GRASS FEEDLOTS

S D PARSONS & A H PENDERIS, The Fertilizer Society of South Africa

Abstract

The finishing of weaned calves on planted pastures for the consumer trade is examined. Results of various trials conducted in Southern Africa are summarized and compared with the conventional grain feedlot. These results are scrutinized on an economic basis and show that the finishing of 18–month old cattle on planted pasture is highly profitable. The two most important variables affecting the profit margin are shown to be the need for a limited energy supplementation and a high stocking rate.

Introduction

The need for increased intensification of agricultural production has been stressed and urged on countless occasions, both from the point of view of increasing needs of the world human population and because farmers require greater productivity to meet increasing production costs, (Harwin & Lombard, 1974; Luitingh, 1974). Suffice it to say that for the purposes of the paper the need for increased intensification of production is accepted as a principle feature of agriculture today.

Whereas agronomic production in South Africa has kept pace with, and possibly exceeded, domestic requirements (eg maize deliveries to maize board up 372% over 25 years), increases in South African red meat production leave much to be desired relative to the rest of the world (Luitingh, 1974), having only increased 169 per cent over 25 years (Abs. Agric. Stat, 1974). With a projected deficit of at least 500 000 carcasses by 1980 and a long term target in excess of 5 million carcasses per year by the year 2 000 it has become a matter of considerably urgency that the rate of production be increased in South Africa (Harwin and Lombard, 1974).

There are two quite distinct phases in the intensification of beef production

(a) an increase in the supply of weaner calves and

(b) the finishing of such calves at suitable mass and grade for the consumer trade.

Although the production of weaner calves is the more urgent problem this paper deals only with the finishing of slaughter stock.

The utilization of cattle in the production of food for human consumption takes place primarily in the areas that have either excess roughage or excess grain. The United States with an excess of grain has developed the maize based feedlot to a high degree, and in recent years South Africa has tended to follow this pattern, finishing more than 25 per cent of its beef in feedlots (Braak, 1974). With South Africa rapidly reaching its maximum potential arable area of approximately 15 per cent it is conceivable that the excess amount of grain available for livestock production will decrease, or at least render the beef feedlot less profitable as a result of higher grain prices in future.

The purpose of this paper is to examine the alternative of finishing slaughter cattle on sown pasture. By comparison with maize grain feeding relatively few data are available for fattening on grass, but preliminary evidence is encouraging and suggests that grass feedlots may be an economically viable alternative. In fact Barnes, Clatworthy and Rodel (1973) state that under Rhodesian conditions, gains on grass were cheaper than those in a feedlot on a high energy ration even when the concentrate feed in the feedlot cost as little as 3,0 cents/kg.

Maize Grain Feedlot

As a reference point and for comparative purposes the profit potential of high energy feeding under grain feedlot conditions has been determined using output from a computer based model developed by Wilson (1974). The results for current South African prices are shown in Table 1.

TABLE 1 Gross margin per steer for optimum grain feeding (after Wilson, 1974)

	Two year old	Heavy weaner
Initial livemass (kg)	375	220
Feeder cost @ R0,45c/kg 1m	169	99
Interest rate / annum (%)	12	12
Labour and vet cost/day (c)	1	1
Slaughter price (c/kg)	100	100
Feed price (c/kg)	65	65
Total feed consumed (kg)	650	681
Optimum feed period (days)	52	84
Final livemass (kg)	457	341
Final cold dressed mass (kg)	238	180
Total maize consumed (kg)	475	498
Gross margin (R)	21,34	31,28

