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INTENSIFICATION OF THE BEEF-COW HERD

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Seldom has a segment of the agricultural industry enjoyed as much publicity or been in such a dynamic position as the beef industry at the present time. With a projected deficit of at least 500 000 carcasses by 1980 and a long-term target of a minimum of 5 million carcasses by the year 2000 it has become a matter of considerable urgency that the rate of production be increased. There seems little doubt that the expected growth in population numbers and buying power and the potential export market will absorb any amount of beef that can be produced in the Republic.

The basic problem facing the beef industry is one of inadequate supplies of the basic raw material in the form of the weaner calf. An increase in the supply of weaner calves can be achieved through the following avenues:

(i) Increasing the proportion of effective breeding cows in the National herd through the earlier marketing of beef animals.

(ii) Increasing the output of weaner calves per 100 cows through an increased input of management and technology.

(iii) Increasing the number of effective breeding cows through an improved stocking rate in the production areas. This can be achieved by improved forage production systems involving both pasture and fodder crops.

Intensification of beef production is normally associated with the intensive finishing of market animals and the intensification process in the cow herd seldom receives the attention it deserves. With a chronic shortage of weaner calves at the present time it is important that due consideration be given to methods of increasing female productivity.

Importance of cow herd in the production cycle

In generating improved profit equations for beef production, the emphasis must inevitably fall on improving efficiency in the cow herd. This is particularly evident from a partitioning of the total nutrients into the various phases of the production cycle which can be summarised as follows:-

	Percentage of total T.D.N.
Rearing of replacements	16
Maintenance of cow and calf to weaning	52
Fattening weaners	32

The object of this paper is to direct attention at various techniques for the improvement in productivity of the beef-cow herd through intensification.

Definition of Intensification

To the economist, the term intensification refers to an increase in the ratio of capital to land or labour, while to the animal scientist it may simply imply the handling of livestock under confinement. In general terms, however, intensification is usually taken to mean the application of practices designed to increase productivity.

For the purposes of this discussion intensification is defined as the increased input of the production resources of capital, labour, management and technology in a logical sequence in order to obtain maximum marginal returns. Since land is ultimately the limiting production resource, intensification will be considered essentially in terms of increased productivity per unit area and land is therefore held constant.

I. Strategies directed at intensification through improved animal performance

Initial attention will be directed at technological and management inputs aimed at maximising marginal returns from the cow herd with a minimum of capital input. These strategies are primarily concerned with stepping up the number and mass of weaner calves per 100 cows at a reduced cost per breeding unit. Since the calving season is the pivot around which the beef production cycle revolves, it is appropriate that initial attention be directed at this basic consideration.

1) *Breeding/Calving Seasons*

The purpose of controlled breeding seasons is essentially two-fold. Firstly it enables adjustment of breeding and calving to take advantage of the most favourable environment for the production cycle and secondly it facilitates optimum management control. Equating the demand for nutrients by the animal and the supply of feed or "fodder flow" to formulate effective production strategies is one of the major priorities in the beef production process.

a) *Optimum reproductive performance.* Optimum reproductive performance is a function of early onset of oestrus after calving, conception at first service and decreased losses at calving. Increasing the proportion of cows bred early in the breeding season is vital to increasing reproductive performance in the beef herd. The length of time from calving to the start of breeding, interval from calving to first oestrus, age of cow and pre- and post-calving nutritional levels are all important factors determining whether a cow will show oestrus early in the breeding season (Wiltbank, 1968). Cows which became pregnant during the first 30 days of the breeding season one year had a conception rate of 91% the following year. By contrast only 54% of the cows becoming pregnant during the last 30 days of the breeding season were pregnant the second year (Table 1).

