PROFIT POTENTIALS IN GAME FARMING[1]

J Behr
Theron, Prinsloo, Grimsehl and Pullen (Consulting Engineers), Pretoria, 0001

JA Groenewald
Department of Agricultural Economy, University of Pretoria, Pretoria, 0002

ABSTRACT

Game farming can be complementary, supplementary, competitive or antagonistic to livestock production. Little is yet known about financial returns to game farming. Ten game farmers' economic returns were therefore compared with those of beef cattle producers. Investment per hectare was found to be comparable. Game farmers invest more in fencing and more in animals, expressed in Rand per animal unit. Gross and net incomes comparable to those of beef farmers can be obtained with game. Returns on capital are also comparable but low; neither game nor beef cattle farming appear to be attractive fields for investment. Game farming appears to be more risky than beef production. Game farmers should devote more attention to financial management and records.

1. INTRODUCTION

Game farming has in the last few years attracted considerable attention in the popular agricultural press. It has not, however, developed into a major agricultural enterprise. If it is to gain a foothold in South African agriculture, it will have to be economically viable. It will have to be able either to compete with, or supplement other farming types which use similar resources.

Much discussion regarding South African game farming has been in either emotional/aesthetic values concerning nature conservation and/or pure biological/ecological concerns relating to preservation of the natural habitat. There has, however, been little research on economic viability of game farming in South Africa. Pure conservational issues - often coupled to tourism, as is the case with national parks - and commercial usage of natural resources for the purpose of food and fibre production must be regarded as different use categories. Commercial game farming is largely the province of the latter.

In a commercial farming environment, game farming becomes part of agricultural resource use. Agriculture arose from the need to provide increasing amounts of food and fibre for human usage, i.e. amounts which could not be supplied by nature in its undisturbed form. There is a dichotomy: Users or consumers of food and fibre have multiplied quantitatively and per capita demands increased with improved living standards. Proportionally fewer people become concerned with providing society's needs for food and fibre. People involved with this will do so only if revenues earned in this process are in some way comparable to those in alternative opportunities. There are many alternative ways to produce food. Game farming is but one of these.

Agriculture arose from the characteristics of Mother Nature. As stated by Theodore Schultz (1974) nature is not in the habit of being bountiful. She is rather niggardly in satisfying man's needs. Necessity forced man to invent agriculture in order to reduce this niggardliness of Nature. Modern agriculture reduces the human effort needed to satisfy the demand for food and clothing. Agriculture has succeeded in doing this by domesticating plants and animals, by changing their nature through controlled breeding and selection, and by applying other inputs. The ability of domestic crops and animals to survive on their own in nature is limited; their survival depends on conditions created by man. The capacity of the soils of the earth to produce domesticated crops and animals is man-made. This whole process has shifted the production possibilities of the earth to the right.

Game therefore has to compete with domestic livestock and crops whose production potential has over centuries been improved by human effort. If game farming is to be able to compete with the production of domesticated animals and crops, it has to satisfy specific human wants on a competitive basis, serving real markets. It also must be able to realise profits for those practicing the trade.

2. SOME FACTORS INFLUENCING THE VIABILITY OF GAME FARMING

Water requirements

Some game species are better adapted than domesticated livestock to environments with limited and unreliable water supplies. Eland can, for example, survive for extended periods without readily available drinking water (Taylor, 1969). They are able to adjust their bodily temperature to that of the environment. By adjusting the bodily temperature, the eland oryx can, for example survive for extended periods without readily available drinking water (Taylor, 1969). They are able to adjust their bodily temperature to that of the environment. By adjusting the bodily temperature, the eland obviates the necessity of cooling down by perspiring moisture. Springbuck also has shown an ability to survive for long periods without drinking water (Taylor, 1968). It therefore follows that game can potentially be used in areas where reliability and/or availability of water renders livestock farming difficult.

Meat production

There is some conflicting evidence regarding the relative efficiency of game species and domestic livestock in the conversion of plant material to meat. Bigalke (1982) states that there is little difference in the effectiveness.

According to Skinner (1970), game is in general less efficient in converting feed to live mass. In a study in the Karoo, springbuck were found to be 19% more efficient than Merino sheep in converting plant energy to salable meat; Merinos are, however, 55% more efficient than springbuck in terms of kilogram gross mass and 46% more efficient in terms of Rand net income (Skinner *et al*, 1986). Collinson (1979) found meat production from impala to be lower than that of cattle both in terms of yield per hectare and yield per animal unit.

