MINISTERIE VAN LANDBOUW, VISSERIJ EN VOEDSELVOORZIENING

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Proceedings of the Sixth International Grassland Congress, p. 371-375 (published 1953)

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Introduction

In intensive rotational grazing the paddocks are stocked with 20 adult cows per ha. (8 cows/acre). In practicing this system, the size of the paddocks depends on the size of the herd. As an average for the whole season the herd is grazing 4–6 days in one paddock when this grazing system is practiced. After having grazed one paddock bare, the herd is moved to the next field.

In ration grazing, every day a paddock containing just enough grass to keep the production of the herd optimal is fenced off by means of a movable electric fence. In practice a movable electric fence is put across a field and shifted forward daily, allowing the herd a new area of about 80 m^2 (1/50 of an acre) per cow. Parallel to this fence, a back fence is erected to keep the herd restricted to a total area of 250 m^2 (3/50 of an acre) per cow, giving rest to the remainder of the field.

The first day grazing is started on a fresh field, an area meeting the requirements of the herd for 2 days is fenced off. This, being about 160 m^2 (1/25 of an acre) per cow, is the minimum area to prevent the cows from bullying each other.

In literature three names are used to indicate this system, close folding, strip grazing and ration grazing.

Efficiency of Ration Grazing Compared with Rotational Grazing

Comparison of the Yield from Ration Grazing with the Yield from Rotational Grazing

Several authors compared the yield obtained from ration grazing and the yield obtained from rotational grazing. Some research workers (Molen 1949) calculated the area saved from grazing by ration grazing compared with rotational grazing. This measure, however, is not reliable. It is influenced by the length of the grass during grazing.

A second group of authors compared the yield in starch equivalents (S.E.) obtained from grazing a certain area by the ration-grazing system and from grazing another area with the rotational grazing system. The results of these experiments are collected in table 1.

The third group of research workers compared the annual yield per acre of one or more farms practicing ration grazing with the yield per acre obtained from farms using the rotational grazing system. The results of this work are summarized in table 2.

Reprinted from the Proceedings of the
SIXTH INTERNATIONAL GRASSLAND CONGRESS

Table 1. Comparison of the yield obtained from ration grazing and from rotational grazing

Authors	Stocking of fields under rotational grazing		Experimental period	Savings from ration grazing in percent of the yield by rotational grazing	Yield calculated in:
	Cows per ha.	Cows per acre			
de Gieus, 1947	(a) 23	9.2	Whole season	15	S.E.
	(b) 20	8	Whole season	34	S.E.
Bosch, 1947–50	21	8.4	Whole season	12	S.E.
Klarenberg, 1948	10	4	Whole season	45	S.E.
Klarenberg, 1950	25	10	Whole season	9	S.E.
Procter and others, 1950	25	10	April 19th to August 14th	29	S.E.
Holmes and others, 1950	(a) 15	6	Whole season	19	cowdays
	(b) 15	6	Whole season	45	cowdays
Procter and others, 1950	25	10	April 19th to August 14th	33	cowdays

Table 2. Difference in total annual yield per acre between farms practicing ration grazing and farms practicing rotational grazing. Roughage from grassland used for feeding during winter is included. The yield is calculated in S.E.

Authors	Number of farms practicing		Average number of cows per ha. of the fields on farms practicing rotational grazing	Increase in yield from ration grazing (yield on farms practicing rotational grazing = 100)
	Ration grazing	Rotational grazing		
Bakker, 1949	(a) 7	31	15	14 percent
	(b) 23	22	15	15 percent
Penders, 1950	½	½	20	7 percent

The results obtained by the authors in table 2 differ somewhat from each other. It must be realized, however, that the standards used by different authors to compare ration grazing with rotational grazing are not the same. In general the difference between ration grazing and rotational grazing is smaller when the rotationally grazed fields are heavier stocked.

Procter and others (1950) find a larger difference, because they finished their experiment in August. The grazing efficiency of ration grazing in fall is much lower than in spring and summer.

The most reliable figures are obtained when an average figure for a larger number of farms is calculated (Bakker 1949). His figures are important because they visualize the profits for the farmer.

Influence of the Time Within the Season on the Grazing Efficiency of Ration Grazing

The most profitable period for ration grazing was soon recognized to be in spring and early summer. In the later part of the summer and in fall the grazing efficiency of ration grazing decreases. Rotational grazing systems drop in efficiency too when the season advances. Work in this field has been done in the Netherlands and England (Penders 1950; Procter and others 1950).

Penders expressed the grazing efficiency in the area saved from grazing by practicing ration grazing compared with rotational grazing, stocking the rotationally grazed fields with 20 cows per ha. (8

per acre). Care was taken that the yield of herbage per ha. for both groups was about the same. These experiments give an impression of the grazing efficiency of ration grazing as compared with rotational grazing.

Procter and others (1950) started their experiments April 14 and closed August 14. The fields they used to compare ration grazing and rotational grazing were grazed four times during this period. The authors calculated the yield before grazing by cutting a number of sample plots. In the same way the residue after grazing was determined.

Diminishing the yield of herbage before grazing by the residue after grazing results in the amount apparently consumed.

By dividing the yield before grazing by the apparent consumption they arrived at the "percentage apparent utilization."