Table 1

Effect of calving date one year on pregnancy rate following year (1)

Calving Period	Number	No. presented for AI Total	%	First conceptions on Females cycling Total	%	Cows pregnant 2nd year Total	%
Day 1 – 30	190	187	98	106	55	173	91
Day 31–60	190	181	95	95	50	168	88
Day 61–90	180	126	70	57	31	98	54
TOTAL	560	494	88	248	44	439	78

(1) Source: City Engineer. City Council Cattle Farms. Johannesburg.

The interval from calving to first oestrus has been found to be affected by suckling, age of the cow and the pre- and post-calving nutritional value. Young cows have a 15–25 day longer interval from calving to first oestrus (Wiltbank, 1968) and hence require a longer rest period, while an adequate energy level before calving is essential if cows and particularly young cows are to show oestrus by 60–80 days after calving (Wiltbank, Rowden, Ingalls, Gregory & Koch, 1962; Dunn, Ingalls, Zimmerman & Wiltbank, 1969).

Conception at first service is essentially a function of the interval from calving to breeding and the level of energy following calving (Wiltbank, 1968). It is known that conception rate at first service increases until approximately 90 days post partum (Cassida, Hauser & Tyler, 1968) and hence the period from calving to breeding is of importance. Level of energy after calving has been shown to affect conception rate in some studies (Wiltbank *et al.*, 1962: Dunn *et al.*, 1969). Recent studies by McClure (1970) with lactating dairy cows have shown that cows losing approximately 1% in body mass per week had a mean blood-glucose level of 28,4 mg/100 ml and a first service pregnancy rate of only 16%. By contrast, cows on a similar feed supplemented with dairymeal lost little weight and had a mean blood-glucose level of 39,3 mg/100 ml and a pregnancy rate of 90%. It was concluded that carbohydrate was the limiting nutrient.

Losses at or shortly after birth can be markedly reduced by management and in this respect controlled breeding seasons have an important advantage. Various workers have shown that both too high and too low levels of nutrition can be extremely detrimental and that calving difficulty is greatly increased in fleshy overfat heifers and cows (Turman, Pope & Stephens, 1965; Pinney, Stephens & Pope, 1972).

b) *Optimum weaning performance.* The effect of season of birth on calf growth to weaning has been well established and in general autumn, winter and early spring calving is more favourable for optimum calf growth than calving later in the season (Harwin, Lamb & Bischopp, 1967). This normally results from a more favourable (flatter) lactation curve in terms of milk supply to the calf and more favourable grazing conditions when the calf is older and hence better able to utilise forage.

In the eastern areas of South Africa the practice of autumn, winter or early spring calving is associated with increased supplementary feeding of the cow-herd in order to ensure optimum reproductive performance. There is a lack of research information on the biological and economic implications of different calving seasons but the results of a budget analysis recently conducted by Bishop, Lyle & Broom are summarised in Table 2. It is evident that on the basis of this analysis winter calving realises a 24% higher profit than autumn calving which is the least profitable system.

Table 2

Budget analysis of various calving seasons in the highland sourveld of Natal (1)

Season	Feed Costs (R)	Income (R)	Margin over feed costs (R)
Early summer (Oct 1 – Dec 15)	7 111	13 630	6 519
Winter (June 15 – Aug 31)	6 169	13 984	7 815
Autumn (March 15 – May 31)	7 521	13 709	6 188

(1) Based on 100 cow herd

c) *Basic Breeding/Calving Strategies.* It is evident from the preceding discussion that the following are basic considerations in formulating optimum calving strategies:

(i) Of primary importance is equating the demand for feed by the cow and calf and the supply of feed to formulate effective season of calving strategy.
(ii) Where controlled breeding seasons are practised the length of the period is of importance for optimum productivity of the cowherd. While 45 days is the theoretical optimum a period of less than 70 days is seldomly recommended in practice.
(iii) With the improved forage systems likely under more intensive conditions, the "fodder flow" will be extended. Under such situations where management input is high it is questionable whether anything is to be gained from fixed breeding seasons. Individual cows could merely be drafted for mating from 50 days post partum.
(iv) "Overmating" heifers from 20–40 days earlier than the cow herd and for a limited 42 day period will increase the percentage of cows being bred early in the season. Lifetime reproductive efficiency of females is also increased by this strategy (Spitzer, Wiltbank & Lefever, 1973; Lesmeister, Burfening & Blackwell, 1973). It is recommended that more heifers be mated than are required as replacements,to enable selection of those heifers that conceived early in the breeding season to enter the breeding herd. This practice has been used to good effect in various commercial herds in the Republic.

