EFFECT OF PASTURE STRAINS AND FERTILISERS ON THE PRODUCTION OF FAT LAMBS AND WOOL

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SUMMARY

1. As a result of the use of strains of perennial rye-grass and white clover and varying applications of artificial fertilisers, pastures differing widely in total annual and seasonal production have been established.
2. No differences in the thrift and productivity of ewes and lambs grazed continuously and. fed to appetite on the different pastures could be observed under a management system aimed at keeping the sward between about 1 and 4 inches in height at all times.
3. In particular, pastures containing white clover of high prussic-acid glucoside content showed no ill effects on thrift or production in ewes confined to these pastures for four years.
4. The more productive the pasture, the more pronounced were the seasonal variations in production and the greater were the problems of efficient pasture control.
5. It is postulated that criticism of these pastures on the grounds that they promote ill-thrift in stock has its genesis in a general inability to effect adequate control at all times.

INTRODUCTION

During the past 15-20 years consequent upon the selection and exploitation of high-producing strains of pasture plants, particularly rye-grass and white clover, the use of artificial fertilisers and high stock concentrations, pastures have been widely established which in favourable climates produce annually up to 15,000 lb or more of dry matter per acre, of a quality sufficient if completely and efficiently utilised to maintain throughout the year over 10 ewes and fatten their

lambs. There is a considerable. fund of knowledge of factors affecting the production of pastures and the main problems of efficient utilisation are at least fairly well understood, although, by no means overcome.

However, there are serious gaps in our knowledge of the complex reactions between the growing plant and its environment. Known mineral deficiency diseases, particularly those due to minor elements, which have prove& so difficult to solve, the toxic properties of pasture induced under certain conditions of rapid and lush growth causing disease such as facial eczema (1), dystokia and inversion of the uterus (2) sometimes seen in ewes on subterranean clover pastures particularly of the Dwalganup strain, serve to remind us of the limitations of our knowledge and to emphasise the inadequacy of chemical techniques in providing measures of the fluctuations which may occur in pasture quality.

In many quarters the definite contention has sometimes been advanced that perennial ryegrass dominant pastures tend to promote ill thrift in stock, particularly under heavy top-dressing, which accentuates very lush growth in certain seasons of the year.

In **1939,** in collaboration with the Grasslands Division, Department of Scientific and Industrial Research, some grazing trials to test such points and to study under controlled conditions pasture and stock management problems were laid down using simple mixtures of perennial ryegrass and white clover and heavy applications of artificial fertilisers. The grazing management was such as to keep the sward at all times between **1** and 4 inches in height, i.e., in a most nutritious stage of growth (3). Thus the stage was set -for all the disasters that are held to beset sheep and lamb production on lush dominant ryegrass-white clover pastures.

PLAN OF TRIALS

The following is a very brief outline of these trials :—

A. 'Pasture Strain Trials

In this trial a further complication. was introduced in that as progress was made in the breeding and evolution of a "super" type white clover, the tendency was to breed a clover with a higher syanogenetic

glucoside content in the leaf and it was deemed desirable to test this strain out before large-scale seed increases of pedigree strains were made. The trial was designed therefore to test pedigree strains of ryegrass and clover against the best natural ecotypes (referred to hereafter as "mother" strains) and to test high cyanogenetic glucoside white clover (pedigree high HCN) against a white clover strain low in glucoside content.

The following five treatments were laid down, on the basis of randomised blocks, each treatment consisting of four replicated one acre plots.

P1-Pedigree perennial ryegrass, pedigree white clover (high HCN)
P2— ,, ,, ,, white clover (low HCN)
P3— ,, ,, ,, mother white clover
P4—Mother ,, ,, ,, ,, ,,
P5— ,, ,, ,, pedigree white clover (high HCN)

Heavy dressings of superphosphate and lime were used annually to accentuate plant growth and any possible associated effects. Rotational grazing was carried out within each treatment with an even line of Romney ewes selected as two-tooths on a restricted random basis. Each treatment carried 16 experimental ewes on which all data were collected, plus replacement ewes and additional sheep and cattle as required to control the pastures. The experimental ewes and as many replacement ewes as possible remained on their respective treatments continuously for 4 years. In so far as the necessary experimental control has permitted, the management has been in accordance with practical fat lamb production under a system of rotational grazing, except that at all times. of the year ***ad lib.*** feeding of the experimental- sheep on grass alone has been achieved. At no time have experimental ewes and their lambs (Southdown x Romney) had access to any feed other than the pasture provided by their respective plots.

