

SOME OBSERVATIONS ON IRRIGATED PASTURES IN CANTERBURY

A. H. FLAY;: and M. H. ROGERS

CANTERBURY AGRICULTURAL COLLEGE

The object of **this** paper is to record some findings associated with the **establishment** and irrigation of permanent pasture on light land in Canterbury, These include notes on the method of establishment, **mixture used**, method and extent of irrigation, response' to manurial treatment, and botanical analyses of 'establishing pasture under various treatments.6 Although the details discussed are based on a **twenty-two** month period of **observation** at **Seafield** Irrigation Farm reference is made **also** to other irrigation experiments 'undertaken at Oxford **Hororata**, and **Southbridge**. The limitations of the material presented are acknowledged, However, in view of the paucity of similar information applied to **irrigation** in other parts of the Dominion and the **necessity** for such knowledge before embarking on extensive irrigation, it is **hoped** the **subject** matter will create a valuable discussion

SEAFIELD IRRIGATION FARM.

This property comprising **nearly** 700 acres is situated about ten miles east of Ashburton, The **herbage** consists chiefly of **browntop** and other undesirable **twitches**. Sorrell and other weeds are prevalent, **Accordingly** frequent **cultivation** and rotations of crops are desirable for **cleaning** purposes. **The soil** varies from **four** to **six inches** in depth and overlies a **few** inches of clay loam which overlies deep shingle, There is adequate **drainage** for surplus water,.

PROCEDURE ADOPTED FOR ESTABLISHING PERMANENT PASTURE ON THIS LAND.

In March 1932, an area of thirty two acres was ploughed out of an old sod bound sward of **browntop**. On one half of this area **levelling** was executed for the border **dyke** type of **irrigation**. The field was fallowed until November and early December when the **following** seed mixture was sown broadcast on a well prepared seed-bed, no cover crop being used.

True Perennial Ryegrass	30	lb.	per	acre
Cocksfoot (N.Z.)	10	"	"	"
Red Clover	3	"	"	"
Certified wild White Clover	2	"	"	"
Total	<u>45</u>	"	"	"

One hundredweight of Superphosphate per acre was applied at the time of **sowing**. The germination was good, Later the area was subdivided **into** fourteen paddocks of approximately two acres **each**. Seven of these were irrigated and the remainder acted as **controls**.

SUBSEQUENT TREATMENT OF THE PASTURES.

In the autumn (1933) an abnormally dry period was experienced from mid-January until May. The irrigated paddocks were watered five times between mid-February and early May. The total amount of water applied was 8.13 inches, 7.38 inches from irrigation and 0.75 inches from rain.

From mid-February to May the irrigated areas were grazed harder than that usually recommended. Since then, however, the system of controlled rotational grazing has been more ideal, the stock being shifted a day or so before really necessary. Some of these pastures were used for fattening Lambs in the autumn, winter grazing has not attempted.

During the dry spell the irrigated pastures showed striking superiority in growth over the non-irrigated on which some young plants died. Cocksfoot and red and white clover appeared to be most seriously affected.

In the late autumn and winter the irrigated pastures showed a pale yellow colour and appeared weakly. This lack of vigour was more pronounced on the areas from which soil had been removed in the process of levelling. The non-irrigated pastures, which had not yet been grazed, did not appear pale and yellow, and were ready for their first grazing in August. The irrigated fields could not be grazed until mid-September.

As the spring advanced the appearance of the irrigated pastures gradually improved. The improvement was in keeping with the amount of fertiliser used. (This will be dealt with later.) Red and white clover, ryegrass, and cocksfoot, in that order, grew vigorously from early October onwards. As the spring weather continued dry irrigation was carried out in October, November and early December, and again in April 1934. The total quantity of water received by these grazed pastures for the season (July 1933 to June 1934) was 38.52 inches -- 6.01 inches, from irrigation and 32.51 inches from rain.

The dry spring had an adverse effect on the non-irrigated pastures, especially during November and December. This effect continued into January 1934 even though 3 inches of rain were recorded in the latter part of December and 3½ inches in the first week of January.

MANURIAL TREATMENTS.

From the time of sowing in November and December 1932, to June 1934, the manurial treatments of the grazed fields selected for botanical analysis are listed as follows :-

IRRIGATED:

<u>Plot</u>	<u>Date Applied</u>	<u>Manure, & quantity used per acre</u>
S3A	May 1933	1 cwt. Super
	August 1933	5 " Lime, 1 cwt. Super
	November 1933	1 " Super
	May 1934	1 " Super
S3C	No manure	

NON-IRRIGATED

C3C	May 1933	1 cwt. Super
	August 1933	5 " Lime, 1 cwt. Super
	December 1933	1 " Super
	May 1934	1 " Super
C3D	No manure	

Other fields received various amounts of Super and lime during the same period but on any one field the total quantity applied did not exceed that given the manured paddocks listed above.