2) *Age at calving*

Age at calving is more closely related to efficiency of the beef cow than any other variable (Kress, Hauser & Chapman, 1969). Calving at 2 years of age is an accepted practice under higher levels of management and nutrition and increases the lifetime production of a beef cow by some fraction of one weanling calf (Pinney *et al.*, 1972). Information concerning the effects of age at first parturition on herd productivity is most limited and for this reason the energy efficiency of 2 years old cf. 3 year old calving was calculated on a production cycle basis for a breeding unit of 100 effective cows. The calculation of the T.D.N. requirements for this unit are summarised in Table 3.

Table 3

Estimated annual T.D.N. requirements for a reproductive unit of 100 breeding cows under two age at first parturition regimes

	Calving at 2 years		Calving at 3 years	
	Number	T.D.N. (kg)	Number	T.D.N. (kg)
Lactating cows	100	138 972	100	140 648
Pregnant cows	85	48 527	83	47 385
Heifers (7 – 19 mths)	15	18 145	17	17 348
Heifers (19–31 mths)	–	–	17	20 980
TOTAL HERD REQUIREMENTS		205 644		226 361

The calculation of the herd energy requirements for mature cows and for the replacement heifers was based on N.R.C. standards. The requirements for lactating 2, 3 and 4 year old cows were based on actual experimental results as reported by Kress *et al.*, 1969. Requirements for replacement heifers were based on a winter mass gain of 0,15 kg/day and 0,45 kg/day for heifers calving at 3 years and 2 years respectively. A summer mass gain of 0,5 kg/day was assumed for all heifers.

It is evident from Table 3 that the earlier calving regime resulted in over a 10% saving in T.D.N. over the production cycle. This was essentially the result of the reduced feed requirement for herd replacements in the case of the 2 year old calving regime. The herd output and efficiency in terms of livemass and monetary returns per annum are summarised in Table 4. A weaning percentage of eighty was assumed in both herds which can be substantiated by both research results and practical experiences. Calf mass at weaning was based on a normal age distribution of cows and recognised age of cow adjustment factors. Monetary returns were based on 50c per kg livemass for weaners and 36c per kg livemass for cull cows.

It is evident from Table 4 that over 10% less nutrients are required to produce a unit mass of weaner calf in a herd calving first at 2 years rather than 3 years of age. This implies that an increase in weaner calf output per unit area of over 10% can be achieved with an accompanying increase in nett profit. While criticism could be levelled at this exercise on the grounds of higher calf losses and lower reconception rates of first calvers in the early calving group, this has not been borne out from results under more intensive systems of feed and management (Pinney *et al.*, 1972; Bernard, Fahmy & Lalande, 1973; Bauer, 1965; Miles, 1973).

d) *Puberty.* Since heifers must be bred early in the first breeding season in order to calve at 2 years of age they should attain puberty at 13–14 months and breed successfully at their first or second oestrus. Studies by Wiltbank, Gregory, Swiger, Ingalls, Rothlisberger & Koch (1966) have shown that even in the early maturing British breeds this does present some problems. Of the Hereford, Angus and Shorthorn heifers fed to gain 0,45 kg/day during their first winter 35, 20 and 19% respectively had not reached puberty at 14 months. With the increased use of the higher producing larger breeds the question of age at puberty becomes extremely pertinent. The results of recent experience at the City Council farms, Johannesburg, deserves special mention. Conception rates on 15 month old heifers averaged 76, 64 and 43% for Simmentaler, Hereford and Charolais crossbreds respectively. While conception rates were 5–15% lower for heifers bred at 15 months cf. 22 months, subsequent studies with natural service suggested that this problem was associated with difficulties encountered in accurately spotting and inseminating young heifers under commercial conditions.

