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WINTER STORAGE CROPS.

A REVIEW OF THE PRODUCTION AND RELATIVE VALUE OF SOME
OF THE COMMON PLANTS USED,

In considering the problem of the satisfactory production of winter grown crops for stock feeding, there are special features apart from the actual husbandry, which may weigh heavily in their favour when balanced against the cost of producing such crops. The first of these is the problem of winter dairying. There are naturally many farms in New Zealand where winter milking has to be practised to provide a regular supply of raw milk for urban population, but the problem of the extension of this to include manufacture of dairy products may sooner or later have to be faced. The Imperial Economic Committee urges that all parts of the Empire pay a greater attention to winter milk production in order to supply dairy produce more evenly to the home market. Much has recently been written bearing on various aspects of the problem in New Zealand. It has been suggested authoritatively that it would be advantageous to this Dominion to depart from purely seasonal dairying and practise more uniform production throughout the year. It is stated that it would help to eliminate the excessive accumulation of stocks of New Zealand butter at certain periods and the absence hereof would steady market prices.

Among the most formidable factors which are limiting winter milking at present are the lack of cheap concentrated foods, and an inadequacy of grass growth in the permanent pastures. To overcome these disabilities the production of the required highly nutritious food on the farm must be undertaken. It is impracticable to shut up a large enough area of permanent pasture in early autumn to grow a reserve of food for the whole winter season. Hay roots and silage by themselves are not quite satisfactory for the purpose of maintaining the cows in full production. The foods by themselves are too bulky and would make too great a drain on time during the summer in their production and harvesting. The problem then resolves itself into growing a crop on some portion of the farm which :

- (a) will grow better than pasture during winter.
- (b) can be grazed during winter,
- (c) will yield well for the full period required, a fodder at least equal to grass,
- (d) repay for the cost of reseedling the area down to permanent pasture,

In order to obtain more information on the relative value of some of the crops widely used for winter grazing, not only by dairy cattle but also sheep, a series of plots was laid down at Massey College for the winter periods of 1932 and 1933. It is not practicable to cost the crop based on experimental plots so that this aspect has not been dealt with. The plants tried out include Prairie grass, College and Australian Algerian oats, Italian rye-grass, black skinless barley, cape barley, rye-corn, vetches, red clover.

The plots were fenced off from stock and the produce cut periodically with shears, dried and weighed. Owing to the difficulty of taking herbage samples during winter free from external moisture, and due also to the varying amounts of moisture held by the different plants, it was found necessary to oven dry the samples. By taking periodic test samples when the herbage was externally dry it was possible to calculate back to green weight and the figures given in this paper are for green weights only. In both years the forage crops followed run out grass and were manured with 2 cwts. super per acre.

GROWTH HABIT OF THE DIFFERENT PLANTS.

In the first year the crop was sown on March 26th. and on March 6th. in the second year,

The first cutting was made 59 days after sowing but the prairie grass and Italian ryegrass were not sufficiently advanced to cut. Where there was an admixture of a cereal and ryegrass, the cereal contributed by far the greater bulk. Where rye-corn and vetches were sown together the greater bulk was given by the latter.

In the first 2 months cl.1 the cereals outyielded Italian ryegrass and Prairie grass and the red clover yielded nothing.

RECOVERY AFTER THE FIRST CUT,

Black skinless barley was outstanding for recovery after the first cutting. Cape barley, though not so good in this respect was better than oats, and rye-corn was also slow. Where these crops were grazed with dairy cattle the black skinless barley was very evenly cropped and in consequence recovery was even and the same can be said of the oats and ryegrass. Cape barley, however, was unevenly grazed and appeared to be less palatable, and there was more waste from trampling. In the second season both barleys were grazed equally by the cattle. The relative lack of palatability of cape barley was much more evident when the 3 cereals sown in strips with and without Italian ryegrass were tried out on a different area under sheep grazing. The sheep showed a very marked preference for the oats and grazed them bare, then grazed the black barley moderately and without obvious relish, but neglected entirely the cape barley, which had to be fed off with bullocks,

Three months after sowing the oats were suffering from an attack of "red leaf" and where this was most evident recovery after cutting and subsequent growth were slow. By August 2nd. this infection was at its height, and it was not until early September that the plants were able to overcome it,

Vetches made good early growth but, were not extensively grazed and where grazing did occur their recovery rate was slower than that of the cereals.,

Prairie grass was very slow throughout the whole of the period under review and cannot be regarded as satisfactory when down for only one season,

By mid August the ryegrass was making headway and was starting into more active growth. The barleys on the other hand were falling off in production and were much less leafy. This was particularly marked in the case of the black barley, and cape barley all through has been the more leafy plant. Rye-corn which was very slow in the early growth stages only started to produce with the advent of warmer weather. In both seasons its winter production was so poor that no weights were taken. The red clover was not in evidence and it has so far contributed nothing towards the grazing and only came into prominence in the late' spring,