B. Manuring Trials

These trials laid down adjacent to and at the same times as the above have followed the same layout and management. except that 5 replications of each treatment were used. The following were the manuring treatments (per acre per annum) of a simple perennial ryegrass-white clover pasture.

M1.—1 cwt. superphosphate (3 per cent. P_2O_5). This

treatment has provided a valuable control for both the manuring and strain trials in that the pasture, although to date still ryegrass and White clover. dominant, is' a" typical mixed sward of English grasses, clover, and flat weeds.

M2.—4 cwt. superphosphate.
M3.—4 cwt. basic, slag.
M4.—4 cwt. super phosphate and 5 cwt. ground lime; stone annually following an initial dressing of 2 tons ground limestone.
M5.—As for M4 plus 2 cwt. of 30 per cent. potash salts.

Heavy application of the fertilisers were used to accentuate any possible effects. Slag was used to test the contentions that the, minor elements it contains have an effect on health of stock and that slag treated pastures. are easier to control, being more. palatable and giving a less intense spring "flush." Potash also is frequently credited with improving "quality" in herbage. Lime was used to correct the natural acid condition of the soil and accentuate pasture growth as much as possible.

T A B L E **1**

Carrying capacity in ewe equivalent* per acre by quarterly periods

		P1	P2	P3	P4	P5
1942	March-May	10.2	9.2	9.0	9.5	10.1
	June-August	4.5	4.2	4.3	4.3	4.3
	September-November	18 7	15.5	i6.3	15.1	14.4
	December-February. 1943	12.9	10.0	11.5	11.9	13.4
	Av. 12 months	11.6	9.7	10.3	10.2	10.6
		M1	**M2**	**M3**	**M4**	**M5**
1942	March-May 8	8	9.2	8.7	9.6	9.8
	June-August	4.0	4.0	4.1	4.3	4.3
	September-November	11.1	15.6	16.9	18.0	17.9
	December-February	8.8	10.1	10.2	11.5	11.6
	Av. 12 months	8.2	9.7	9.8.	10.9	10.9
1946	March-May	1.5	8.8	8.8	9.1	8.9
	June August	6.1.	5.9	6.2	6.1	6.3
	September-November	8.3	9.7	9.3	10.4	10.5
	December-February	9.3	10.4	11.5	11.8	12.2
	Av. 12 months	7.6	8.7	9.0	9.5	9.5

*Based on appetites of ewes, lambs,' and cattle as given by Woodman (4).

RESULTS AND DISCUSSION

Table 1 presents the carrying capacity of. the pasture strain and manuring trial pastures by seasons for two years which represent extremes in the spread of seasonal production. The characteristics and well-known fluctuations in pasture pro-

duction with seasons are clearly shown,. as are the effects of the pedigree strains, particularly pedigree clover and heavy manuring: A winter carrying capacity of over 4 ewes per acre is a tribute to a well-managed pasture when it is realised that the sheep were fed to appetite on pasture alone and gained in body weight at about 7 lb per month from February to August. when lambing commenced. A maximum carrying capacity of 18.7 E.E. in the spring (P1, 1942) emphasises the problems of management associated with a perennial "crop" which fluctuates so widely in seasonal production. The higher producing pastures P1 and P5 were correspondingly more difficult to control, as October production was considerably greater than on the other plots, and in 1942; for example, P1 reached a peak of 26 E.E. for the month as compared. with 19 E.E. for P2 over the same period.

All stock have' been kept under close observation and data collected under the following headings:—

Ewes

1. Live weight changes at 2-weekly intervals.
2. Fleece weight (greasy and clean scoured), staple length, medullation, and subjective estimates of Wool quality.
3. Causes of deaths and the incidence of barrenness and abortion.

Lambs

1. Number born, alive, dead, and aborted, and birth weight of live lambs.
2. Deaths and causes.
3. Live weight gains.
4. All lambs were slaughtered to dress out at 34-35 lb carcase weight and dome 30 measurements taken after Hammond (5), Palsson (6), and McMeekan (7), and graded as for export.

These data for 4 years and 7 years in the case of the strain and manuring trials respectively have been subjected to appropriate statistical treatment and no significant differences between treatments have been found. The complete lack of any trends and the small magnitude of differences are a striking feature of the results.