There appears to be very little difference in growth of springbuck, impala and sheep from birth to Maturity (O' Donovan, 1980). Eloff *et al* (1973) however state that the sheep catch up at an age of approximately 18 months.

These production comparisons should also be seen in terms of manageability as domestic livestock is easier to manage than game. It may be relevant to speculate that early man domesticated some animals precisely because of this manageability. Improvements in productivity followed through controlled breeding. The Russians started farming eland in the late

nineteenth century. Their manageability, as compared with other species may have been an important consideration (Skinner, 1966).

Average dressing percentages (cold carcass mass as percentage of live mass) of many game species seems to be somewhat higher than those of cattle. The difference appears to be between 5 and 10 per cent (O' Donovan, 1980; Posselt, 1963; Talbot *et al*, 1965; Skinner, 1973; Von la Chevallerie, 1970).

Carcass compositions differ, e.g., hind quarters contribute proportionally more to total carcass mass in the case of antelope than with cattle, a difference of between 2 and 5 per cent. The fat content is also lower, seldom over 2,5 per cent, compared to approximately 7 per cent for lean cattle (Leger *et al*, 1967; Skinner, 1978; Talbot *et al*, 1965; Van Zyl *et al*, 1968).

Reproduction

Some authors have come to the conclusion that game are often more fertile than livestock (O'Donovan, 1980; Skinner, 1973). Springbuck reach puberty at an age of 28 weeks. If 75 per cent of lambs are harvested, a lambing percentage of over 100 per cent is attainable (Skinner *et al*, 1971). Because of a shorter pregnancy cycle, eland are more fertile than cattle (Skinner, 1986). Mature impala ewes have a lambing percentage of between 90 and 95 per cent (Fairall, 1983). These percentages compare well with those of cattle and sheep in South Africa.

Grazing

Game can be divided into grazers (which eat grass), browsers (eating leaves) and those which eat grass as well as leaves. A combination of different species can therefore increase carrying capacity somewhat in mixed environments. Different browsers utilize plants at different heights. Impala eat up to a height of 1,5m, kudu up to 2,5m and giraffe higher than 2,5m (Gouws, 1980).

Grazers also exhibit different grazing behaviour types. Some, like reedbuck, prefer long grasses, some, like wildebeest, prefer shorter species and others are indifferent. Certain game species such as kudu can utilize plants which are toxic to cattle or sheep without any harm to themselves (Lightfoot, 1977; Young, 1982).

Different game species are potentially competitive, complementary or supplementary to each other and to livestock. Provided other factors such as costs and marketing problems do not outweigh such phenomena, this may favour game farming together with livestock or alternatively, farming with different game species in certain environments.

Disease

Game animals are subject to a variety of diseases and game are often accused of being carriers of stock diseases. A case mentioned often is that of malignant catarrhal fever ("snotsiekte") which is carried by wildebeest, apparently without much harm to the carrier, and which is a deadly cattle disease. Game are often also carriers of brucellosis, foot and mouth disease and rabies. In such cases, game species must be regarded as antagonistic to livestock and sometimes to each other. Elementary production theory indicates that if antagonistic relationships are of a significant magnitude, only one of the two enterprises involved should be pursued.

Certain economic considerations

It appears from the above that game are generally less efficient than livestock in converting the feeds utilized by livestock into meat. The possibility of complementary and supplementary relationships among game species and between game species and livestock in certain environments favour mixed farming. This may be counteracted by some antagonistic relationships.

Game meat exhibits some desirable traits: The dressing percentages are higher, hind quarters are larger proportionally to carcass mass, and fat content is lower. Whether these advantages can be utilized commercially by farming game, will depend on the identification and the utilization of appropriate markets and marketing channels.

Game farming requires unique capital outlays, a very important part of which consists of appropriate fencing. Some species, such as kudu and water buck require fences at least 2,3m high. Then as has been pointed out, game is more difficult to manage than livestock.

Although locally encountered game may, as claimed by some authors (Skinner 1970; Johnstone, 1973; Thresher, 1980) be biologically more efficient than livestock in certain environments, it is necessary to do some analysis in which its viability is compared *vis-a-vis* livestock.

