CONTROL OF RUSHES WITH HORMONE WEEDKILLERS IN TAURANGA

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THIS paper outlines the work done over the past 3 seasons in Tauranga County on the control of rushes with hormones and indicates what measure of success has so far been attained. It must be stressed that the paper is limited to work done in this district and that the information obtained from these trials, and recommendations made as a result of them, may not necessarily apply to other districts with differing soil types and climatic conditions.

Although Tauranga County consists primarily of undulating to hilly pumice country, there are large areas of swamp country adjacent to Te Fuke and also many swampy valley bottoms scattered throughout the county. A large portion of this country has been drained, at least to some extent, but there are also considerable areas on which lack of drainage is undoubtedly the principal factor limiting production, and which are more or less waterlogged over the winter. Portions of the swamp country are rendered more difficult to develop because they contain a considerable quantity of stumps and timber which renders mowing impossible.

Except on those farms where drainage is adequate, rushes have always been a problem on this swamp country. The commonest species is *Juncus effusus*, which is the soft type of rush readily eaten by cattle during the winter. The next most common species is *J. polyanthemus*, a thin-stemmed, tough, wiry rush which is seldom, if ever, touched by stock. Experiments have been carried out on both these species. In selecting areas for trial the most heavily rush-infested portion of the paddock has invariably been chosen, and in most trials both *J. effusus* and *J. polyanthemus* have been growing together. In the first 3 trials laid down spraying was done with a knapsack spray pump using a low-volume nozzle, and in most of the later trials spray was applied through a hand spray pump. Some trials have also been sprayed with a farmer's pump and boom under practical field conditions.

The first three trials were laid down in January, 1951, with the ethyl ester of 2,4-D, the sodium salt of 2,4-D, and the butyl ester of 2,4,5-T, each at 2lb. of acid equivalent per acre. One trial was laid down on a moderately well-drained area somewhat wet in winter; the other two were on much wetter areas, one in particular being extremely wet in the winter. The principal species of rush in this last trial was *J. polyanthemus*, and *J. effusus* was the main rush in the other 2 trials. In all cases the rushes had been mown about 2 months before spraying and the new growth was about 15in. high when the trials were laid down. The results of these trials were outstanding. In all 3 the ethyl ester of 2,4-D gave virtually complete control of both *J. effusus* and *J. polyanthemus*; the 2,4,5-T was disappointing. It browned off the tops a little, but the plants made full recovery after about 3 months. The sodium salt was virtually useless, the rushes being almost completely unaffected. The weather during the autumn of 1951 was warm and there was ample rainfall.

As a result of these 3 trials, work during the following year was directed at finding out the optimum rate of application of the ethyl ester

of 2,4-D and also to testing the value of the polyethylene glycol ester of 2,4-D. In January 1952 a further 5 trials were laid down, 4 in the Te Puke district and one at Katikati. *J. effusus* and *J. polyanthemus* were both present in the trials, which were sprayed with polyethylene glycol ester of 2,4-D and 2 proprietary lines of the ethyl ester of 2,4-D, 1lb. and 2lb. of acid equivalent per acre in 20 gallons of water being used in each case. In all cases rushes were cut 6 to 8 weeks before spraying. Weather conditions after spraying were drier than in the previous year, and results, although very encouraging, were not so spectacular. They indicated that 1lb. of acid equivalent per acre was too light, regardless of the type of hormone used. Even at 2lb. of acid equivalent per acre, the polyethylene glycol ester of 2,4-D gave only about 30 per cent. kill, whereas the ethyl ester of 2,4-D gave 70 per cent. control. It is considered that the drier autumn may have been responsible for the poorer kill in these trials. The trial at Katikati is worthy of note. Here about 70 per cent. kill was obtained with the ethyl ester of 2,4-D on a very poorly drained area which was under water most of last winter. As a result of this there was a dense growth of seedling rushes last season, which demonstrated that improved drainage must go hand in hand with hormone spraying if permanent rush control is to be obtained.

