STRIP VERSUS PADDOCK (ROTATIONAL) GRAZING OF DAIRY COWS

By
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Dr. McMeekan was to have given this paper, but has not been able to do so owing to his absence overseas. It has fallen upon me to describe the work he has been carrying out at Ruakura to obtain factual information on the relative merits of the break and paddock systems of grazing dairy cows during the main growing season.

The electric fence and the break. grazing technique of pasture utilization were introduced to New Zealand by Professor W. H. Riddet some 15 to 20 years ago. The electric fence is now standard equipment on dairy farms throughout the country. It undoubtedly has proved of immense value in solving the problems associated with providing pasture during the normal periods of feed shortage particularly during the late winter and early spring.

It has become very clear that the technique of break grazing enables limited supplies of pasture (available when feed is in short supply) to be rationed to the herd over an extended period, and fed off in an extremely efficient manner; it also provides an invaluable method whereby the rate of rotation of the herd can be slowed down during the autumn and winter months so as to allow a longer spell between successive grazings in keeping with the slower rate of pasture growth. This is essential if maximum pasture growth is to be obtained and if reserves of high quality feed are to be accumulated for late winter and early spring use.

Of recent years, however, there has been a tendency for some farmers to use the break grazing method also during the main period of pasture growth when there is no shortage but rather an abundance of feed ; and when,- in order to maintain pasture quality, a short rather than a long interval between successive grazing is required.

Hitherto, no experimental work has been done. in New Zealand to compare break with normal rotational grazing during periods of feed abundance, and since the shifting of the electric fence does involve extra work, Dr. McMeekan felt that the benefit to be derived from its use during the main growing season should be critically examined. So far three experiments have been carried out.

THE FIRST EXPERIMENT

For this trial eight fields, comprising approximately 16 acres of land, were employed. The pastures were predominantly ryegrass and white clover with a small proportion of cocksfoot and Yorkshire fog. Each field was divided into two equal parts with a semi-permanent electric fence. One half of each field was grazed off in breaks with ten identical twin members, while the other half was paddock grazed by their co-twins.

The' grazing procedure was as follows. As each new field was entered, the break grazed twins were given a strip of their half of the field large enough to provide for a 24 hour period, while the paddock grazed twins were allowed to graze over the whole of their half of- the field. Both groups remained on their respective halves for the same length of time, being shifted on from one field to the next when the break fed group had completed the grazing of their area.

In regulating the size of the daily break, a high degree of grass utilization was aimed at. Thus, if grass was obviously being wasted in one 24 hour period, the size of the strip allowed in the next was reduced. On the other hand, if it was thought that the previous day's ration had been insufficient to allow full intake, the area of the strip was increased. The animals were permitted to back-graze as in normal break grazing practice.

No set plan of rotation was followed; at each shift the cows were moved to the field considered most suitable for grazing. In order to avoid any side effects of the two grazing systems, such as might result from their influence upon the botanical composition or productivity of the pastures, the half of any field which had been break-grazed at one grazing was paddock-grazed when next entered and vice versa. It must be emphasized that the purpose of this trial was not to study the cumulative effects of break and paddock grazing upon the pastures, but to determine whether milk and butterfat production was affected by differences in grazing method.

Clearly, under a paddock grazing system, the animals are permitted to select first the most palatable and perhaps the most nutritious feed in a paddock but, before leaving the paddock, are obliged to consume feed initially rejected ; whereas; under a break grazing system, the cattle are obliged each day to eat a mixture of the more and the less palatable feed.