The available evidence on this is both sparse, contradictory and inconclusive. Thresher (1980) concluded that game could not compete economically with a beef ranch he used as benchmark. Benson (1985) concluded, however, that game should be more profitable than livestock. Benson's argument is however partially based on an assumption that venison would achieve prices which are a multiple of beef prices. His price assumptions are difficult to accept in the light of results obtained by Behr and Groenewald (1990).

In Kenya, Hopcraft (1970) compared Thomson's gazelle (springbuck) with Boran cattle in a semi-arid region, and found Thomson's gazelle to be financially competitive. In Natal, Collison (1979) found that net income per hectare could be increased from R2,80 with only cattle to R5,00 per hectare if impala was introduced and combined with cattle.

It is in order to shed some more light on an area with so many conflicting results that the comparisons reported in this analysis were done.

3. RESEARCH PROCEDURE

Results of a limited number of game farmers were compared with those of cattle farmers. A prerequisite for using the data of a game farmer for this purpose was the existence of sufficient records, preferably for more than three years.

During a mail questionnaire survey 752 farmers indicated that they derived some revenue from game (Behr and Groenewald, 1990); only 105 of these have held records which may potentially have been useful for economic and/or financial analyses.

A limited number of these farmers were visited in order to collect data. It was assumed that if some game farmers could do as well or better than the cattle farmers they were compared with, this could indicate that game farming was potentially viable. If, on the other hand, practically none of these farmers achieved comparable results, the potential viability of game farming would indeed be very doubtful. Of 17 farmers visited, the records of only 10 could potentially be used to supply sufficient information. These farmers were categorized in three groups:

(i) Involved mainly with biltong hunting: 5 farmers, of whom 2 stock game and livestock together.

(ii) Involved mainly with trophy hunting: 4 farmers, one of whom stocks game and livestock together.

(iii) Mainly venison production: One farmer, who stocks game with livestock.

In order to compare these farmers' structure and financial results with those obtained from beef farmers, results obtained at the Zoutpan Experimental Farm north of Pretoria (Cornelius and Marincowitz, 1986), and mail-in records of farmers participating in the Directorate of Agricultural Production Economics' beef farming record projects in Northern

Transvaal and Natal (Directorate of Agricultural Production Economics, 1986 and 1988) were used. Thus results of game farmers who kept records were compared with beef farm units on which suitable records were kept.

4. RESULTS

Farm size and capital investment

Table 1 provides details concerning farm sizes of the ten game farmers, the Zoutpan data and the averages of the two postal record project groups. Wide variations in farm size, total investment and investment per hectare were encountered among the game farmers. The trophy hunting enterprises included one very large, and one rather small unit. Some of the other game farms are mainly beef producers. Investment per hectare can generally also not be said to be atypical compared to beef farming units.

The composition is however different, due to a few unique features of game farming. Farmers who receive hunters also provide housing facilities. Those in the trophy hunting business do in fact have to provide luxury type housing facilities. Among the biltong hunting enterprises, one invested R7 255 in housing, while the investment of the others varied between R24 500 and R94 080. The trophy hunting enterprises' investment in housing varied between R125 779 and R328 208.

Table 1 Farm sizes and capital investment (1984/85)

Category	Farm number	Hectares	Capital invested (R)	
			Total	Per hectare
A. Venison prod.	1	4 036	1 606 674	398
B. Biltong hunt.	3	2 135	1 412 723	662
	8	1 615	551 415	341
	9	1 815	575 164	316
	10	1 100	652 799	593
	11	4 202	1 013 166	241
C. Trophy hunt.	4	1 884	815 951	433
	6	480	314 128	654
	7	3 000	1 357 722	453
	12	13 408	3 017 804	225
D. Beef Cattle:				
Zoutpan		2 000	523 190	262
N Tvl		2 610	395 698	178
Natal		1 797	987 173	549

Game farmers need to put up game fencing in order to be permitted to continue game hunting and cropping activities outside the general hunting season. Fencing between camps is less important, and is often removed when farmers switch from livestock to game farming. Game fencing is more expensive than ordinary fencing, and a game farmer has to pay the full cost in contrast to other farmers who are responsible for half the cost of boundary fences. Game fencing also does not qualify for State subsidies. Table 2 provides comparative data on investments in fencing per hectare, and the contribution of fencing to total investment.