It was during the season just past that the most extensive series of rush trials was laid down. The first one was in October 1952 on a paddock that had been sprayed by the farmer in January 1952 with 1.35lb. of acid equivalent of ethyl ester of 2,4-D per acre through 32 nozzles with a boom. He had obtained about 50 per cent. kill on *J. effusus* and *J. polyanthemus*, and the trial was laid down on the regrowth rushes, which varied in height from 6in. to 18in. Spray treatments were applied at 40lb. pressure through the boom with 32 nozzles on 7 plots and 46 nozzles on the eighth. The tractor travelled at 2 m.p.h. and measurements showed that 22 gallons of water were applied per acre on all plots except one, on which 44 gallons were applied. A wide range of spray treatments was applied at varying rates of acid equivalent per acre.

This trial confirmed that the ethyl ester of 2,4-D at the rate of 1.35lb. of acid equivalent per acre (3 pints per acre), though giving a fair degree of control, did not give a full kill. Best results were obtained from the use of the amine salt of 2,4-D at the rate of 2lb. of acid equivalent per acre. The doubling of the quantity of water per acre to 44 gallons by using 46 nozzles and applying the ethyl ester of 2,4-D at 1.35lb. of acid equivalent per acre gave no better results than when the smaller amount of water per acre (22 gallons) was used.

About the time this trial was laid down several farmers were asking if control could be obtained by spraying uncut rushes. This was of considerable practical importance to the farmer on timber country where mowing was impossible. Other farmers wanted to know if control could be obtained by spraying the stumps of freshly cut rushes. A fresh series of trials was thus designed to give the answer to these two questions. A paddock of heavy rushes was selected and a portion of these was mown in early November 1952 and the balance left uncut. The day after cutting plots were sprayed on the cut and uncut rushes with the ethyl ester of 2,4-D at 1, 2 and 3lb. of acid equivalent per acre in 20 gallons of water. In early January the rushes cut in November and not sprayed had a regrowth of 2ft. and further plots were selected from these rushes and sprayed with the ethyl ester of 2,4-D at 1lb., 2lb. and 3lb. acid equivalent per acre. At the same time similar spray applications were made to rushes that had never been cut. Two trials of this type were

laid down. We thus had in each trial, plots sprayed at cutting, plots on which regrowth after cutting was sprayed when 2ft. high, and uncut rushes sprayed in November and uncut rushes sprayed in January. Both *J. effusus* and *J. polyanthemus* were present in each case. These results indicated—

- (a) that 1lb. of acid equivalent per acre is too light a spraying, regardless of the time or stage of growth of rushes;
- (b) equally good results were obtained from 2lb or 3lb. of acid equivalent per acre;
- (c) the spraying of rush stumps directly after cutting is not satisfactory;
- (d) the spraying of uncut rushes is not satisfactory, unless the growth is not particularly dense or heavy;
- (e) the best stage to spray appears to be about 6 to 8 weeks after cutting, when the regrowth is 18in. to 2ft. in height and still soft.

Further trials were carried out to test the relative effectiveness of volatile and non-volatile esters of 2,4-D applied on regrowth rushes at 1.35lb. of acid equivalent per acre in 22 gallons of water through the farmer's boom. These trials indicated that the ethyl ester is slightly more effective, although neither gave 100 per cent. kill, because 1.35lb. of acid equivalent per acre is too light an application.

Finally, after the spring spraying had given such surprising results with the amine salt of 2,4-D, it was felt that this material should be tried further against the ethyl ester. Two trials were laid down; one in early March where the two types of rushes had been mown in early January and which had a regrowth of 12 to 18in.; and the other on country which was too rough for mowing and contained much timber, so the rush growth (*J. effusus*) was heavily grazed by stock in the winter and again in November, and the regrowth, 2ft. 6in. to 3ft. high, was sprayed in mid-January. In each trial the ethyl ester and the amine salt were each applied at 2lb. and 3lb. of acid equivalent per acre in 20 gallons of water. In each trial the amine salt was just as effective as the ethyl ester, and 3lb. of acid equivalent per acre gave no better kill than 2lb., both giving virtually 100 per cent. kill.

It might be interesting here to outline briefly the symptoms of hormone damage to rushes. It should be stressed that results are not spectacular in so far as speed of kill is concerned. The first symptom to show up is a browning of the leaves, starting at the tips and slowly working downward. This may or may not be accompanied by distortion. Then the base of the leaf, at the crown of the plant, starts to constrict in circumference and goes yellow-brown. This discoloration gradually darkens until the whole base of the leaf is blackish-brown to black and quite rotten. At this stage the leaves pull out readily and the plant may be considered as being killed. If rushes are sprayed in January, the paddock usually presents a dismal appearance in May and June, with masses of dried-up rushes, and it is suggested that cattle be wintered on the area to trample out these dead rushes and encourage pasture plants to grow in their stead. It is realised, of course, that this cannot be done on land which is very wet during these months.