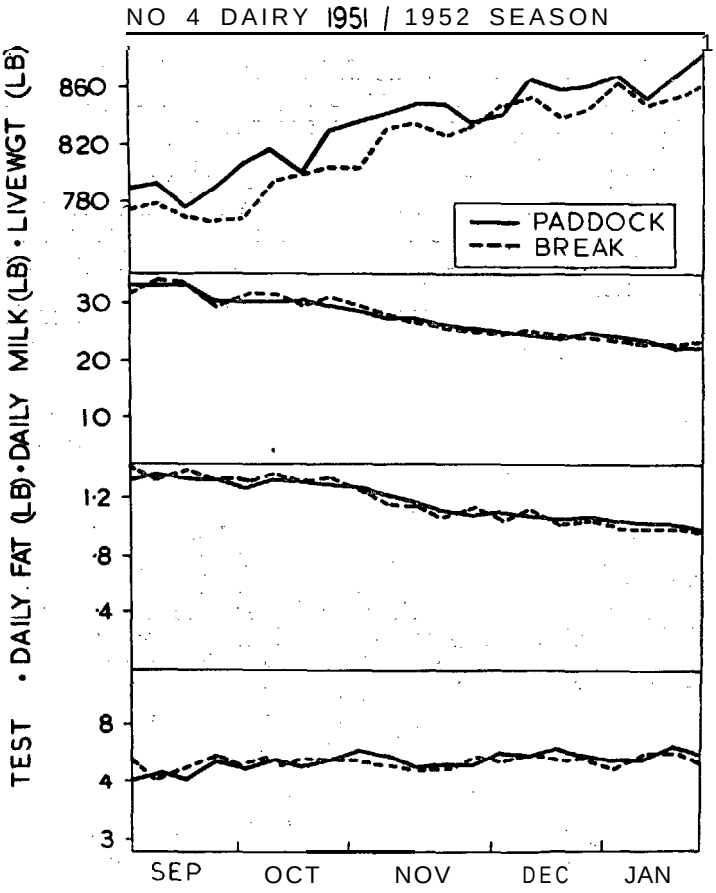

Figure 1.

The experiment was started on August 30 at which time the groups of twin members had each averaged 29 days in milk and were producing at very similar levels. It was continued for 21 weeks, throughout the main growing period, being terminated on January 23. The year was a good one for grass and it was not necessary to feed supplements until February.

RESULTS

The length of time spent in each field varied from two to seven days. No differences in the relative efficiency of utilisation could be observed between the two halves of each field at the end of any one grazing cycle, nor were there any obvious differences in the rate of recovery after grazing. At no one time was topping necessary to maintain an even cover. On only one occasion, on both halves of one field, were dry stock needed to chew up feed left by the milkers, although at various times fields not needed by the milkers were grazed out by yearling heifers, a total of 583 heifer grazing days being involved. During the experiment half the total area was cut for silage.

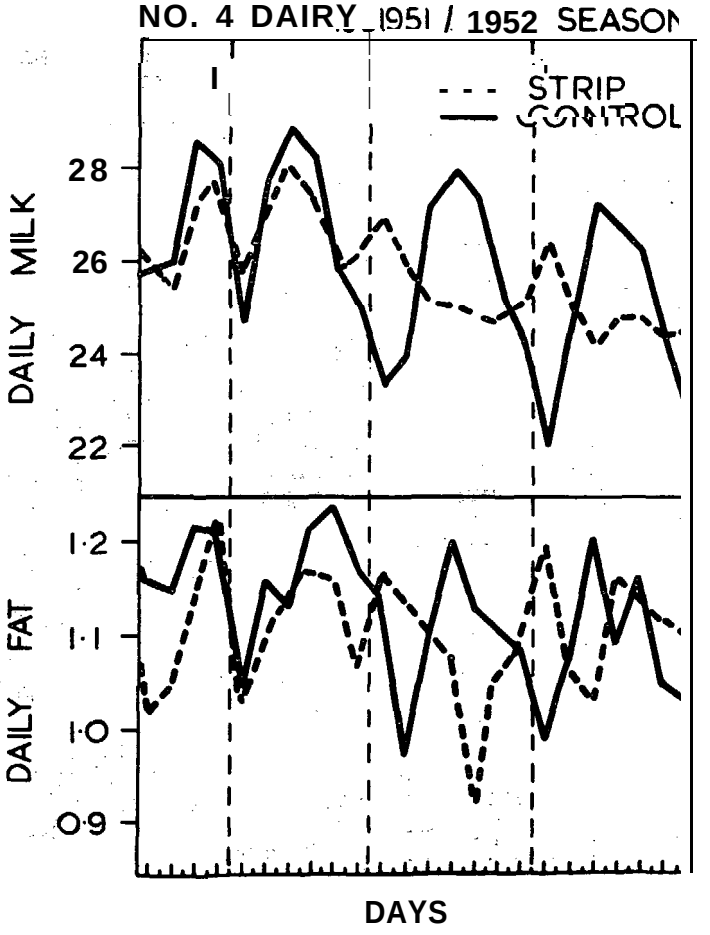

Figure 2.

