POTENTIAL FOR THE RADICAL IMPROVEMENT OF THE HIGHLAND SOURVELD*

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The Highland Sourveld of Natal is 1 804 733 hectares in extent. Of the 1 233 455 hectares which are owned by white farmers, 1 118 512 hectares (90,7 per cent) remain as veld and carry 400 049 mature livestock units (stocking rate = 0,36 mlu per ha). The annual rainfall in the area is between 800 and 1 500 mm with an average of 920 mm. There are usually about three dry months and the mean annual temperature varies between 13°C and 15°C. Cool summer conditions are followed by regular severe frosts depending upon local conditions (Anon 1972). The climate and particularly the reliability of the rainfall therefore lends itself to growing highly productive pastures when once soil nutrient deficiencies have been corrected.

The new growth of the veld in the Highland Sourveld develops relatively early in the season and provides grazing for about 220 days. An important characteristic of the veld grasses is however that their nutritional value falls off rapidly in the late summer and early autumn. Intensification in the management of the veld can result in an improvement in its carrying capacity of from about 0,36 mlu/ha to about 0,86 mlu/ha. Harwin (1974) has shown however that although this improvement results in a significant increase in the financial returns which may be expected from a cow and calf beef enterprise maintained in the summer on veld alone, the returns are small when compared with those from cultivated pastures and particularly those involving low cost operations. The potential mean carrying capacity of such pastures is about 3,5 mlu/ha for about 240 days. Temperate pastures can be grown on both dryland and under irrigation and can be used for both summer and cool season grazing. They can also be useful in increasing the grazing duration and thus reducing the dependence of the livestock farmers on the conserved products of arable lands for winter feed.

The arable lands of the Highland Sourveld have a high cropping potential and while much of the land is at present used to grow forage crops (hay and silage) one of the most important objects of researchers and producers alike should be to reduce the dependence of the livestock industry on arable land. In so doing it is possible to increase the area of land available for the production of human food.

In improving the veld by radical techniques one of the important questions which should be answered is the nature of the improvement technique which should be applied, and the extent to what it is used. Harwin (1974) has clearly shown that the profit margin, both per unit area and per unit animal increases significantly as the degree of intensification is increased. The most important natural limiting factor restricting complete pasture intensification in the Highland Sourveld is the slope of the land. However, an analysis of the situation clearly indicates that in spite of these restrictions the carrying capacity of the Highland Sourveld can be greatly increased by using radical techniques. The results of this analysis are shown in Table 1 and confirm the claim that, even though liberal allowances are made for all possible errors, there is nevertheless the possibility for increasing livestock numbers significantly. In considering these results it is of interest to note that the greatest potential for increasing the number of livestock which can be carried, lies in those areas with the steeper

TABLE 1 *Potential for intensification in the Highland sourveld of Natal*

Land class (% slope)(1)	Proposed pasture type	Area (%)(1)	Area ha	Potential stocking rate (mlu/ha)	Potential livestock population
0 – 8	Veld totally replaced	16,4	189 028(2)	3,5	165 398
0 – 15	Low to high cost pasture	15,8	176 729(3)	3,0	265 086
> 15	Fertilize and oversow and some mechanical fortification	25,0	279 643	2,5	699 107
	Fertilize and oversow only	31,9	356 824	2,0	713 648
Bottomland	Total replacement	8,4	93 955	2,5	234 887
Forest	–	2,0	22 370	–	–
	Total/Mean	100,0	1 118 549	1,77	2 078 126

Existing population = 400 049 mlu (= stocking rate of 0,36 mlu/ha)
Estimated potential improvement = 400% (= stocking rate of 1,86 mlu/ha)

(1) Scotney, D.M. Personal communication
(2) Assume that only 1/4 of total area is available
(3) Assume that only ½ of total area is available

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slopes. It is significant, however, that research work in the past has been directed at the two extreme situations viz the veld and intensive cultivated pastures. For this reason the present research program in Natal which is directed at the steeper slopes appears adequately justified.

Having assessed the potential for Radical Veld Improvement in the Highland Sourveld it is now necessary to examine the relative merits of each of the techniques discussed above as well as the manner in which they are optimally used and integrated in animal production programs.

Conventional high cost pastures (dryland and irrigation)

The total replacement of the veld by ploughing and establishing grass-dominant pastures under irrigation using conventional techniques is expensive but nevertheless financially rewarding. Although this claim has not been verified by experimentation, Harwin (1974) extrapolating from experimental data, has shown that this is true for beef cow/calf enterprises. In practice it would seem unlikely that irrigated pastures would be used to any great extent for grazing in large-scale beef operations. The principal reason for this claim is that in most instances the potential of these pastures with respect to both the quantity and the quality of herbage is too great. The only possible exception to this claim is in the case where these pastures are used to supplement dryland pastures in providing grazing for cows and young calves. Another justification for these pastures is in cases where high-quality grazing is required in the autumn so that yearling steers can achieve a desirable mass before finishing off and marketing.

