

S O M E OBSERVATIONS ON SHORT-ROTATION RYEGRASS

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INTRODUCTION

In 1943 a new ryegrass appeared on the New Zealand market, known first as H1, but later as short rotation ryegrass. This new grass was a hybrid produced by the Grasslands Division, Department of Scientific and Industrial Research, and combined some of the more valuable features of its parents Italian and perennial ryegrass. Since that time the grass has been tried over a wide range of soils and climate with varying management and utilisation, so that the picture of its sphere of usefulness is now fairly clear. The characteristics of the grass as first produced are as follows :—

The fertility and moisture requirements for optimum production are high, being intermediate between Italian and perennial ryegrass; a very quick establishing grass, producing a large flush of feed in the first season; one of the earliest spring grasses; non-productive in hot, dry weather and subject to severe mortality ; a phenomenal power of regeneration from shed seed under conditions of high fertility; permanence variable, depending on fertility, moisture, and management; habit of growth upright and open, demanding rotational grazing; palatability excellent.

In other words, this grass leans towards the Italian parent, but *is* capable of becoming more or less permanent on a wider range of soils. Since the first release subsequent selections have aimed at eliminating its lack of permanence. There is some evidence that this has been achieved in part with the nucleus seed of 1948.

At Lincoln College great use has been made of this grass. Since 1943 eighteen fields have been sown in which short-rotation ryegrass was a dominant constituent of the mixture. One original pasture still remains, E.8; now in its seventh year, it is still a good pasture.

At the present time 242 acres of our 542 acres of pasture contain short-rotation ryegrass as a dominant. We have made some use of it on the lighter land at Ashley Dene and we have results of observations at the Kirwee Experimental Farm. Over the last two seasons measurements of seasonal production have been made so that we have accumulated some evidence. But first a word of warning as to our experiences: we extended the use of short-rotation ryegrass during a cycle of rainfall of over 30 inches per year. We now appear to have entered a cycle of about 20 inches, so that our earlier experiences may be of limited value under conditions of lower rainfall.

RAINFALL RECORDS LINCOLN COLLEGE STATION

Station average (67 years)	25.92 inches
Average rainfall, 1936-46	31.18 "
Rainfall, 1947	24.33 "
" 1948	20.06 "
" 1949 (nine months)		13.26 "

Lincoln College experiences : Heavy cropping land.
E.8 Short rotation ryegrass and white clover.

Soil: a deep silt loam overlying a stiff retentive clay. This pasture was sown in 1943, cut for ryegrass seed in 1944 and white clover seed in 1945 and 1946, and since used for grazing.

TABLE I.
Seasonal Production E.8, 1947-1949

Period	Dry Matter Production in lbs.				Actual grazing sheep carried per acre
	Total	Species		Other	
		Rye	W. clover		
1947-48					
Sept.-Nov.	2740	2354	352	34	7.1
Dec.-Feb.	714	392	281	41	2.1
Mar.-May	1055	720			3.1
June-August	1520	1339	298	37	5.0
Total, 1947-48	6029	4805	1108	116	4.3
1948-49					
Sept.-Nov.	3642	3022	353		7.1
Dec.-Feb.	1249	991	58	207 200	
Mar.-May	206	198	7		1.2
June-August	1019	943	63	131	4.0
Total, 1948-49	6116	5154	481	481	3.8

The 'characteristic's' of short-rotation ryegrass are apparent from these results, i.e.:' good winter and spring, production but unreliable summer and autumn production.

In the summer of 1947/48 mortality of the ryegrass was estimated at 70 to 80 per cent. In the autumn complete regeneration occurred from shed seed giving excellent winter and spring growth. This new growth survived an even drier summer in 1948/49. An important feature of this field has been the use of a simple mixture of one grass and one clover, enabling the grazing management to be adapted to the requirements of the species.

E. 4. Short-rotation and perennial ryegrass, timothy, Montgomery red and white clover.

'Soil: A deep silt loam overlying a stiff retentive clay. This pasture was sown in March, 1947, and has since been used for grazing. 15lb of short-rotation and 5lb of perennial were sown.

