SEEDING RATES OF SHORT-ROTATION RYEGRASS

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This paper describes particular aspects of a comprehensive series of trials being carried out at Grasslands Division and designed to extend the work reported by Sears at the Grasslands Conference in 1950. (1.) It is concerned almost exclusively with seeding rates of short-rotation ryegrass in relation to subsequent productive performance, with only brief reference to the characteristics and performance of perennial ryegrass. But before presenting detailed results it is necessary to define the farmers' requirements from an establishing pasture, i.e., those characteristics expected of a pasture during its first 6 months of growth.

The first essential is that the pasture should develop into a well-balanced, high-producing, weed-free sward and hence reach the full operation of the fertility cycle as soon as possible. This means the successful development of the individual plants of ryegrasses and clovers in the association. Successful development is largely determined by sowing practices, seeding rate, and subsequent management of the pasture mixture, assuming of course that factors such as drainage, nutrient supply, and seed-bed preparation are not limiting growth.

There is also the question of feed supply on the farm during late autumn and winter. The opinion is held by some that this factor alone determines almost entirely the practices followed during establishment. I think it will be agreed that autumn-sown pastures, particularly on dairy farms, contribute an important part of the feed supply during autumn and winter, but to prejudice the development of a balanced pasture in favour of maximum early production would be a dangerous practice. What should be aimed at, there-

fore, is a balance between the two requirements—successful individual plant development coupled with relatively good supply of feed.

The first trial to be described was laid down in the autumn of 1951. Plots were sown down with perennial and short-rotation ryegrass, separately and in association with each other, at 15lb. per acre and 401b. per acre respectively. Three pounds of white clover and 41b. of red clover per acre were sown,. in all cases, The plots were grazed at the 3 to 4in. stage by harnessed wethers, dung and urine being returned in proportion to plot yields. There were certain irregularities for the first and last grazings. At the first the lower seeding rates induced a more prostrate habit of growth of individual plants and in these plots the pasture was at the, 2 to 3in stage. The last grazing occurred after a summer spell to encourage red clover growth; the pasture was consequently at about the 12in. stage.

Time will not permit the presentation of results obtained from the perennial ryegrass comparison. Briefly, these results have shown, however, that a low rate sowing of perennial ryegrass yields much less than a comparable short-rotation ryegrass sowing and also the weed growth in such a developing pasture is -too vigorous to permit a reduction in seedingrate from the accepted 401b. per acre. Dr Mitchell in his' paper discussed tillering of. these two ryegrasses and reported work carried out on plants grown under controlled conditions. He showed that short-rotation ryegrass had a faster tillering rate than perennial ryegrass and also that larger tillers are produced by short-rotation ryegrass grown under high fertility conditions. This fact explains in part our suggested reductions of short-rotation ryegrass seeding from the normal rates used for ryegrass. The faster tillering rate allows for a quicker filling out of an establishing sward of short-rotation ryegrass than for a comparable sowing of perennial ryegrass.

Results presented in Table I give the total dry -matter 'per acre and species yields of pastures sown -with short-rotation ryegrass at 15lb. per acre and 401b. per acre respectively, both sown with 316. white clover and 41b. of red clover. The period. of measurement Was from 3rd April, 1951 to 21st January, 1952 (a growth period of 293 days).

Table I: Total dry matter (lb. per acre) and species yields of pastures sown with short-rotation ryegrass at 151b. per acre and 401b. per acre.

Mixture	Total Dry Matter (lb. per acre)	Species Yields of Total Dry Matter				
		Ryegrass	Red Clover	White Clover	Other Grasses	Other Species
M_1	10,340	6,890	1,460	1,340	440	210
M_2	10,240	5,870	1,560	1,590	880	,340

M_1 = Short-rotation ryegrass at 40lb. per acre + 31b. of white clover per acre + 4lb. of red clover per acre.

M_2 = Short-rotation ryegrass at 151b. per acre + 31b. of white clover per acre + 41b. of red clover per acre.

The above results show the following main points:

1. There was no significant difference in total dry matter production for the two sowings.
2. Short-rotation ryegrass yield was greater from. the heavier than from the lighter sowing.
3. Both red and white clover yielded less in the 401b. than in the 15lb. sowing.
4. The heavier, sowing gave better control of undesirable species (mainly *Poa* annua) than the light.