Observations showed that the application of fertilizer reduced during the winter, the degree of the pale yellow appearance already referred to and hastened recovery. From October 1933 onwards a proportional increase in growth of red, and white clover was noticeable and bore a parallel relationship to the amount of manure applied; Where 3 cwt. of Super and 5 cwt. of Carbonate of lime per acre per annum was applied ryegrass, and to a lesser extent Cocksfoot, became more vigorous. In the grazed pasture no smothering effect by the clovers has been noted.

BOTANICAL ANALYSIS OF IRRIGATED AND NON-IRRIGATED GRAZED PASTURES.

In the summer of 1933-34 it was evident that changes were taking place in the plant cover and to measure these the pin-point method of Analyses (1) was adopted. On the irrigated pasture plots were pegged off where little or no levelling or filling had been done. In each of the two irrigated and non-irrigated fields selected three plots were used. On each plot 250 pin points were taken making a total of 750 points for each field. Although counts were taken when the grass and clover growth was about the same stage of recovery after grazing it was not always possible to analyse the areas at the same time. As shelter from a plantation and levelling caused variation in growth on about one half of the no-manure irrigated and non-irrigated fields botanical analyses were made in areas not affected by these factors. The following table sets out the data obtained:-

T A B L E I
PERCENTAGE OF GROUND COVERED BY VARIOUS SPECIES CONTRIBUTING
To THE SWARD OF DIFFERENTLY TREATED PASTURES.

	M A N U R E D *			N O - M A N U R E		
<u>IRRIGATED FIELDS</u>	1934 Jan. 11	1934 Apr. 20	1934 Sep. 24	1933 Nov. 23	1934 Mar. 24	1934 July 27
Ryegrass	114.9	10846	109.6	86.4	105.5	62.1
Cocksfoot	14.7	15.6	17.2	6.0	13.3	7.2
White clover	76.7	64.4	66.8	17.9	88.4	9.6
Red Clover	18.5	26.0	41.6	4.7	16.0	8.9
Trefoil	9.5	17.2	4.4	58.0	9.5	13.9
Browntop	2.3	--	0.1	--	1.3	0.8
Sorrel	6.7	1.1	2.4	4.3	4.5	1.7
Flat weeds	1.1	--	0.3	1.9	0.7	0.1
Other weeds	0.8	0.1	1.2	0.4	0.5	1.1
Bare spaces	5.9	1.1	2.4	8.3	0.9	17.3
<u>NON-IRRIGATED FIELDS.</u>	1933 Dec. 16	1934 Apr. 21	1934 Sep. 11	1933 Dec. 1	1934 Apr. 21	1934 July 23
Ryegrass	73.2	115.3	130.0	87.2	92.4	46.0
Cocksfoot	5.3	7.9	4.8	3.5	3.2	3.1
White clover	11.1	115.3	82.8	15.5	78.9	16.9
Red Clover	1.5	17.3	13.6	2.7	11.7	5.9
Trefoil	0.7	10.9	--	1.3	7.9	8.1
Browntop	--	0.3	0.4	0.7	0.8	0.3
Sorrel	13.1	6.8	9.2	17.2	14.1	7.7
Flat weeds	0.4	0.1	--	0.3	--	--
Other weeds	--	--	--	0.3	--	--
Bare Spaces	26.3	0.4	3.2	18.8	5.1	25.7

* See page 2 for manures applied.

While a perusal of this table shows that the plants have behaved according to experiences on better land with a favourable distribution of rainfall it is significant so far that the growth of desirable species such as ryegrass, clovers and cocksfoot is being maintained and that an influx of undesirable plants is being prevented. These findings are in agreement with those of Trumble and Davies in Australia (2). Observation showed also that the density of the sward of herbage improved with irrigation and topdressing.

BOTANICAL ANALYSES OF TOPDRESSED IRRIGATED PASTURE CUT FOR HAY.

In September 1933 an irrigated topdressed area was closed for hay. Water was applied on 13th October (2.7 ins.) and 11th December (5.9 ins.). Two cuts of hay were taken, the first on 6th December 1933 yielding 2.86 tons per acre, and the second on 28th February 1934 yielding 1.13 tons per acre - a total of 3.99 tons per acre. Table II sets out the percentages of the various species contributing to the ground cover and for comparison purposes analyses of a similarly manured irrigated but grazed area are included.

