THE EFFECT OF DALAPON ON VARIOUS GRASS SPECIES

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SUMMARY

RYEGRASS was more susceptible to dalapon damage when treatments were applied to very short or immature growth. Resistance increased with increase in height and maturity. Cocksfoot when small and leafy showed variations in tolerance similar to ryegrass, but resistance of clumpy mature plants decreased with increase in height of regrowth. Seasonal tolerance work has shown that dalapon has its most severe effect on ryegrass when applied during or immediately before a period of reduced growth activity. Tall fescue treated in February or March was more severely affected than when treatments were applied in November or January.

INTRODUCTION

Those experienced in the use of dalapon will be familiar with the variations in effect which may be obtained from applications of a given quantity of this material. Amounts which prove quite safe on desirable pasture species at one stage may cause severe damage at another, or weed grasses which are controlled by relatively small doses at the right time will often resist much greater quantities at some other stage.

The factors which cause the variations and influence their extent appear to be manifold, but probably the most important are:

1. Season at which treatments are applied,
2. Stage of growth, that is, height and maturity of treated growth.

Observations indicate that fertility conditions also exercise a considerable influence on species tolerance, but no trial work has been done to determine the importance of this factor.

During the past year a number of trials have been conducted at the Rukuhia Soil Research Station with the intention of throwing some light on these problems, and in this paper some of these trials are described.

EXPERIMENTAL

Dalapon used in all trials was the commercially available material which is 85 per cent active (73 per cent acid equivalent). Amitrol was the 50 per cent active powder. All treatment rates quoted are in pounds per acre of the commercially available materials and were applied to all trials in 30 gallons of water per acre.

STAGES OF GROWTH TRIALS

Trials in this series were laid down to determine the extent to which the effect of dalapon is influenced by pasture heights and degree of maturity at the time of treatment.

Trial A—Ryegrass (*Lolium perenne*)

This was laid down on a grass dominant ryegrass white clover (*Trifolium repens*) pasture.

Treatments, which were replicated 3 times, were as follows:

Dalapon at 0, 2½, and 5 lb,
each applied to pasture at four stages of growth,
tall, medium, short, and bare,
and at two times,
early spring (3/9/58) and spring flush (5/11/58).

A mowing programme was initiated well in advance of the spraying dates to produce growth at the different stages, details of which may be summarised as follows:

Stage	Early spring		Spring flush	
	Height in.	Days' growth	Height in.	Days' growth
Tall	4-5	23	10-12	28
Medium	3-4	12	6-7	15
Short	2	7	3	7
Bare	$\frac{1}{2}$	0	$\frac{1}{2}$	0

Quantitative assessments of treatment effect were obtained by:

1. Point analyses before and after treatment.
2. Dry matter weights and herbage dissection of a cut taken four to five weeks after treatment.

A prior trimming cut had been made two weeks after treatment to remove dead herbage from the treated plots and excessive growth from the controls and so reduce growth on all plots to a uniform height.

It will be noted that there was not a great deal of difference in height at treatment between the various stages of the early spring part of the trial. This was caused by a desire to apply treatments at the earliest possible stage of spring growth, and the rather low fertility throughout the trial area, which resulted in very slow growth in the early stages of the preliminary mowing programme.

Urine spots which produced patches of more vigorous growth on all plots caused further complications. The location of these higher-fertility spots was charted to obtain any information which they might yield on the influence of fertility levels.

Though differences in height were not great, the differences in the type of growth in the various stages were quite important. Taller plots bore a darker, more mature pasture, while on the later mown plots the growth was a much lighter green and more succulent.

Assessment of the treatment effects was by point analysis; a summary of these results is given in Table 1.

TABLE 1—EFFECT OF DALAPON ON RYEGRASS AT DIFFERENT STAGES

Results of Point Analysis—Mean cover hits 100 points				
Time of treatment	Height of growth (in.)	Control	Dalapon 2½ lb	Dalapon 5 lb
Early spring (3/9/58)	4-5	43	31	10 ab AB
	3-4	40	35	14 a A
	2	39	29	6 b AB
	$\frac{1}{2}$	41	22	4 b B
	MEAN	41 aA	29 bB	8 cC
Spring flush (5/11/58)	4-5	13	14	4 a A
	3-4	17	14	6 a A
	2	17	10	3 a A
	$\frac{1}{2}$	19	8	5 a A
	MEAN	16 aA	12 bB	5 cC

Results show that the preliminary mowing to produce the various heights brought about no marked change in sward composition.

Regardless of the length or maturity of growth when treated, statistical analysis of the results of point analysis show that both 2½ and 5 lb of dalapon gave significant reductions from control in the cover of ryegrass. For both times of application dalapon applied at 2½ lb gave significantly less cover than control and the dalapon 5 lb treatment reduced the count even more.

