PASTURE UTILIZATION AND THE NEAR FUTURE

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IN THE NEAR FUTURE, the efficiency with which New Zealand pastures are utilized must improve. This should be possible through applying available information, which should be well known and accepted by all, but which is too often under-rated or neglected. It is particularly important to accept that pasture utilization and pasture production are interdependent.

GENERAL BACKGROUND

Our progenitors planned and worked well, but, while giving full credit for past effort, we should be striving to follow their example by looking forward with purpose rather than backward with pride. The prediction of Sears (1949) that at least 800 lb butterfat (or its equivalent) per acre per annum would come from grazed pasture has not been realized. With good animals and stockmanship, farms at Waimate West, Massey University and Ruakura Agricultural Research Centre have produced the equivalent of a "self-contained" 450 to 500 lb butterfat per acre per annum, but their pasture management has not been ideal. Interestingly, Davidson (1965) found that farmers had difficulty in repeating research results, particularly in good years.

Maximum production per acre must be the aim, and the natural order places soil as first in importance, then plants and, lastly, animals. In this sense, it is unfortunate that New Zealand farmers are well supplied with land and can consider animal requirements first — numbers related to winter feed supply; spring pasture "controlled by taking the top off" ; conservation of surplus herbage undertaken reluctantly. Smith (1965) reported good production using 1½ cows per acre per annum and very little winter-fed hay. This indulgent and inefficient approach to pasture utilization permeates to the hardest hill country.

PRODUCTION OF HERBAGE

At Palmerston North, mown ryegrass pastures produced 140 to 180 lb dry herbage per acre every day in early summer and 30 to 40 lb per acre per day in winter (Brougham, 1956; 1960). If fully-fed Jersey cows require approximately 28 lb or 20 lb dry herbage per day, when milking or dry (Hutton, 1962), this growth might have supported at least 6 milking cows per acre in summer or 2 dry cows per acre in winter. Lowland sheep might have been 7 to 10 times more numerous (Coop and Hill, 1962). Brougham (1958) showed that such production was possible where *at least* 3 (winter) or 7 (summer) layers of ryegrass leaf lay between the soil and the sky at any point within a pasture, and where higher leaves were removed when the lowest placed leaves were cut off from light. Judgement of when and how to graze must be based on this result and other similar results for other pasture species.

UTILIZATION OF HERBAGE

Utilization of pasture herbage has problems, two of which are dominant : (1) The difficulty in equating animal numbers with seasonal growth; (2) The uneven effects which animals cause during grazing.

A constant stocking with approximately 1 milking cow per acre caused approximately 75% of available herbage to be left after the average grazing (Campbell, 1966), whereas where pasture supply and animal demands were better equated (Schothorst, 1963; Muller, 1965), mean overall. losses from grazed pastures were about 40% per annum, being least on firm soils. Brougham (1959) suited sheep numbers to the growth of vigorous ryegrass-white clover pasture and recorded daily growth rates of 80 to 100 lb dry herbage per acre in summer and 10 to 25 lb per acre in winter- less than under mowing alone, but high nevertheless. On irrigated Victorian pastures (Murphy and Hayes, 1964), seasonal stocking up to 30 crossbred Merinos per acre yielded 200 to 230 lb wool plus 400 to 550 lb liveweight gain per acre per annum. In similar fashion, Browne (1967) has produced 700 to' 800 lb liveweight gain per acre per annum with beef cattle on Irish pastures. Thus, fixed animal numbers must mean poor utilization in a simple grazing system.

These workers generally made full practical use of the herbage available, and this is a restrictive practice (Weeda, 1965), because inadequate leaf cover makes only partial use of available light energy.