3) *Age of culling*

The productivity of a cow herd is influenced by its age and lower profits ensue if a cow is kept in the herd too long, due to diminishing productivity with age. This would appear a rather mundane consideration, but in fact the production and income consequences of alternative culling and replacement policies are of very real significance.

A recent study by Rogers (1972) has indicated that optimal age for replacement is influenced more by declining productivity after 9 years of age than by existing cattle prices or interest rates. This study suggests that although many variables must be considered, the retention of cows beyond 10 years of age is likely to result in reduced long-term productivity and profits in most situations.

The profit per cow in herds with various age of culling strategies was calculated at constant price and interest rate structures using the results of Rogers' study. These results are summarised in Table 5 and indicate that profits per cow in the herd could be reduced by as much as 24% by a policy of culling cows at 14 years instead of 10 years.

Table 5

Assessment of age of culling strategy on herd productivity

(Adapted from Rogers (1972))

Age of culling	Profit per cow in herd (R)	Index
10 years	36,6	100
12 years	32,3	88
14 years	27,7	76

4) *Age of Weaning*

Deviations from the normal weaning age of 6 to 8 months are generally directed at early weaning in order to alleviate delays in post partum reproductive ability in lactating beef cows (Symington & Hale, 1967; Laster, Glimp & Gregory, 1973). The latter workers obtained increases in conception rate in a 42 day breeding period of 25,9, 15,6 and 79% for 2 year old, 3 year old and mature cows respectively, with early weaning. The practice adopted was to wean all calves 8 days before the commencement of the breeding season at an average age of 55 days and a range from 34 to 76 days.

Early weaning appears to offer decided possibilities for increasing the efficiency of feed conversion in a cow and calf operation. Due to the lack of any published material on this aspect the potential increase in efficiency of T.D.N. utilisation was calculated using a hypothetical example. The results are summarised in Table 6 and it is evident that the early weaning of a calf at 3 months can realise a potential saving in T.D.N. requirements of 15%. Certainly under breedlot conditions this system has considerable promise and should greatly contribute to increased profits. Under intensive pasture systems it is also likely that early weaning could be beneficial and that the nutrient conservation benefits could be affected by controlling stocking rates.

The late weaning of calves is particularly relevant in the case of autumn and winterborn calves. Provided abundant nutrients are available for the cow this procedure has given good results in practice; Objective data on the merits of this practice are not available.

i) *Creep-feeding*

Clearly the decision as to whether to creep feed or not will depend on the relationship between beef and grain prices and the liveweight response per unit of feed. Responses to creep-feeding vary widely as is evident from the results of various workers. Kynoch-Capex (1970) concluded that responses from creep-feeding are extremely variable and that gains may vary from between 10 kg and 55 kg with an average of 27 kg under local conditions. Reynecke (1973) working with Friesland cows under beef management conditions obtained a mass advantage of 39,1 kg in one group in one season to an overall response of some 11,3 kg the following season. Creep-feeding had no economic advantage. By contrast, results obtained with creep-feeding under mixed bushveld conditions by Harwin & Venter (1970) showed considerable economic promise despite the fact that non-creep calves were gaining at a rate of 872 g per day. Of particular significance was the advantage of creep feeding in the case of calves born late in the season. The value of creep-feeding as a strategy for increased productivity in the cow herd will depend on seasonal variations and price relationships. It would appear to have its greatest advantage as a strategy during periods of adverse forage supply during the suckling period.