By early September the ryedorn was beginning to get stemmy and was mainly neglected by the cattle and grazed less evenly than the other cereals. The bsrleys had passed their zenith of growth and were yielding very little. The oats that were free from red leaf yielded a good crop and were the most leafy of the cereals. The Italian ryegrass was approaching its best. When cut for silage on October 22nd, the cereals were in head but the ryecorn which was the most advanced, presented a stemmy and fibrous crop with little leafage and nothing to recommend it for silage purposes. Black barley was less leafy and suffered more from rust than the Cape during the first season, but mildew attacked the Cape and not the black barley in the second year. Oats were the latest and the most leafy of the cereals even though they had been grazed closer than the others.

The vetches where grazed lightly continued to thrive and kept up with the cereals in rate of growth, but where they had been cut or grazed more heavily they failed to recover and were disappointing for silage purposes.

Italian ryegrass, whether sown alone or with a cereal was growing strongly and was not far enough advanced in growth when cut to give its best yield of silage. It was only on the plots where ryegrass was sown that weeds were suppressed.

THE SECOND SEASON'S TRIAL.

In the main the growth features of the plants were the same as in the first season. The incidence of disease, however, affected the oats to a lesser extent and the Cape barley slightly more than in the previous season. The second season has thus been chosen for a more critical review of the seasonal production. The results of the winter of 1933 are as follows :

C R O P,	TABLE 1.			GREEN WGT. PER ACRE OF THE GRAZINGS,			GREEN WGT. PER ACRE OF THE SILAGE CUT, (1)			TOTAL (green wgt.)		
	Tons	cwt	s.Qrs.	Tons.	Cwts.	Qrs.	T.	Cwts.	Q			
2 $\frac{1}{2}$ bush, Algerian oats + bushel winter vetch.	7	8	3	10	13	0	18	1	3			
2 $\frac{1}{2}$ bush, Black skinless barley + $\frac{1}{2}$ bush, winter vetch.	7	11	2	8	13	0	16	4	2			
2 $\frac{1}{2}$ bush, Cape barley + $\frac{1}{2}$ bush. winter vetch.	8	2	1	9	18	2	18	0	3			
4 bush. Algerian oats (2)	8	5	0			1	16	5	1			
4 " (College) (2)	7	10	1	10	10	3	18	8	3			
4 " Black skinless barley	9	7	0	7	8	0	14	15	0			
4 " Cape barley	7	17	2	6	1	0	13	18	2			
3 " Algerian oats + 20lbs. Italian ryegrass	7	12	2	11	14	3	19	7	1			
3 bush. Black skinless barley + 20 lbs. Ital. ryegrass.	8	8	3	9	13	3	18	2	2			
3 bush. Cape barley + 20 lbs. Ital. ryegrass.	8	9	2	9	16	3	18	6	1			
3 bush. Ryecorn + do (3)	6	10	2	11	13	0	18	3	2			
40 lbs. Ital. ryegrass	6	12	3	10	5	3	16	18	2			
35 lbs. do + 5 lbs. red clover.	6	0	0	10	16	2	16	16	2			
40 lbs. Prairie. grass	4	2	1	10	19	3	15	2	0			

(1) Cut for silage Nov. 8th.

(2) Algerian oats are of Australian origin unless otherwise noted.

(3) The ryecorn both when sown pure and in combination with vetches was so poor that weights were not taken. Ryecorn in combination with ryegrass was weighed but by far the greater bulk represented the ryegrass.

GROWTH PERIOD,

It will be seen from Table 1 that some of the combinations or pure seedings gave heavy yields under a system of cutting comparable to grazing and also gave a satisfactory hay or silage crop. Others again gave either a heavy yield for grazing and little hay or silage or else heavy silage crops with relatively little grazing. The growth habits can be further analysed according to the period within the winter grazing season at which most growth is recorded., Figure 1 indicates this and is based on the weights obtained at the different cuttings. For the purpose of this record 5 cuttings were made on each of the plots with the exception of the College Algerians, Prairie grass, Italian ryegrass alone and with red clover and ryecorn. There was insufficient growth to warrant them being cut and weighed on the first cutting date and in consequence the produce of the first two growth periods is recorded in the second,

FIGURE 1 .

The cutting dates were as follows (Sown March 6th.).