TABLE II.
Seasonal Production E.4. 1947/1949

Period	Production in lbs of each species					
	Total lbs. D.M.	Rye	Timothy	Red	White	Weed
1947-48						
Sept.-Nov.	4778	4310	19	81	72	296
Dec.-Feb.	2700	1013	32	1542	113	—
March-May	1662	886	141	404	231	—
June-August	1630	947	44	391	248	—
To. 1947-48	10770	7156	236	2418	664	296

Period	Production in lbs of each species					
	Total lbs. D.M.	Rye	Timothy	Red	White	Weed
1948-49						
Sept.-Nov.	2751	690	3	769	1241	—
Dec.-Feb.	1979	188	32	1445	343	—
March-May	356	141	—	134	49	—
June-August	484	343	25	27	89	—
To. 1948-49	5570	1362	111	2375	1722	—

No attempt was made to separate the two ryegrasses, but short-rotation has been and still is the dominant contributor. This field shows a common experience with short-rotation ryegrass : a tremendous flush in the first spring followed by a summer slumping with fairly severe mortality. Production was maintained in this case by Montgomery red clover,

but in the long cover. so provided -grass grub became active and regeneration of ryegrass from seed was seriously affected. There was some recovery by winter, but by the following spring over-grazing and attacks of grub resulted in almost complete suppression of the ryegrass. The detrimental effect of this on winter growth is shown in the winter period of 1949. Without the clovers, total production of this field' would be very inferior in the second season. Timothy has played little part in this pasture owing to the severe competition with short-rotation ryegrass in the early stages and with red clover later. Short-rotation ryegrass does not lend itself readily to complex mixtures either in the establishment stage or in the subsequent management ; nevertheless this type of pasture, though difficult to manage under conditions of irregular rainfall; is extremely valuable and is worthy of use on reasonably fertile land.

Comparison with other fields:

Other pastures on a similar soil type gave results as follows :-

TABLE, III.

Seasonal Production of Five Fields 1948-49

POUNDS OF DRY MATTER

Season	S.R. rye & white clover	S.R. rye Mont. red & white clover	Per. rye & white clover	Timothy & Mont. red	Phalaris & whit clover
	E.8	E.4	s.5	S.1	S.E.9
Spring	3642	2752	3221	2822	2930
Summer	1249	1979	106	2190	1502
Autumn	206	355	92	596	799
Winter	1019	484	414	476	550
Total	6116	5 5 7 0	3833	6084	5781

The low production of the perennial ryegrass field was a reflex of faulty grazing management. The other fields show a surprising similarity in total production, but season of production varies considerably. The valuable winter growth of short-rotation ryegrass is shown in E.8.

Other Fields of Short-rotation Ryegrass

S.E. 4 & 5 Soil: A deep silt loam overlying- a retentive clay. The field was 'sown in 1945

- with short-rotation ryegrass and white clover. Cut twice for seed and once for hay. Now in its fifth year it is an excellent pasture. Due to the high fertility and reasonable summer soil moisture the ryegrass has been fully permanent.
- E.2 Soil: As in S.E. 4 & 5.
This field was sown in 1943 and cut for seed three times. It was ploughed when 4 years old, while still a first-class pasture.
- S. 5 & 6 Soil: As in S.E. 4 and 5.
The field was sown in 1947 with 10lb short-rotation ryegrass and 3lb white clover and cut for clover seed in 1949. It is an excellent pasture.
- N.E.3 Soil: As in S.E.4 and 5, but with less moisture and somewhat overcropped.
The field was sown in 1948 with 5lb short-rotation ryegrass and 3lb Nucleus white clover. It was cut for seed in 1949 and yielded 34 bushels M.D. ryegrass. Regrowth from shed seed was very noticeable. Thus on the heavy cropping land the grass is successful. Permanence is achieved either by survival of the existing plants when summer moisture is reasonably effective, or by re-seeding.