6) *Synchronisation of oestrus*

Despite the intensive research into oestrus synchronisation, many of the problems remain unsolved. Ferti-

Table 6

Estimated T.D.N. requirements under two age of weaning regimes

		Early Weaning Period (days)	Early Weaning T.D.N. (kg)	Normal Weaning Period (days)	Normal Weaning T.D.N. (kg)
(a)	Cow Maintenance Lactation (1)	90	409,50	210	950,79
	Dry Period	120	354,90	–	
(b)	Mass gain of cow (2)	90	25,20	210	44,10
(c)	Milk production (3)				
	6,8 litres/day	90	183,60		
	4,5 litres/day	–	–	210	286,65
(d)	Calf Growth (4)				
	First 3 months	90	67,19	90	67,09
	Last 4 months	120	384,27	120	290,45
	TOTAL	210	1 426,36	210	1 639,08

(1) Based on 0,0098 kg/kg W^{100} during lactation and 0,0065 kg during dry period (after Neville, 1971).

(2) Based on mass gain during lactation of 0,11 kg/day.

(3) Based on 130 kg T.D.N./kg milk at 4% B.F.

(4) Excluding nutrients received from milk (Maddox).

lity at the synchronised estrus remains relatively poor (Wagner, Veenhuisen, Gregory & Tonkinson, 1968; Smith & Vincent, 1973; Wiltbank, 1967; Menne & Groskopf, 1969). The advent of prostaglandins is cause for considerable optimism since they are successful in controlling both oestrus and ovulation in cattle (Rowson, Tervit & Brand, 1972). At the present time, however, this product is not commercially available at competitive prices.

7) *Multiple births*

Limited multiple ovulation and multiple births can be induced in cattle by treatment with exogenous gonadotrophins. Both PMSG (Schilling & Holm, 1963; Turman, Laster, Stephens & Renbarger, 1971) and FSH (Bellows, Anderson & Short, 1969; Bellows & Short, 1971; Vincent & Mills, 1972) have been used. A lack of repeatability in ovarian response and birthrate have, however, deferred practical utilisation of induced multiple births. With increased intensification in the future this practice is likely to assume increased importance.

8) *Multiple Suckling*

The strategy of multiple suckling offers considerable potential for increased productivity of the cow herd under intensive conditions. Jòblin (1969) reported an increase of 25% in beef per acre for double calves over single calves. Reynecke (1973) also obtained promising results with Friesland cows under beef management conditions in the eastern Orange Free State.

9) *Artificial Breeding*

In addition to the considerable advantages of artificial breeding from a genetic improvement and disease standpoint, artificial breeding has tremendous advantages in terms of management control. With increased emphasis on multi-camp grazing systems the use of artificial breeding is likely to become increasingly important.

10) *Genetic Factors*

Genetic considerations of importance in designing breeding strategies to increase productivity in the cow herd include choice of breed and type, size of cow, selection programme and mating system.

a) *Breed and type.* Assessment of breeds and crosses for optimum productivity of cow herds under intensive production situations in the Republic has been limited. Perhaps this is not as serious as it may seem since there is increasing evidence that actual breed differences in efficiency of meat production appear to be relatively smaller than those for body weight or growth rate and the same is true of milk production. As pointed out by Taylor (1971) on the basis of variation in relative growth versus absolute growth between breeds, breed differences in productivity are more likely to be of the order of 5% than 15%. Variation between farms accounted for about 54% of the total variation in the weight of meat produced under New Zealand conditions, compared with an estimate of 5% for breeds and 6% due to sex (Everitt, Evans & Franks, 1969). Despite these indications that breed differences in efficiency should not be overemphasised there is no doubt that specific attributes of various breeds will be used increasingly more skilfully in increasing cow herds productivity.