TABLE 2 Summary of Southern African research results : Grass feedlots

Trial No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Fertilization					Stocking rate				Supplementary maize			Mass gain per ha		Estimated Gross Margin (2)				
	kg per ha			kg N per head	Cost per ha (R) (1)	Head per ha	Live-mass per ha (kg)	Irrigation (mm)	Days on Trial	kg per head daily	Total kg per head	kg per ha	Live-mass (kg)	Cold dressed mass (kg) (4)	Per ha (R)	Per head (R)	Type of cattle (6)	Ref No	Site
	N	P	K																
Star Grass No 2 *(Cynodon aetheopicus)*																			
1	350	37	–	29	147,30	12	2916	–	105	–	–	–	–	414	212,30	17,69	a	Barnes et al 1973	Henderson
2	350	37	–	18	147,30	20	4860	–	105	–	–	–	–	356	124,36	6,23	a		Henderson
3	350	37	–	18	147,30	20	4860	–	105	3,0	315	6300	–	1258	616,86	30,84	a		Henderson
4	650	37	–	39	252,30	16,5	–	920	186	–	–	–	1325	(702)	280,56	17,00	b	Rodel et al 1975	Henderson
5	650	37	–	54	252,30	12	–	930	229	–	–	–	1550	(822)	394,85	32,90	b		Grasslands
6	690	90	–	29	302,70	10 (5)	3200	730	243	2,7	270	2700	2504	(1327)	771,36	32,14	b	Anon 1975	Rhodesia
Eragrostis curvula																			
7	53	18	–	23	30,27	2,3	1044	–	–	–	–	–	325	(172)	116,89	50,82	c	AE&CI 1969	Bapsfontein
8	635	88	–	61	281,21	10,4	3309	–	–	–	–	–	1434	(751)	379,90	36,52	c		Modderfontein
9	270	16	175	67,5	152,47	4	444	–	186	–	–	–	523	239	32,61	8,15 (3)	a	Bosman 1975	Döhne
10	270	16	175	67,5	152,47	4 (5)	444	–	186	2,0	744	1488	708	350	108,09	27,02 (3)	a		Döhne
Kikuyu *(Pennisetum clandestinum)*																			
11	175	–	–	19	61,25	9	1962	–	169	5,0	845	7605	1674	912	662,50	73,61 (3)	b	Rethman et al 1977	Nooitgedacht

Notes: Financial Data –

(1) Nitrogen @35c/kg; Phosphate @67c/kg and Potassium @27c/kg

(2) Gross Margin = Gross income – (Fertilizer cost + feed cost + Irrigation cost + interest on animals and fertilizer) where
Gross Income = Livemass gain x 45c/kg or = cold dressed mass gain x 100c/kg or 3 below Feed cost = R65,00/t
Irrigation cost = R5,00/100 mm
Interest calculated at 12% annum

(3) Gross income as actually obtained viz – trial no 9 – 89c/kg cold dressed mass
trial no 10 – 94c/kg cold dressed mass
trial no 11 – 108,8c/kg cold dressed mass

Animal data

(4) ( ) indicates estimated cold dressed mass at 53% dressing out.

(5) Filler cattle were incorporated viz – trial no 6 – 14 yearling steers from mid-Jan to May.
Filler gain – 1025 kg
trial no 10 – Gain of fillers = 86 kg/ha
Gross margin estimates based on slaughter stock plus fillers.

(6) a = yearling steers
b = yearling steers and heifers
c = steers

For profit maximization on high energy feed (2,7 MCal, 13% CP, 7—10% CF) the optimum feeding period is 7 and 12 weeks for two year olds and heavy weaners respectively. Shorter or longer periods of feeding under the assumed price conditions would result in lower profit.

The calculated gross margins per head (gross income minus variable costs) of approximately R21 and R31 respectively are understood to be higher than is generally expected on most commercial feedlots.

Taking three tonnes of maize per hectare as a reasonable average yield for dryland conditions it would be possible to feed approximately six heavy weaners on the grain yield of one hectare of maize thus yielding a maximum per hectare gross margin from maize feedlots of R185.

Grass Feedlots

As previously stated there is a paucity of data for grass feedlots especially in South Africa. The available data, and gross margin calculations based on these data are summarized in Table 2. All economic calculations relating to these data have been based on current prices. Although there is a wide variation in economic performance from one source of data to another it would appear that with few exceptions the return per hectare is superior on grass feedlots to that on maize feedlots. Further examination of the data suggests that there are at least two factors of importance in determining high gross margins per hectare on grass feedlots viz energy supplementation and stocking rate.