These are the over-all conclusions for the full period of the trial. For a clearer picture of the events which led to equal total production from both sowings, however, the growth period of 293 days has been broken into three periods (each period made up of 3 grazings) as shown in Table. II. This table gives the total dry matter per acre and species yields of the two swards.

Table II: The important features of this table are:—

1. In the first period total production from the heavier grass seeding was significantly greater (at the 5 per cent level) than from the lighter sowing. This was followed by a period when equal total production was obtained from both sowings and during the third period production was significantly greater from the lighter sowing. At the conclusion of the trial indications were that the sward developed from the lighter sowing would continue to outyield that from the heavier sowing.

2. More dry matter per acre was' obtained from short-rotation ryegrass in the heavier sowings than in the lighter sowings for both the first and second periods, but for the final period yields of ryegrass were equal.

3. Greater clover yields were obtained in all periods from the lighter sowing.

4. Weed species were present in greater amounts in the light-rate grass sowings in all periods.

Table II: Total dry matter (lb. per acre) and species yields of the two swards for the periods shown.

Period	Mixture	Total Dry Matter (lb. per acre)	Species Yields of Total Dry Matter				
			Ryegrass	Red Clover	White Clover	Other Grasses	Other Species
3/4/51-30/7/51 116 days	M_1*	1,940	1,689	12	29	66	144
	M_2	1,290	930	7	39	107	207
30/7/51-8/10/51 70 days	M_1	2,100	1,785	24	76	163	52'
	M_2	2,170	1,581	21	128	322	118
8/10/51-21/1/52 107 days	M_1	6,300	3,415	1,421	1,234	218	12
	M_2*	6,780	3,360	1,533	1,418	458	11

*Denotes significantly higher tbtal yield at the 5 per cent level than comparative treatment.

This trial has shown that although total production was equal for the full growth period measured, the need for feed during the late autumn and winter rules in favour of the heavier sowing, for it is during this period that heavier sowings outyield light sowings.

The other point is that individual plant development appears to be better in the lighter sowings than in the heavier sowings. This is certainly the case with clover plant development, as is shown by dry matter yield obtained from clover growth and by population counts of surviving red and white clovers made during the trial. One count made 103 days after sowing showed that there were approximately 50 per cent more plants per unit area still surviving in the lighter-rate sward than in the heavier-rate sward.

A second trial was laid down in the autumn of 1952. Seven mixtures containing a basic seeding of 31b. of white clover and 4lb. of red clover per acre are being compared; short-rotation ryegrass has been sown at 0, 10, 15, 20, 30, 40 and 60lb. per acre respectively. The trial is under grazing at the 3in. .to 6in. stage.

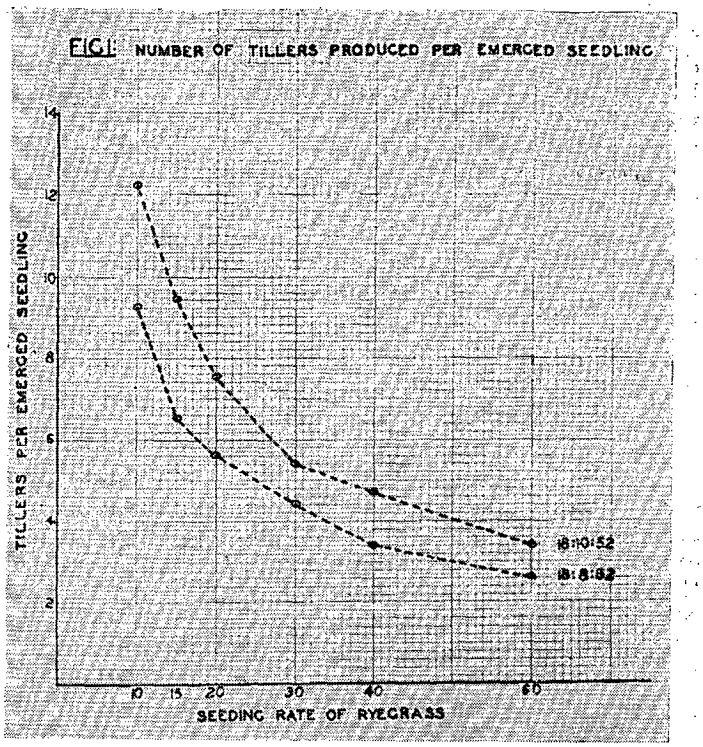
In addition to total and species dry matter yields, measurements of clover populations and of tiller numbers have been made; The latter are presented in Table III.

