The Intakes of Grass and Silage by Dairy Cows During the Summer

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INTRODUCTION:

AN attempt is being made by the Ruakura Dairy Nutrition Section to assess the relative feeding values of the supplementary fodders commonly employed to sustain summer milk production during periods of pasture shortage. Silage is the most usual summer supplement and despite the use of irrigation, special pastures and crops, silage will undoubtedly remain in the North Island as an integral part of our pastoral dairying set up at least for the next generation.

Although a tremendous volume of work has been done overseas on the conservation and losses involved in silage making, very limited data exist anywhere associating differences in feed composition with value for milk production purposes.

Overseas, silage is principally used to provide the bulk or maintenance portion of the ration, but in New Zealand, a considerable amount is also used as a production ration to supplement pasture in the summer.

In practice, some attempt may be made to provide a higher quality product for summer feeding by using the silage made from the earlier cuts of grass, that from the later, more mature cuts, being used for wintering purposes. Frequently, however, there is little difference in quality as judged on the basis of their protein and crude fibre content.

This paper describes the results obtained in an experiment conducted last year in which 12 sets of lactating twin cows were used in an attempt to assess the benefits to be derived from feeding a really high quality silage over the summer period, as compared with one of much poorer quality.

EXPERIMENTAL MATERIAL AND METHODS.

(1) THE SILAGES FED:

Overseas the crude protein content of a silage is accepted as an index of its quality and in the present experiment this has been the criterion employed to distinguish between good and poor quality silage.

The "poor" silage was made from very rank grass actually carried over from the autumn saved pasture stage. It was ensiled unwilted in a stack and had a crude protein content of 11% which is not very different from the usual run of silages which average 12-13% of crude protein.

The "good" silage was made from grass cut in the leafy stage corresponding to good cow fodder. Due to the early cutting the average amount of dry matter cut per acre was approximately 1¼ tons which is only slightly more than half the two tons normally obtained. The crude protein content of this "good" silage was 18%.

(2) THE ANIMALS EMPLOYED:

The experimental animals consisted of 14 sets of identical twins, 12 of which were lactating and 2 dry. From the time of calving until the commencement of silage feeding they had all been similarly grazed at pasture. At the time that silage feeding commenced, the

twin sets were split into two groups for grazing purposes, each group of 14 animals being rotationally grazed over similar areas each of 9½ acres. The purpose of the high stocking rate employed — which approximated 1.5 cows per acre, was to ensure that the animals should have a real need for the silage supplement and eat substantial quantities of it.

(3) THE EXPERIMENTAL PERIODS:

The 15 weeks of the trial comprised 4 periods. The first period, called the "pre-experimental period" was of 3 weeks duration and during it no silage was fed. The second period called the "initial experimental period" was also of 3 weeks. During it, pastures were deteriorating and silage was fed in restricted quantities, an average consumption of up to 5lb. of dry matter per cow per day being permitted. The third period denoted the "experimental period" was of 6 weeks. During it, pasture conditions further deteriorated and the intake of silage was allowed to increase. During the 4th period, one of three weeks and denoted the "post experimental period," no silage was fed and only the pasture available on their respective areas was available to the two groups of grazing animals.

The pre-experimental period provided data as to the uniformity of the cattle employed. During the initial experimental period the aim was to investigate the effect of the two silage supplements when fed at a low level in similar amounts on a dry matter basis. The silage was offered to the cows individually in boxes and similar average daily intakes of the two groups secured by day to day adjustment of the time allowed each group for feeding.

During the experimental feeding period the aim was twofold; first to investigate the effect of the two silages when fed at a higher level but still in similar amounts on a dry matter basis and secondly, when fed in each case ad lib, thus allowing differences between the two silages in respect of palatability to show up.