Individual milk weights and dairy butterfat tests were recorded throughout the trial. The effect of the two grazing systems upon production is summarised in Table 1.

TABLE 1

PRODUCTION DATA-No. 4 DAIRY-1951-52 SEASON (147 DAYS)

Average:	Paddock Grazed	Break Grazed
Milk (lb.)	4003	4023
Fat (lb.)	175	175
Test	4.40	4.41

Quite obviously, considering the period as a whole, break grazing did not result in the production of any more milk or butterfat than did paddock grazing.

Liveweight and lactation curves are shown in Fig. 1. The average weight of the paddock grazed group was throughout a little greater than that of the break-grazed group, but the weight curves were essentially the same and both groups gained approximately 100 lb. over the experimental period. The lactation curves were very similar for the break- and paddock-grazed animals.

Despite these similarities, there were interesting differences with respect to 'short-term fluctuations in milk yield. Daily milk production was much more variable for the paddock than for the break-grazed herd and, whereas the yield of the break-grazed group showed no systematic variation, that of the paddock-grazed group fluctuated according to a quite well defined and oft repeated pattern **(Fig. 2).** Thus, after entry into a new field, milk yield tended to rise for the first two or three milkings, thereafter falling so long as the herd remained in the same field. The daily butterfat yield did. not show the same sort of variation and it appears that the large daily variations in milk yield of the paddock-grazed group were ironed out by compensatory changes in butterfat test.

On five separate days during the experiment, the grazing behaviour of the cows was observed and recorded. Observations were made on one field on the first and sixth days of grazing and on another on the first, third and fifth. The main findings were:

1. The break-grazed cows exhibited greater variability in both grazing and ruminating times than their paddock grazed mates.

2. The grazing time of each herd increased during the period spent in each field.
3. Ruminating times of the break-fed herd increased as grazing proceeded from the first break to the last. There was no definite trend with the paddock-fed herd.
4. On average, the break-fed cows grazed 34 minutes less per day but ruminated 38 minutes longer than did their paddock-fed mates.

In this 'experiment, a noticeable deterioration in feed quality occurred from the first to the last day of break grazing in a field. This apparently led to increased grazing time and increased ruminating time. The paddock-grazed cows when first introduced into a new paddock had short grazing and ruminating times but, as the feed became less readily available, the time spent in grazing increased but that spent in ruminating did not. The overall smaller ruminating time of the paddock-grazed group may possibly indicate that their feed was of higher average quality.

THE SECOND EXPERIMENT

This experiment, conducted during the 1954-55 season, was carried out to obtain a measure of any cumulative effects of the break and paddock systems of grazing. In design, this experiment was similar to that of the first except that after each grazing cycle the break and paddock-fed cows re-.entered the same halves of each field that they had previously grazed.

Clearly, with this design., any differences between the amount of feed left on the two halves of a field after grazing, or any differences in the rate or recovery of the two halves, must directly influence the amounts of feed available to the paddock and break-grazed herds when the area is next grazed off.

Eight fields were again used, the total area involved being a little more than 16 acres. Twelve sets of twins were employed but one of these had to be discarded owing to an illness of one member that was not associated with its grazing treatment.

The experiment was begun on September 2, at which time the mean liveweight and average milk and butterfat production of the two herds were very similar. It was continued for 21 weeks, as in the first experiment, terminating on January 26 at which time summer supplementarv feeding commenced.

The break-grazed herd were throughout given a fresh break after each milking. The season was an abnormally dry one and grazing management was less

