THE ESTABLISHMENT OF CLOVERS IN PASTURE

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Detailed studies of single species such as have been given by the previous speakers provide an essential background for a full appreciation of the various combinations applying in the field.

Good pasture establishment and control entails a constant adjustment of methods to fit in with the tolerances and needs of each species under the local climatic and soil conditions. At the same time it is of primary concern to provide for current and future feed and soil fertility demands, and thus in many cases a compromise is the only solution.

Basic to the whole subject of this symposium is the full appreciation of the very low initial growth rate of clovers relative to most other pasture species, more especially from autumn sowings. No emphasis is needed on the value of clovers for sustained pasture growth. So great is this that most farmers are now prepared to go to considerable trouble to secure their rapid development, both by new sowings and from oversowing into established pasture.

There is also little need to stress the obvious greater value of the pedigree strains and the parallel increase in return from efforts toward their encouragement.

There is, however, a need for a constant review of methods of establishment of this clover group to fit in with the changing population of associated species, as well as total management developments. Very important in this respect is the use of the new short-rotation ryegrass, while also the intensive pasture control possible with the electric fence opens up new possibilities for incorporation by oversowing.

The, general principles of species competition and succession within pasture associations have, of course, been the subject of considerable research. Outstanding in this field is the work of Stapledon and Davies in Britain and of Levy of New Zealand.. The standard New Zealand text on this subject is still the publication by Levy in 1923. In this work emphasis was laid on the probability of early loss of clovers and slow-developing grasses when sown under cereal or cover crops. At the same time reference was also made to the possible relative protection of the clover in such mixtures, due to a parallel check to the grasses by the covering crop. The general recommendation is that sowing under a cover is a risky practice largely dependent on weather, especially if steps are not or cannot be taken to guard the development of the pasture mixture.

The other extreme of simple pasture development is by the sowing of a mixture only of grasses and clovers of relatively slow development.

The inclusion of much more rapid developing grasses (such as Italian or short-rotation ryegrass) in the pasture mixture, however, calls for careful attention to give the slower species a chance.

Early grazing appeals as the obvious control rather than any excessive reduction of seedings or the withholding of nutrients etc. valuable for the growth of the early grass component.

It appears obvious from inspection of many paddocks that much loss of clover in new swards has resulted from too little early grazing, farmers having failed to appreciate the need for a change in policy to meet the change in growth potentials of the species now being used.

Measurements of clover establishment have been made at Grasslands both in specific trials as well as part of other projects.

Differences in the clover establishment due to competition from different grass species have been observed and measured in the course of many mixture trials. The general result has been a definite inverse ratio of clover to grass, depending on the early vigour of the grass species, the suppression of clover being greatest under Italian and short-rotation ryegrass, less under perennial ryegrass, and very little under cocks-

foot, timothy, dogstail, fog, and browntop in that order.

Anything which aids relative earliness of the grass such as fertilisers, drainage, sowing date, etc., can act in the same manner. The converse also holds true up to a certain point. Also, rapid and vigorous weed establishment can produce similar effects and can act even to the detriment of the grasses. It is essentially a case of relative growth from seedlings under the. conditions, both "natural" and induced, and the progressive differential reactions to variations in light intensity, soil nutrients and moisture, growth form, and any damage from grazing stock as well as other destructive agents.

To study the effects of grazing practice on new pastures specific field trials were commenced in 1948. In the autumn of that year a plot series was sown at Grasslands at Palmerston North. This was on a good seed-bed and consisted of three different rates of an equal mixture of short-rotation and perennial ryegrass (15, 30, and 45lb.) with a mixture of white (31b. pedigree) and red clovers (31b. of pedigree cowgrass, plus 31b. pedigree Montgomery red). Superimposed on these rates of seeding were mowings at the 3in., 6in. and 12in. stage in a layout of two randomised blocks of plots each 14ft. x 6ft. The mowing was done with a rotary motor-mower, all plots being cut down to a height of lin. every time they reached their appro-phate treatment height. An initial dressing of super-phosphate at 4cwt. per acre was given all plots, and in addition the fertility balance was held by returning dung and urine at each mowing in proportion to the plot yields. This was collected from other trials and returned to the various treatments in proportion to their yield of dry matter.

Results of the trial, which extended to December 6, 1948, are shown in Table 1. For this purpose the data from all sowing rates have been combined, since among these sowings there was very little continued difference, either in yield or composition, after the in-itial growths up to early June. For this period there was a considerable increase in total production (ap-proximately 30 per cent.) and also much less weed (*Coronopus didymus* mainly) in the plots with heavier grass seedings. Such weed was, however, soon under control by the mowings on all the treatments, and thus this early advantage of the heavier sowings was not as useful as under normal grazing practice.

It can be seen that there was a considerable increase in the total D.M. yield with the rise in height at cutting. This occurred mainly in the early period and was dependent on the growth of the sown grasses. The opposite trend is seen in the clovers, weeds, and volunteer grasses (mainly *Poa annua*). The increase in total growth is, however, offset to some extent by the lowered quality, as indicated by the crude protein figures.