Table 2. Investment in fencing per hectare (1984/85)

Category	Farm number	Investment per ha (R)	% of total Capital
A. Venison production	1	25.6	6.4
B. Biltong hunting	3	39.7	6.0
	8	26.9	7.9
	9	24.8	7.8
	10	70.6	11.9
	11	5.0	2.1
C. Trophy hunting	4	32.4	7.5
	6	20.0	3.0
	7	4.6	1.0
	12	14.2	7.0
D. Beef cattle : Zoutpan		9.2	2.6

Eight of the farmers had invested considerably more (at least 3 times as much) in fencing per hectare then was the case at Zoutpan, and in these cases, the fencing constituted a much higher percentage of total capital. Although investment in fencing per hectare should logically be inversely proportional to farm size if only boundary fencing exists (as on some "pure" game farms), the limited number of cases in this study precludes such a comparison.

The farmer specializing in venison production stocked only two species (kudu and impala). One of the biltong hunting enterprises (No 8) stocked three species (Eland, kudu and impala). On the other seven farms, the number of species varied between 8 and 20. Kudu, impala and zebra were the most common. Meissner's standards (1982) were used to calculate total game animal units (A.U.). Capital invested in game and livestock are shown in table 3. Investment per animal unit of seven game farmers exceeds that of Zoutpan, and eight have invested more per animal unit than the average of the Northern Transvaal and Natal beef farmers involved. In the case of Farm 11, game has been valued more conservatively than on the other farms.

Revenues

Game farmers can derive revenue from the following sources :

(i) Daily tariffs paid by hunters; this tariff varies between R30 for local recreational hunters and R800 paid by trophy hunters, mostly from abroad.

(ii) Sales of carcasses include carcasses sold by the farmer (including carcasses of animals shot by trophy hunters if the trophy hunter is entitled only to the trophy) and payments by hunters per unit shot.

Table 3. Capital invested in game and livestock, 1984/85

Category	Farm no	Game (R)	Livestock (R)	Investment per ha	Investment per Animal Unit	Game Animal Units
A. Venison production	1	318 000	320 620	158	703	438
B. Biltong hunting	3	778 625	108 300	415	716	931
	8	132 040	-	82	772	173
	9	60 900	-	34	644	95
	10	215 798	-	196	723	237
	11	188 000	198 020	92	471	558
C. Trophy hunting	4	175 000	-	93	582	221
	6	161 700	-	337	902	255
	7	470 000	-	157	558	809
	12	507 775	271 430	58	687	549
D. Beef Cattle : Zoutpan		-	133 891	67	582	-
N Tvl		-	137 850	53	568	-
Natal		-	278 784	155	473	-

(iii) Trophy sales, regarded by Gouws (1980) and Berry (1986) as the most prolific source of revenue.

(iv) Sales of live game.

(v) Sales of curios.

(vi) Standard fees per shot fired, regardless whether an animal is killed or not.

In order to calculate gross income, appreciation of livestock and/or game has to be added to the above. This can be positive or negative, depending on which was the larger, natural increases in numbers or take-off. Table 4 provides information regarding gross incomes per animal unit over a period of five years. Since the likelihood of bias will be large with a sample of only 10 farmers, no averages were computed for the game farmers.

The following conclusions can be drawn from the limited information available:

(i) Farmer 1, a venison producer, has consistently obtained higher gross incomes per A.U. from his livestock than the beef farmers involved. His gross incomes per A.U. from game compared poorly both with his gross income from livestock and with the incomes obtained by beef farmers.

(ii) Among the biltong hunting concerns, farmer 3 did rather poorly in 1985/86. In the other two years, his gross income from livestock (per A.U.) was comparable to those of beef farmers, but not his gross income from game. In the case of farmer 11, data cover only one year. In that particular year, game provided a gross income per A.U. comparable to those obtained by beef farmers, whilst his livestock did not do that well. Among the three specialised biltong hunting concerns that did not keep livestock as well, one (farmer 8) realized poor gross incomes compared to beef farmers. The gross incomes per A.U. of the other two were comparable to those of beef producers.