In practice, animal demands change, as exemplified by farmers bringing cows and ewes to parturition weeks before spring pasture growth begins. Some use is made of autumn-saved pasture, but, because dead material always accumulates under long growth (Brougham, 1958; Hunt and Brougham, 1966), this is only worth while where stocking is light and waste immaterial. Hence efficient utilization almost certainly requires conservation of surpluses, and these *can* appear where animal intake is regulated to ensure full feeding without waste from trampling and fouling. Greenhalgh (1966), with Friesians grazing pasture, offered 35 to 55 lb dry herbage per cow per day and recorded intakes varying only from 26.1 to 27.7 lb per cow per day. Leafy herbage is usually highly digestible (e.g., Minson *et al.*, 1960; Dent and Aldrich, 1966) and suited to fast animal production (Armstrong, 1964). Eadie, Hill Farming Research Organisation, Edinburgh, found only 40% digestibility for dead material, which was plentiful at the end of winter. Thus, animal productivity may guide judgement regarding underfeeding, but it will *not* guide judgement on waste. Conservation harvests should aim to replace grazing only.

PASTURES AND NITROGEN

Special mention must be made of clover growth, which has been measured (Sears, 1953) to be responsible for an input of 350 to 400 lb nitrogen per acre per annum in highly productive ryegrass plus white clover pasture, at no direct cost. But irksome adjustments to management are needed to maintain clover vigour. In the United Kingdom, uncertainty of white clover growth, low subsidized cost of fertilizer nitrogen (N.Z.$0.05 per lb N at farm gate), and increased ease of farming are reasons for a rising interest in the possibilities in "pure grass plus fertilizer nitrogen" pastures. Several workers (Castle and Reid, 1965; Brockman, 1966; Cowling, 1966; Shaw *et al.*, 1966) indicate that fertilizer nitrogen will give maximum production only where properly managed pure grass is used. In New Zealand conditions, this approach may be difficult to justify. In an Irish beef experiment (Browne, 1967), supplementation of "clover" nitrogen with fertilizer nitrogen was barely economic. It is probable that, in New Zealand, only spring use of fertilizer nitrogen to promote early growth may be justified, and then only if forms other than sulphate of ammonia are used.

ANIMAL EFFECTS

Uneven animal effects are commonly represented by dung and urine patches and by selective grazing. Alder, Hurley, and Lancashire, Palmerston North, found that oesophageal fistulated cattle and sheep preferred white clover herbage, while Lancashire (1963) recorded that sheep on short pasture consumed quantities of clover stolons. Uneven distribution of excreta has been exemplified by set-stocked Merinos (Hilder, 1966) who deposited 30% of their dung on less than 5% of the pasture, and by dairy cows (Goodall, 1951). The writer (Edmond, 1965) noted that only 30% of the area of a "well managed", rotationally-grazed dairy pasture was influenced by dung and urine.

Concentration of animals may overcome much unevenness, but heavy pasture damage may result. Most evidence (Edmond, 1966; Brown, 1967 ; S. C. Altena, pers. comm. 1967) indicates that repeated heavy treading will seriously reduce pasture productivity. Oestendoorp, Netherlands, and Gleeson, Ireland, have successfully folded animals to secure efficient pasture utilization with little treading damage — grazing only when soil is stable. Aids such as feeding platforms can help, but protracted or repeated use may be suspect, and, unfortunately, farm-scale return of excreta to pastures is still difficult. Most United Kingdom farmers consider the muck heap to be a liability.

SET-STOCKING

Set-stocking is preferred by sheep farmers, and Inglis (1965) believes that it maintains a relatively efficient fertility cycle. With seven Merino ewes set-stocked per acre, Willoughby (1965) found that any one pasture plant was subject to defoliation on average every 20 days or so, and he suggested that death and decay of herbage are very important in set-stocking. Such wastage occurs in New Zealand and might be controlled by increasing animal numbers. However, unless stock concentration is controlled and conserved feed offered in the winter, grazing pressure may seriously damage pasture in a number of situations.

UNKNOWN FACTORS

Available data do not permit calculation of practical stocking rates. There is a serious lack of animal behaviour data, particularly relating to irritability, which will be increasingly important under closer folding and more frequent moves. There is no recommended method for ensuring that animals graze pasture at any desired height. Conventional grazing, with excreta returned directly to the pasture, has yet to be compared in practice with "on-off" type grazing involving the return of excreta by devices such as irrigation. A machine is needed for harvesting and transporting surpluses of herbage, anywhere at any time, without damaging pasture. And so on. It is suggested that stocking rates may reasonably be more than double the rates currently accepted as being high.