Experience on medium cropping land

- N.11 This field is in a high state of fertility and was sown in 1943 with short-rotation ryegrass and white clover. It was cut for seed four times and ploughed after 6 years. It was a first-class pasture throughout its life.
- W.5 This field dries out more readily than N.11. It was sown in 1944 with short-rotation ryegrass and white clover and was cut for seed four times and then ploughed. The persistency of the ryegrass was due to reseedling. Both these fields had been lightly cropped and were in good heart.

“More recent sowings on medium land have been less successful.

Nucleus fields were sown in 1946, 1947, and 1948 on land that had been heavily cropped. In each case

there was a clover failure, due- in part to excessive ryegrass competition in the early stages of growth. Following ryegrass seed harvesting, mortality in the 1946 and 1947 sowings was estimated at 80 to 90 per cent. " Re-growth from seed occurred, but failed on account of dry weather and the activity of grub and porina. An attempt to bring about a regeneration of these fields by topdressing, hand feeding of cattle, and over-sowing with clover has not as yet resulted in any worth-while grazing. The 1948 -sowing suffered a less severe mortality of 30 to 40 per cent. Similar rejuvenation treatment has been given to this field, again with little result as yet. On the medium land our earlier favourable opinion of the grass has had to be revised.

The persistency of the grass under these conditions is too doubtful to justify the expense of pasture establishment.

As low rainfall and medium to low fertility are features of much Canterbury cropping land, short-rotation ryegrass has only a small part to play in its economy.

Holding Yard for. Wool-shed : Medium to heavy land in a high state of fertility. After a short summer fallow this field was sown on April 9, 1948, with $2\frac{1}{2}$ bushels of short-rotation ryegrass and 2lb white clover. An excellent establishment of ryegrass occurred, but clover growth failed, partly due to competition and partly due to lateness of sowing. In addition to normal high carrying capacity over the first winter, the field was heavily and continuously grazed in November and December while shearing was in progress. By March all the ryegrass was dead. No re-growth occurred- with autumn rains and the field was ploughed. In this case failure cannot be attributed to low fertility. Summer drought and lack of clover are two important features, but the main factor was the grazing management and the absence of seeding.

In Demonstration Plots: In an area sown in strips in 1945 with different species of ryegrass and white clover and grazed as a common area the selective grazing of sheep has always been detrimental to the short-rotation ryegrass strips. Judicious spelling, however, has enabled them to recover; Regeneration from shed seed has been an important feature.

Medium Light Land at Kirwee Experimental Farm

Short-rotation ryegrass was sown extensively at

Kirwee both alone and in association with perennial ryegrass. In trials short-rotation, out-yielded perennial ryegrass. Table I gives the dry matter production for two seasons of a field sown in February, 1944, half in short-rotation ryegrass and half in perennial ryegrass with clovers.

TABLE IV.
Production Field 17, Kirwee., 1944-46

Period	Production in lb dry matter.	
	Short-rotation ryegrass and clovers	Perennial ryegrass and clovers
May, 1944-May, 1945	8220	6652
May, 1945-May, 1946	4284	3571

The autumn of 1946 was a bad season for grass grub. Short-rotation ryegrass was killed 100 per cent and the perennial ryegrass was affected to perhaps 30 per cent. There was still a pasture remaining on the perennial half of the field.

An association of the two grasses was also tried and gave an improved spread of production. However, a mixture of the two grasses in 1947 gave results familiar to many farmers. The short-rotation ryegrass took charge of the pasture in the first winter and spring and died in the summer, leaving a patchy open field. In 1948 separate sowings were reverted to. Field 14, an old subterranean clover pasture used for chou moellier in 1947, was resown after a summer fallow on February 2, 1948, with 1 bushel of short-rotation ryegrass, 2lb red clover, and 1lb white clover. Volunteer subterranean clover and short-rotation ryegrass gave a result equal to those obtainable in a high-rainfall area in its first winter. The following details of stock carried have been supplied by Professor Coop: During the months of June, July, and August, making allowance for a small quantity of hay and run-off, the field had a full winter carrying capacity of 14-15 sheep per acre. Apparently the ryegrass had the ability to utilise the nitrogen supplied by a vigorous growth of clover.

