probably lead to the same conditions as brought about by cultivation, that of free plant competition where weeds are likely to strike with the sown species, whereas in the usual method, the existing vegetation is killed by chemicals and replaced by the sown species.

Initial work indicates that field crops may be drilled directly into pastures without prior cultivation, provided the existing pasture species are killed with chemicals. The process is simple. Apply chemicals to a sward, say, that has been attacked by grass-grub or suffered in a dry spell and drill the crop directly into the sward. The work done to date indicates that the crop establishes weed-free and utilises the nitrogen released by the dying vegetation and from animal faeces and urine on the surface.

TO FACILITATE CROP HARVESTING

The successful harvesting of small seed crops is largely seasonal. In a dry season harvesting is successful; in a wet season many crops are ruined or the yields lowered by the crop not ripening evenly or suffering damage from adverse weather. Weedkillers used as crop desiccants have resulted in a higher seed yield. This is most likely due to the chemical causing the crop to ripen more evenly and allowing it to be harvested earlier. This earlier harvesting allows the pasture to recover before winter sets in, thus restoring vitality to the pasture. The crop can be direct headed successfully even though wet conditions intervene between the date of application and harvesting. The use of chemicals as desiccants to facilitate potato digging is well known, but chemicals can be developed further to aid the harvesting of maize. This would enable later-maturing, higher-producing varieties to have a wider geographic distribution.

TO ASSIST FARM MANAGEMENT

The clover-grass relationship in a sward may be altered by farm management practices. This is usually a slow process and not always satisfactory. In Hawke's Bay, for example, the usual practice is not to sow clover with ryegrass seed crops, because the clover reduces the ryegrass yields by smothering. Poor strains of clover usually dominate the crop after several years and if harvested for seed, much of it is rejected. The application of sulphate of ammonia to boost the ryegrass is not always successful in suppressing the clover. Weedkillers could be used to suppress the clover in a grass seed crop or suppress the grass in a clover seed crop.

CONCLUSION

With increasing knowledge of weedkillers their use can be extended. It is considered that weedkillers are much more effective in reducing plant competition than cultivation. Costs are less also, hence weedkillers should be equally as successful on hill country as cultivation on flat land. Even on flat land there is some evidence to indicate that the amount of cultivation could be reduced considerably. It is this indirect use of weedkillers that will increase the demand for weedkillers in the future.

DISCUSSION

Q.—Has any advance been made in barberry (*Berberis* spp) control?

A.—Barberry is resistant to over-all spraying with 2,4-D and 2,4,5-T. The most promising treatment at the moment is the basal application of a 2,4,5-T concentrate in diesel oil. Such a material is now commercially available in which the 2,4,5-T is more miscible with diesel oil than was previously the case.

Q.—Should barberry be sprayed at any particular time of the year?

A.—The generally accepted time is in the spring as dormancy is breaking.

Q.—What is the life of dalapon in the soil when applied at relatively high rates such as 15lb. or 20lb. per acre?

A.—There is no experimental evidence available, but the material is soluble and in a light soil its disappearance would be quite rapid; say, 2 to 4 weeks.

Q.—Is there an effective spray to control willow weed (*Polygonum persicaria*)? If so, what is the optimum time for treatment?

A.—There is no satisfactory material for the control of this weed after emergence. The most promising material at present appears to be 2,4-DB.

At the pre-emergence stage willow weed is controlled by the carbamates, but these materials are suitable for restricted use only.