CONTROL OF WEEDS

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I. PROMISING NEW CHEMICALS FOR WEED CONTROL

The discovery of chemicals that could be used for selective weed control stimulated a new interest in chemicals lethal to plants. New preparations of the present acids of the well-known hormone weedkillers have been offered by manufacturers for trial work and a heavy programme of work is required to determine the advantages of such new developments for use in New Zealand.

Improved analytical methods have enabled the active principle (the 2,4 isomer of M.C.P.) to be separated from the inert ingredients contained in old preparations of M.C.P. Trials on rushes and buttercups in New Zealand have shown that preparations based on the pure 2,4 isomer are at least one third more active than preparations based on impure M.C.P. Progress has also been made with new formulations of M.C.P. acid. The potassium and amine salts of M.C.P. show higher solubility than the sodium salt preparations of M.C.P. now available and are less likely to crystallize out of solution or on the surfaces of sprayed plants. A water-based ester, the polyethylene glycol ester of M.C.P. has been used in preliminary trials and shows promise of having increased toxicity over the water-based materials without decreased selectivity.

From 2,4-D and 2,4,5-T acid base a new low-volatile ester, the alkyl cyclo-hexyl ester, has been formulated. This material has been compared with standard formulations in trials on Spanish heath, rushes and lawn weeds but trials have not been down sufficiently long to determine its value. The results of experiments in New Zealand with micronised 2,4-D and 2,4,5-T acid agreed with overseas results that these preparations had lower herbicidal properties than the commonly formulated salts and esters. Emulsions of 2,4-D and 2,4,5-T acid now under trial should prove better than the micronised forms. Further preparations based on 2,4-D and 2,4,5-T that require testing in New Zealand are the mixed isomers of trichlorophenoxyacetic acid and the activation of 2,4-D and 2,4,5-T with amino triazole. Trials will be undertaken with these promising materials as soon as supplies become available. A new parent hormone acid (4-C) has been developed in the United States where it has proved promising

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for the control of fern. It is more selective on legumes and controls a few weeds not susceptible to the other hormones. Preliminary trial work has been commenced in New Zealand with the butyl and butoxy ethanol esters of 4-C on Spanish heath, fern and lawn weeds.

From the phenoxyacetic acid (hormone base), several compounds have been made which overseas have proved to be successful for crop weed control. Only preliminary testing of these materials has been carried out in New Zealand. An important compound that should prove complementary to T.C.A. is "Dalapon". This recently developed compound has shown great promise for weed control in lucerne, onions and some horticultural crops. It is more toxic to fibrous rooted grasses than T.C.A. and should be effective for the control of tall fescue and Nassella Tussock. Comprehensive trials are to be put down on these species as soon as experimental supplies of this material become available.

II. SOIL STERILIZATION

The most outstanding development in weed control chemicals since the discovery of hormone weedkillers has been made in the soil sterilization field with the advent of weed-killing compounds based on urea. The older types of soil sterilants have major disadvantages - arsenicals are poisonous and chlorates have explosive properties. Compounds based on chlorates, made safe with the inclusion of inert materials such as borate compounds, have an efficiency only equal to their chlorate contents. Chlorate compounds have in some trials not proved lethal to grasses even at rates of 2 tons per acre. Borate compounds have not proved particularly toxic to weeds such as blackberry, (Rubus fruticosus) and Convolvulus arvensus. When these materials are used the period in which the soil has remained free of weeds has been comparatively short. However, the organic compounds based on urea (C.M.U., P.D.U. etc.) are non-toxic to animals, and are relatively easy to apply. Six trials to date comparing the old compounds with the urea compounds show that the urea compounds are many times more toxic per unit than chlorates and borates. In one trial 20 lb. per acre of C.M.U. has given better control than 2 tons of borates, chlorates, and mixtures of borates and chlorate. In the same trial 40 lb. of C.M.U. has given complete control of all vegetation except for one small plant of Paspalum. At 80 lb. per acre everything has been killed and after 15 months the ground is still free of all vegetation. At lower rates the urea compounds are selective enough to be employed for crop work. Carrots, onions, lucerne and potatoes show sufficient tolerance to be weeded with low rates of these compounds.