Table III: Results of Emergence and Tiller Counts per unit area from the six sowing' rates made at intervals during the trial.

Seeding Rates of Short-rotation ryegrass	10 lb. per acre	15 lb. per acre	20 lb. per acre	30 lb. per acre	40 lb. per acre	60 lb. per acre
'Viable seeds sown per sq. ft. (2/4/52)	47.8	71.7	95.6	143.4	191.2	286.8
Emerged seedlings per sq. ft. (4/5/52)	33.4	46.6	61.2	91.5	119.8	184.2
Percentage emergence of viable seeds sown	70.0	65.0	64.0	63.8	62.7	64.2
No. of tillers per sq. 'ft. (18/8/52)	306	303	342	403	403	476
No. of tillers' per sq. ft. (20/10/52)	442	436	461	498	568	634

The first point of interest from this table is that with the number of emerged seedlings for each sowing rate there was a higher percentage emergence at the lower rates of sowing than at the higher rates. Though statistical analysis of these figures shows no significant differences, except for the 10lb. per acre sowing, last year's trial showed a significantly higher percentage emergence for the 151b. per acre sowing than for the 401b. per acre sowing. The percentage emergence figures and- confidence limits were 49.8 ± 4.00 for the high rate and. 59.7 ± 4.38 for the low rate.

The next point of interest is that illustrated when the number of tillers at each count is divided by the number of emerged seedlings. This figure gives the number of tillers, produced per seedling, but does not take into account seedling death or tiller death. Fig. 1 shows this for both counts.



Both curves gave significant tests for regression of tillers produced per seedling on seeding rate ; or in other words, increasing rate of seeding is associated with decreasing numbers of tillers, both regressions being significantly curved.

For coupling with the above tiller counts, the dry weights (in gms.) of 100 tillers were also obtained on the two dates of sampling. These results are shown in Table IV.

Table **IV:** Results of dry weights (in gms.) of 100 tillers for the six seeding rates for the dates shown.

Seeding Rate	10lb. per acre	15lb. per acre	20lb. per acre	30lb. per acre	40lb. per acre	60lb. per acre
Count 18.8.52 .	3.20	2.90	2.61	2.98	2.70	2.81
Count 20.10.52	5.39	5.12	4.91	4.14	4.01	3.51

The results obtained from the weighings on the first date showed that there were-no significant differences in weights per 100 tillers for all seeding rates. For the. weighings on the second date, however, there was a highly significant regression of tiller weight on seeding rate. This regression denoted that there was a significant downward linear trend of tiller weight with increasing seeding rate.

The measurements indicate that tiller development of individual ryegrass plants, both in numbers produced per plant and size of individual tillers, is better in the lighter sowings. Several factors may be involved. Dr. Mitchell discussed the influence of shading on tiller development, and stated that under shading the tillering rate of short-rotation ryegrass is much slower than under full light. These findings, of course, were obtained under controlled conditions. In swards developing from mixtures in which the seeding rate ranges from 10lb. per acre to 601b. per acre in the increments already shown, it would be expected that in the initial stages of development of these swards there would be a correlation between seeding rate and light intensity at ground level. In the light grass sowing rate swards little shading would be present, whereas in the heavy seeding rate swards considerable shading would occur. This factor is doubtless of considerable importance in explaining the results obtained, but it is probable also that the greater clover population and stronger clover growth in the lighter sowings exerts an appreciable influence. The difference between the August and October results may well be explicable in terms of better nitrogen nutrition of the grass through better clover growth.

Finally I will discuss the influence of grazing height on pastures establishing from light and heavy sowings of short-rotation ryegrass. A paddock trial is in progress at the Grasslands Division "Palmerston North, where two grazing heights of mixtures identical to those described in the first trial reported are being compared. The 3in. to 4in. grazing height adopted in the previous trials had been shown to be the most satisfactory one for pasture establishment at high seeding rates (Sears 1). The reason for this system is the elimination by defoliation of excessive competition from ryegrass on the slower developing clovers. By reducing the seeding rate of the ryegrasses in the mixture however, much of this competition

between species in the establishment- stages. is eliminated, and the need for-rigid adherenceto 3in. grazings may .not be warranted. Moreover, the; possibility of a wet autumn and winter, common in the Manawatu, should not be overlooked. Under these conditions the grazing of young autumn-sown pastures 'presents something of an embarrassment to dairy farmers and first grazings take place when the herbage height is anything between 3in. and 12in. Consequently much clover seedling death occurs, and the pasture then goes into the spring growing season with poor potential clover growth.