High-quality dryland pastures, eg kikuyu maintained by a moderate fertilizer regime can be both highly productive and financially rewarding in both the cow/calf and weaner situations. (See Figures 1–6).

The indications are that although only about 60 to 80 kg N are required per hectare to maintain these pastures in a highly productive condition, the quality of the pasturage is too high for beef cows and their heifer calves (Table 2). It would seem that these pastures are best utilized by steer weaners and yearlings because a rapid mass gain achieved as cheaply as possible is required. These claims are verified by the data presented in Table 2 and Figures 1 and 2.

The cost of maintaining high-producing dryland pastures can be drastically reduced by combining into a single pasture and without nitrogen top-dressings compatible grasses and legumes. Such mixtures would include a mixture of red and white clover planted in alternate rows with grasses such as nylgrass or even kikuyu. The potential of such low-cost pastures is as great as that of the pure kikuyu pastures already discussed (See Table 2 and Figures 1 and 2) and for this reason are best utilized as suggested above.

TABLE 2 Relative merit of beef cow and calf and yearling enterprises (1973 – 74)

Pasture class	Cow and calf enterprise					Yearling enterprise			
	Mean stocking rate (mlu/ha)	ADG (kg) Cows	ADG (kg) Calves	Grazing duration (days)	Final mass of calves (kg)	Mean stocking rate (mlu/ha)	ADG (kg)	Grazing duration (days)	Mean final mass (kg)
Veld	0,79	–0,16	0,67	215	227,7	0,80	0,34	249	318,0
Fertilized veld	1,64	–0,05	0,78	201	239,5	2,49	0,79	219	300,7
Fortified veld	1,56	0,15	0,78	201	239,5	1,92	0,01	235	354,7
Eragrostis/nitrogen	2,31	0,08	0,75	187	225,9	3,13	0,47	219	338,8
Eragrostis/clover	2,49	0,09	0,74	187	223,2	3,42	0,60	263	393,3
Kikuyu	3,51	0,32	0,82	243	279,0	3,56	0,67	277	420,0
Nylgrass/clover	2,77	0,46	0,95	243	315,7	3,35	0,55	263	380,1

Low-cost semi-intensive to semi-extensive pastures

Recent research directed at examining the principles involved in re-inforcing the veld and so its gradual replacement with improved grasses and legumes has shown that this can be done and is a practical proposition on veld which would normally not be ploughed. In principle the methods used to achieve this are as follows:

(a) The veld is fertilized, heavily grazed and then oversown with improved grasses when its competitive ability has been sufficiently reduced. Oversowing legumes into the veld at this stage is unlikely to be successful in view of the restrictions imposed by the low pH and P status of most Highland Sourveld soils. Vigorously-growing grasses, both natural and oversown would be too competitive for legumes established by broadcasting.

Until recently the fertilization of the veld has not been highly regarded as a method of improving its productivity. The principal reason for this is that fertilizers have in all instances resulted in the disappearance of the climax veld grasses (eg *Themeda triandra*) and their replacement by various pioneer grasses such as species of *Eragrostis* and *Sporobolus.* In considering this situation it was felt that the reaction of the veld to fertilizers could be usefully used to generate high-producing pastures by avoiding the successful invasion of undesirable grasses with the successful introduction and establishment of imroved grasses such as *Eragrostis curvula* and cocksfoot (*Dactylis glomerata*). The technique has been successfully applied in small-plot experiments as well as in large-scale grazing trials and veld reinforcement programmes. The results have essentially been a considerable improvement in the carrying capacity.

(b) Improved grasses and legumes can be sodseeded into the veld by mechanical means. This technique has been successfully used to establish legumes in the veld. The most important reasons for the successes achieved are that competition from the native grasses is eliminated and high concentrations of lime and superphosphate are banded into a well-prepared micro seedbed. Treatment such as this is conducive to the rapid early growth of the introduced grasses and legumes. No concerted efforts have been made to introduce grasses into the veld by sodseeding because the seed of vigorous stoloniferous and/or rhizomatous grasses has not been easily available. The availability of kikuyu seed now makes it possible to sodseed this grass into the veld and to couple its development with the fertilization and oversowing techniques discussed. The object of such a procedure would be to develop long-duration pastures which have a high carrying capacity.

The results obtained from experiments in which steers were grazed on pastures representing various levels of intensification have been analysed and published elsewhere (Thereon & Mappledoram, 1974).

