"THE INFLUENCE OF THE ANIMAL ON PASTURE PRODUCTION"

by

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One good effect of wartime shortages and their attendant difficulties is that they focus the producers' attention upon avoidable waste. To the pasture man this involves both full utilisation of all the fertilisers he can obtain and also application of all the methods he knows to get the best out of the feed he is able to grow.

Even if there were no shortages, or farming difficulties present as they are, it is still axiomatic that the man who is going to do best at any time is the one who makes the fullest use of all means at his disposal, and this paper is offered as a summary of the effects of one of the major factors in pasture production, viz., the animal itself.

In New Zealand the merits and demerits of different pasture plants and mixtures of plants have been studied assiduously; fertilisers and land treatment have been well emphasised as a means of increasing pasture growth and carrying capacity, but for the most part the effect of the grazing animal on the sward has been overlooked.

Any approach to the problems of pasture production is irrational unless it takes into account the cyclic nature of pasture growth, both forward from the soil through the plant and animal, and also the reverse back through the animal and plant to the soil. A pasture at any stage can be considered as abiotic climax, that is the expression of a state of balance between the grazing animal, conditions of growth and the plant community itself.

In 1934, Mr. Bruce Levy, in a paper to the Grasslands Conference at Palmerston North (1) gave a complete statement as to the importance of the biotic factor in pasture development and his thesis put forward is still potent and well worth remembering. This was, "that stock in large numbers adequately fed make the country, while stock in large numbers inadequately fed ruin the country."

The effect on the animal on the sward, however, is not a simple one but is a complex mixture of several separable factors.

These may be divided broadly into three groups:

(a) The effect of defoliation of the pasture plants, and the bearing this pruning has on light-intensities impinging on the crown of the plants.

(b) The effect of trampling on the pasture which it is eating and the soil on which that food is growing.

(c) The effect of returning to the land in the form of dung and urine, nearly all the nutrients consumed.

These factors operate simultaneously but the total effect varies according to the intensity of each.

(1) Defoliation Effect:

There is considerable information on the effect of defoliation of different plants by different animals at different times of the year. As a generalisation it can be said that plants with low crowns can be grazed closely, while plants with high crowns do better if grazed lightly, i.e., not too

close to the ground. Plants will produce more and attain dominance in a sward (other things being equal) if spelled at the time of their maximum growing period, while if grazed hard then will tend to produce less or to be eliminated from the sward. Some plants thrive better if growing in the shade, while others need ample light and space.

To illustrate these several important factors, extreme cases are quoted. Brown top or Danthonia pilosa associations thrive exceptionally well under close and continuous defoliation, while the cocksfoot - tall fescue types of sward are at their best within a lenient defoliation habitat. The rye-grass/white clover swards must be carefully grazed to avoid over-shadowing of one species by another, and in order to avoid other less desirable elements coming in either through, over or under defoliation at any particular time.

It has been found that animals vary considerably in both their intensity and efficiency as grazers. Sheep neglect very little and graze closely, cattle are less intense whilst horses are the least even in their grazing habits. Due to the selectiveness in grazing of different animals, we find that ragwort and oxeye daisy can be controlled by sheep but not by cattle, whilst on the other hand, piri piri is controlled by cattle but not by sheep. The use of cattle and wether sheep in the control of bracken fern and the goat in the case of blackberry may also be cited.

(2) Effect of Trampling:

Consolidation of the soil and compaction of the turf are important factors under normal grazing conditions. Heavy treading is useful in the case of sod-bound pastures and in the elimination of fern and other growth by crushing. On the other hand, trampling over the sward renders the grass dirty and unpalatable - it cuts up areas and so leads to waste of surface, and to the infestation of the pasture by weeds, such as buttercup and docks. Losses of feed due to cutting up of the surface, pugging and tracks must be very considerable and are a strong argument for a properly adjusted grazing control.

One of the bugbears attendent upon increased carrying capacity is winter poaching of pastures and the future may well envisage the adoption of stall feeding over the worst winter poaching periods.

Any one who has grazed stock over long spells of wet weather will fully appreciate the damage done to pastures by stock, and stall feeding methods introduced here and elsewhere are an endeavour to overcome it, as well as to feed expensive bought-in feeds in the most economical manner.

(3) Return to Nutrients:

The value to plant growth of animal droppings has long been realised by both arable and pastoral farmers. Especially is this so in countries where weather conditions lead to indoor feeding for long periods and where a large quantity of droppings is collected. Elaborate storage and distribution systems have been devised to overcome losses and great effort is made to maintain a constant return to the cropped and/or pastured land.