The general trend is a decreasing grazing efficiency of ration grazing compared with rotational grazing as the season advances. The residues after grazing are larger during the latter part of the season. In accordance with this the percentage of apparent utilization drops too when the season advances.

In general the figures are somewhat more favorable for ration grazing than for rotational grazing.

The Grazing Residue

The grazing efficiency is influenced largely by the residue after grazing not consumed by the herd. Work in this field has been done by Waite and others (1950).

Several factors influence the size of the grazing residue.

(1) Fresh grass can be rendered unuseful by dung dropped during the grazing period. Under ration grazing only dung dropped within 5–6 hours after the beginning of the grazing causes losses. These losses are 2-4 per cent of the yield. If dung is dropped after 6 hours the losses are negligible. In rotational grazing these losses are somewhat larger.

(2) Grass grown on spots where dung or urine has been dropped during previous grazing periods is partly rejected by the animals.

(3) The upper part of the grass carrying more leafy material has a higher protein content than the lower part. If the grass offered to the cows is too old and in consequence the protein content too low, the animals select a ration meeting their requirements by grazing less of the lower part of the grass. This results in larger after-grazing residues. The herd can be forced to consume this residue by not being offered a new pasture, but the result will be a decreasing yield of milk per cow.

In rotational grazing the herd tends to graze in layers, starting at the top. In consequence, at the end of the grazing the ration becomes short in protein and the yield of milk per cow declines. If ration grazing is practiced the herd consumes the grass from top to bottom in one day.

Reducing the grazing residue is an important matter to arrive at a higher grazing efficiency. Decrease of the grazing residues can be obtained by the following methods:

(*a*) Alternative grazing and cutting for hay, silage, or artificially dried grass decreases the grazing residues.

(*b*) Topping of the grazing residues reduces the residues in the next grazing period.

(*c*) Grazing of the residues by horses diminishes considerably the grazing residues in the next grazing period.

(*d*) Practical farmers often claim good results from top-dressing the grazing residues with liquid manure.

Noteworthy is that the animals lose their dislike of grass growing on droppings after the first heavy night frost.

Relation Between the Milk Yield Per Cow and the Protein Content

As pointed out before, the composition of the grass consumed by the herd in the ration grazing system is more stable than under rotational grazing. In accordance with this all the authors dealing with this matter agree the herds under ration grazing have less ups and downs in milk yield than cows grazing in a rotational grazing system.

Opinions are diversified about the average daily milk yield per cow. Most authors claim the average daily milk yield from ration grazing to be higher than from rotational grazing. Some authors oppose this. Farmers also sometimes complain that ration grazing yields less milk per cow daily. Complaints of this nature result from grazing on grass too low in protein content. The author (de Geus 1947) reported the minimum crude protein percentage in the dry matter of the ration grazed grass to be 14 per cent when the daily production per cow is 17 kg. When the crude-protein content of the grass dropped below 14 per cent the average daily milk yield of 17 kg. per cow could not be maintained.

By comparing table 2 and figure 3 in the publication of Holmes et al. (1950) a minimum crude-protein requirement of 10–11 per cent in the dry matter of the grass can be calculated at an average daily milk yield of 14 kg. per cow.

In practicing ration grazing this has to be kept in mind. In spring the farmer wanting to practice ration grazing has to take care that his fields show grass of different lengths. This is very important in the month of May and the first week of June.

Under Dutch circumstances the period of May 18 till June 10 is a critical period. During this period the protein content of the first cutting drops below the minimum requirements to keep up the daily milk yield.

So ration grazing requires having a field, pregrazed in the last week of April, available for grazing in the last part of May.

Besides this an aftergrowth of an early first cutting has to be available on June 1 if the farmer wants his cows to produce optimal daily milk yield on grass only.

Growth of Cows During the Grazing Season

During the grazing season mature dairy cows gain in weight both under ration grazing and rotational grazing. Several authors compared the live-weight gain from ration grazing and rotational grazing (de Geus 1947, unpublished data; Holmes et al. 1950; Klarenberg 1948; Klarenberg 1950; and Penders 1950). All of these experiments are carried out with dairy cows. The results of the experiments concerning live-weight gain are contradictory. No reason is known for this.

Influence on the Sward

On permanent pastures it is important to know how the quality of the sward is influenced by the grazing method. Bosch controlled the botanical composition in an experiment covering 4 years. During the experiment the quality improved and no significant difference was found between the two methods of grazing.

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DISCUSSION

C. P. McMeekan, New Zealand:

One can readily see the advantage of ration-grazing in some situations for reasons of limited area and farm management. I am not at all convinced, however, that it gives more milk per unit of land area. In trials using identical twins, in New Zealand, no gain from ration grazing has been found. The system is used in New Zealand but only to control bloat.

R. E. Blaser, United States:

In rotation grazing for periods of 7 days with dairy cattle, it has

been observed that the milk yield increases for the first 2 or 3 days and then declines. This is assumed to be due to a decrease in the leafiness, and thus quality, of the available herbage as grazing progresses.

B. Elwood Montgomery, United States:

Could not the decline in milk yield during periods of rotation grazing be due to trampling and the fouling of the vegetation with droppings, resulting in reduced consumption?

R. E. Blaser, United States:

Under normal rotation grazing there is, without doubt, both a change in leafiness and acceptability of the remaining herbage. This will result in lower consumption of high quality material.