THE PROSPECT

Developments overseas must be studied, but the virtual absence of subsidies in New Zealand (Johns, 1967) must inevitably cause us to develop our own farming systems. To approach maximum production of animal products per acre, all farming operations will need to be continually reviewed — biology, particularly in agriculture, is always active, never static. It will be necessary to have adequate drainage and/or irrigation and uninterrupted fertilizer programmes, correct use of vigorous species according to their growth characteristics, regulation of animal intake and treading, effective return of accumulated excreta, efficient conservation and disposal of herbage surpluses and easy and efficient handling of animals. It is likely that adequate access races (especially on sheep farms), movable fences and aids such as feeding platforms will become commonplace. Thus, a great deal of progress may be made by solving present problems using the knowledge currently available -without recourse to sophisticated or costly techniques.

In Europe and U.S.A., climate, circumstances and convention have caused the development of costly and complex farming systems, in which pasture is but one of a number of animal feeds. Some unwieldy methods are tolerated. One farmer applied 1 ton nitrogenous plus 4 to 5 cwt other fertilizer per pasture acre per annum. Another grazed his stock outdoors for only 6 weeks per annum. T. Jackson, Edinburgh University, by holding and hay feeding hill country ewes on a slatted area for six winter months had improved stocking rate, utilization and quality of his hill country pasture. But it was most significant that M. Walshe, Fermoy, Ireland, was using New Zealand-style methods and mediocre cows to produce 580 gal milk per acre per annum from year-long grazing of grass plus clover pastures, and home-grown silage. His overheads were small, production was relatively high and the economic result beyond question.

CONCLUSION

New Zealand's natural resources permit her to lead the world in the production of low-cost pasture feed and relatively low-cost agricultural products, but the international climate requires that efficiency be improved forthwith. In the near future, improved efficiency will stem largely from improved pasture utilization. Such improvement can lead to substantial increases in productivity per acre, without the need to resort to expensive and novel aids.

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DISCUSSION

Mr Edmond appears to disagree with subsidies, yet all round the world people are better fed because of subsidies.

In the United Kingdom, subsidies aim to ensure constant supplies of cheap foods for the consumers. In New Zealand, the aim is increased productivity and ideally this might best be assisted by sensible provision of loans to worthy individuals from a fund outside the normal conservative sources of finance; such loans would have an effect similar to subsidies.

If, on steep sheep plus cattle country, one was stocked up for full utilization of the grass, what would the solution be, if, in the event of severe drought, there was no available supplementary fodder?

At present, I think the only progressive answer is that the farmer should yield some independence by seeking national assistance for fodder, as did the Taranaki farmers after a recent brief drought.

The average farmer is not yet concerned with the production of 800 lb butterfat per acre per annum. Increases in productivity must be interpreted in terms of present economic conditions, both on the farm and nationally. To implement the changes called for in this paper, legal and fiscal measures would be needed which may not be what people want. Would Mr Edmond comment?

Your arguments are the same as those presented when best productivity was 300 lb butterfat per acre per annum, yet productivity has continued to increase apace. New Zealand has operated in a favoured environment, possibly a fool's paradise. Now, as current export earnings indicate, the situation is becoming difficult. To retain economic security, I think that it is going to be a case of "what the people *have* to do" rather than "what the people *want* to do". This paper is aimed to spur progress, and as such is relevant.

COMMENT (A. T. G. MCARTHUR) : Increases in production from, say, 300 to 350 lb butterfat per acre per annum are usually highly profitable. In my opinion, we are nowhere near the point where extra production is not highly profitable.

How can pasture herbage be converted into animal products with maximum efficiency?

The question requires a lengthy answer. The first essential is to allow the pasture to grow. In some cases, grazing may be too low, and it may possibly pay to take the cows round more quickly for a while, and to consider putting the stock on pasture only for the time they need to secure full intake.