PASTURE PRODUCTION AT DARGAVILLE DEMONSTRATION FARM

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The Dargaville Demonstration Farm consists of 125 acres about 2 miles north of Dargaville. The farm carries a milking herd of about 65 cows plus replacements. It is controlled by a committee of local farmers with the local Fields Instructor of the Department of Agriculture as chairman, and a grant is made by the Department of Agriculture to this committee to enable the carrying out of a programme of experimental, work.

The two main soil types on the farm are Kaipara clay and Te Kopuru sand. Kaipara clay covers the low-lying flats. It is a member of the "mottled clays of the broad flats" as described by Mr N. H. Taylor. Te Kopuru sand on the other hand is found on the higher terraces. This is a mature sand podsol, well leached and with a well-developed iron pan, a complete contrast to Kaipara clay. Te Kopuru sand is a problem soil, winter wet and summer dry; it is usually found in an unimproved state carrying rushes, low scrub, and swamp vegetation. Kaipara clay, on the other hand, is a major soil type of the productive, low-lying flats around the Kaipara Harbour. It is a heavy, wet soil, difficult to drain due to lack of fall and in parts subject to flooding. But, with correct treatment, Kaipara clay carries some of the most productive pastures in New Zealand.

MOWING TECHNIQUES

A number of pasture mowing trials has been carried out at the Dargaville Farm in recent years. Most of these have been on the Kaipara clay soil, as mowing trials on Te Kopuru sand have failed to maintain a reasonable sward. Two main techniques of mowing have been used (1).

1. "Mowing and clippings returned", where the grass

clippings are returned, after weighing, to the plots from which they were taken. There is no stock grazing and cutting is made when the grass is from 2 to 5in. high.

2. "Rate of growth" technique. Here small, movable cages are used to protect mowing areas for short periods in a field under grazing. Weighing cuts are always made from a pre-trimmed area at regular fortnightly intervals. In a recent paper (2) Linehan, Lowe, and Stewart have objected to methods involvmg pre-trimming. They say "The general effect . . . on yield estimates would probably be: (a) if the sward is not fully grazed to the level of the pre-trimmed -area, the yield estimate will be too high; (b) if the. grazing period is short and stocking heavy, yield estimates will be too low; (c) if the grazing period is prolonged sufficiently, the growth of herbage on the pre-trimmed site, although at first slower than outfield, will in time exceed that outfield, since the latter is being continuously impeded through defoliation by grazing animals and the net effect would be to exaggerate yields."

These workers were concerned with bullocks grazing in periods of 1 to 2 weeks. Rotational grazing by. dairy stock, as at the Dargaville Farm, more closely approximates the 'mower type of defoliation. Both (a) and (b) of Linehan's conditions apply to some extent and these work in opposite directions. Pre-trimming has many practical advantages and, as operated at Dargaville, it is felt that a reasonable estimate of yield is obtained by this method. Some over-estimation of yield may occur through the protective effect of the cages (3). This has been investigated in England and is being checked under New Zealand conditions. The effect of frequency of cutting (1) has, however, a much greater influence on yields than any of the above factors and the "rate of growth" technique gives low estimates on this account.

PASTURE PRODUCTION ON KAIPARA CLAY SOIL AT DARGAVILLE

The "rate of growth" trial is conducted on a field sown to grass in 1926 which has been fairly regularly topdressed each year with 3cwt. per acre of phosphatic fertilisers and 5cwt. per acre of lime. Table I shows the yearly production of dry matter of pasture herbage over the past 4 years.

TABLE I-Production of Dry Matter of Pasture at Dargaville.

Year June 1 to May 31	Yield lb. dry matter per acre	Butterfat Production at Dargaville Demonstration Farm
1949-50	11,220	13,100lb.
1950-51	13,330	17,990lb.
1951-52	16,130	17,910lb.
1952-53	19,030	19,790lb.

The butterfat production works out at about 145 lb. per acre for 1950-52 and 1601b. for 1952-53. This was secured partly from the highly productive Kaipara clay and partly from the low-producing Te Kopuru sand, which occupies about 35 acres of the 125 acres of the farm. Unfortunately it is not possible to estimate the proportion that each of these soil types contributes to production. The 19,030lb. of dry matter in 1952-53 is the highest yearly production secured to date in Extension Division trials and, as far as I have been able to ascertain, is higher than any yield secured to date in New Zealand. Richardson (4) quotes a yield of 24,520lb. of dry matter on an irrigated perennial ryegrass, cocksfoot, white clover pasture at Woods Point, South Australia. This is the highest figure I have noted, but Richardson cut at 28-day intervals and had the advantage of irrigation. The Dargaville production of 19,030lb. of dry matter is higher than any other recorded non-irrigated pasture yield, as far as I can determine.