Specific traits considered to be important under intensive production systems are summarized in Table 7. It would appear likely that the high producing dual purpose and dairy breeds will become increasingly more involved in intensive beef systems. This aspect will receive further consideration under crossbreeding.

b) *Size.* The question of size of cow for optimum efficiency has received considerable attention from researchers during recent years (Kress *et al.*, 1969; Klosterman, 1972). Although it is generally recognised that there is no one optimum size for all situations there is probably an optimum size for a specific situation. Evidence in favour of the larger high producing late maturing type of animal under more intensive conditions includes the following:

(i) Although large cows produce less per unit weight their maintenance requirements per unit of body weight are also less and hence they are at least equally efficient to a small cow in producing calf weaning mass (Kress *et al.*, 1969).

(ii) Fixed costs accrue on a per animal basis and hence are less for a larger higher producing animal. This is particularly relevant since economists tell us that fixed costs are increasing at a faster rate than costs per unit of feed or T.D.N. Fixed costs become increasingly more important under intensive beef systems.

(iii) Performance of calves of larger cows is important since rapid growth and late maturity are important attributes under intensive conditions. This is not only important in the market animal but also in heifers where there is an increasing body of data suggesting depressed lifetime performance of females due to fat deposition prior to breeding (Turman *et al.*, 1965; Pinney *et al.*, 1972). The higher salvage value of larger cows is also an important advantage of large cows.

(iv) Cartwrigth (1971) has suggested optimum efficiency from a small F1 cow of high productivity mated to a sire of a large breed as a terminal cross. While this concept appears most attractive it requires specialised cross-breeding systems on an integrated basis in the industry and is unlikely to have widespread application in the immediate future in South Africa.

c) *Crossbreeding.* American studies have shown a marked superiority for hybrid cows over purebreds even in the case of crosses between British breeds under temperate climatic conditions (Gregory, 1972). In some cases the cumulative advantage in cow productivity exceeds 20% (Warwick, 1968; Mason, 1966; Preston & Willis, 1970). There seems little doubt that crossbred cows will be used in commercial herds in order to exploit heterosis and the complimentary effect of

Table 7

Relative importance of production traits and optimum performance capability according to degree of intensification

Trait	Intensive	Semi-intensive to Semi-extensive	Extensive
Fertility	++	++	+
Weaning Mass	++	+	0
Economy of gain	++	++	++
Growth rate	High	Medium – High	Medium
Carcass Maturity	Late	Medium	Early
Muscling	++	++	++
Mature size	Large	Medium	Medium

++ : Very important
\+ : Important
0 : Moderately important (relatively speaking)

breeds. Both reproductive performance (Turner, Farthing & Robertson, 1968; Gregory, 1972) and weaning performance (Warwick, 1968; Turner & McDonald, 1969) show substantial heterotic effects.

A 10% increase in efficiency per cow would appear to be a reasonable average expectation for the short term impact of crossbreeding on productivity of the cow herd. Opportunities do exist for more dramatic increases in particular situations or with more specialised crossbreeding programme in the longterm.

d) *Selection.* Considerable pressure is being exerted to increase the milk yield of beef cows through the introduction of purpose and dairy breeds. It has been suggested, however, that this increased milk production may come at the expense of total productivity. Deutscher & Whiteman (1971) and McGinty & Frericks (1971) reported low reproductive performance of beef x dairy crossbreds when energy levels were low. Recent work by Kropp, Stephens & Holloway (1973) indicate that at moderate levels of supplementary feeding high reproductive rates would be attained with high milk producing breeds under beef systems. The performance of Simmentaler and Sussex females under commercial conditions of veld grazing during summer and maize silage during winter are presented in Table 8. While these results do not show the relative efficiency of the two breeds the results do indicate that a high level of reproductive performance could be maintained in the dual purpose breed together with a marked increase in weaning weight.

Table 8

Performance of beef and dual purpose females over first four calving seasons (1970–73) in the eastern Transvaal highland sourveld (1)

Breed	Number Mated	Percentage calves weaned	Percentage cows calving 1st 42 days	Average Birth Mass	Average Wean Mass
Simmentaler	146	87	67	35	216
Sussex	276	88	71	32	185

(1) Coromandel Stud Farm. Lydenburg. Eastern Transvaal.