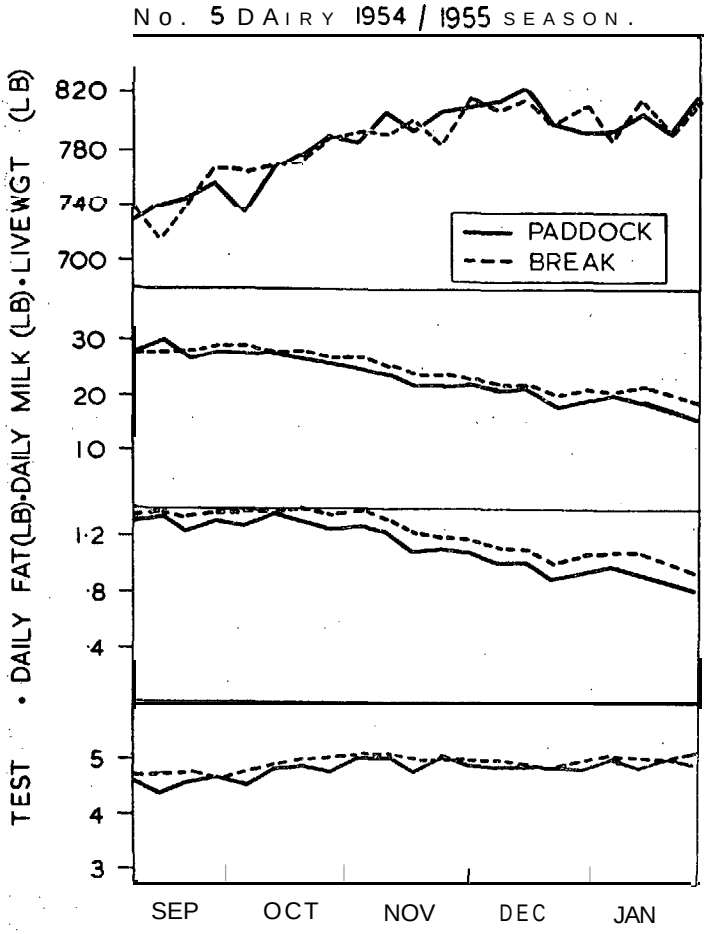

Figure 3.

lenient than in the previous trial. The experimental area was at no stage grazed by stock other than the two twin herds.

RESULTS

During the 21 weeks of the experiment, each of the eight fields was grazed eight times. During the period from the beginning of September to the end'of November each complete grazing cycle took between three and four weeks and the time spent in each field varied from two to' 4½ days. Because the season was very dry, there was noticeably less feed -on the experimental area after the beginning of December than

during the previous months. The fourth grazing cycle was completed on December 9, and after this date the average length of each grazing cycle was only approximately twelve days and time spent in each field varied from ½ to three days. When the experiment ended on January 26 there was little feed on either- the paddock or the break-grazed areas.

Average milk and butterfat yields are shown in Table 2.

TABLE 2

PRODUCTION DATA-No. 5 DAIRY-1954-55 SEASON (147 DAYS)

Average:	Paddock Grazed	Break Grazed
Milk (lb.)	3416	3620
Fat (lb.)	164	178
Test	4.92	5.03

It is clear that the break-grazed twins outproduced their paddock-grazed mates. Over the 21 week period difference in milk production amounted to 204 lb. per cow and the difference in fat production to 14 lb. per cow.

It should perhaps be mentioned that after the experiment finished on January 26 both groups were grazed on their respective areas until March 9, and that during this period each herd was fed the same quantity of supplementary feed in the form of chou moellier. By March 9 the average differences in production between the herds had increased to 436 lb. of milk and 22 lb. of fat.

Seasonal changes in liveweight and production are shown in Fig. 3. The liveweight curves are virtually identical and both groups made substantial weight gains over the experimental period.

The lactation curves for milk and butterfat show that the difference in production between 'the break and paddock-fed animals began to appear at an early stage of the experiment-before the completion of the first grazing cycle-but became pronounced only during the second month of the trial, by which time there was noticeably more grass available upon those halves of the fields that previously had been grazed by the break feeding method.

Supporting evidence for the view that more feed did, in fact, accumulate upon the break-fed than upon the paddock-fed areas is -afforded by the differing amounts of material that were obtained from the two

halves of the field cut for silage. The dry matter yield per acre from the half previously break-grazed was' 1,724 lb. whereas that from the half previously paddock-grazed was only 795 lb.

In this second experiment the daily milk yields of the paddock and break-grazed herds varied in the quite distinctive ways that have already been, described in connection with the first experiment.

THE THIRD EXPERIMENT

In both the experiments already described, the procedure adopted was for the break and paddock-grazed herds to enter each new field at the same time and the paddock-grazed herd remained on their half of the field until the break-fed animals had finished their last break. Frequently, this procedure resulted in the paddock-grazed herd being left in a paddock considerably longer than they would be permitted to by most dairymen practising a normal rotational grazing system aimed at high production.

It may be quite reasonably argued, that in both of the first two experiments the production of the paddock-grazed group of cattle may have been adversely affected by their being forced to remain so long in each paddock and towards the end of the stay either starve or eat less palatable feed rejected earlier.

