CONTROL OF RUSHES

F. B. THOMPSON AND F. C. C. HUPKENS VAN DER ELST
Rukuhia Soil Research Station, Hamilton

Summary

Results are presented of trials over a period of four years to control *Juncus effusus* on peat land.

Overall boom spraying with 2 or 3 lb active ingredient of 2,4-D did not give good kills of rushes unless applied in October. Mowing a month after spraying increased the kills. Spot spraying at the rate of 8 lb per acre in July or August gave good kills and was cheaper than the boom spraying.

Results from the ethyl ester and the amine salt of 2,4-D were similar, except that rain shortly after spraying reduced the effect of the amine salt.

INTRODUCTION

ALTHOUGH IT WAS previously reported (Thompson, 1953) that rushes could be controlled by spraying with 2 lb 2,4-D (all rates given in lb active ingredient per acre), in practice this treatment has not, in many cases, been particularly satisfactory, and rushes have continued to be a problem, particularly on peat land. There have been reports, which have been difficult to verify, to the effect that increased kills of rushes may be obtained by various modifications of the normal spraying with 2,4-D.

This paper gives results of a series of experiments carried out over the last four years, in which the effects of various treatments claimed to increase the efficiency of 2,4-D for the control of rushes were examined. Times and rates of application, and forms of 2,4-D, were also studied. In view of the expense of overall spraying with the high rates of 2,4-D necessary to obtain good kills, and the damage to the clovers in the pasture, methods of spot spraying were investigated.

EXPERIMENTAL

All the trials were carried out near Hamilton on deep peat which was shallow drained and which had been sown to pasture several years previously. In all plots the dominant rush was *Juncus effusus*, but in many plots there were also occasional plants of *J. pallidus*, *J. polyanthemus* and *J. luxurians*. Except in spot spraying treatments and drain spraying trials, all applications were made in 30 gal per acre of water at 30 lb/sq. in. pressure. Unless otherwise stated the applications were made to regrowth from a prior mowing. Usually the regrowth was from 1 to 1½ ft high.

Owing to the difficulty in determining what is a single rush plant, counts to determine percentage kills are not satisfactory and were seldom used. In general, results were assessed by visual estimates of percentage kills, or by ranking the treatments in each replication.

Generally the treatments were replicated three or four times. Most of the treatments were applied in spring, and the final assessments made the following spring.

RESULTS

BRUISING

Just prior to spraying with the ethyl ester of 2,4-D, using the logarithmic attachment to the Oxford Precision Sprayer (Sweetman, 1959), the rush stems on some plots were bruised by dragging harrows, twice in the same direction, over the plots. The results showed that bruising had no effect on the kill of rushes.

WETTING AGENT

The recommended rate of a non-ionic wetting agent (approximately 1 ml per gal) was added to the spray mixture of the ethyl ester of 2,4-D and the effects assessed in logarithmic trials. The wetting agent had no observed effect on the results.

ADDITION OF SODIUM DICHLOROPROPIONATE

A trial commenced in October, 1959, showed that when 7.4 lb of sodium dichloropropionate was added to 2 lb of the amine salt of 2,4-D, there was practically total kill of the rushes, whereas the 2,4-D alone gave only about 80% kill. In the light of subsequent information it is now considered that these good results were due, in part, to the fact that the applications were made at the optimum time of the year. In further trials laid down in November and December, 1960, it was found that the addition of sodium dichloropropionate improved the results obtained with low and ineffective rates of the amine salt of 2,4-D, but the results were not worth while. At the highest rates used, namely 4 lb of 2,4-D and 6 lb of sodium dichloropropionate, the mixture was no better than 2,4-D alone. However, all the results were poor, presumably because it was too late in the season.

TIME OF APPLICATION

Two trials were conducted in which different plots of rushes were sprayed each month over a period of twelve months. In the first, which was commenced in November, 1960, and continued until October, 1961, 2 lb of 2,4-D both of the amine salt and the ethyl ester, was applied each month. In the second trial, which covered the period December, 1961, to February, 1963, 3 lb of ethyl ester was applied.

The period required for the regrowth during the winter months to reach a height of 1 ft after mowing was somewhat underestimated. Because of this and some grazing by cattle, the growth was often less than 1 ft high at the time of spraying, particularly in the first of these two trials. However, this factor does not appear to have materially affected the results, because good kills were obtained from the October spraying when the growth was only 6 to 9 in. high at the time of treatment.

In both trials best results were obtained from the spraying in October. Spraying in September in one year gave good results, but the next year they were very poor. In both years November sprayings were not satisfactory. The autumn and winter months gave intermediate and poor results respectively. Poor results were obtained from the sprayings applied from May to July, 1961, and from March to September, 1962. The optimum time therefore appears to be a short period in spring.

FORMS OF 2,4-D

The amine salt and the esters of 2,4-D were compared in three trials. The first was commenced in October, 1959, another in December, 1960, and the third was the "time of application" trial from November, 1960, to October, 1961. In the 1959 trial good results were obtained from both the amine salt and the ester. In the second trial, although the ester was slightly better, both materials were unsatisfactory, possibly because applications were not made at the optimum time. In the third trial results varied somewhat from month to month, but there was very little overall difference between the two formulations. However, on two occasions, *i.e.*, December, 1960, and June, 1961, when rain fell within a few hours of spraying, the amine treatment was very inferior.

In one trial 2,4-DB was applied at 2 lb, but it had practically no effect on the rushes.