Differences in treatment effect due to the height or maturity of the ryegrass at the time of application are shown by the letters at the side of Table 1 for the high rate of dalapon. Treatments were not significantly different for dalapon applied in the spring flush period. In early spring dalapon applications of 5 lb gave significantly less control of ryegrass when applied to medium than when applied to both bare and short growth.

Trial B—Ryegrass and Cocksfoot (*Dactylis glomerata*)

This was a small scale trial of two replicates laid down on separate pure stands of ryegrass and cocksfoot.

Dalapon at 5 lb was applied to growth at the following three stages:

Tall (10 to 12 in.), medium (6 to 8 in.), and short (3 to 4 in.), and two times:

Spring (29/10/58) and summer (27/12/58).

Treatment effects were assessed by counts of surviving plants. Results are given in Table 2.

TABLE 2—RELATIVE NUMBER OF SURVIVING RYEGRASS AND COCKSFOOT PLANTS

(Control = 100)

Species	Time of treatment	Height of growth at treatment		
		Tall	Medium	Short
Ryegrass	Spring	63	54	23
	Summer	52	34	5
Cocksfoot	Spring	63	48	14
"	Summer	57	27	5

Here again the pattern of effect was similar to that obtained in trial A. On both species the effect was considerably more severe where short growth was treated, this being particularly so with the summer treatment. In spring when short growth was sprayed, dalapon had a more severe effect on cocksfoot than on ryegrass, but as height at treatment increased, differences between the species largely disappeared.

Trial C—Mature Cocksfoot

In this trial treatments of dalapon at 5, 10, and 15 lb were applied in November to an area of clumpy mature cocksfoot of the type which frequently gains undisputed possession of areas not subject to regular grazing.

This rank growth was mown to produce regrowth at three heights: Tall (8 to 10 in.), medium (4 to 6 in.), and short (2 to 3 in.). Results were again determined by counts of surviving plants, which were divided into two groups:

Large (over 3 in. diameter at base).

Small (under 3 in. diameter at base).

Results are given in Table 3:

TABLE 3—RELATIVE NUMBER OF COCKSFOOT PLANTS SURVIVING DALAPON

(Control = 100)

Treatment	Plant size	Height of growth at treatment		
		Tall	Medium	Short
Dalapon 5 lb	Large	100	100	100
	Small	42	45	52
Dalapon 10 lb	Large	80	100	100
	Small	0	0	0
Dalapon 15 lb	Large	17	21	59
	Small	0	0	0

In this trial dalapon had its most severe effect when applied to the tallest regrowth. This was most pronounced in the case of large plants treated with 15 lb where only 17 per cent survived treatment at the tall stage compared with 59 per cent at the short stage.

On this type of clumpy growth the influence of height at treatment is the opposite to that noted on the less well developed plants in Trials A and B. It is assumed that the root system of the plants in Trial C was too deep to be affected by dalapon action through the soil, while only those with a considerable amount of regrowth could absorb sufficient to destroy the well developed crowns.

SEASONAL TOLERANCE TRIALS

In this series of trials the variations in effect of dalapon applied at different seasons were studied.

Trial D—Ryegrass

This was laid down on a ryegrass/white clover pasture.

Treatments were dalapon at 1½, 2½, and 5 lb applied in mid autumn (3/4/58) and early winter (3/6/58). Treatments were replicated four times and data were obtained by mowing and weighing, dry matter determination, and herbage dissection.

Details of ryegrass production during the course of this trial are given in Table 4.

TABLE 4—RELATIVE D.M. PRODUCTION OF RYEGRASS TREATED WITH DALAPON IN AUTUMN AND WINTER

Date cut	(Control = 100)					
	Mid autumn			Early winter		
	Dalapon (lb/acre)			Dalapon (lb/acre)		
	1½	2½	5	1½	2½	5
16/4/58	60*	70*	52*			
16/6/58	94	86	14	110*	97*	82*
4/9/58	77	85	40	55	19	Nil
25/9/58	101	126	64	140	53	15
21/10/58	116	138	123	105	121	70
Total production:	91	104	62	104	72	40

*The greater part of the yield at these cuts was produced before treatments reduced growth.

April treatments were considerably less severe than those applied in June. Both 1½ and 2½ lb in April caused only a slight or moderate reduction in ryegrass growth during the winter months, with rapid and complete recovery as soon as spring growth commenced. Five pound applied at this time had a severe effect which persisted throughout the winter. Many ryegrass plants appeared to be killed and it was considered that production from this species would be permanently depressed. However, with spring growth a remarkable recovery occurred. Ryegrass plants which previously seemed dead began to make fresh growth and during October exceeded controls in production.