T A B L E II

PERCENTAGE OF GROUND COVERED BY VARIOUS SPECIES IN A TOP-DRESSED, IRRIGATED SWARD UNDER HAYING AND GRAZING CONDITIONS,

SPECIES	OUT FOR HAY			GRAZED		
	1934 Jan'y	1934 April	1934 Sept.	1934 Jan'y	1934 April	1934 Sept.
Ryegrass	90.4	85.2	92.4	114.9	108.6	109.6
Cocksfoot	5.6	15.6	7.2	14.7	15.2	17.2
White clover	91.6	78.8	32.0	76.7	64.4	66.8
Red clover	26.0	59.6	115.6	Se. 5	26.0	41.6
Trefoil	2.4	13.2	--	9.5	17.2	4.4
Browntop	1.2	0.4	0.8	2.3	--	0.1
Sorrel	5.2	2.4	2.4	6.7	1.1	2.4
Flat weeds	--	--	--	1.1	--	0.3
Other weeds	1.2	0.8	--	0.8	0.1	1.2
Bare spaces	4.8	0.4	4.4	509	1.1	2.4

This table shows that apart from an increase in Red Clover under haying conditions the two fields compare favourably in regard to ryegrass and other plants. This result is at variance with the general belief that under average Canterbury conditions haying reduces the ground cover of ryegrass and weakens the pasture. Possibly the difference may be attributed to the use of a permanent ryegrass plus irrigation.

THE EFFECT OF RED AND WHITE CLOVER SEED PRODUCTION ON THE COMPOSITION OF A MIXED IRRIGATED PASTURE.

To show the effect of red and white clover seed production on the composition of a mixed irrigated pasture analyses were made in September 1934, five months after the crops were harvested. The data along with the analyses of similarly treated hayed and grazed pastures are set out in Table III.

T A B L E III

Percentage of ground covered by various species contributing to an irrigated and topdressed mixed sward following (1) Grazing, (2) Haying, (3) White clover seed production, and (4) red clover seed production

S E P T E M B E R 1934 - 22 months after sowing and 5 months after cutting hay and seed crops. -				
SPECIES	GRAZED	HAYED	WHITE CLOVER SEED	RED CLOVER SEED
Ryegrass	109.6	92.4	45.6	36.4
Cocksfoot	17.2	7.2	1.6	8.8
White clover	66.8	32.0	101.6	45.2
Red clover	41.6	115.6	55.2	105.6
Trifolium	4.4	--	0.1	0.8
Browntop	0.1	0.8	0.1	--
Scorrel	2.4	2.4	2.4	4.8
Flat weeds	0.3	--	0.01	--
Other weeds	1.2	--	--	0.8
Bare spaces	2.4	4.4	4.0	8.0

Table III shows that cutting a mixed pasture for white or red clover seed leaves white and red clover plants dominant. It is considered that the notable reduction in ryegrass following such management is due in a large measure to smothering.

OBSERVATIONS ON IRRIGATED PASTURES IN OTHER PARTS OF CANTERBURY

At Hororata and Oxford new pastures were sown for irrigation purposes. The preparation of seed-bed, times of sowing, seeding and manuring, were much the same as for Seafield. In these two districts observations showed that during the autumn (1933) these irrigated pastures grew strongly and gave high carrying capacities. During the late autumn and winter they were pale and weakly. As the spring advanced this poor appearance gradually gave way to a better growth, especially of clovers.

At 'Oakleigh' (mid-way between Southbridge and Rakaia) an established ryegrass and subterranean clover pasture was irrigated. Re-establishment of the subterranean clover in early autumn gave good late autumn, winter and spring growth.

The chief reason for referring to the irrigation experiments at Oxford and Hororata is to show that the pale yellow discolouration and weak growth of the herbage during establishment was not confined to the Seafield pastures but it occurs as well, but to a lesser extent, in non-irrigated pastures sown in late spring and early summer.

The fact that topdressing red&es the degree of discolouration and weakening suggests that soil fertility is a deciding factor in its development. In support of this view it was noticeable that herbage on patches filled in to a depth of two or more feet during levelling was not affected, whereas in areas where soil was removed a marked prevalence of the condition was evident. In addition, discolouration did not occur in these pastures in the late autumn and winter of

1934 even though $1\frac{3}{4}$ inches more water were received per month than when discolouration occurred,,

CONCLUSION.

The information presented shows certain effects of irrigation, manuring, grazing, haying, and red and white clover seed production on the botanical analysis and appearance of irrigated mixed pastures at Seafield,

REFERENCES.

- (1) Levy & Madden: N.Z. Jour. of Agric. Vol. 46. May 1933, pp. 267 - 279
- (2) Trumble & Davies: Bull, No, 80 Commonwealth Council for Scientific & Industrial Research;

+ + + + + + + + + + + + +
+ + + + + + +
+ +
+