	No. OF DAYS AFTER SOWING. . INTERVAL.	
1 st. cut made April 26th.	51	51
2nd. cut " May 30th.	85	34
3rd. cut " July 18th.	134	49
4th. cut " Aug. 23rd.	170	36
5th. " (silage) made Nov. 8th.	237	77

In addition to the above, the whole field was subsequently cut for hay, but none of the cereals and only the ryegrass, red clover and prairie grass contributed to it. Weights were not taken, but it is estimated that the yield of hay was in the vicinity of 1 ton per acre, the prairie grass giving a somewhat heavier yield than the ryegrass alone and about equivalent to the yield on the ryegrass and red clover plots,

SEASONAL PRODUCTIVITY.

It will be seen from Figure 1 that the different grasses and cereals varied considerably in their productivity at the different seasons. The vertical columns represent the weights of green material from the respective plots at the 5 cuttings, the final and tallest one being the silage cut. The following points present themselves from an analysis of the yield chart,

Algerian Oats and Vetches, gave a moderate initial yield and a slow recovery after which the yield increased as the winter gave place to spring. The silage crop was not so heavy as where Italian ryegrass replaced the vetches and was only slightly below that from ryegrass and red clover and prairie grass. The amount of winter grazing was better than Italian ryegrass but below that of the barleys though the total yield (including the silage crop - see table 1) was greater in both cases.

Black Skinless Barley and Vetches gave a large initial yield but production then fell away rapidly and only a moderate yield of silage was got.

Cape Barley and Vetches gave a smaller initial yield than the black barley and the subsequent recovery was better, but unlike the oats production decreased as the season advanced. Even so a greater amount of grazing was got from this plot than from the two previous ones and though the silage crop was smaller than in the case of the oats and vetches the total yield from both mixtures was approximately the same.

A cereal with Italian Ryegrass. The total yield from these mixtures was greater than in the corresponding mixtures where vetches were used, but a heavier seeding of the cereal was given,

Algerian Oats and Italian Ryegrass gave a moderate initial yield consisting mainly of oats but recovery after the first cut was better than in the case of oats and vetches and production gradually increased as the season progressed. The final silage crop was the heaviest of any produced, and amounted to $1\frac{1}{4}$ tons green weight, though the grazing was less than in the case of the barleys and ryegrass. The influence of the ryegrass was becoming apparent in the 3rd. cut (mid July) and assisted substantially in giving the extremely satisfactory yield of silage. As these two plants are slower in maturing than the barleys and rye-corn the cutting date for silage could have been postponed to their advantage,

Black Skinless Barley and Italian ryegrass, gave a very heavy initial growth but production decreased considerably after the first cut. The Italian ryegrass was at a disadvantage on account of this excessive early competition and did not properly recover until spring when it featured very largely in the silage cut. The total yield and the weight of silage from this combination was higher than from either black barley alone or with vetches. It gave less grazing than the pure sowings but was better than the barley and vetches.

Cape Barley and Italian ryegrass also showed to some extent the suppressing effect of rapid early growth of the cereal on the ryegrass. Only in the 3rd. cut, did the ryegrass add materially to the yield. The yield of grazing and silage differed little from the corresponding black barley plot, but the grazing was better than for oats and ryegrass and the silage cut and total yield were less.

Rye-corn and Italian ryegrass form a poor winter grazing combination. The weight of the silage cut was almost equal to that of oats and ryegrass, but there could be no comparison between them for stock feeding purposes, the rye-corn being very stemmy and fibrous while the oats were leafy and more succulent. Thus the oats and ryegrass gave more grazing, as much or more silage, and a better feeding product. These factors in themselves rule out rye-corn for winter production purposes.

Pure Cereal Sowings.

Algerian oats. The Australian seed was earlier in growth than the College variety and produced more grazing through the winter. The latter, however, more than compensated for this by the very heavy silage crop yielded and finished by producing nearly 2 tons more (green weight) than the Australian seed. The College variety is the latest maturing of the cereals tried and it was not enough advanced in growth for a first cut to be taken on April 26th.

Block Skinless barley gave the heavier first cut of all the plants on trial but after this, production lagged considerably. Even so the amount of grazing was heavier than from any other series. The silage cut was very disappointing and was only half that given by the College Algerian. This brought down the total yield to a very low figure and excluding Cape barley was the lowest in the trials,

Cape barley alone gave a poorer yield of grazing and rather a heavier silage crop than the black barley and the total yield was the lowest in the trials. As has been mentioned previously, mildew attacked this crop to a minor degree, and the true reflection of this on yield is impossible to determine but it is feasible to suppose that the total yield would have been as great as that of black barley. The yield at the first cut was intermediate between that of oats and black barley and recovery and subsequent yield were better than black barley,

