THE INDUCTION OF CLOVER DOMINANCE FOR FATTENING LAMBS: A COMPARISON WITH RAPE

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Summary

The dry matter yields of clovers and grasses in mid-summer were measured following the application of paraquat to pasture in spring at rates ranging from 1 to 8 oz per acre. In one trial the yield of clover increased and grass decreased with increasing rate of paraquat application, while the total dry matter yield remained relatively constant. In a second trial, an increase in yield of clover was associated with a greater decrease in grasses: the decrease in total yield differed between different times of paraquat application. The carcass weights of lambs fattened on white clover (*Trifolium repens*) and rape were shown to be similar. Lambs were fattened on white clover at rates ranging from 12.5 to 27.5 per acre in a preliminary investigation of the effects of different stocking rates.

INTRODUCTION

TRIALS in which sheep grazed pastures containing different plant species have shown that liveweight gains of sheep grazing white clover (*Trifolium repens*) dominant pasture are greater than when sheep graze ryegrass (*Lolium* spp.) pasture (see, for example, Maclean *et al.*, 1965; Hight and Sinclair, 1965). Paraquat at relatively low rates has been widely used to suppress grasses to increase white clover seed production (Leonard, 1964), and Palmer (1967) has reported the results of trials carried out in the North Island in which paraquat was applied to pasture to induce clover dominance for subsequent grazing by lambs.

In the South Island, rape is widely grown in the drier areas, notably Canterbury, for fattening lambs. Blackmore and Thompson (pers. comm.), however, have found that at Marton in the North Island the liveweight gain of lambs grazing clover can be greater than that of lambs grazing rape. Trials were therefore carried out under South Island conditions to compare the carcass weight of lambs after grazing white clover and rape and to determine the optimum rate and time at which paraquat should be applied to pasture to induce clover dominance.

METHODS

Paraquat was applied to pasture in 20 or 24 gal of water per acre with wetting agent. Rates of paraquat given in this paper refer to ounces of paraquat ion per acre. Herbage from an area of one square yard, selected at random, was sampled by cutting with shears at a height of about one inch and dissected for the measurement of dry matter yields of grasses and clovers: any flatweeds present were included in the "grass" component.

Lambs were arranged in groups according to liveweight and lambs within each group were then allocated at random to different treatments after drenching with tetramisole. Wool weight, carcass weight and grade were recorded at the time of killing.

TRIAL DETAILS AND RESULTS

1. THE EFFECT OF PARAQUAT APPLIED AT DIFFERENT RATES TO PASTURE ON THE DRY MATTER PRODUCTION OF GRASSES AND CLOVERS

Trial P1 (Rakaia, Paparua Stony Sandy Loam)

Paraquat was applied on September 20 at 0, 1, 2, 4 and 8 oz to pasture comprising mainly white clover, perennial ryegrass, cocksfoot (*Dactylis glomerata*), sweet vernal (*Anthoxanthum odoratum*), goose grass (*Bromus mollis*), subterranean clover (*Trifolium subterraneum*), *Poa* spp., hairgrass (*Vulpia* spp.) and some flat weeds. Plots were 5 × 60 sq. yd with four replicates (relatively large plots were used so that the effects of the different treatments on a following wheat crop can be measured).

At the time of sampling on January 16, most of the clover plants were at the flowering or seed-head stage. Flat weeds were present only as occasional plants. The dry matter yields of white clover and grasses are shown in Fig. 1.

Differences in total yield between the different rates of paraquat application were not statistically significant. With increasing rates of paraquat, however, the proportion of grass decreased with an approximately equivalent increase in white clover. Cocksfoot was the main grass species recovering from the application of paraquat. During subsequent grazing by lambs, almost all the herbage was removed from plots treated at the higher rates of paraquat, whereas untreated pasture was grazed to only a limited extent.

Fig. 1: The effect of paraquat at different rates on the proportions of clover and grass in pasture. (Results expressed in lb D.M./acre.)

Trial P2 (Rangiora, Ashley Silt Loam)

Paraquat at 0, 1, 2, 3, and 4 oz was applied to pasture, predominantly perennial ryegrass (60%) and white clover (30%) with few flat weeds, on two occasions. Trial A was sprayed on September 27, and Trial B, located adjacent to Trial A, on October 27. Plots were 3 × 12 yd with four replicates with Trials A and B independently randomized. Herbage was sampled on January 10 (Trial A) and January 14 (Trial B): the results are summarized in Table 1.