The total early yields of the clovers are, of course, relatively quite small and may not give a full picture of the position at the end of the trial period. At this stage the 3in. plots held a dark green sward with a dense bottom of grass and clovers, while the other extreme was presented by the 12in. series, which were open in the bottom and with the grass plants yellowish and spindly in growth. It appeared obvious that because of this there would be a considerable drop in future growth on these open plots, both from drying out of the soil surface and from lack of nitrogen, similar to the position applying on many farm paddocks.

Running parallel with this plot series were measurements of enclosures within a Massey College paddock sown at the same time. The special-purpose mixture used for this paddock was:—

Pedigree short-rotation	ryegrass	25lbs.	per	acre
,,	perennial	,,	15lbs.	,,	,,
,,	white clover		3lbs.	,,	,,
,,	cowgrass		4lbs.	,,	,,
	Total		47lbs.	,,	,,

Part of the paddock had been double sown, so enclosures were made on both sowings, and treatments similar to the plot series above were carried out, using the same technique of mowing and proportional return of dung and urine. The results in this series were very similar to the plot trial.

Again the sowing rate made very little difference except in the initial growth period of 2 to 3 months. For this period the double sowing produced much more growth, especially in the series allowed to grow to 12in.

The total yields and botanical compositions and crude protein are shown in **Table 2.**

TABLE 1. EFFECT OF CUTTING HEIGHTS ON TOTAL YIELD AND COMPOSITION. PLOT SERIES - GRASSLANDS DIVISION. SOWN AUTUMN, 1948.

Main treatment	No. of cuts	Period ending	Dry matter/acre (in hundreds lb.) Averages of Replicates A	B	Mean	Botanical Constituents in hundreds lb. D.M. Rye	Other grasses	White clv.	Red clv.	Other spec.	Crude Protein % of D.M.
Cut at 3in.	6	7.9.48	30.8	32.3	31.5	24.0	2.7	0.3	TR	4.4	—
	5	6.12.48	50.9	47.1	49.0	38.9	5.3	2.8	1.0	1.3	
	II	TOTAL	81.7	79.4	80.5	62.9	8.0	3.1	1.0	5.7	24.8
Cut at 6in.	4	7.9.48	33.0	30.6	31.8	25.5	2.4	0.1	TR	3.7	—
	3	6.12.48	49.5	52.1	50.8	45.1	2.9	1.6	0.5	0.6	—
	7	TOTAL	82.5	82.7	82.6	70.6	5.3	1.7	0.5	4.3	20.4
Cut at 12in.	2	7.9.48	52.4	45.6	49.0	43.9	1.4	TR	TR	3.7	—
	2	6.12.48	61.4	58.1	59.7	56.8	0.8	1.4	0.5	0.2	—
	4	TOTAL	113.8	103.7	108.7	100.7	2.2	1.4	0.5	3.9	16.1

The major point of difference is the relatively greater suppression of white clover and the less effect on the red clover, which had a much better strike in this paddock trial than in the plot series.

Again, however, there was the similar difference in appearance of the plots at the end of the trial, very much in favour of the 3in. series. The better performance of the red clover in the 12in. series was no doubt due to the lowering of vigour of the grass plants under this extreme treatment toward the end of the trial period.

Although these plot trials showed quite a definite pattern of development and confirmed our recommended methods of encouraging the clovers, especially the white clover, there are limitations with the technique used. These are because of the evenness of the mower cutting, as well as the dung and urine returns. Paddock trials were therefore started. On March 18, 1948, an area at Grasslands was sown with the following mixture:—

Pedigree short-rotation ryegrass		20lb.	per acre
„	perennial „	20lb.	„ „
„	white clover	3lb.	„ „
„	Montgomery red clover	3lb.	„ „
„	broad red clover	3lb.	„ „

and divided into nine separate paddocks of three randomised blocks. Treatments of grazing by sheep down to the lin. level each time the average growth reached 3in., 6in., or 9in., were followed up to October 21, 1949, after which all paddocks were given equal spells between three grazings up to January 30, 1950.

Production was measured by means of moveable enclosures, two enclosures each 10ft. x 4ft. being measured separately in each paddock at each grazing. Botanical composition by weight and crude protein and fibre were determined on samples from each of these cut areas. In addition, counts of the clover plants were made on a series of 12 separate square foot areas taken at random within each paddock at intervals throughout the trial. The yield data are summarised in Table 3.

TABLE 2.-EFFECT OF CUTTING HEIGHTS ON TOTAL YIELDS AND COMPOSITION ENCLQSURES WITHIN MASSEY PADDOCK 8. SOWN AUTUMN, 1948

			Dry matter per acre in hundreds lb.			Botanical Constituents in hundreds lb. of Dry Matter per acre.					Crude protein % D.M.
Main Treatments	No. of cuts	Period ending	Single sowing	Double sowing	Average	Ryegrass	Other Grasses	White Clover	Red Clover	Other Species	
Cut at 3in.	6	7.9.48	30.5	3i.6	31.1	30.4	0.4	TR	TR	0.2	—
	5	6.12.43	44.4	41.9	43.1	32.2	1.8	4.2	3.6	0.8	—
	11	TOTAL	74.9	73.5	74.2	62.6	2.2	4.2	3.6	1.0	25.9
Cut at 6in.	4	7.9.48	35.0	42.8	38.9	38.8	TR	TR	TR	TR	—
	3	6.12.48	55.7	49.5	52.6	48.6	1.0	0.7	2.1	0.3	—
	7	TOTAL	90.7	92.3	91.5	87.4	1.0	0.7	2.1	0.3	21.2
Cut at 12in.	2	7.9.48	41.8	47.9	44.9	44.4	TR	TR	TR	0.4	—
	2	6.12.48	56.7	52.0	54.3	49.4	0.3	0.3	4.1	0.2	—
	4	TOTAL	98.5	99.9	99.2	93.8	0.3	0.3	4.1	0.6	13.6