MOWING AFTER SPRAYING

In a trial in which growth 1½ to 2 ft high was sprayed in October, 1959, half of each plot was mown close to the ground a month after spraying. The mowing very greatly increased the kills obtained.

MOWING ONLY

Plots of rushes were mown at 4-, 8-, and 16-weekly intervals in a trial to study the effect of frequency of cutting. The 4- and 8-weekly mowings reduced the amount of rush growth to such an extent that it was no longer a problem and did not affect pasture growth. Although the regular mowing did not eliminate the rushes, it reduced considerably both their number and their size. Spraying of the regularly mown rushes would be very much easier and cheaper than on unmown areas.

The 16-weekly cutting did little more than temporarily reduce the rush growth immediately after mowing. Before the next mowing there was vigorous rush regrowth 2 ft high and the shading effect of this severely retarded the pasture.

SPOT SPRAYING

Since the main objection to manual spot spraying is the labour involved, a record was kept of the actual time taken to spray three 20-ac paddocks in July and August, 1959. The time would obviously vary according to the equipment used and the degree of rush infestation. In this particular case a tractor-mounted unit was used with one man on the tractor and two men on the ground, each with a lead of hose. The spraying time in a paddock with a light infestation was equivalent to 9 min per ac, whereas two paddocks with heavy infestation required 24 and 35 min per ac. The spray mixture was applied at the rate of 10 lb of 2,4-D per acre, and good kills were obtained. A 20-ac paddock required 3 gal of concentrate (3.6 lb active ingredient per gal) or 24 fl. oz per ac. Assuming a round figure of 30 min per acre, the cost per acre would be:

Labour: 3 men for ½ hour @ 8s. 0d. per hr	= 12s. 0d. per ac
Material: 24 fl. oz of 2,4-D @ 56s. 6d. per gal	= 8s. 6d. per ac
Tractor running: ½ hr @ 6s. 0d. per hr	= 3s. 0d. per ac

TOTAL COST

23s. 6d. per ac

In comparison, overall boom spraying at 2½ lb of 2,4-D, which is the minimum rate for satisfactory results, would cost £2 per acre for the material alone.

In July, 1961, rushes were spot sprayed both manually and with the automatic spot spraying boom described by Beddek (1961), with various concentrations of 2,4-D to obtain more information on the rates required to give kills at this time of the year. It is difficult to assess rates applied in spot spraying, but as far as can be calculated the rates varied from 3 lb to 17 lb of 2,4-D. Assessment of the results in January, 1962, indicated that 7 or 8 lb gave about 75% kills. There was very little increase in effectiveness with double these rates, but 3 or 4 lb gave only 40 or 50% kills.

PARAQUAT

In trials to control rushes in drains on peat, paraquat at ½, 1, and 2 lb, plus wetting agent, was applied in 150 gal of water in January, 1963. *Juncus effusus* and *J. planifolius* were immediately affected by the paraquat, and an inspection in May, 1963, indicated that the 1 lb rate had killed most of the rushes, but a few plants still had a trace of green. The ½ lb treatment was only slightly inferior to 1 lb.

Detailed trials in which *J. effusus* in pasture was spot sprayed were commenced in April, 1963, and an inspection a month later indicated that 1 lb had given an apparent kill of almost 100%.

DISCUSSION AND CONCLUSIONS

Although paraquat is very promising, there has not yet been sufficient trial work to enable firm recommendations to be made for its use in the control of rushes. In the meantime, 2,4-D alone at the appropriate rates appears to be the most suitable material.

The results of the trials indicate that good kills of rushes from spraying with 2 or 3 lb of 2,4-D were the exception rather than the general rule. To obtain good results from these rates, the material had to be applied at the most favourable time of the year. In both 1961 and 1962 this was in October. However, owing to seasonal variations in the weather, it could well be that in another year October could be a period of unfavourable growth for spraying. On the peat land where these trials were conducted, the period of rapid plant growth comes later in spring than on mineral soils, and the growth frequently declines rapidly in summer when the peat dries out. Therefore it is possible that the period of maximum susceptibility of rushes to 2,4-D is of shorter duration on peat than on mineral soils.

It would not be practicable to increase the rates for overall boom spraying to ensure better kills at other times of application, not only because of the severe damage to the clovers in the pasture, but also because the treatment would be too expensive. Interest therefore centres on spot spraying. Labour is the most expensive item in manual spot spraying, and in the example for which costs were given the three-man team was probably a very efficient labour unit. On many farms there would be less labour available, and the cost of labour per acre might be greater. However, even if the cost of this item were doubled, spot spraying would probably still be cheaper than boom spraying, provided the infestation was not too dense. Since with spot spraying the cost of the 2,4-D is very low, and clover damage, if any, is reduced to a minimum, it is practicable to increase the rate of 2,4-D to ensure kills from applications made at times of the year when farm labour is more readily available than in spring. The trials indicated that 8 lb was adequate for July spraying.

If the rushes are mown but not sprayed, it would be necessary to mow four or five times a year, that is, every time the regrowth reached a height of 1 or 1½ ft, to obtain effective control. The cost of mowing depends on the degree of rush infestation and could vary from 10s. 0d. to 30s. 0d. per ac. From the figures quoted, the cumulative cost of repeated mowing would be more than that of spraying.

The control of rushes on the Rukuhia Soil Research Station's peat experimental area on the Moanatuatua swamp was a serious problem until about three years ago. Boom spraying was not entirely satisfactory and caused serious damage to the clovers. However, since the adoption of mowing plus spot spraying, either mechanical or manual, rushes have no longer been a serious problem.

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