During this period, therefore, the twelve sets of milking cows were sub-divided for purposes of silage feeding, into two groups each of 6 sets. Six twin members were fed the less palatable silage ad lib and the average intake of their six co-members receiving the more palatable silage, was restricted to the same level by limiting the time allowed for feeding. In the case of the second group of 6 sets of twins each set of twin members were allowed to eat as much silage as they could during a liberal time interval. The post experimental period produced data as to the carry over effects of the treatment imposed.

At no stage were the two sets of dry twins fed silage and they were allowed access to pastures only for the same time each day as the milkers. As will become clear later, their main purpose was to provide data as to the digestibility of the pasture available to the milkers but it so happened that they also provided useful information as to feed requirements for maintenance during the periods of the experiment.

(4) INTAKE MEASUREMENTS:

It is considered that in the past the value of many nutrition experiments carried out with free grazing animals has been severely limited by lack of complete information as to the individual intakes of the animals concerned, for this has rendered difficult, if not impossible, reliable interpretation of the results obtained.

In the present experiment therefore an effort was made to obtain this vital information and the method employed has been that which was developed and is now being extensively used at Ruakura.

Essentially the method consists of obtaining two separate estimates, one of the amount of faeces voided by each animal and the other of the "intake" factor, i.e., the factor by which the amount of faeces voided has to be multiplied in order to obtain the quantity of feed eaten. This factor is, of course, dependent upon the levels of indigestibility of the feedstuffs consumed. Where the diet of the animals consists solely of pasture the procedure adopted is a comparatively simple one. Each animal is fed a known quantity of the insoluble marker material, chromic oxide and the total faeces voided is estimated from the chromium concentration of samples of the dung, while estimates of the intake factor of the grazed pasture are made on the basis of the nitrogen content of the same faecal samples.

Where cows are consuming both grass and silage, a rather more complicated procedure has to be followed to estimate the grass intake, for only part of the faeces voided is derived from grass, and the concentration of nitrogen in the dung cannot be used as a basis for estimating the intake factor appropriate to the grass consumed. The following rather laborious procedure was therefore adopted.

The amount of silage consumed by each experimental animal was measured directly in the feeding stalls. At the same time using separate animals a digestion trial was carried out to determine the indigestion coefficient of the silage and the data so obtained enabled the amount of dung derived from silage to be calculated for each of the experimental animals.

The total amount of dung voided by each of the experimental animals was determined by the chromium marker method and this, after subtraction of the amount already calculated as derived from silage gave an estimate of the amount derived from grass. An estimate of the intake factor appropriate to the grass was made on the basis of the concentration of nitrogen found in the dung of the dry cows, which had received no silage, but which had grazed the same pastures as the milkers.

EXPERIMENTAL RESULTS.

(1) SILAGE QUALITIES:

	D.M.	O.M.	Crude Protein
	Chemical Composition % (Dry matter Basis)		
Good Silage	26.1	87.8	18.2
Poor Silage	20.6	89.9	11.2
	Digestion Coefficients %		
Good Silage	60.4	64.0	39.9
Poor Silage	55.2	58.5	26.7
	Digestible Nutrients %		
Good Silage	15.8	57.6	7.3
Poor Silage	11.5	52.6	3.1

Throughout the silage feeding periods the good silage averaged 18% crude protein and the poor 11%. The good silage had been ensiled wilted and its dry matter content was 26% compared with 21% for the unwilting poor silage. The overall organic matter digestion coefficients for the good and poor silages respectively were 64% and 59% ,a difference of only 5 digestibility units.

Considering the great difference in quality between the two materials ensiled a larger difference might well have been expected. A second somewhat surprising feature was the low digestibility of the protein fraction for both silages of 40% for the good, and only 27% for the poor. Despite the low protein digestion coefficients of the good silage, it nevertheless contained more than twice as much digestible protein as the poor silage.