However, it is only of recent years that the value of returns by the animal during grazing is being appreciated. Several trials measuring it more or less indirectly have been carried out, and positive results secured.

A trial to measure the effect of sheep droppings on pasture growth and composition has been in progress at Palmerston North for the past 2 years. An area sown down in

March, 1940, with a mixture of grasses and clovers, limed with 10 cwt. carb. of lime, and topdressed with 4 cwt. super per acre, was divided into 10 plots which were grazed in 4 lots each of 2 plots, by wether sheep, after the pastures were ready for grazing. By collecting the dung and urine as required in containers suspended from the animals, neither dung nor urine was returned to one lot of plots, no urine to a second and no dung to a third. To the second the sheep returned dung normally, to the third urine normally and to the fourth both dung and urine.

The seed mixture consisted of perennial ryegrass 25 lbs., cocksfoot 10 lbs., crested dogstail 3 lbs., timothy 4 lbs., Poa pratensis 2 lbs., white clover 3 lbs., Montgomery red clover 3 lbs., alsike clover 2 lbs. - total 52 lbs. Since then all plots have been topdressed annually with 4 cwt. super per acre.

A record was kept of the dry matter produced by cutting small areas protected from the animals by steel frames, and mowed regularly to avoid cutting the same areas twice. The dung and urine were collected twice daily and analysed.

Before detailing the results, I would like to mention that in this trial as in all our sheep grazing trials, the strong growth of hogcress Coronopus didymus, and other annual weeds, was soon eliminated by the close sheep grazing.

A summary of the main features of the results of this trial is contained in Tables 1 - 2 and Graph I. Full details of the technique, chemical analyses, etc., have been published elsewhere (2).

TABLE 1.

Yields in lbs. D.M. per acre of the four treatments.						
	20.7.40-1.12.40.	2.12.40-20.7.41.	Total 1st Year.	21.7.41-1.12.41.	1.12.41-20.7.42.	Total 2nd Year.
Full return of urine and dung	4818	9468	14286	9063	8152	17215
No return of urine or dung	5576	6579	12155	5127	6522	11649
Urine returned dung NOT returned	3757	9572	13329	6169	6385	12553
Dung returned urine not returned	4576	8036	12612	6471	7777	14248

TABLE 2.

Botanical changes resultant upon the treatments.
Clover-grass relationships at various periods of the trial.
Percentage of clover in the swards.

	20.7.40-1.12.40.	2.12.40-20.7.41.	Total 1st Year.	21.7.41-1.12.41.	1.12.41-20.7.42.	Total 2nd Year.
	cl:gr	cl:gr.	cl:gr.	cl:gr.	cl:gr.	cl:gr.
Full return of urine and dung	15-85	25-75	20-80	25-75	34-66	30-70
No return of urine or dung	19-81	47-53	33-67	42-58	48-52	45-55
Urine returned dung NOT returned	11-89	25-75	18-82	34-66	40-60	37-63
Dung returned urine NOT returned	21-79	53-47	37-63	43-57	37-63	40-60

TABLE 3.

Relation of fertiliser substances in the feed to substances removed in excrements.

For period - 1.12.40 - 20.7.41.

No return plot	N. lb.	CaO lb.	P_2O_5 lb.	K_2O lb.
Removed in feed (per acre)	242.8	89.3	57.7	207.4
Recovered in excrements:				
In urine	169.2	1.4	1.3	178.8
In dung	67.8	89.8	70.1	28.2
	237.0	91.2	71.4	207.0
Difference	+ 5.8	- 1.9	-23.7	+ 0.4

The following conclusions may be drawn from the above results:

1. The capacity of a good soil, when seeded with good grasses and clovers, to support growth of pasture from its own reserves is remarkable. In the first few months of the trial there was little difference between all treatments except in botanical composition. It would not appear as if the clover played a great part in fertility in the first year although it can be seen that after a lull the no-return plot again picked up in production. This was reflected in the total and also the grass growth thus illustrating the working of the clover cycle very well. This is emphasised in the dung return plot where the growth was good after the slow acting dung had stimulated the clover and later the grass. This latter, of course, was helped by the nitrogen in the dung. The white clover used in the trial is of pedigree origin.

2. The drain by pasture from the soil is high in respect of N, K_2O and P_2O_5, and CaO. The return of N, provided by clover cannot be assessed, but as pointed out was probably not very great in the first year, although it would appear that it is high after that. Where nutrients were returned back to the pasture they were equal to approximately a ton of sulphate of ammonia, 6 cwt. superphosphate, 2½ cwt. of carbonate of lime and 15 cwt. of 30% potash salts per acre per year. This nutrient value of returns, of course, varies with the production and class of stock.