These data show that the profitability of a beef enterprise increases with an increase in the degree of intensification in the forage production program. The principal reason for this is that both quantity and the quality of herbage available to the grazing animal is greatly increased. In addition there is an improvement in the duration of the grazing season.

Table 2 verifies this claim in terms of both yearling and a cow-and-a-calf enterprises. Figures 1 and 2 clearly indicate the relative changes in the performance of yearlings and cows and calves when grazed in different classes of pasture. The most important feature of the data presented in these curves is the improvement in the performance of animals which results from an intensification of forage production when compared with that of the veld. This deduction holds irrespective of whether comparisons are made between individual animals or between the performance of animals grazing similar areas.

In a large-scale grazing trial in East Griqualand fertilizing the veld and oversowing with cocksfoot (*Dactylis glomerata*) has increased the carrying capacity of 90 ha of veld from about 110 grazing days to over 360 grazing days per hectare per annum without any reduction in the performance of the animals. In addition to an increase in carrying capacity, the grazing season has been lengthened by grazing excess summer growth as foggage. This has resulted in a lengthening of the grazing season by at least three weeks.

While there is little doubt that the economic intensification of livestock production can be achieved by the radical improvement of the veld, there are however certain problems which require attention by researchers and producers alike. Some of these problems are as follows:

(i) Intensification in the pasture production programme requires more sophisticated management and attention to detail than that required when managing the veld if the efficiency of the animal production system as a whole is to be improved.

(ii) Of particular importance is the maintenance of the sward in a productive condition so as to avoid a degeneration of the pasture through the successful invasion of undesirable pioneer grasses. A vigorous sward depends upon the maintenance of a desirable fertility status in

the soil. An accurate assessment of the amount and frequency of fertilizer applications is complicated by the grazing situation and requires constant monitoring and correction.

(iii) The data presented in Figures 3, 8 and 9 show that a decline takes place in the rate at which animals gain in mass. The decline takes place during the latter half of the season and varies with the class of pasture. The decline in the rate of mass gain may be associated with certain animal factors but it is more likely that the principal reasons are a decline in the quantity and the quality of the available herbage.

Regarding the quantity of herbage, it is known that the rate of growth of most grasses and legumes declines in late summer and autumn and is low when compared with that in spring. Coupled with this is the fact that the stocking rate imposed upon the pastures increases with the growth of the animal (see Figures 2, 5 and 6). It is also highly likely that the quality of the herbage decreases with time in spite of the fact that animals are grazing pasture regrowth. It must also be remembered that the changes in both the quality of the herbage and the quantity available are likely to accentuate the effects of each other and particularly so at a period when the demands of animals are increasing considerably.

If the decrease in annual growth rates are of concern, then there is a need to examine ways and means of rectifying the situation. It would seem at this stage that the only opportunity for achieving this is by manipulating the botanical components of the sward and by strategic fertilization so as to maintain a continuous forage flow.

(iv) Figures 2, 6 and 7 show that from a cattle breeding point of view the mass gains of female animals grazing high quality pastures are probably excessive and not inducive to high conception rates being attained. This is an important factor and indicates a clear need for research into the strategic development and management of pastures with a view to optimizing forage resources. Other approaches whould be to restrict the development of pastures to a particular level of intensification and the generation of special purpose pastures to meet the needs of particular stock at a particular time. Another alternative would be to manipulate the stocking rate with respect to fertilizer application. With limited knowledge of the subject it would appear that a great deal could be gained by studying the interaction between stocking rate and the level of fertilizer application with a view to optimizing economic returns from a cattle production programme based on radically improved veld.

(v) An important characteristic of radically improved veld in a practical farming situation is that the high carrying capacity which is rapidly generated serves to reduce the stocking pressure on the remainder of the farm most of which therefore becomes unproductive. Clearly therefore it is vital to improve radically the veld at a rate which is commensurate with the demands of the livestock population. In addition it should be pointed out that although the radical improvement of the veld is financially highly rewarding, additional capital is required at a time when capital is also required to increase the cow herds. For these reasons therefore, the development of production programmes involving the radical improvement of the veld and the building up of cattle population requires careful planning and optimization.

Summary and conclusions

There is ample evidence to substantiate the claim that sophisticated and economically viable beef cattle production programmes in the Highland Sourveld are dependent upon the radical improvement of the veld. Nevertheless, research is required to find solutions to some of the problems which have been exposed as a result of the large scale practical application of some of the various RVI techniques which can be used. Other practical problems such as financing a veld improvement programme have been exposed in practice and serve to indicate the precautions which must be applied in future so as to achieve a well balanced and properly integrated development programme in which all the various production factors are properly optimized.