In one trial where C.M.U. had been applied at 4 and 8 lb. per acre excellent control of weeds was obtained with no apparent damage to potatoes. Further trials are necessary to establish the residual toxicity of these urea compounds in various soils at various rates of application. Susceptible crops planted in areas treated with urea compounds may be destroyed by the carry-over of residual toxicity of the chemical. Preliminary trials have shown that Paspalum dilatatum requires up to 60 lb. per acre for control and that in general deep-rooted plants such as Californian thistle (Cirsium arvensis) are more difficult to kill than shallow rooted plants. Deep-rooted plants are more effectively controlled with a more soluble form of urea than C.M.U., namely P.D.U. Future trials may show that a combination of these two compounds will give more effective control for certain types of weeds than either used alone.

III. REVIEW OF WORK TO DATE WITH T.C.A. (Trichloracetic Acid)

To date 76 trials have been laid down with T.C.A. applied alone or in conjunction with other materials such as I.P.C., chlorates, borates, hormone weedkillers and phenols. Thirty-three of these trials are finalised. The finalised trials include 12 trials on pasture weed species, 15 trials on crops and 6 trials on miscellaneous vegetation such as was found on tracks and ditches. Trials now open include 18 trials on pasture weed species, 12 trials on crops, and 13 trials on miscellaneous or special vegetation such as Nassella tussock (Nassella trichotoma). The trials on weed grasses and pasture weeds were put down on barley grass (Hordeum murinum), tall fescue (Festuca arundinacea), fog (Holcus lanatus), creeping fog (H. mollis), couch (Agropyron repens), Indian doub (Cynodon dactylon), Kikuyu (Pennisetum clandestinum), browntop (Agrostis tenuis), onion rooted twitch (Arrhenatherum elatius var. bulbosum), rushes (Juncus spp.), Paspalum distichum, Carex longifolia, Pennisetum macrourum and Themeda triandra. Good control was secured with all species except tall fescue, and Themeda triandra. In all cases rhizomatous grasses were more susceptible than stoloniferous grasses and the established fibrous rooted grasses were the most resistant. Best control was obtained where the T.C.A. was used in conjunction with cultivation. These experiments showed the need for a follow-up treatment such as cultivation or repeat treatment of T.C.A. if eradication was required otherwise the small percentage of viable roots left quickly re-infested the area. The crops treated with T.C.A. were lucerne, clover species, brassicas, potatoes, Phormium tenax and linenflax. Potatoes, linen flax and brassicas showed more tolerance than the legumes while Phormium tenax in the seedling stage was highly

susceptible. The work in crops has shown that T.C.A. forms a useful adjunct to cultivation for weed control. Rhizomatous grasses are best cleared by ploughing, cultivating, putting in a resistant crop such as brassicas or potatoes and applying T.C.A. before crop emergence. Such an application will also keep the crop free of annual grasses, spurrey, (Spergula arvensis), red root (Amaranthus retroflexus), Pigweed (Polygonum aviculare), fathen (Chenopodium album), and willow weed (Polygonum persicaria). Nassella tussock, being a fibrous-rooted grass is difficult to kill with T.C.A. but good control has been obtained where the applications have been made after burning. Usually two applications are required for control. Seedling Nassella is quite susceptible to T.C.A. T.C.A. is too selective to give a kill of all species growing on footpaths. Clovers and many broadleaved weeds survive the T.C.A. applications and the period for grass control is short.

Work to date has shown that T.C.A. is best applied in conjunction with cultivation. Best results are obtained if the soil is moist at the time of application and if rain falls immediately after treatment. More T.C.A. is required on mineral clay soils than on soils low in colloidal content but T.C.A. is leached more readily in light soils than in heavy soils and in wet weather the period of T.C.A. activation in sandy soils is short. T.C.A. has proved a selective grass killer with few exceptions and as such is a valuable chemical for control of weeds not normally killed by hormone weed-killers.

IV. TOLERANCE OF PASTURE SPECIES TO WEEDKILLERS

Many requests are received for methods to control annual weed grasses in established pastures or in seed crops. Trials have determined the tolerance of weed grasses such as goose grass, barley grass and hair grass to selective grass killing preparations such as T.C.A., I.P.C., and C.I.P.C. The tolerance of pasture species to these grass-killing chemicals had to be determined before recommendations could be made on the control of annual weed grasses in pastures and seed crops. Pure stands of short rotation and perennial ryegrass, cocksfoot and timothy were sown at heavy rates of seeding (40 lb. per acre) and a trial was carried out at the Marton Experimental Area to determine the tolerance of these species when T.C.A. was applied at different rates to pastures of different ages. T.C.A. applied 4 months after sowing, at 5 and 10 lb. per acre, had little or no effect on the ryegrasses and timothy but 20 lb. T.C.A. depressed establishment. Cocksfoot was not depressed at any rate of application, when the grasses were treated 8 months after sowing (November),

40 lb. T.C.A. depressed the ground cover of all species, but lighter rates had little effect. This trial indicates that annual weed grasses may be eliminated from pasture or small seed crops without damaging the sown grass species.