Continuous selection for increased weaning weights although largely increasing calf growth, together with selection for early conception of young heifers appear to be critical areas for increased cow productivity. Although genetic change is relatively slow (1–2% per annum) it is permanent.

II. Strategies directed at intensification through improved forage production per unit area

In view of the necessity for an increase in both the output per 100 cows and the total number of cows in South Africa it is vital that attention be directed at improved forage systems for beef cows. Fortunately, some encouraging facts have emerged from recent research resulting from closer co-operation between animal and pasture scientists. These include the following:

(i) Promising results with various radical veld improvement techniques in the highland sourveld from the research of Theron and co-workers in Natal.

(ii) A better understanding of the potential of *Eragrostis curvula* for both hay and grazing in the eastern areas of South Africa.

(iii) Promising results with the integration of stargrass and veld fertilisation in the tall grassveld areas of Natal (Pons, 1974).

(iv) Marked increases in herd productivity from the effective utilisation of annual forage crops (particularly maize silage) for winter feeding of beef cows.

(v) Promising results from preliminary research on the replacement of natural vegetation with *Cenchrus ciliaris* in the extensive ranching areas of the Transvaal and north-west Cape.

The opportunities for intensification on the National scene can be gauged from the distribution of major ecological areas and livestock population summarised in Table 9. Although the eastern high potential area occupies less than 6% of the total European farmland in the Republic a threefold increase in carrying capacity in this area would be equivalent to a 50% increase in carrying capacity in the bushveld/S.W.A. area. It is submitted that a threefold increase in carrying capacity in the higher rainfall areas appears a more likely attainable goal from both a biological and economic standpoint.

Table 9

Relative areas and Livestock population of major ecological areas (1967/68 Census)

Area	Area as % of Total	Livestock Population as % of total	Stocking Rate Ha/M.L.U.
Karoo	45,98	21,08	16,95
Bushveld/S.W.A.	32,15	31,08	8,02
Central Grassveld	12,35	27,69	3,46
High Potential	5,77	15,69	2,86
Winter rain	3,73	4,45	6,51

Source: Institute for Crops and Pastures (T. Skinner)

It is the purpose of this paper to consider the biological and economic potential of various pasture management and radical veld improvement techniques, together with the utilisation of forage crop in beef cow-herds. The results presented in Table 10 are based on a synthesis of component research by Theron in the high-land sourveld of Natal. Although the integration of these techniques into optimum production systems is still in its early stages the results of this budget analyses are deemed to be of considerable significance. It is evident from Table 10 that the carrying capacity per annum increases from 0,41 to 5,00 m.l.u. per hectare. The substantial increase in calf mass per unit area is associated with a decreased cost per cow unit and a substantial increase in the margin over feed costs both per animal and per hectare. This increase in productivity is of the order of 500–700% for the more intensive systems.

The conclusion is justified that the profit potential exists for intensification of the cow herd with these improved forage systems. Since the capital requirements increase, attention to marginal returns and capital planning are important considerations. In view of the potential for maize silage as a forage for beef cattle this aspect deserves special attention. In order to carry the principle of intensification to its logical conclusion the feasibility of operating a cow herd on maize silage has been developed and the results compared to a kikuyu pasture programme. The basic assumptions are summarised in Table 11. It is interesting to note that the margin over feedcosts is most encouraging. There are, however, definite limitations to this operation and these figures are presented merely to indicate another facet of intensification which may develop in the future as land prices continue to escalate.

Conclusion

Various management, genetic and nutritional strategies directed at intensification of the cow herd have been reviewed and an attempt has been made to quantify their potential impact on the level of herd productivity.

Quite obviously a holistic approach to intensification is necessary in which breeding, management and feeding strategies are integrated and optimised. There is little doubt, however, that this paper has focussed attention on the tremendous impact of improved forage systems. Various radical veld improvement techniques can increase herd productivity by many hundreds of percent.