Grass and Clover sowings,

Italian ryegrass with and without red clover, gave a very poor initial yield as compared with the cereals. Even on the second cut 85 days after sowing the yield was relatively poor, but the third cut (mid July) was the heaviest got from any of the trial plots while the 4th. cut (Aug. 23rd.) was only slightly exceeded by oats and vetches. The red clover though it germinated and showed above ground 16 days after sowing did not contribute to the yield until the final (silage) cut and in this cut alone did red clover and ryegrass outyield the pure ryegrass sowing. Owing to the relative slowness of growth the silage crop would have been heavier had these plots been cut somewhat later. The amount of grazing was disappointing and was less than from any of the pure cereals but the heavy silage crops placed them above the pure barleys for total yield,

Prairie Grass as a grazing crop in the first season was very unsatisfactory and gave the lowest yield of grazing of any of the plots. It was comparatively slow in establishment and yielded poorly until the final cut (silage) when it was exceeded by oats. This brought the total yield higher than the pure barleys but not up to the level of any of the other plots,

DISCUSSION,

It will be seen from what has already been written that by a study of stock feed requirements it is possible to regulate the supply of winter grazing crops accordingly. Where a grazing is desired from April to the end of May the barleys are outstanding, but their subsequent growth is so poor that to sow them alone does not seem desirable. If they are sown with 1 bushel of ryegrass a good silage crop can be assured and if required a subsequent crop of hay can be got from the ryegrass. The weakness of this combination lies in the period between the end of May and the end of August when production is low. The ryegrass is suppressed strongly by the heavy initial yield of the cereal and only recovers as the barleys fail. This suppression of the ryegrass is less evident with Cape barley than with black skinless but it is relatively less palatable. No other plant tried can approach the barleys for early growth. For production later in the season both oats and ryegrass are outstanding and a combination of the two gives the prospect of a very heavy silage crop and a further hay crop if so desired. This combination with ryegrass from a yield point of view and where grazing is an important feature, is better than oats and vetches or oats alone, or better than ryegrass alone or with red clover. Prairie grass is out of the question for 'a single season's production as although the yield in spring is good it is too slow in establishment for a winter grazing crop. Rye-corn did very differently in the trials in both years and cannot be recommended for this purpose,

Disadvantages of pure sowings,

The disadvantages of the pure sowings are outlined as follows :

1. Danger from disease in the cereals which lowers their production and palatability,

2. The extreme tuftiness and lack of foliage in the black barley after the first two grazings which makes it unsuited for ensiling.
3. The lower palatability of Cape barley.
4. The relatively poor early growth of oats.
5. Silage made from cereals is not suitable for keeping longer than one season when stacked owing to the rapidity of deterioration.
6. Italian ryegrass, like oats, is too slow in its development to warrant being sown alone.
7. It is poor economy to grow for winter feed a crop which requires to be reploughed and reseeded in spring before the silage crop is taken (as with barley) or if the silage is taken (oats) where there is risk of the failure of the succeeding crop due to lack of soil moisture.

The sequel to an even production throughout the winter would be to divide the area for winter forage crops into two. In one half sow black barley with ryegrass and in the other oats and ryegrass. The areas need not be fenced separately, for although the oats will attract the stock first and they will be grazed closer to the ground than the barley yet the growth habit is such that little damage is done to them. The gradual increase in the amount of ryegrass appearing in the barley will continue to attract the stock to that area and the barley will be grazed with it. The oats are at all times palatable and eagerly grazed but the barley will not be neglected.

The effect of the incidence of disease in either the oats or barley will be less felt where ryegrass is present. If disease appears on the cereal the decreased competition from the infected plants enables the ryegrass to increase its production earlier as a compensation.

In view of this danger of disease appearing in the cereal, ryegrass should always have a place in such a Winter programme. Also the very early spring feed it provides is extremely important in dairying. It is more palatable to stock than permanent Pasture and it helps to avoid excessive defoliation of the best fields at a time when the cows are in full milk and when the pastures are very sensitive to hard or close grazing. Similarly it reduces the necessity of cutting the permanent grass paddocks too frequently for hay or silage and thus helps towards a greater production over the whole farm and a better return from the stock. I suggest that the combination of these factors alone warrants and covers the cost of ploughing up and reseeding to Permanent pasture. It is impossible to assess the cash value of such a crop as its benefits are not confined solely to the immediate returns but are distributed over the farm.

The heavy seeding of cereals as described here may appear excessive on some farms though not on others. In seasons when cereals are cheap heavy seedings are likely to be more profitable than lighter sowings, but where ryegrass is sown conjointly with a cereal, heavy seedings should be avoided as any increase in yield from the cereal is discounted by a slower recovery of the ryegrass. Thus the earlier the cereal in producing its maximum yield, the greater the danger to the ryegrass through too heavy seeding.

It is desirable, in order both to conserve the amount of feed in winter and to prevent digestive trouble in the cattle to limit the grazing period to one not exceeding 2 hours per day,

With the, improvement of Italian ryegrass now being undertaken it would appear that the benefit to be derived from the inclusion of this grass in the cereal sowing will be considerably &eater,