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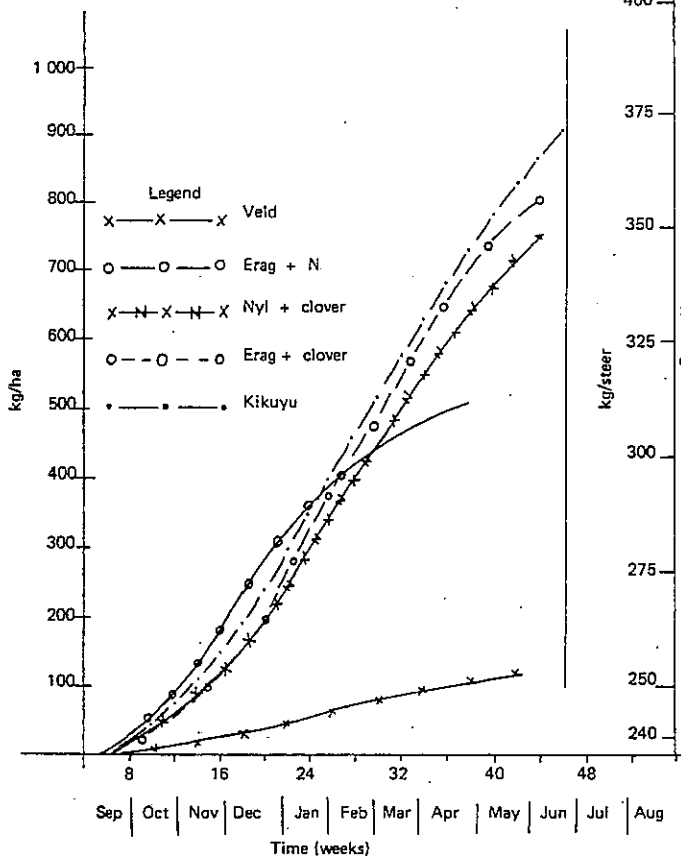