In terms of future business decisions by both producers and agriculturalists there seems little doubt that more attention must be directed at pasture intensification techniques, particularly in the higher rainfall areas of South Africa. The improved utilisation of annual fodder crops and maize silage in particular is included in this context since pasture intensification and improved utilisation of annual forage crops must advance together.

The future prospects for increased beef production in South Africa are excellent since intensification can be associated with an improved profit position.

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Table 10

Potential of various pasture intensification systems in the Highland Sourveld (1)

	Stocking rate /annum m.l.u./ha (2)	Grazing duration (days)	Forage Cost (R) /ha (3)	Cost/cow per annum (R) (4)	Calf Growth A.D.G. (5)	% Calves Weaned (6)	Calf Mass /ha (kg)	Total Mass /ha (kg) (7)	Margin per Cow (R) (8)	Margin per ha (R)
Veld (4 camps)	,41	180	27,5	98,25	,82	80	32,5	50,7	–14,8	–4,2
Veld (8 camps)	,60	200	35,3	86,12	,86	80	53,7	79,5	4,9	1,9
Fert/Fortified Veld	1,78	220	95,7	71,92	,86	85	203,5	272,5	32,1	38,1
Kikuyu	2,26	230	98,9	59,24	,91	85	278,2	376,0	56,5	82,8
Grass/Legume (Dry)	2,11	190	88,9	53,21	1,0	85	256,6	344,9	56,4	79,5
Grass/Legume (Ir)	3,02	270	87,5	37,56	1,0	90	520,5	646,3	109,3	220,0
Intensive Pasture (Ir) (9)	5,00	365	251,8	75,60	1,0	90	743,9	1068,8	74,2	247,1

(1) Synthesis of available experimental data of Dr. E.P. Theron and team.

(2) Includes Summer pasture and area required for Winter feed production (maize silage).

(3) Based on actual costings from experiments. Land values were taken at R200/ha for veld and R250/ha for area under pastures. Interest rate of 9 percent. Fencing costs at R250/kilometer including gates plus 10% labour. Estimated cost of R17-40/ha and R26,55/ha for 4 and 8 camp systems respectively.

(4) Includes both Summer and Winter feed costs only – other fixed and variable costs are not included.

(5) Based on Tabamhlope project (Theron *et al.)* Simmentaler cows with Hereford cross Calves.

(6) Assumptions necessary in the case of intensive pasture systems.

(7) Includes salvage mass of cow (17% replacement rate) based on Tabamhlope experimental results.

(8) Margin over feed costs based on 50c/kg for weaner calf and 36c/kg livemass of cow.

(9) Production and costing data based on Report of Sub Enterprise Systems team. Heard & Wiseman (1973).

Table 11

Assessment of potential for "breedlot" using maize silage under zero-grazing system(1)

System	Stocking Rate m.l.u./ha	Cost/cow p.a. (R)	Calf Mass / ha (kg)	Margin/ cow (R)	Margin/ ha
"Breedlot"	5,69	78,81	645,6	43,28	164,0
Kikuyu	2,50	59,24	244,0	56,50	82,8

(1) Assumptions:

(a) *Maize Yields* (t/ha)

Whole maize plant silage	40,0
Ear-corn silage	27,2
Corn Stover	12,8

(b) *Herd productivity*

Weaning mass at 274 days	260,0 kg
Nett weaning rate	90%
Replacements	17%

(c) *Cost and values*

Whole plant silage	R4-50/tonne
Ear-corn silage	R5-37/tonne
Stover silage	R4-21/tonne
Lucerne hay	R30-00/tonne
HPC (40%)	R125-00/tonne
Growmore Chicken Litter	R16-00/tonne

(d) *Income*

Weaner calves	50c/kg live mass
Cull cows	R160

(e) *Procedure*

All requirements according to N.R.C. are provided by whole maize, lucerne (for calves up to 5 months) and HPC supplement. From sixth month calves supplemented with silage plus protein supplement.

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