In order to clarify this issue, a third experiment was carried out, also in the 1954-55 season. In general the design resembled the other two. Eight fields, each subdivided into two equal halves, were used and identical twin milking herds were again employed. There was no dry stock involved. The break-fed cows were given a fresh strip twice daily. The time they spent in each field varied from 1 to 4½ days. The paddock-grazed herd were shifted to a new field each day quite independently of their break-fed mates and covered the whole of their area during successive eight-day grazing cycles. Grass surplus to herd requirements was made into silage, the acreages cut being so arranged that similar quantities of dry matter were saved from the break and paddock-grazed areas. Hence any differences that existed in respect of the amounts of feed grown under the two grazing systems should have been reflected in the production and growth performance of the two herds of cattle.

The trial began on September 8, and was continued for 19 weeks, finishing on January 19, at which time supplementary summer feeding was commenced.

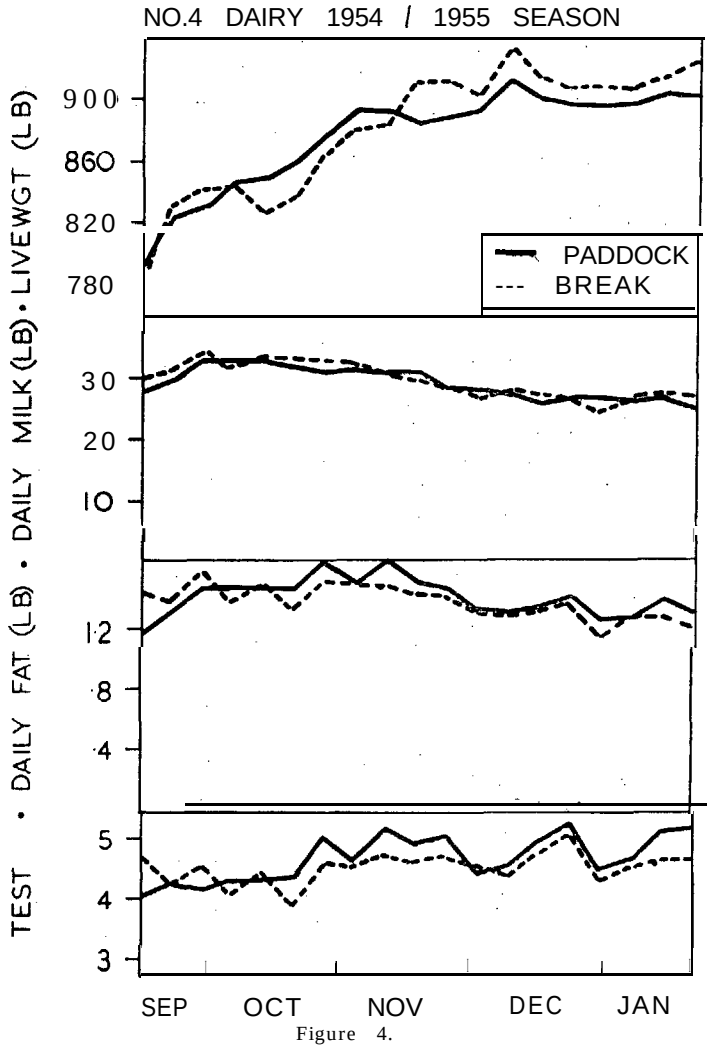

Figure 4.

RESULTS

Abundant feed.was available, to both herds during September, October and November and during these months the time the break-fed cows spent in each paddock varied from $1\frac{1}{2}$ to 43 days. Owing to the dry weather, feed was in short supply during early December, and for a fortnight it became necessary to provide the break-fed. herd. with a new paddock each day. However, rains which fell in mid-December led to considerable growth, and during the last month of the trial the

time the break-fed cows spent in each paddock varied from two to four days.

The production results have been summarised in Table 3:

TABLE 3

PRODUCTION DATA-N;. 4 SEASON (133 DAYS)

Average :	Paddock Grazed	Break Grazed
Milk (lb.)	3858	3889
Fat (lb.)	179	174
Test	4.76	4.65

The break-grazed group produced more milk and less fat than the paddock-grazed group but neither in the case of milk nor fat was the difference in yield appreciable and could easily have arisen by chance. The small difference in average test similarly cannot be considered significant. Weight and lactation curves are shown in Fig. 4. These serve mainly to emphasise that both groups of cattle performed very similarly.