From the trials so far carried out the following conclusions may be drawn:

1. Before full and permanent control of rushes can be obtained drainage must be improved to remove excess water. Unless this is done, there is a strong possibility of reinfestation.
2. *J. effusus* can be easily controlled by hormones. *J. polyanthemus*, although rather more resistant, can also be severely checked, and it is well worth while spraying this species.
3. To get best results it appears that rushes should be mowed about the end of November and sprayed in early January when the regrowth is 12 to 18in. in height. The spraying of uncut rushes or the stumps of freshly cut rushes is not as effective and is not at present generally recommended.
4. The most effective control has been obtained by using either the ethyl ester of 2,4-D or the amine salt of 2,4-D. Though a fair measure of control has been obtained by using 1.35lb. of acid equivalent of the ethyl ester of 2,4-D per acre, it is considered that it would be safer to increase this to 2lb. of acid equivalent per acre; the amine salt of 2,4-D should be used at the rate of 2lb. of acid equivalent per acre.
5. It is suggested that 22 gallons of spray solution be applied per acre. This may be done with the boom and 32 nozzles travelling at 2 m.p.h. Although this speed seems rather slow, it should be remembered that most rush country has a fairly rough surface not conducive to greater tractor speeds.
6. On country that is too rough to mow and containing a predominance of the soft rush *J. effusus*, it is suggested that stock be crowded on to the area in the late winter and spraying done when regrowth is 12 to 18in. high.

And now, let us examine the cost of spraying rushes and compare it with the cost of the older method of digging and burning. Today in Tauranga County it costs £6 10s. per acre to dig fully mature rushes from a moderately infested area and a further £1 10s. per acre to heap and burn the rush clumps—a total of £8 per acre. This does not give permanent control and further digging is usually needed after 3 or 4 years, usually at half the initial cost per acre.

On the other hand, spraying with 2,4-D at 2.0lb. of acid equivalent per acre costs £2 7s. 3d. per acre for material and £1 6s. 6d. for spraying—a total cost of £3 13s. 9d per acre. It is thus obvious that the hormone spraying of rushes offers the most economical method of rush control yet available.

Even if the most pessimistic of views regarding hormone control of rushes is taken and it is assumed they have to be sprayed every third year to control seedling growth, it is still cheaper to spray than to dig, especially when one considers the condition of a paddock after a heavy growth of rushes has been dug. It is true to say that the increased production obtained from a rush-infested area after the rushes have been properly sprayed will yield a very handsome profit within a few months of the spraying being done.

To conclude, it must be again repeated that this is only an interim report, and that the recommendations given today could easily be altered in the light of further experience. Even so, however, it is obvious that hormones do offer great possibilities in the control of the two species of rush under discussion, and that even with our present knowledge rushes can be sprayed to give very profitable results to the farmer.

DISCUSSION

Q. What varieties of rushes are not susceptible to hormones?

A. (Thompson): Trials have shown that *J. vaginatus* is the most resistant, that *J. effusus* is the most susceptible, and that *J. polyanthemus* and *J. luxurians* are intermediate.

Comment: I consider that for general rush spraying esters of 2,4-D are to be preferred to the amine salts of 2,4-D, as esters are needed for the more resistant species.

A. (Allo): It is preferable to have rushes identified before spraying, and if *J. effusus* or *J. polyanthemus* are the species present, the amine salt of 2,4-D is to be preferred, as clover is less affected by this than by the esters of 2,4-D.

Comment: Susceptibility may be related to the type of pith. The most susceptible rush (*J. effusus*) has complete pith and the more resistant (*J. vaginatus*) has very little pith; intermediate types are intermediate in resistance.

Comment: The most important factors in rush control are penetration (for which fresh growing stems are best), correct formulation, and complete cover.

Q. Do the young stems of resistant species have continuous pith?

A. (Healy): Not always, but pith is more complete in the young stems of most species.