It is recognised that overheating during the ensiling process will depress protein digestibility and for this reason low protein digestibilities tend to be characteristic of the less consolidated stack, rather than better compacted pit silages. In the present instance the pit material was apparently overwilted, which retarded compaction and resulted in overheating, although it is to be noted that the resultant silage had a dry matter content of 26% which was within the range of 25-30% recommended by overseas ensiling authorities.

(2) BUTTERFAT PRODUCTION:

During the experimental period of silage feeding the production difference between the cows supplemented with good and poor silage did not appear to be materially affected by the way in which they had been fed, that is, by whether the two silages had been fed at similar intake levels or at ad lib levels, and in figure 3 the butterfat production of all twelve cows fed good silage is shown compared with that of their mates fed poor silage.

Overall the most noticeable feature is the steady decline in butterfat yield in both groups. During the pre-experimental period of uniform treatment at pasture, yields were similar. During the initial experimental period, when pasture was still in adequate supply the small amounts of the two silages fed did not arrest the fall-off in production, and produced no differential effect upon yield. During the six weeks of the experimental period, when silage was fed at a level more than twice as high as during the previous period butterfat yield was in favour of the good silage. The difference was approximately 0.5lb. of butterfat per cow per week for each of the six weeks which represented an 11% difference.

With the termination of silage feeding at the start of the post-experimental period and with pasture conditions remaining at a similar poor stage of growth to that experienced in the experimental period, butterfat yields declined rapidly although cows which had previously received good silage retained a considerable measure of their previous advantage in fat yield. This represented 0.4lb. of butterfat per cow per week and due to the decline in yield the percentage difference increased to 15%.

(3) LIVEWEIGHT:

The liveweight trends indicate that on the average there was a slight gain during the course of the pre-experimental period with bare maintenance of condition during the two silage feeding periods. A decline in weight occurred for the first two weeks after termination of silage feeding with a rapid decline in the third week. Mean liveweights for the two groups of cows were similar throughout the experiment.

(4) DRY COWS:

The mean liveweight of the 4 dry cows was only 50-60 lb. greater than that of the 24 milkers and the general pattern of the liveweight changes was practically identical for both classes of animal. This means that one can usefully compare the intakes of the dry and milking cows throughout the four periods of the experiment.

(5) DRY MATTER INTAKES:

Figure 4 tabulates the data for mean dry matter consumption in lb. per cow per day of silage and grass separately. In giving the results the data for each period are presented on the basis that the cows were subsequently divided in the experimental period of silage feeding.

In the preperiod all cows grazed together. For the milkers the intakes of grass represents the mean intake of six cows whose intakes were independently measured during each of the three weeks. Similarly the intakes of the dry cows represent the mean intake of two cows determined in the same way. During the preperiod mean fat production and liveweights were similar for all four groups of six milkers and they ate similar quantities of dry matter. The mean dry matter intake of the 24 milking cows who averaged 800 lb. liveweight was 35 lb. or 4.4% of liveweight, which is considerably in excess of the 3% level commonly applied overseas in rationing to appetite.

The mean dry matter intake of the 4 dry cows who averaged 860 lb. in weight was 24 lb., representing 2.4% of liveweight.

During each of the three weeks of the initial experimental period, silage consumption steadily increased and averaged 4.5 and 4.3 lb. for respective good and poor silages. It will be remembered that the aim was to feed to similar intake levels.

The good silage was extremely palatable and cows on good silage ate their silage in half the time required by their mates eating poor silage.

Reasonable grazing was available in this period and the average total intake of the 24 milking cows fell by only 1 lb. of dry matter; from 35 lb. to 34 lb. Grass intakes and total intakes were similar for all four groups of milkers. The dry cows apparently ate more grass in this period than previously, but in both of these periods, ate less than the milkers.

In the experimental period silage feeding was changed from once to twice a day. Consumption increased steadily each week as would be expected under conditions of failing pasture growth. As in the initial experimental period intakes were again successfully equalised in those groups where this was desired. Cows receiving the good silage ate an average of 10.5 lb. in 1½ hours, whereas their mates receiving poor silage consumed 10.6 lb. but required 3 hours per day to eat this amount. The difference between feeding times reflect the marked difference in palatability between the two silages.