This trial was therefore designed to determine whether grazing a 15lb. per acre. ryegrass sowing at any height between 3in. and 9in. caused any difference in clover vigour. The total dry matter figures and species yields obtained from this trial- are presented in Table V.

Table V: Total dry matter (lb per acre) and species yields of high and low rate short-rotation ryegrass sowings grazed at 3in. and 9in. respectively.

Period of growth April 2, 1952 to October 1, 1952.

	Grazing height	Total Dry Matter lb. per acre	Special yields of total dry matter				
			Rye. grass	Red Clover	White Clover	Other Grasses	Other Species
High rate of sowing	at 3in	2,970	2,790	35	45	35	65
	at 9in.	3,030	0 0	50	25	20	35
Low rate of sowing	at 3in	3,030	2,660		95	70	145
	at 9in.	4,150	3,650	118	120	60	210

The results above show the following main points:

1. The mean total production for the two rates of sowing did not differ significently for the total period of measurement shown (182 days);
2. The mean total production for the two heights of grazing were significantly different, With 9in. grazing yielding approximately 30 per cent more 'than. the 3in. grazing.
3. The yield of clover was better in the lighter grass sowings than in the heavier sowings, and observations and counts of clover plants have shown that there are as many plants per unit area persisting in the 151b. per acre swards grazed at 9in. as in the 401b. per

acre swards grazed at 3in. These counts have also shown a marked decrease in numbers of plants present in the. 401b. per acre sward grazed at 9in.

Although not shown in Table V, the trial has also shown that the differences in yields between the two sowing rates at the first 9in. grazing are not as great as when grazed at 3in. The figures presented in Table II showed, that for the first growth period a difference between seeding rates of approximately 50 per cent D.M. was obtained with the 3in. grazings. By grazing at 9in., however, this difference was about 10 per cent only. In other words, the feed obtained from the 151b. per acre ryegrass sowing grazed at 9in. during the late autumn and early winter was only about 10 per cent less than that obtained from the 40lb. per acre sward grazed at 9in. This., difference was reversed in the second grazing.

The trial demonstrates that there is little risk of depressing clover growth by grazing at heights greater than 3in., provided the ryegrass is sown at a low rate per acre. The trial also shows the point already made, that greater production is obtained from 9in. than from 3in. grazings.

In conclusion then, the results present&d in this paper have shown the following points:

1. Individual plant development of short-rotation ryegrass and also of the associated clovers in the mixture is better in the lighter sowings than in heavier sowings. Because of this the swards developing from autumn sowings of 15lb. of short,-rotation ryegrass per acre or thereabouts have greater potential. clover growth and consequently ryegrass growth for the following spring.
2. More latitude in grazing height is, possible in the establishment of light sowings than of heavy sowings. Consequently more feed can be obtained from, these light sowings during the late autumn-early winter by grazing at 6in. or 9in. without affecting clover growth. At the 3in grazing height, however, more feed is obtained from the heavier sowings.
3. Heavier sowings suppress weed growth to a greater extent than the lighter sowings. This applies more at 3in. grazing level than at 9in. grazing level.

REFERENCES

1. Sears, P. D. "Establishment of Clovers in Pasture," New Zealand Grassland Association: Proceedings of the 12th Conference, pp. 132-141.

DISCUSSION

Q. (Lynch): Will Mr Brougham describe the technique of pasture measurement used in the first trial in his paper?

A. The technique used was that published and described by Mr Sears as the proportional return technique.

Q. (Jacques) : Dr. Mitchell has stated that the effects of light and temperature are more pronounced on short-rotation than on perennial ryegrass. -What effect has this on the seeding rate required for these two species ?

A. In trials he carried out Mr Levy found that with perennial ryegrass high seeding rates are better than low to combat weed growth. I have found that with short-rotation ryegrass lower seeding rates can be used. Short-rotation ryegrass has a faster tillering rate and larger tillers than perennial. This results in a more rapid filling out of the sward. Therefore the seed rate in comparison with perennial ryegrass can be reduced. But if a good seed-bed is obtained by such methods as adequate cultivation, fallowing, and chemicals, it may be advantageous to cut down the seeding rate with perennial ryegrass.