TABLE 3. EFFECT OF GRAZING AT DIFFERENT HEIGHTS ON TOTAL YIELDS AND COMPOSITION. PADDOCK TRIAL - GRASSLANDS - PALMERSTON NORTH. SOWN AUTUMN. 1949.

Main treatment	No. of grazings	Period ending	Total D.M. per acre. Av. in hundreds lb.	Botanical constituents in hundreds lb. D.M. per acre. White clover	Red clover	Crude Protein % of D.M.	Crude Fibre % of D.M.
Grazed at 3in. up to 21.10.49	8	21.10.49	45.4	0.7	0.2	27.5	16.8
	3	30.1.50	60.3	9.4	11.5	16.9	21.8
	11	TOTAL	105.7	10.1	11.7	—	—
Grazed at 6in. up to 21.10.49	4	21.10.49	58.3	0.6	0.2	22.2	18.9
	3	30.1.50	53.1	4.7	10.0	16.3	23.0
	7	TOTAL	111.4	5.3	10.2	—	—
Grazed at 9in. up to 21.10.49	2	21.10.49	61.7	0.1	TR	20.9	19.9
	3	30.1.50	52.8	2.0	2.5	14.9	24.3
	5	TOTAL	114.5	2.1	2.5	—	—

Against the early increase in total production, the picture of clover suppression and lowered herbage quality (as measured by the dry matter per cent. and the crude protein and crude fibre content) is quite clear. There was, however, a greater suppression of the white clover than of the red, the former feeling the effect of the 6in. treatment much more than the latter, although both were depressed greatly by the 9in. grazings.

Another clear picture of the position is seen in the progressive clover counts in Table 4.

TABLE 4. CLOVER PLANTS NUMBERS PER SQUARE FOOT IN THE DIFFERENT GRAZING TREATMENTS AT THE DATES SHOWN. PADDOCK TRIAL-GRASSLANDS-SOWN AUTUMN, 1949

Date of count	3in. Grazing		6in. grazing		9in. grazing	
	White Clover	Red Clover	White Clover	Red Clover	White Clover	Red Clover
Establishment before treatments 20.4.49	27	14	27	14	27	14
27.7.49 . .	27	8	17	5	6	3
17.11.49 . . Just after end of treatments	24	7	18	5	8	3

It could, of course, be argued that there was still a sufficient clover population in the 9in. series to enable! a quick build-up to a balanced pasture. There was, however, quite a difference in size and structure of the clover plants in the three treatments. In the 3in. series the plants were much more robust with many more leaves and a much stronger root system than the other extreme in the 9in. series. The performance of these weak plants subsequent to the discontinuation of the early difference in grazings was very poor, and the 9in. paddocks at the end of the total trial period had not picked up to any extent and certainly did not show much prospect of doing so.

This grazing trial is being repeated this season. So far the results have been very similar to last year, both with the total yields as well as the differences of clover suppression.

The results of these four independent trials as well as field observations made quite clear the need for more early grazing control of new paddocks. A rotational grazing system aimed at grazing at the 3in. to 4in. stage for the first 6 months would probably be the best plan, as this will allow a certain amount of latitude for bad weather and soil conditions which necessitate delays in putting stock on to such young swards. Another point is that in order to give the clovers a further chance in some cases, it may be advisable to " bleed " the early growth a little by grazings during the daytime only, or by quick " on-

and-off" grazings for an hour or so with big mobs for the first few months.

Certainly it appears that the common practice of allowing new pastures to get away to almost the silage stage is a big factor in early clover failure, especially the white clover, in mixtures containing early developing ryegrass strains. There are, of course, many special farming conditions not calling for rapid clover establishment or which call for a supply of a large bulk of feed such as would be present in the spring from an ungrazed autumn pasture. Some farmers, too, may prefer to develop their pastures with the use of less aggressive grass components, while others still are prepared to take the gamble under crops of various sorts.

It is essential, however, for success in grassland farming to regard the pasture as a crop in itself. For that purpose it is highly desirable to stop any gambling on the establishment of good clovers, as the loss of the seedlings of good strains established on a good seed-bed leads to a very risky reliance on buried seed, that brought in by stock, or later oversowings by the farmer.

The same principle of control should also be followed in such clover introduction into established swards. Again both observation and experiment have shown that fairly close grazing in the early stages is essential, with the intensity depending not only on the clover itself, but also on the vigour of the other species already present in the sward.