In the two groups where ad lib feeding was allowed, intakes were 11.8 and 9.9 lb. for good and poor silages respectively each eaten in 3 hours per day.

Gross intakes of all milking cows were considerably lower than in the previous period, falling from 30 to 18 lb., and there was some indication of differential intake of grass between cows that received good silage and their mates that received poor silage. As there was liberal time allowed for eating silage there was some indication that the silage consumption figures were near their maximum for these types of silages, when fed in conjunction with grass. The fact that dry cows were able to consume some 24 lb. of dry matter from grazing compared with 18 lb. eaten by the milkers indicated that the milkers were not short of grazing, but that some other factor was operating during this period to restrict their appetite for dry matter.

In the post-experimental period on pasture alone, the milkers' consumption of grass increased and the drys' decreased in relation to their grass intakes over the experimental period. The milkers ate 25 lb. of dry matter and the drys only 19 lb.

Visual observation of the grazing areas showed that grass cover was maintained over the silage feeding period. In other words, the

feeding of silage had a pasture-sparing action and it was not until the third and last week of the post-experimental period that the grazing area was recognised as being as "bare as a board."

(6) CONCLUSION:

Dry matter intake figures can be converted to a digestible organic matter basis. Digestible organic matter values for pasture are very similar to the well known Total Digestible Nutrient values and for comparative purposes will be considered as identical.

The fact that the dry cows maintained liveweight during all periods except the post-experimental period indicated 14-16 lb. of D.O.M. as the maintenance requirement of cows of 8-900 lb. liveweight. Gaines, Brody and Procter arrived at values approximating 8 lb. of T.D.M. for a cow of 1,000 lb. liveweight. It appears that in N.Z. the maintenance requirements of cows grazing at summer pasture is approximately twice that of similar cows overseas, kept under predominantly stall fed conditions. This suggests that a heavy energy expenditure is involved where cows have to graze short pasture, which will naturally vary throughout the grazing season depending upon the ease with which the animals are able to obtain their fill.

We have seen that during the 6 weeks experimental feeding period good silage proved 11% better than poor silage in maintaining butterfat production. This difference may appear disappointingly small but it must be remembered that the difference was largely maintained after the end of the silage feeding period. Also even at the higher level of supplementation, the silage fed provided only one third of the total intake so that a much larger difference could hardly have been expected. It appears that both silages had a valuable pasture sparing action and it would appear desirable to attempt to obtain a measure of the effect of this in maintaining production by making provision, in future experimental designs, for a further treatment group that would receive no silage at all.

The main object of the inclusion of the ad lib fed groups in the experimental period was to ascertain whether differences in palatability would result in large differences in the quantities of silage eaten and to investigate the effect that this might have on the consumption of grass and the production of the animals. During this period palatability exerted a considerable effect upon the rate of consumption but not upon the total quantity eaten.

FEED INTAKE

Dry Matter lb./Cow/Day.

Period	Silage	MILKERS						DRYS
		Silage	Grass	Total	Silage	Grass	Total	Grass
Pre-experimental	Good	—	35.6	35.6	—	34.7	34.7	23.9
	Poor	—	35.9	35.9	—	34.9	34.9	24.5
Initial Experimental	Good	4.3	29.8	34.1	4.6	29.6	34.2	26.5
	Poor	4.2	29.6	33.8	4.4	29.9	34.3	25.4
Experimental	Good	10.5	19.2	29.7	11.8	16.4	28.2	23.0
	Poor	10.6	17.0	27.6	9.9	18.2	28.1	24.0
Post-experimental	Good	—	24.8	24.8	—	24.8	24.8	19.2
	Poor	—	25.5	25.5	—	24.7	24.7	19.3