FIG 1 *Mass gain of steers (kg/ha) 1973/74 season*

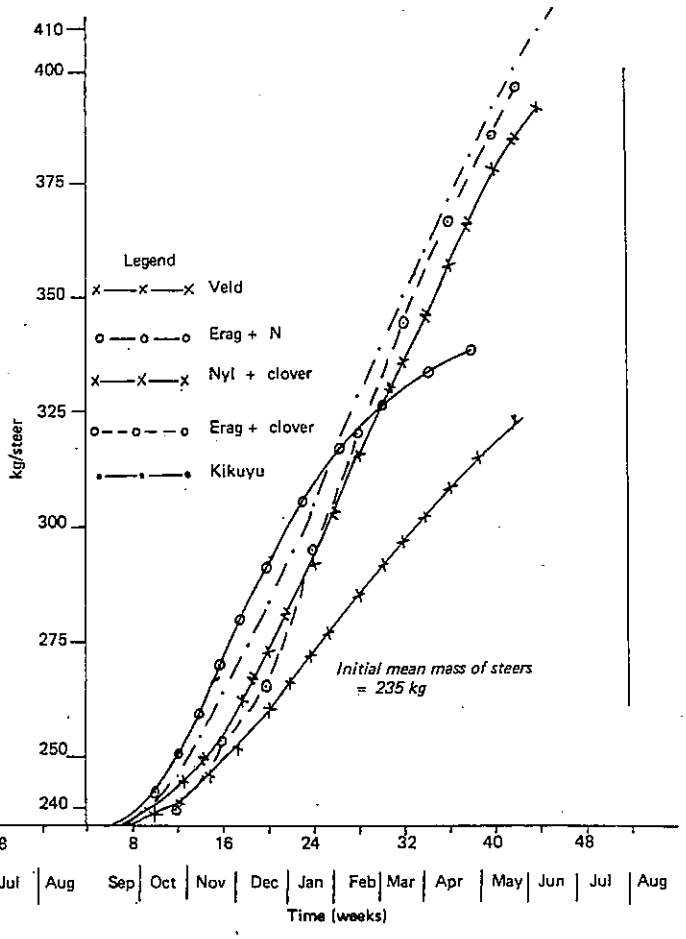

FIG 2 *Mass gain per steer in kg 1973/74 season*

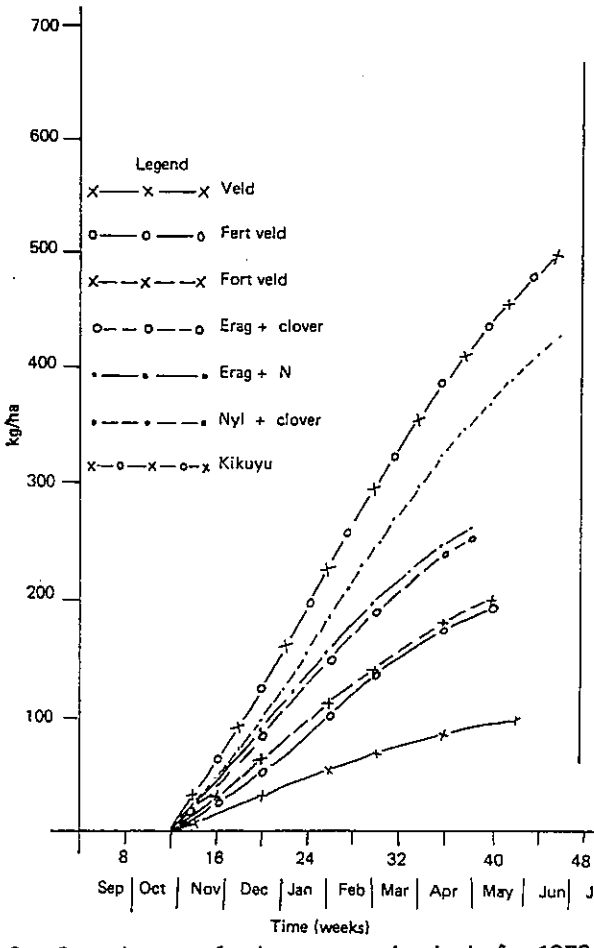

FIG 3 *Growth rate of calves mass gains in kg/ha 1973/74 season*

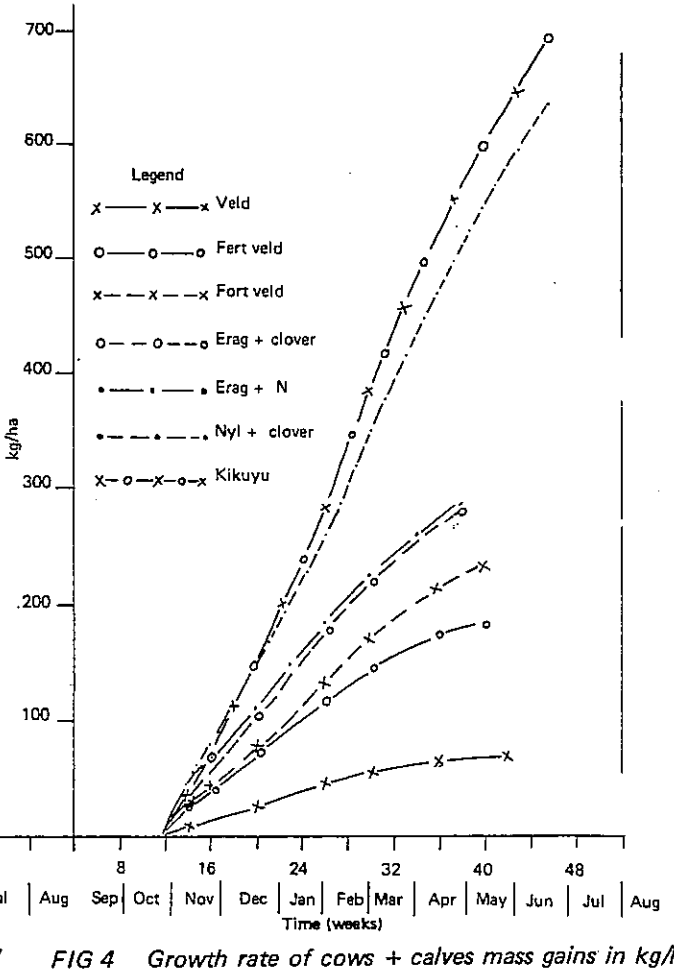