At both times of application, the dry matter yield of clover increased with increasing rate of paraquat and yield of grasses decreased. At the highest rate of paraquat application, total dry matter yield was reduced by about one-fifth at the earlier spraying and by about half as a result of the later spraying. At the time of sampling, grasses on the untreated plots were at the seed-head stage; on sprayed plots, particularly at the higher rates, grasses were green and leafy. As in the trial at Rakaia, subsequent grazing removed the major part of the herbage on sprayed plots and only a small proportion of unsprayed herbage.

TABLE 1: EFFECT OF PARAQUAT APPLIED AT DIFFERENT RATES TO PASTURE ON THE DRY MATTER YIELD OF GRASSES AND CLOVERS (TRIAL P2)

Date of Spraying	Pasture Component	Yield of Dry Matter (lb/acre)				
		0	1	2	3	4
Sept. 27	Clover	750	970	1,370	1,420	1,430
	Grass	4,170	3,780	2,380	2,450	2,540
	Total	4,920	4,750	3,750	3,870	3,970
Oct. 27	Clover	640	890	940	1,030	1,200
	Grass	4,170	2,250	1,570	1,520	1,180
	Total	4,810	3,140	2,510	2,550	2,380

2. PRELIMINARY TRIAL TO COMPARE DIFFERENT RATES OF STOCKING

Trial P3 (Rangiora, Ashley Silt Loam)

Under similar conditions to those in Trial P2, a simple non-replicated trial was carried out to compare the performance of lambs grazing clover at different stocking rates. An area of pasture, predominantly perennial ryegrass and white clover with some flat weeds, was sprayed with paraquat at 3 oz on September 25. Samples of herbage indicated a dry matter yield of 4,380 lb clover and 1,390 lb grass per acre.

Twenty Southdown lambs were drenched with tetramisole and allocated to four plots giving five lambs per plot. The areas of the plots were varied to give rates of 12.5, 17.5, 22.5, and 27.5 lambs per acre. The lambs were drafted for killing on January 18. By this time stock at the highest rate (27.5 per acre) had eaten most of the herbage available on the plot while the residual herbage increased with decreasing stock intensities so that at the lowest rate a considerable amount of grazing remained after drafting. The results were as follows:

<i>No. of Lambs per acre</i>	<i>Relative Liveweight (Dec. 20)</i>	<i>Mean Carcass Weight (lb)</i>	<i>Mean Carcass Value (NZ\$)</i>
12.5	100.0	29.8	4.06
17.5	100.4	28.2	3.89
22.5	98.1	27.0	3.67
27.5	98.5	28.8	3.93

In spite of differences of greater than a factor of 2 in stocking rate, the mean weights and values per carcass were similar and, although the intermediate rates of stocking showed slightly lower values, there was little difference between the mean carcass values at stocking rates of 12.5 and 27.5 lambs per acre.

3. COMPARISON OF RAPE AND CLOVER FOR FATTENING LAMBS

Trial P4 (Rakaia, Paparua Stony Sandy Loam)

Adjacent to Trial P1, a trial was laid down to compare the grazing value of clover-dominant pasture, produced by the application of paraquat, and rape cultivated in the normal manner. The two treatments were applied to plots, 40 × 50 yd with four replicates. Cultivation began with ploughing on September 23, and rape (Broad-leaf Essex) was drilled on October 17. Paraquat was applied on November 6 at 4 oz in 20 gal of water. The rape was not ready for grazing until early January and contained variable amounts of fathen (*Chenopodium album*). Clover had by this time flowered and set seed. In one replicate the growth of clover over about half the plot was very poor and corresponded with a patch of very light stony soil (Waimakariri stony sandy loam) : this also affected the adjacent plot of rape but to a more limited extent.

On January 9, eight Corriedale wether lambs were allocated to each plot, giving a stocking rate of 19.4 lambs per acre. Lambs were drafted on January 26, killed on January 27, and the individual carcass weights recorded.

With all four replications included, the mean carcass weights were 27.9 lb (clover) and 29.7 lb (rape). The apparent difference of 1.8 lb per carcass was not statistically significant. If the second replication is omitted because of the effects of the stony area described above, the means were 28.4 and 29.4, respectively, giving a non-significant difference of 1.0 lb per carcass. The standard error per carcass was 2.27 lb and the coefficient of variation 7.9%.