The seasonal spread of production is shown by

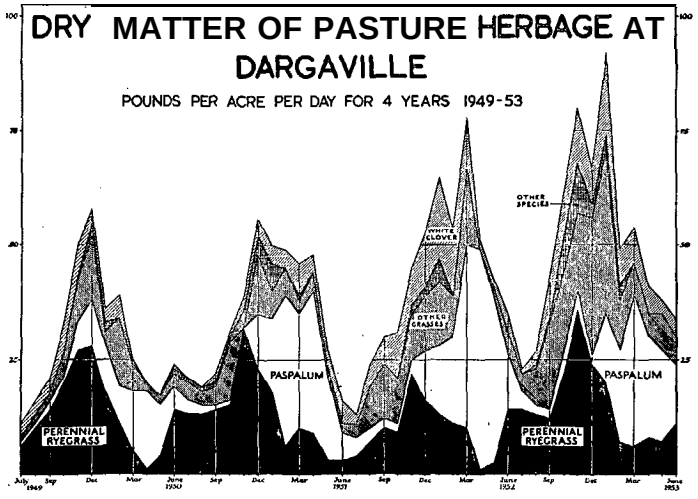

Table 2. For this summary, the seasons are S-monthly periods based on spring as September, October, and November.

TABLE 2—Production of Dry Matter of Pasturer at Dargaville in Seasonal Periods (lbs. per acre).

Season	Production Year			
	1949-50	1950-51	1951-52	1953-53
Winter	1960	2140	1980	2970
Spring	4490	3830	4110	6740
Summer	3000	4500	5960	5790
Autumn	1770	2860	4080	3530

ln the first 3 years winter and spring production has been relatively constant, though summer and autumn production has increased steadily ; 1949-50 was consiclere'd to have a dry late summer and autumn; 1952-53 shows most marked increases in winter and spring production, but slight declines in summer and autumn growth.

PRODUCTION OF PASTURE SPECIES

Sward examination shows a not very attractive mixture of perennial ryegrass *(Lolium perenne),* paspalum *(Paspalum dilatatum),* and white clover *(Trifolium repens),* with patches of kikuyu *(Pennisetum clandestinum)* and plenty of Yorkshire fog *(Holcus lanatus),* browntop *(Agrostis tenuis),* and weeds of various sorts. Table 3 and Graph 1 show how these pasture species have contributed to pasture production.

TABLE 3-Production of Pasture Species in Different Seasons.

(Means over 4 years).

Species	Production of Dry Matter in lb. per acre.			
	Winter	Spring	Summer	Autumn
Perennial ryegrass	1080	2220	1030	640
Paspalum	190	460	1880	1800
White clover	350	420	780	280
Other grasses (mainly fog)	600	1360	980	330
Other species	60	340	140	nil

Production has been secured from a pasture dominantly ryegrass in winter and spring and dominantly paspalum in summer and autumn, with much white clover and Yorkshire fog.

TOPDRESSING OF PASTURES ON KAIPARA CLAY

The manurial requirements of pastures on Kaipara clay have been investigated in several mowing trials at Dargaville under "mowing and clippings

returned" technique. Swards have been similar to that of the "rate of growth" trial. Highly significant responses to super-phosphate and to lime have been secured but not to potash. Four cwt. of superphosphate per acre per annum over 5 years gave grass production averaging 18 per cent higher than "no treatment", and lime at 1 ton per acre initial dressing and 5cwt. per acre annually thereafter raised the response to 22 per cent over control. This result was on a soil which originally gave, on analysis, high phosphate figures and pH averaging 5.5.

Trials now in progress compare rates of superphosphate at 0, 1½, 2, 3, and 4cwt. per acre. As yet no significant differences in responses have been obtamed, but the first year's figures are not yet complete. Other trials compare different forms of phosphatic fertilisers at rates equivalent in phosphate to 4cwt. per acre of superphosphate. In one case, 3 years' results showed Heskett slag to yield consistently lower than superphosphate on both limed and unlimed land. Basic slag gave slightly (but not significantly higher yields than superphosphate. Yields from North African phosphate plots were equal to superphosphate on unlimed ground, but where lime had been applied superphosphate gave higher yields than North African phosphate. Several "fused" and concentrated phosphatic fertilisers are being compared in a new trial which has not yet shown any significant differences among them.

PASTURE PRODUCTION ON TE KOPURU SAND

Responses to lime, phosphates, potash, molybdenum, and possibly copper have been secured on Te Kopuru sand. Soil analyses show the soil to be extremely depleted in most nutrients, and to be acid. There is no doubt that development will be a costly undertaking, one of the biggest problems being that of drainage and the impervious ironstone pan. The soil is, however, favoured in its easy topography and excellent climate, so that attempts to solve the problems of nutrient deficiency and drainage are well worthwhile. At present pasture production of the best pastures on Te Kopuru sand is limited by wet winter and dry summer conditions.