FIG 4 *Growth rate of cows + calves mass gains in kg/ha 1973/74 season*

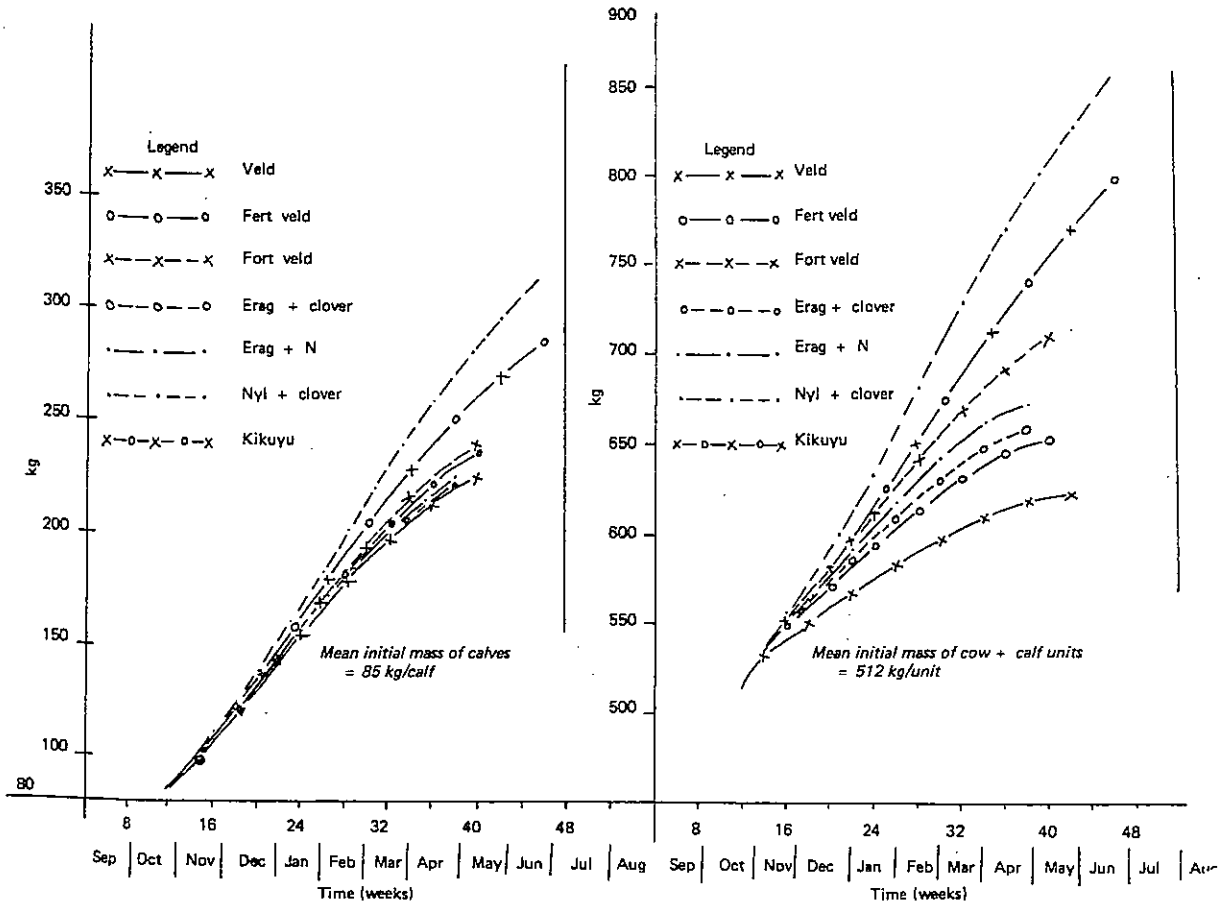

FIG 5 Mass gain per calf in kg 1973/74 season

FIG 6 Mass gain per cow + calf unit in kg 1973/74 season

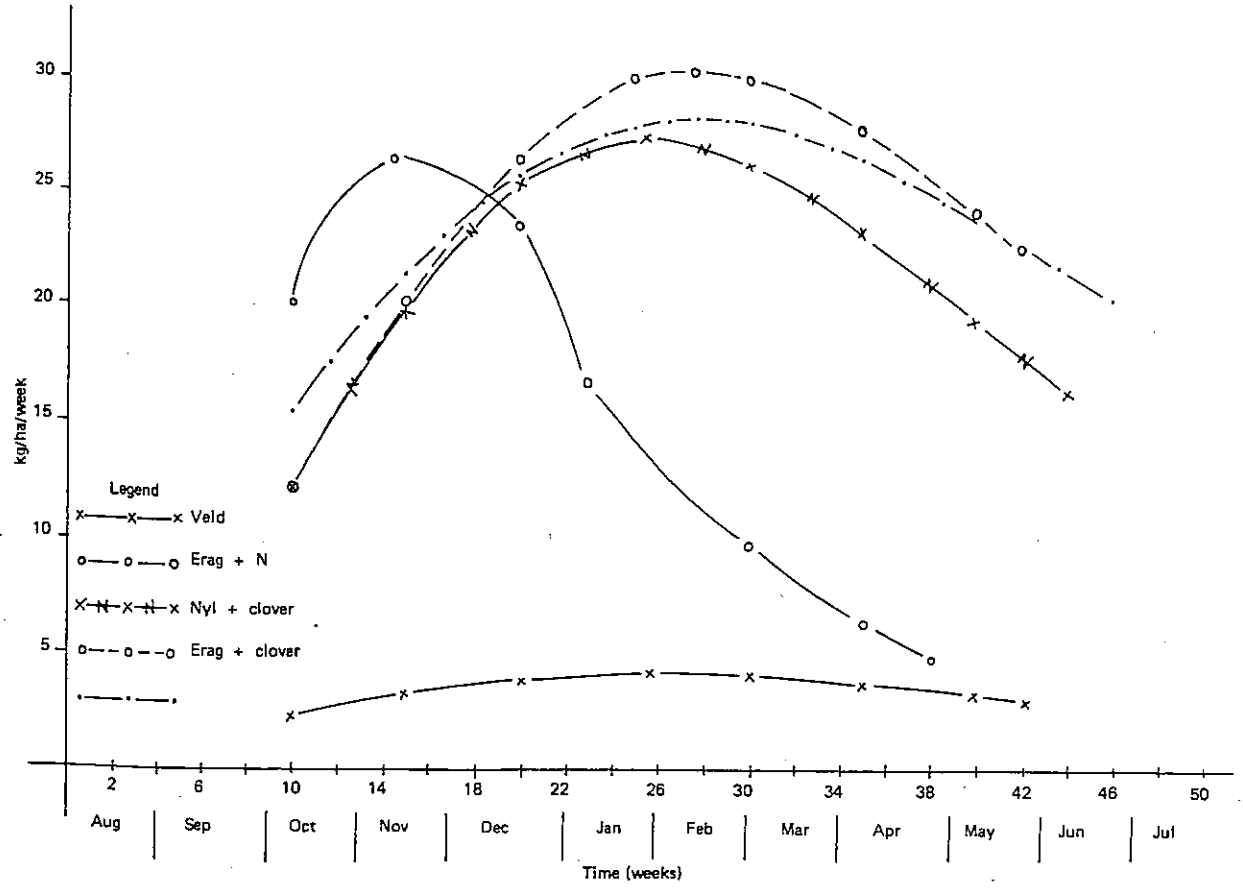