DISCUSSION

At Rakaia (Trial P1), the fall in dry matter yield of grasses (1,650 lb) following the application of paraquat at 4 oz was offset by an increase in the yield of clover (1,170 lb) to give a total dry matter yield slightly, but not significantly, lower than the untreated pasture. In Trial P2 at Rangiora, paraquat at 4 oz almost doubled the dry matter yield of clover at each time of application. However, the total yield was reduced by the lower yield of grasses, particularly at the later spraying. At the time of spraying (October 27), this pasture was longer, owing to growth between grazing which finished shortly before spraying Trial A on September 27 and the later spraying date of Trial B. Had it been grazed during October

as originally intended, the results might have been different. However, later spraying, although extending spring grazing, will shorten the period between spraying and the more or less fixed period of grazing by lambs in mid-summer and is therefore likely to lead to lower yields.

The value of pasture is determined not only by the total dry matter yield but also by the amount which lambs will readily eat. In these trials, lambs given equal access to treated and untreated pasture close-grazed sprayed pasture and largely avoided untreated pasture. Thus, although the total yield may be reduced in some cases by spraying, a greater quantity of herbage may be consumed and hence liveweight gain per unit area could be greater on sprayed pasture. Maximum early growth and development of lambs is important both for the production of early, prime lambs and also where liveweight of ewe hoggets can be increased to a level at which performance is improved (see work of Hight quoted by Williams, 1968). Furthermore, the high proportion of clover consumed could be expected to give enhanced liveweight gains and it is probable that the palatability and nutritional value of the grass regrowth or recovery is greater than unsprayed grasses which, particularly in dry periods, become fibrous and unpalatable and at the same time depress clover growth. Spraying could also prevent flowering, seed formation, and spread of annual grass weeds.

The present evidence suggests that perennial ryegrass normally recovers from the application of paraquat at up to 4 oz per acre so that, where perennial ryegrass is present, sprayed pasture appears to revert to a balanced ryegrass/clover mixture. In drier areas, where annual grasses predominate, perennial grasses could be introduced by direct-drilling in autumn. Increased clover growth during summer is likely to increase the quantities of nitrogen fixed by the root nodules; this nitrogen could later become available for grass or arable crop growth. Wheat which is likely to follow if clover-dominant pasture has replaced rape in the rotation could benefit from increased levels of soil nitrogen.

The grazing trials suggest that lambs grazing clover at the same intensity of stocking, about 20 lambs per acre, can be drafted about the same time to give similar carcass weights and values. In Trial P4 (Rakaia), however, grazing had to be delayed until the rape had matured sufficiently. The clover was by this time fully flowered and could therefore have been grazed up to three to four weeks earlier. The earlier availability of clover for grazing would allow grazing by ewes and lambs, earlier weaning, or the use of "creep-feed" methods of grazing, all of which could lead to earlier killing. The trials gave no indication that grazing white clover near to ground level affected its nutritional value and lambs readily graze clovers at all stages of growth.

The relative costs of growing rape by normal methods and of chemically treating pasture will vary depending mainly on cultivation costs and the rate of chemical applied, but a preliminary assessment suggests that costs of applying paraquat would be about half the cost of rape establishment. During the period of cultivation for rape, grazing is lost, whereas, with sprayed pasture, growth of clovers and grasses before spraying and after drafting lambs could provide extra spring and autumn grazing. Although rape regrows in autumn, grazing can lead to stock losses and the farmer is committed to further cultivation for subsequent pasture or crop establishment.

Obviously white clover of reasonable vigour must be uniformly distributed throughout a pasture which is to be sprayed to induce clover dominance. The rate of recovery of clover could be restricted by dry soil

conditions, particularly at the time of application of paraquat (Leonard, 1964). However, growth of rape under such conditions is likely to be affected to the same or greater extent.

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REFERENCES

- Hight, G. K.; Sinclair, D. P., 1965: *N.Z. J. Agric. Res.*, 8: 1079-86.
Leonard, W. F., 1964: *Proc. 17th N.Z. Weed & Pest Control Conf.*: 49-52.
Maclean, J. W.; Thomson, C. G.; Jagusch, K. T.; Lawson, B. M., 1965: *Proc. Ruakura Fmrs' Conf.*: 34-40.
Palmer, P. C., 1967: *Proc. 20th N.Z. Weed & Pest Control Conf.*: 50-7.
Williams, P. P., 1968: *Proc. 21st N.Z. Weed & Pest Control Conf.*: 128-38.