Most pasture weeds can be controlled by hormone weedkillers but an important aspect of pasture spraying is clover tolerance. A large scale trial was put down at the Invermay Research Station and at the Merton Experimental Station to determine the tolerance of three clover species to five of the most common forms of weedkillers. At the early stage of growth (2-3 true leaf stage) at the rates employed all clover species were depressed except by the most selective preparation of D.N.B.P. and sodium M.C.P. At a later stage (4 months after sowing) only the oil based ester of 2,4,5-T depressed the clover. These trials also showed that the clovers were affected differently by the various weedkillers. White clover at an early stage of growth was significantly more resistant to D.N.B.P. than red and subterranean clover, and red clover was significantly more resistant to M.C.P. than subterranean and white clover. At a later stage of growth white clover becomes more susceptible to 2,4-D than to M.C.P. It is clear from these trials that if the main clover in the sward is white clover, 2,4-D is the most selective preparation at the early stages of growth but M.C.P. causes less damage when the clover is well established. If the pasture is predominantly red clover then the most suitable preparations to employ are those based on M.C.P. Compounds of 2,4,5-T base are more lethal than either M.C.P. or 2,4-D to all clover species, hence 2,4,5-T is more suitable for the eradication of clovers in lawns and playing greens.

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V. TRIALS ON THE CONTROL OF WEEDS IN CROPS

Twenty trials were laid down on various crops during the past year. The trials included one trial on potatoes, one "desiccant" trial on maize, two trials on swedes, four weedkiller trials on maize, two trials on wheat, ten trials on lucerne and one trial on cowgrass. For all these crops very promising results have been obtained. In potatoes, T.C.A. gave effective control of grasses and red root (*Amaranthus retroflexus*), while the water-based preparations of M.C.P. gave control of the broad-leaved weeds present and C.M.U. gave control of all weeds present. Damage resulted only through the use of oil-based esters of 2,4-D applied at the post-emergence stage. Two trials conducted on swedes showed that excellent control of grass-weeds, spurrey (*Spergula arvensis*), redroot (*Amaranthus* spp.), fathen (*Chenopodium album*),

pigweed (Polygonum persicaria) could be obtained by a pre-emergence application of T.C.A. at 10 lb. per acre. I.P.C. also gave good control of weeds, particularly members of the Polygonacea but rates over 1.0 lb. per acre reduced the germination of the swedes. Yield data are not available from the maize trials but indications are that maize may be treated up to 2-3 weeks before tassel formation without damage, particularly if water-based preparations of M.C.P. and 2,4-D are used. Hormone damage makes the maize brittle and yield reduction occurs from this cause if windy weather follows applications. The crop desiccant trial was designed to dry the maize once the cobs were fully formed to permit earlier harvesting. Yield data are not available from this trial.

Hormone weedkillers were applied at two growth stages to wheat. The first application was made at the 3-5 true leaf stage and the second application was made when the wheat was fully tillered. At the early growth stage all preparations, particularly the esters of 2,4-D, caused distortions of growth of the cereals. At the later stage of growth no damage occurred from any of the treatments. Observations await confirmation by yield figures but the results of this trial agree with overseas work, which shows that applications made before the 6 leaf stage of growth of all preparations of hormone weedkillers will cause distortion of seed heads, the more selective M.C.P. preparations causing less damage than equivalent 2,4-D preparations. This is not always associated with yield reduction.

T.C.A. formed the main treatment in the lucerne trials. In a few trials, forms of I.P.C. were also included. All the treatments were applied when the lucerne was dormant. The T.C.A. applications gave good control of annual grasses and rhizomatous grasses but reduced the yield of lucerne in the first cut after treatment. The I.P.C. treatments did not retard the lucerne growth but effective grass control was not always obtained. These trials show that grasses can be kept out of newly sown stands of lucerne but that yield reduction of the lucerne occurs up to the first cut when old weedy stands are renovated by the use of T.C.A.

Spectacular control of broad-leaved dock (Rumex obtusifolius) was obtained in cowgrass with the use of maleic hydrazide. Docks show too much resistance to be eradicated with hormone preparations in cowgrass, as cowgrass is a susceptible crop and docks are a resistant class of weed. In this trial no damage was done to the cowgrass by the application of maleic hydrazide.

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