FIG 7 Curves showing the growth rate of steers over the summer grazing period 1973/74 season
Gains in mass in kg per ha per week

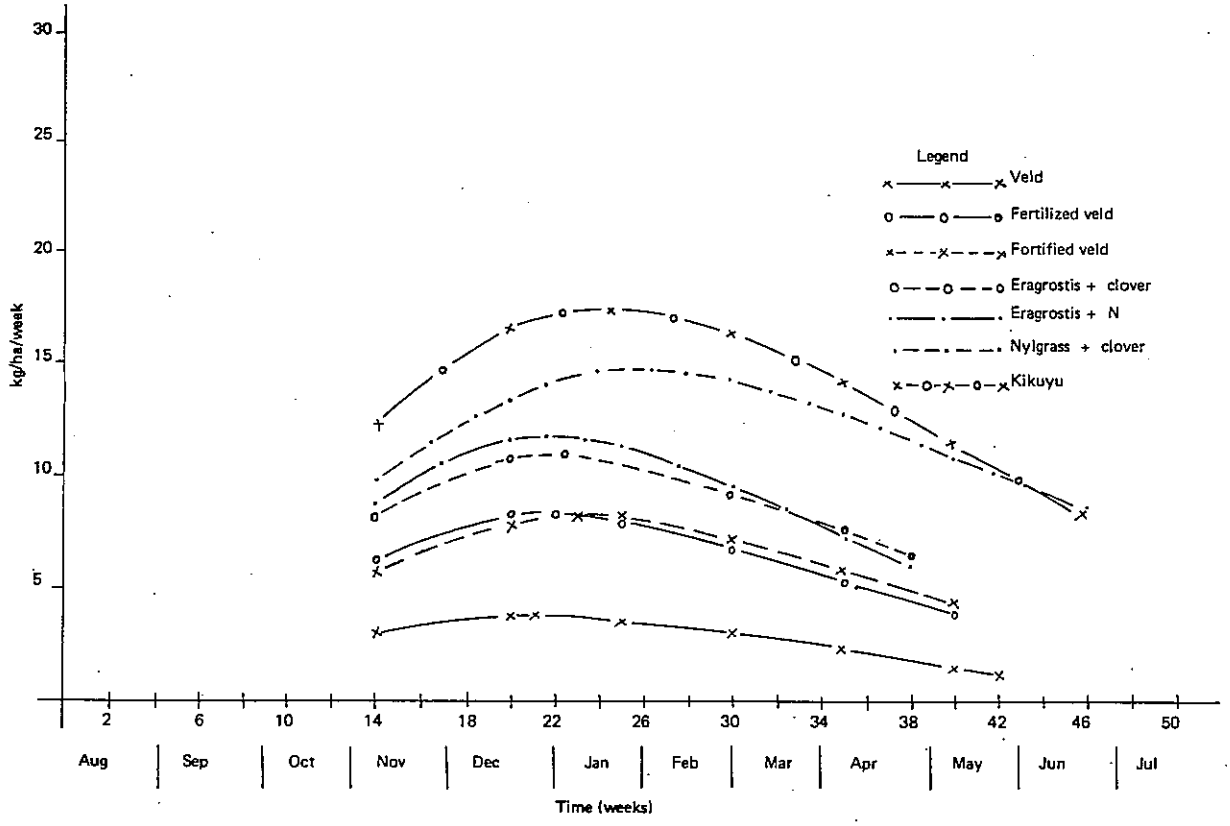

FIG 8 Curves showing the growth rate of calves for the summer grazing period 1973/74 season Gain in mass in kg per ha per week