3. The application of urine which is high in nitrogen and potash, results in quick growth of grass. The feed produced was very palatable and paddocks grazed without dung dropped on the sward were always cleanly grazed. The production, however, was not sustained. This may be due to a phosphate or calcium limitation in the soil resultant upon the non-return of phosphate or calcium in the dung.

4. The application of dung which contains practically all the calcium and phosphorus eaten as well as nitrogen and potash, results in a slow acting stimulation of the

sward mainly through the clovers, which, however, is followed by a stimulation in the grass. Dung, however, makes the food unpalatable and the dung return paddocks were always harder to graze cleanly than were the urine or no-return paddocks.

5. The return of both dung and urine results in both a quick and sustained growth. The sward is balanced between grass and clover and if harrowed or the droppings are well spread, the resultant food is palatable and well eaten.

The above summary of facts leads us, of course, to make some statement as to how best one can use them in actual farm practice. Following are a few suggestions which will probably open up some discussion on the subject.

PASTURE MIXTURES:

Remembering that the final pasture sward composition will be a reflection of the management adopted as well as the growth conditions, make the basis of the mixture of those species which will do best under those total conditions. It is as useless including low fertility species on high carrying country as it is including high fertility species on low carrying country. Include in all mixtures, however, sufficient quick growing species to give early growth to ensure early stock grazing. This will supply readily available nutrients to the slow growing plants as well as helping in weed smother. It would appear for instance, that for those who wish to establish cocksfoot as a permanent element, it is better to sow it with a small amount of Italian rye than to sow it alone with clover. We have repeatedly, at Palmerston North, sown complex mixtures of seeds in order to study species behaviour. The resultant swards have always developed into simple mixtures of ryegrass and white clover dominance under intense sheep grazing. Under lax grazing or haying conditions the complexity is maintained but it seems quite apparent that the special purpose simple mixtures each managed according to its own requirement, are superior to the general mixtures so common of recent years.

PASTURE MANAGEMENT:

Wherever possible, adopt the rotational system of grazing both in order to get a complete and even defoliation and also to get full and even distribution of animal excrements. Several feeding trials at Palmerston North demonstrate the high nutritive value of high-producing pastures. This value falls with height of pasture, however, and so avoidance of clumpy and uneven paddocks should be aimed at.

In these days of acute superphosphate shortage the contention that good clovers and grasses with a small amount of superphosphate will, if properly managed, without waste of stock droppings, etc., do for us what we have been achieving up to now with large quantities of topdressing on poor swards poorly managed, and is well worthy of serious consideration.

SHED WASHINGS AND HARROWING:

Recent propaganda by the Department of Agriculture has in detail set forth the advantages and methods of saving and distributing washings from the dairy sheds. This, and also droppings from sheep shed and yards, will prove a valuable means of conserving for good use, material which is at present wasted.

The use of chain harrows to spread dung dropped in the paddock not only spreads the nutrients more evenly but also overcomes the clumpy and unpalatable nature of the growth around dung "pats."

Elimination of the over-extensive use of the one night paddock on the dairy farm, of foul pig pens and stock camps wherever possible should receive consideration.

SILAGE AND HAY:

In all our investigational work to date on these, nothing has been so outstanding as the poorness of herbage put up for winter, spring and autumn feed. It is quite hopeless to expect better feed out of the stack than goes in. It looks as though the loss in ensiling is at least 30% of dry matter and probably more in hay. While we agree that the quality of the product is largely dependent on the weather, it has been seen that in large numbers of cases paddocks are shut up year in and year out without thought as to pasture quality. It would seem as if a more rational approach would be to shut up paddocks previously built up by stock and afterwards rebuilt up. Admittedly this is not always convenient or suitable but the great amount of labour, etc., entailed and the valuable part good silage and hay can play, call for special consideration.

The feeding out of silage and hay should be done with both the value of nutrients from the stock and also the damage from their hooves, steadily in view.

In connection with feeding out it is well worth mentioning the system of feeding spring grass developed at Massey College by Prof. Riddet. Here the grass is rationed by means of a movable electric fence. The hay and silage is fed out on the grazed area, and so a complete and even return of droppings is secured without spoiling the remainder of the paddock which, when grazing is complete, has been fully and cleanly utilised.

REFERENCES:

(1) Levy, E. Bruce: Biotic Factor Report Grasslands Conference, 1934.

(2) Sears, P.D. & Newbold, R.P. : Effect of Animal Droppings on Pasture. J.S.I.R. 1942.