Energy supplementation

The form of energy supplementation and the level and period of supplementation are of importance. Hart, Bond, Carlson & Rumsey (1971) investigated the response of steers grazing *Dactylis glomerata* pastures to different levels of either maize meal or molasses. They found that 1 kg of maize supplement produced about twice the gain as 1 kg of molasses supplement. This difference was found to be consistent with net energy values for maize and molasses. Furthermore, these authors found a direct relationship between response to energy supplementation and stocking rate. Average daily gain (ADG) of animals on grass alone or grass plus molasses decreased as stocking rate increased, but ADG of animals on grass plus maize did not change significantly. When maize was fed gain per hectare increased as stocking rate increased, but not when no supplement was offered or when molasses was fed.

Hart et al (1971) found that at high stocking rates there was little advantage to feeding more than three to four kilogrammes of maize per head daily. When little forage is available (high stocking rate) average daily gains of 132 g (Mott, Rhykerd, Taylor, Perry & Huber, 1967), 112 g (Wise, Barrick & Blumer, 1965), 112 g (Baker, 1962) and 102 g (Hart et al, 1971) per kilogram of maize fed were reported. Without question, as in the case of grain feedlots, the optimum period and rate of supplementation will depend on the price relationship of beef and maize. Current information suggests that approximately 300 kg of maize per head, fed over a period of about 100 days gives good results.

Stocking rate

Production per animal and production per hectare are dependent on the rate at which a pasture is stocked. Gain per animal is constant as stocking rate increases to a "critical" point. Beyond this point gain per head is inversely related to stocking rate. Gain per hectare increases as stocking rate is increased to the "critical" point, then decreases with further increases in stocking rate.

Since production is normally measured in terms of the most limiting recourse and since land is in most cases most limiting, production per hectare is generally more critical than production per animal. Hart et al (1971) have shown that although production per head decreased at high stocking rates, production per hectare increased when maize or molasses was fed but decreased when no supplementation was offered. From this and other work it would seem as though stocking rate is one of the most critical factors in determining production and hence profit margin.

One group of research workers who have conducted experiments on optimum stocking rate suggest that between 15 and 17 steers per hectare give optimum results on Star grass pasture (Table 3). At farm level this has been translated as an initial stocking rate of approximately 4 500 kg livemass per hectare (Anon., 1975). Nevertheless, optimum stocking rates need to be determined for species other than Star grass. From Figure 1 it is apparent that stocking rates of less than 10 head per hectare produce less than optimum economic results. One of the reasons for this phenomenum is that at low stocking rates the nitrogen fertilization rates per head are high (Table 2 Col. 4). It would appear from the data presented in Table 2 and according to Rodel et al (1976) that optimum economic results are achieved when the pasture is stocked so that between 25 and 30 kg N/head is applied. Almost certainly high stocking rates would require high levels of husbandry including rotational grazing of the pasture.

TABLE 3 Changes in carcass-mass of steers grazing at different stocking rates on Star grass fertilized with 24 kg nitrogen/steer/ha

Stocking rate: steers/ha	Initial carcass-mass kg	Carcass-mass when removed from pasture kg	Carcass-mass gain/ steer kg	Carcass-mass gain/ ha kg
12,0	97,0	129,0	32,0	384,0
14,7	97,0	133,0	36,0	529,0
17,3	97,0	126,3	29,3	506,9
20,0	97,0	121,6	24,6	492,0

Source: Rodel, Groenewald, Scheerhoorn, Boultwood, and Hopley, 1975.