CONCLUSIONS

Viewing the results of the three experiments together, what conclusions can be drawn?

Let us consider first the effect of the two grazing methods upon the utilisation of a given quantity of pasture. The first trial clearly suggests that 'under reasonably lenient management a given quantity of pasture will yield the same amount of milk and butterfat irrespective of whether it is fed off in breaks or grazed off on the paddock basis. However, we have already noted that in the second experiment the milk and butterfat productions of the two herds began to diverge before the first grazing cycle had been completed and thus at a stage when there should not have been any difference between the amounts of feed available upon the two halves of each field.. At the time this production difference first appeared the cows were being far from Iiberally fed and it may well be that the break feeding method is superior to the paddock system under hard grazing conditions where intake is being restricted..

Now let us turn to the question of any cumulative differences that may arise in the amount of pasture grown under the two systems. As already mentioned; in the second experiment, the difference in production between the break and paddock-grazed animals became

pronounced only in the second month of the trial, and there is little doubt that at this stage the superior performance of the break-fed cows was mainly due to their being better fed, for there was at this time appreciably more feed upon the areas that had been fed off in breaks than upon those previously paddock-grazed. This could have been due either to less feed having been consumed under break feeding during the first rotation or to the more rapid recovery of the break-fed pastures after being grazed off. With the dry weather one would expect any difference in the amount of cover left on the pastures after grazing to be particularly important in influencing the rate of recovery. This second trial, therefore, suggests that under rather artificial conditions where paddock and break-grazed animals are grazed fairly tightly and forced to spend the same length of time in each field before being shifted on to another,. more grass will be grown and more milk and butterfat produced by the break feeding method than by the paddock grazing system, at least in a dry season.

From the practical point of view, the third of the three experiments is perhaps the most important for the two systems of grazing that were contrasted are those- between which the ordinary farmer would normally choose.

The results indicate that even in a dry season no greater production of either grass or butterfat will be obtained from a break feeding system than from one of paddock grazing so organised that the herd is rapidly shifted from one paddock to the next. This is perhaps not so surprising as it might at first appear. From the grazing management aspect, two important factors influence the amount of feed grown upon a given area-the frequency and the severity with which the pasture is grazed.

In the third trial, the interval between grazings was considerably greater for the break-fed pastures than for the paddock-grazed ones and greater growth might be expected on the break-fed areas on this account. It seems probable, however, that this advantage was completely offset by the break-fed paddocks being the more severely defoliated at each rotation ; the paddock grazed areas, although grazed frequently were on each occasion left with sufficient cover to prevent drying, out and with sufficient quantities of photosynthetic tissue to enable them to continue growing at a rapid rate.

However, whatever the true explanation of the results obtained in these three trials, it is clear that

they have quite failed to demonstrate any superiority of the break over the paddock grazing system as a method of feeding dairy cows during the main period of pasture growth.

DISCUSSION

P. B. Lynch: The great drawback of this sort of trial is the fact that the personal judgment of the operator in managing. the grazing counts for so much. For instance, you mention in the last trial that the break-grazed areas may have been more defoliated than was desirable. Another person may have managed the pastures better so they weren't so badly affected. I think to draw general conclusions from this sort of trial can be very dangerous.

L. R. Wallace: Certainly grazing management will affect results, but certain conclusions can be drawn from the trials. In the first trial where there was plenty of grass break grazing was no advantage., In the second trial, break grazing gave more feed in dry conditions, where the rotational grazed pastures were overgrazed. In the third trial, where there was no overgrazing, break grazing was again of no advantage.

C. E. Iversen: We can make martyrs of ourselves by overdoing the break grazing, but if there is plenty of feed we can have a number of grazing systems all working well. Possibly in the first and last trials you were understocked.

L. R. Wallace: Break grazing with the electric fence has a lot to offer this country. It enables you to subdivide better, and ration off growth when pastures are slowing down. During winter it allows a longer rotation so that paddocks can be adequately spelled between grazings. However, when pastures are growing well, it is more important to keep the feed of good quality than make it go further, and shortening the rotation is the best way to achieve this. I seriously question the merit of using- the electric fence during the period of flush of pasture growth.