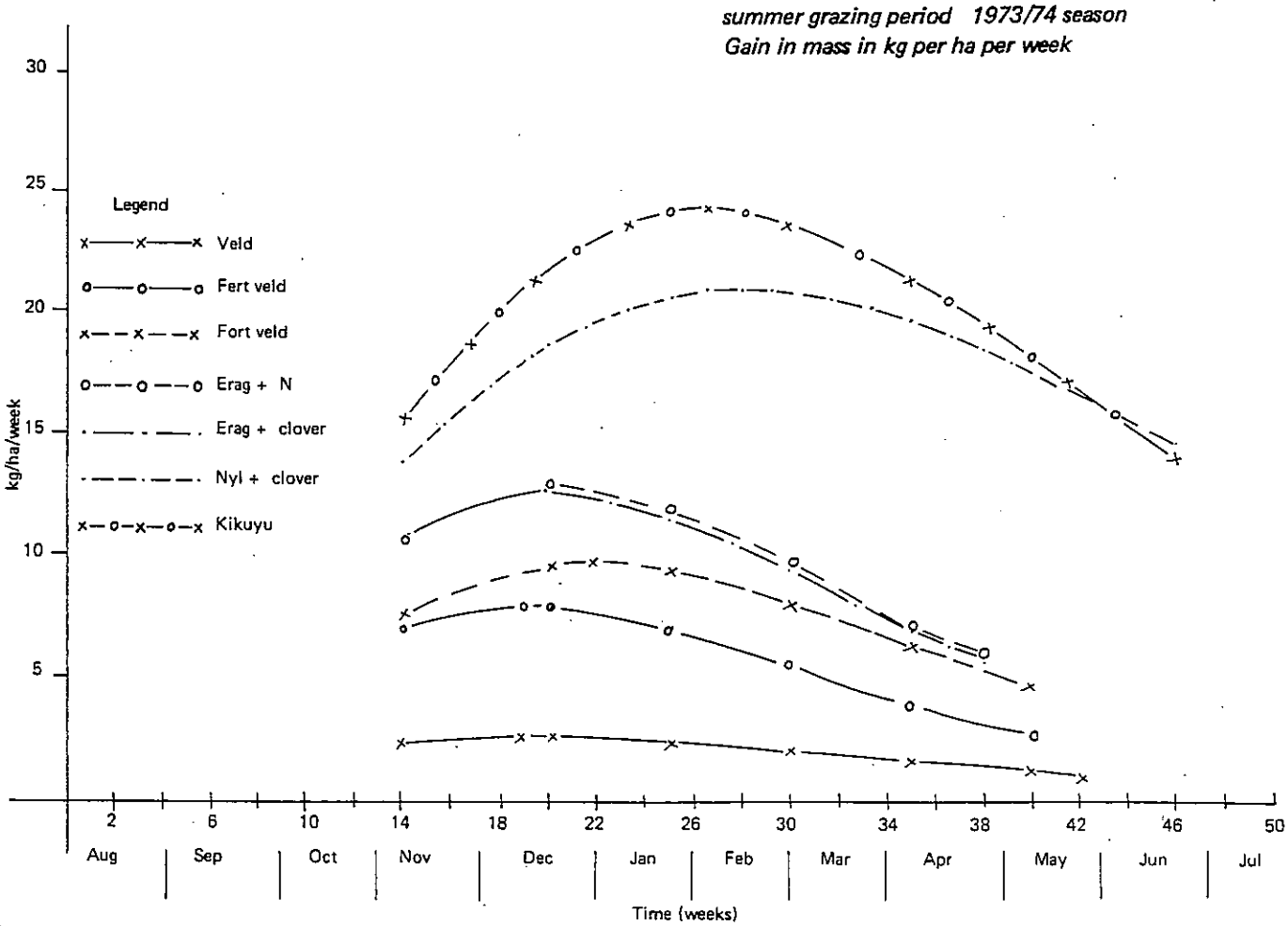

FIG 9 Curves showing the growth rate of cows + calves for the summer grazing period 1973/74 season Gains in mass in kg per ha per week