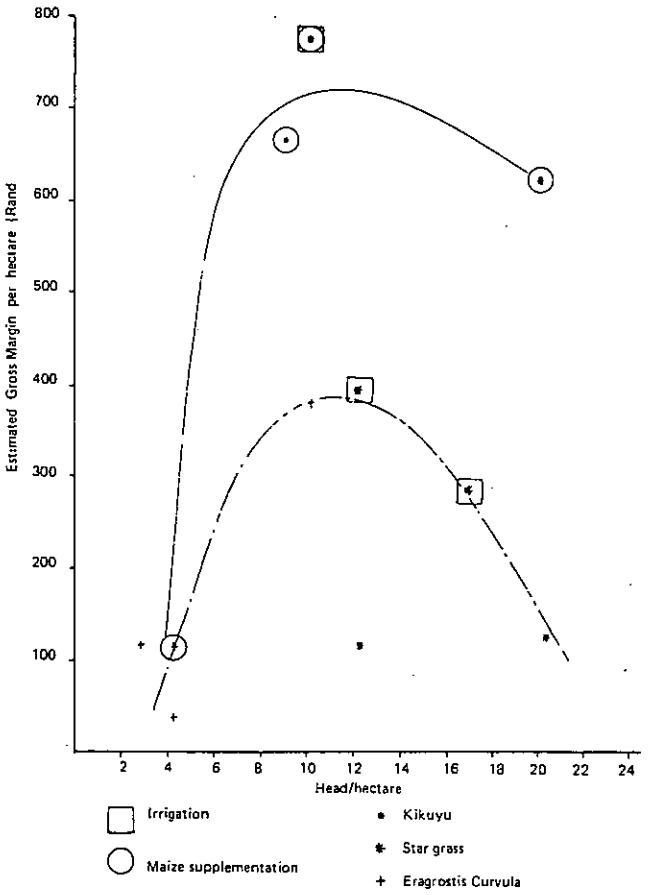

FIG 1 Effect of Stocking Rate and Supplementation on Gross Margin

Potential for grass feedlots in RSA

A preliminary investigation (Luitingh, 1975) suggests that some 12 million hectares of South African farmland is ecologically and economically suitable for veld replacement or improvement through the introduction of improved grass species. It is further estimated that at least 3 per cent of this area, ie 381 000 hectares, could be under pasture in the near future with active extention. Additionally, Möhr has estimated that of the 4,71 m hectares planted to maize some 25 — 30 per cent of lower maize potential soils could more profitably be planted to grass (Luitingh, 1975).

In total then it could be economically advantageous to South African farmers to establish some 1,25 m hectares of pasture for beef production in the relatively near future. At very conservative stocking rates this would be sufficient for upwards of 2,5 m head on grass feedlots during summer. A figure which in fact far exceeds the total number of cattle slaughtered annually in South Africa. That this estimate is conservative can be gauged by the fact that Theron (1975) has calculated that the total Natal cattle population alone could be quadrupled to 2 078 126 MLU through pasture intensification.

Opsomming

GRASVOERKRALE

Die afronding van gespeende kalwers op aangeplante weidings as deel van die proses van intensifikasie van beesvleisproduksie word ondersoek. Die resultate van verskeie proewe wat in Suidelike Afrika uitgevoer is word vergelyk met die van die konvensionele graanvoerkraal. Die resultate word op 'n ekonomiese grondslag ontleed.

Die bruto marge van 'n konvensionele voerkraalonderneming is gewoonlik in die omgewing van R21 en R31per kop vir tweejaar-oue diere en swaar speenkalwers onderskeidelik. Dit kan bereken word op R185 per hektaar in die geval van swaar speenkalwers. Die bruto marge van meeste 'grasvoerkrale' is hoër as R185. Verdere ontleding van hierdie metodes van afronding wys daarop dat van die veranderlikes wat 'n effek op die bruto marge van 'grasvoerkrale' het, veral energiebyvoeding en veelading van belang is.

Beskikbare inligting wys daarop dat ongeveer 300 kg mieliemeel per kop, gevoer oor 'n periode van 100 dae, goeie resultate lewer. Dit wil ook voorkom asof optimum ekonomiese resultate verkry kan word indien 'n weiding belaai is sodat 25 tot 30 kg N/kop toegedien is.

Dit wil voorkom asof dit lonend sal wees vir boere om in die nabye toekoms ongeveer 1,25 miljoen hektaar aangeplante weidings in RSA te vestig met die doel om swaar speenkalwers af te rond.

References

ABSTRACT OF AGRIC. STAT., 1974. Div. agric. marketing res. Pretoria.