In regard to conjectures raised by Coop (8) in discussing the hydrolysis and detoxication by the

animal of the prussic and glucoside of white clover that the high prussic acid glucoside clover might depress keratin production or predispose to bloat and other disorders, it is to be emphasised that in these trials there has been no evidence of these effects. No cases of bloat occurred in the ewes, lambs, or cattle over the four years 'of the strain trial and differences in wool production for sheep between the high and low HCN "clover pastures have been inconsistent in direction, of the order of 1 to 2 per cent. and statistically non-significant.

Considering the trials as a whole, production has been of a markedly high order as judged by stock carried, growth rates, wool production and the quality of fat lambs, which would 'be difficult to better, 75 'to 97 per cent. being of highest export grade and fattened off the mothers.

In addition to evidences of thrift already 'mentioned, it is pertinent to note that there has been' no necessity to dag ewes and lambs, nor have there been any symptoms of internal parasitism, and vermicides have not been used. Counts made of the worm populations in 'the stomachs and small-intestines of lambs slaughtered showed the level of infestation to be of a idw order 'for ***Ostertagia,*** *Cooperia, Nematodinus,* and *Trichostrongyl* oxei. This is no-doubt due to a high level of nutrition (9, 10) and a high uniform quality in the pastures under the system of management adopted. The extent to which pasture control, the use of cattle, and also the prevention of excessively close grazing have played a part by their effects on the intermediate stages of the parasite is a matter for conjecture.

The least satisfactory results in these trials has been with reference to fertility in the ewes and deaths in lambs, results possibly due in some measure to the policy of allowing the ewes to feed to appetite at all times, which resulted in a state of fatness usually regarded as excessive in breeding ewes. Over the seven years in all experimental sheep the number of dry ewes has averaged 10 per cent. and excluding the two-tooths 8 per cent. of the ewes put to the ram. "This is about 3 per cent. higher than in good commercial flocks.

In regard to lamb deaths, the rate has averaged 11.9 per cent. and with the two-tooths excluded, 9.7 per cent. of lambs born. Less' than 1 per cent. -of these deaths- have occurred' after' 3 days of age. Except

for a few cases of abortion, most of the losses have occurred at or just after birth and are probably 'no more than normal accidents associated with' parturition. In many commercial flocks the rate often exceeds 15 per cent.

The death rate in ewes has averaged 5.6 per cent; of ewes put to the ram, which is somewhat less than in the average commercial flock. The main causes of death have been eversion of the vagina (25 per cent.), enterotoxaemia (25 per cent.), difficult parturition (21 per cent.) and sundry infections including garget.

In spite of these losses and infertility, the lambing percentage $\left\{ \frac{\text{lambs docked x 100}}{\text{ewes put to ram}} \right\}$ has averaged 106 per cent. and excluding the two-tooths 115 per cent. which is, comparable with that of good commercial flocks.

As judged by the uniform results for growth and production in stock and the evenness of grazing, the different pastures have been equally palatable. It has been observed, however, that where any small areas of ranker growth did develop, these were impossible to control with sheep, even by confining them on these areas with hurdles. After mowing, however, these areas were again normally grazed.

CONCLUSIONS

It is clearly shown in these trials that, for the particular environmental conditions at least, the various pastures under the same grazing management are all highly satisfactory and equally good as a sole diet for ewes and lambs, and resulted in a high level of production as judged by commercial farming standards. Fluctuations in the rate of plant growth due to season and accentuated by treatments have been of considerable magnitude over the seven years, but have failed to have any measurable or observable effects on the stock. We have, however, been unable by the various treatments, nor have any of the seasons been such as to induce that abnormal flush of pasture growth which is a forerunner of outbreaks of facial eczema. It is not contended that these trials have made any contribution to the solution of such a problem.

The difficulties of pasture management and of complete and efficient utilisation, especially with the most productive pastures in a favourable season, have

been of. considerable magnitude. Under experimental conditions, pasture control probably approaching the ideal has been achieved by -drawing upon additional non-experimental stock as required. Under commercial farming conditions such control is never attained, largely because of economic factors.

We conclude by postulating that inefficient grazing management and pasture control, with consequent deterioration in digestibility, nutritive vaiue, and palatability, is, largely responsible for the unfavourable criticism so often heard of such highly productive pastures.

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