After normal spring and early summer grazing the mortality was substantial, approaching 90 per cent. Complete absence of grazing throughout the autumn and winter has not yet effected a recovery.

Kirwee experience has thus been somewhat mixed.

Certain features of the grass are extremely valuable, but the lack of persistency is the limiting factor.

On Light Land at Ashley Dene

Short-rotation ryegrass has been used as a constituent of mixed pastures in place of Italian ryegrass at the rate of 5 to 10lb per acre. The quick initial growth is of value, but the turf tends to be left in an open patchy condition.

In recent years beneficial results have been obtained by using short-rotation ryegrass in association with volunteer subterranean clover, e.g., Field 22. Soil: A light stony silt loam. This field was in old subterranean clover pasture for eight years and was sown in wheat in 1947. After harvesting (32 bushels) the stubble was roughly worked and sown in oats and grass for greenfeed, one bushel of short-rotation ryegrass being broadcast in front of the drill. The intention was to summer fallow and sow to grass the following autumn. However, an excellent growth of volunteer subterranean clover caused the ryegrass to develop so well that the greenfeed was left for pasture.

In spite of a dry summer and autumn there was very little mortality among the ryegrass plants. During the past winter and spring the field has been one of the best on the farm, carrying a very heavy stocking. Although this field is comparatively light, it is in a good state of fertility. On similar soil in a lower state of fertility short-rotation ryegrass would be an utter failure.

This field again suggests an important feature of short-rotation ryegrass—its high nitrogen requirement. It would seem here that the grass is limited less by a light soil and a dry summer than by lack of nitrogen; also the strain is a later selection whereas that at Kirwee, it is believed, was of the earlier type.

Effect of Different Grazing Systems

Mention has been made of the importance of the grazing management in the survival of short-rotation ryegrass. While one could point to several specific instances at the College, there was no factual analysis of the effects of differential grazing. The officers of the Grasslands Division of the Department of Scientific and Industrial Research have very kindly provided the following information obtained from a trial carried out at Palmerston North:

In the autumn of 1946 a complex mixture was

sown in different fields and subjected to different grazing systems. The percentage dry weight analysis of the herbage for the month ended September 26th, 1949, $3\frac{1}{2}$ years later, gives the following results:

TABLE V.

Effect of Different Grazing Systems on Species Balance

Species	Percentage Composition	
	Continuous Grazing	Rotational Grazing
Short-rotation ryegrass	2	35
Perennial ryegrass	49	38
Other Grasses	17	3
White Clover	32	2 2
Other Species	Tr	2

DISCUSSION

The experiences outlined above indicate that the plant breeder has given us a valuable addition to our grassland species. High palatability, high, productivity, and earliness of spring growth are the outstanding features of this grass. However, there are certain limitations associated with its use and management. The land must be reasonably fertile and reasonably retentive of moisture. The grass must have large supplies of nitrogen, thus demanding a strong sole of clover. In a mixture the seedling rate of this grass must not be too high. Under dry conditions the grass may die, so that opportunity must be given the plant to re-seed. The management must be adapted to suit the requirements of the grass.

Given these conditions the great weakness of the grass-its lack of permanence-can be overcome.

The name "short-rotation" implies that the grass is adapted to the short-rotation system of arable farming typical of Canterbury. However, the soils of much of this region have neither the fertility nor the moisture status to maintain a grass with the characteristics described. As a result short-rotation ryegrass has met with a somewhat mixed reception in Canterbury. On heavily cropped soils deficient in nitrogen and on light soils subject to summer drought the grass is of doubtful value for pasture purposes beyond the first year. There is very little use made of the complex mixed pasture in the short-rotation farming systems. Most of the pastures are sown

with, a view to seed production. Consequently we find short-rotation ryegrass used as follows:-

1. As greenfeed on a wide range of soils.
2. As a short-lived pasture for seed production on the medium cropping land.
3. As a constituent of long-rotation or permanent pasture on the heavy cropping and daisy land.

Acknowledgments:—

Mr. P. D. Sears-Grasslands Division, Department of Scientific and Industrial Research, for information supplied in Table V.

Members of the Lincoln College staff for assistance in preparation of the paper.