ANON., 1975. Star grass is a winner. Top Farmers Publ. Mobeni, Natal.

AE&CI FIELD MANUAL, 1969. Ed. by F. Hyam.

BAKER, F.S., 1962. Fattening steers in dry lot and in pasture. *North Florida Exp. Sta. Mimeo Rep.* 62, 5.

BARNES, D.L., CLATWORTHY, J.N. & RODEL, M.G.W., 1973. Grass, legumes and maize: a basis for massive expansion in animal production in Rhodesia. *S.Afr. J. Anim. Sci.* 3, 153–159.

BOSMAN, S.W., 1975. Miskende gras wys sy slag met vleis. *Landbwkbd* Oct. 24, No 42.

BRAAK, G.H., 1974. Some thoughts on intensive animal production. *S. Afr. J. Anim. Sci.* 4, 219–220.

BRANSBY, D.I., BOOYSEN, P. DE V. & TAINTON, N.M., 1977. The evaluation of pastures and grazing management in terms of livestock production. *Proc. Grasld Soc. sth. Afr.* 12 in press.

CHAPMAN, H.L.M., HAYNES, C.E. & KIDDER, R.W., 1961. Feeding value of limited fed mixed feed, citrus pulp, ground snapped corn, and blackstrap molasses for fattening steers on pasture. *Everglades Sta. Mimeo* 61, 19.

CLATWORTHY, J.N., 1977. A comparison of irrigated grass-clover and nitrogen-fertilized grass pastures for beef production. *Proc. Grassld Soc. sth. Afr.*, 12 in press.

HART, R.H., BOND, J., CARLSON, G.E. & RUMSEY, T.R., 1971. Feeding corn or molasses to cattle on Orchardgrass pasture. *Agron. J.* 63, 397.

HARWIN, G.O. & LOMBARD, J.H., 1974. Intensification of the beef cow herd. *S. Afr. J. Anim. Sci.* 4, 247–258.

KIDDER, R.W. & BEARDSLEY, D.W., 1952. Protein and carbohydrate supplements for fattening steers on Everglades pastures. *Florida Agric. Exp. Sta. Bull.* 493, 16.

LUITINGH, H.C., 1974. Certain aspects of the future development of the beef cattle industry. *Fert. Soc. S. Afr. J.* 2, 9–20.

LUITINGH, H.C., 1975. Increasing beef production – some considerations *Glen agric.* 4, 17–26.

MOTT, G.O., RHYKERD, C.L., TAYLOR, R.W., PERRY, T.W. & HUBER, D.A., 1967. Techniques for measuring the contribution of pasture in pasture-gain feeding systems. ASA Special Publication No 13, 95–108.

PETERSON, R.G., LUCAS, H.L. & MOTT, G.O., 1964. Relationship between rate of stocking and per animal and per acre performance on pasture. *Agron. J.* 64, 27.

RETHMAN, N.F.G., EDEN, D.W., BEUKES, B.H. & DE WITT, C.C., 1977. The utilization of *Eragrostis curvula* and *Pennisetum clandestinum* pastures for growing out and finishing young beef steers. *Proc. Grassld Soc. sth. Afr.*, 12 in press.

RODEL, M.G.W., GROENEWALD, I.B., SCHEERHOORN, G., BOULTWOOD, J.N. & HOPLEY, J.D.H., 1975. Effects of combinations of stocking rate and levels of fertilizing with nitrogen on carcass-mass gains of steers grazing Star grass pastures, and on subsequent performance in feed-lot. Roneod pamphlet.

THERON, E.P., 1975. Potential for the radical improvement of the Highland Sourveld. *Fert. Soc. Sth. Afr. J.* 2, 73–80.

WILKINSON, J.M. & TAYLER, J.C., 1973. Beef production from grassland. Butterworths, London.

WILSON, E.M., 1974. Grain livestock research project. Final report. Univ. Rhod.

WISE, M.B., BARRICK, E.R. & BLUMER, T.M., 1965. Finishing steers with grain on pasture. *North Carolina Agr. Exp. Sta. Bull.* 864, 48.