When applied in June 1½ lb caused a reduction of almost 50 per cent during the winter months and 2½ lb appeared almost as severe as 5 lb applied in April. However, recovery in the spring from both rates was good. Plots treated with 5 lb in June produced practically no ryegrass in winter. Most of the plants appeared dead, but in spring many recovered and grew with such vigour that at the time of the last cut their production was rapidly approaching that of control.

This trial was the autumn parallel of a spring trial previously reported (1) which showed that ryegrass recovery from treatment in September was rapid, whereas recovery from November treatment was much slower. A similar trend was seen in the autumn trial just described, where April treatments were much less severe than those in June. This seemed to indicate that treatment of ryegrass early in a period of active growth had a relatively slight effect, whereas treatment before or at the beginning of a decline in growth was much more severe.

A further comparison of the two trials showed that autumn treatments were more severe and their effects of longer duration than similar applications in spring.

Trial E—Tall Fescue (*Festuca arundinacea*)

Dalapon at rates of 10, 15, and 20 lb with and without amitrol at 2 lb was applied to a pure stand of tall fescue.

Treatments commenced in November 1958 and further plots were treated each month from January to May. Briefly results were as follows:

1. Treatments applied in November or January were of little value. Even at 20 lb dalapon destroyed only 25 to 30 per cent of the tall fescue. With the addition of 2 lb of amitrol this was increased to a little over 50 per cent. Lower rates with or without amitrol did little more than burn off the foliage.
2. The treatments applied in February and March were about equal in effect and were better than those applied earlier. When dalapon alone was applied at 20 lb it gave a 95 per cent kill and the addition of 2 lb of amitrol increased this to 100 per cent. Other rates of dalapon alone were relatively ineffective, but the mixture of 15 lb of dalapon and 2 lb of amitrol was nearly as good as 20 lb of dalapon alone. It is too early to determine the effect of April and May treatments.
3. Treatment of growth at different heights indicated that better results may be obtained if regrowth is allowed to reach a height of 12 in. or more before spraying. Inferior results were usually obtained from the treatment of short regrowth.
4. Vigorously growing high-fertility plants were usually more readily killed than those growing under low-fertility conditions.

CONCLUSIONS

1. Ryegrass is most likely to be damaged by dalapon treatments applied:
  - (a) At a time when it is entering a period of reduced growth activity such as in early summer or late autumn.
  - (b) To very short or immature growth.
2. Ryegrass appears to show greatest resistance to dalapon damage when treated:
  - (a) Early in a period of increasing growth activity, such as in early spring, and to a less extent in autumn.
  - (b) When foliage has been allowed to reach a more advanced stage of height and maturity.
3. Cocksfoot in a small and leafy condition has exhibited variations in tolerance fairly similar to those of ryegrass, but when clumpy mature plants were treated, those with most regrowth showed the greatest degree of susceptibility.
4. Tall fescue was more severely affected by treatment in February and March than by similar treatments applied in November or January.

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REFERENCE

1. Thompson, A., 1958 Proc. 11th N.Z. Weed Control Conf., pp. 96-102.

DISCUSSION

Q.—I have noticed that the effect of dalapon differs more with type of growth rather than the height of the grasses; for example, autumn is a more effective time to spray than spring. Is this also your experience?

A.—It is true that spring is generally a less effective time than autumn. Ryegrass, for instance, is more affected when the plants are going down-

hill than when they are increasing in vigour. The length of growth is also important, however, as mentioned.

Comment: The habit seems to be the most important; for example tall fescue and *Glyceria maxima* (perennials) are easier killed in autumn, but annuals, such as *Poa annua*, are more easily killed in spring. This has been borne out in drain trials.

Q.—Could you say what differences in resistance of grass species were noted in urine spots?

A.—Vigorous growths in urine spots and more fertile areas are more resistant than the same species in lower-fertility areas.

Comment: In Southern Hawke's Bay similar results have been obtained. Vigour of pasture species is vital. As to height, with short growth with less root the plant has less resistance. We have had good kills in autumn and early winter on browntop, but it has been poor when the soil was waterlogged.

Q.—What effects have been noticed from rain soon after treatment?

A.—Times for spraying on trials were chosen when rain was not expected. In general, however, a small amount of rain has not worried applications, but very heavy rain would affect treatment.

Comment: In Southern Hawke's Bay I have had a good kill right through winter even with 1 in. of rain within 24 hours of spraying. In this case much of the dalapon is probably root absorbed.

Comment: At Invermay heavy rain soon after treatment has reduced the effect of dalapon on lucerne, so apparently the effect on grasses would be reduced.

Comment: In Southland we have had poor results with rain soon after spraying.