In one mowing trial on Te Kopuru sand, the herbage production from the best treatment was 3770lb. of dry matter for the period September 10, 1946 to December 19, 1946. After this, the sward

produced practically nothing. It. had deteriorated under mowing from a mixture of browntop, paspalum, subterranean *(Trif olium* ***sub terraneum),*** and suckling ***(Trifolium dubium)*** clover to one dominantly catsear ***(Hypochoeris radicata)*** and ribgrass *(Plantago lanceolata)* with practically no grass or clover growth.

POSSIBILITIES OF INCREASED PRODUCTION

Te Kopuru sand awaits development, but the Xaipara clay flats have been shown to be capable of carrying pastures of a productive capacity scarcely equalled in New Zealand. With adequate drainage and topdressing, with improved pasture species and grazing management, there seems no reason why Kaipara clay could not carry at least 1 dairy cow per acre. The pasture production figures indicate that, in the last 4 years at least, this stocking rate should not be impossible to achieve. Here, at least, is one area in New Zealand where it is reasonable to expect substantial increases in stock production.

REFERENCES

(1) Lynch, P.B. (1951), Methods of Measuring Grassland Production, Proceedings of the Thirteenth Conference, N.Z. Grassland Association.

(2) Linehan, P.A., Lowe, J., and. Stewart, R. H., (1952), The Output of Pasture and its Measurement, Journal of the British Grassland Society, Vol. 7, No. 3, September 1952.

(3) Williams, Stella S., (1951), Microenvironment in relation to Experimental Techniques, Journal of the British Grassland Society, Vol. 6, No. 4, December 1951.

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DISCUSSION

Q. Could the speaker say something about the results with serpentine superphosphate used in some of the trials ?

A. There were no sigificant differences between serpentine and super applied at equivalent amounts of phosphate. The level we applied is fairly high. A fertiliser not quite as efficient as super might give equivalent results at such high rates as 4cwt. per acre. We have had to try these fertilisers at varying rates. There was no question of the inferiority of North African phosphate on limed ground, but it was equal to super on unlimed ground.

Q. Could the relatively poor butterfat production in view of the pasture production mentioned be explained? Dairy farmers elsewhere could produce twice as much butterfat from such pasture production.

A. The problem on the Kaipara clay, particularly on the Dargaville farm, is the difficulty of getting water off.

Quite a big section of the farm is not adequately drained. Thirtv-five acres of this farm are on the Te Kopuru sand producing a pretty poor proportion of the total production.

Q. What manurial responses are you getting on Te Kopuru sand?

A. For several years we tried to measure responses by mowing, but the technique was not good enough and we had to rely on observational measurement. We got responses to lime, phosphate, and potash and saw a definite molybdenum response. I was told by Mr Arnold that there was a copper response recently, but only observational.

Q. Did you put the 4cwt. of super on in one lot or in 2 lots of 2cwt., and if so was there any difference ?

A. In these trials super and all fertilisers were applied in one dressing only. In most trials it was a spring dressing. The trials were started in the spring and we kept up dressings accordingly. I cannot give information on the relative values of 2 dressings or 1 at Dargaville.

Q. Is Mr Lynch trying to standardise technique throughout the country to two-weekly intervals, without cognisance of the differences in Central Otago and this province, Taranaki and Manawatu, etc. ? The height at cutting must have an enormous influence.

A. There are two methods of cutting-or two intervals. In the first we try to cut at a comparable stage of growth—4 to 6in. high. This method is universally adopted for fertiliser comparisons. Where we are trying to measure production in seasons of low growth that method would fall down. In winter in cold climates where we have no growth we would not be able to appreciate small changes in growth. We also want to know the time in spring in all districts at which growth begins. Mowing fortnightly throughout the year we find gives a lower total pasture production than other methods. In high-producing pastures the difference would be less than in low-producing pastures. There might be a difference of 9000lb to 10,000lb. from that under other techniques. We have to compromise and fix an arbitrary fortnightly interval, which certainly does not result in an overestimate of total pasture production.

Q. Why standardise over all the country with a technique which is inflexible in relation to growth of grass, which is so variable ?

A. We want to be able to compare pasture production in Dargaville with that at Marton and Winton. We must have a standard method. A trial at Marton showed a difference between a fortnight and 6 weeks of 75 per cent; and between weekly and 6-weekly a difference of over 100 per cent. There was more than twice as much grass if we left the interval from 1 week to 6 weeks. We must insist in all trials comparing pasture production throughout the country that at least we have standard cutting intervals.

Q. That may be all right if you have standard mixtures, but what of pastures' in the north? It cannot apply to kikuyu and paspalum in the north and ryegrass and white clover in the south.

A. Where possible we have standardised on ryegrass-white clover. I don't think a standard applied to ryegrass-white clover will lead us far astray.