(iii) Gross incomes per A.U. of two specialized trophy hunting concerns were consistently higher than or comparable to those of the beef farmers, while those of the other one may be regarded as comparable. Farmer 12 who combines trophy hunting with domestic livestock production, realized better gross incomes per A.U. from game than what he obtained per A.U. from livestock in three out of four years. The revenues from game tended to be higher per A.U. than the average of beef farmers. The situation was the reverse in 1984/85.

(iv) In general, it can be concluded that depending on management practices, and probably also the particular year, game can yield gross incomes per A.U. comparable to those obtained from beef cattle.

Expenses

Total farm expenses were computed for the ten game farmers. In order to facilitate comparison, these were expressed per animal unit (Table 5).

The four farmers who combine game with livestock farming (Farmer 1: venison; farmers 3 and 11 : biltong; farmer 12 : trophy) invariably spent less per A.U. than the Northern Transvaal beef producers; in only one year (1982/83) did one of them (farmer 12) incur larger expenses per A.U. than the Natal beef producers. Of the specialized game farming concerns, one (farmer 4) tended to have higher expenses per animal unit than those of beef farmers. The expenses of the others tended to be below that. The general impression gained is that game is generally associated with lower expenses than beef cattle.

Net incomes and efficiency

The last step in the analysis was to compute net farm incomes. It was decided to convert these to an efficiency measure (net income per R100 capital investment) in order to make meaningful comparisons. Results are represented in Table 6.

The data should be evaluated in the light thereof that the period covered was generally a period of severe drought, which seriously affected profitability of both beef and game farming. It appears that on the average, that the beef farmers taking

Table 4 Gross incomes per animal unit obtained from game and livestock.

Category	Farm No	Enterprise	81/82	82/83	83/84	84/85	85/86
					RAND PER A.U.		
A. Venison Production	1:	Game	N.A.	72.59	37.74	58.75	123.24
		Livestock	N.A.	210.35	207.90	313.95	329.26
		Total	N.A.	136.05	118.22	173.42	208.29
B. Biltong Hunting	3:	Game	N.A.	N.A.	36.78	62.78	-80.30
		Livestock	N.A.	N.A.	200.00	240.00	-287.13
		Total	N.A.	N.A.	70.97	98.56	-108.51
	8:	Game	N.A.	144.12	115.17	167.73	192.60
	9:	Game	316.83	265.71	120.74	117.45	261.34
	10:	Game	N.A.	179.27	267.27	118.22	N.A.
	11:	Game	N.A.	N.A.	N.A.	219.89	N.A.
		Livestock	N.A.	N.A.	N.A.	186.66	N.A.
		Total	N.A.	N.A.	N.A.	209.30	N.A.
C. Trophy Hunting	4:	Game	N.A.	193.85	231.47	257.67	268.45
	6:	Game	N.A.	N.A.	N.A.	156.73	232.34
	7:	Game	N.A.	N.A.	209.73	293.66	212.27
	12:	Game	228.40	299.18	203.54	151.01	N.A.
		Livestock	65.46	100.95	128.09	272.78	N.A.
		Total	193.66	225.30	166.67	211.45	N.A.
D. Beef Cattle :	Zoutpan		195.10	188.90	198.60	229.90	N.A.
	N Tvl		127.29	103.46	138.64	234.89	N.A.
	Natal		172.92	164.74	193.88	192.96	213.89

N.A. = NOT AVAILABLE

Table 5. Farm expenses per animal unit over five years

Category	Farm no	1981/82	1982/83	1983/84	1984/85	1985/86
		Rand per animal Unit				
A. Venison Production.	1	N.A.	44.78	52.69	69.28	50,00
B. Biltong hunting	3	N.A.	N.A.	10.72	42.12	57.49
	8	N.A.	108.29	116.91	127.27	132.96
	9	226.76	246.44	226.37	252.51	158.93
	10	N.A.	207.14	100.16	92.99	N.A.
	11	N.A.	N.A.	N.A.	96.06	N.A.
C. Trophy hunting	4	N.A.	268.99	317.57	351.62	260.09
	6	N.A.	N.A.	N.A.	80.47	94.88
	7	N.A.	N.A.	N.A.	146.91	123.84
	12	110.33	120.45	116.22	119.31	N.A.
D. Beef Cattle :	Zoutpan	N.A.	N.A.	N.A.	N.A.	N.A.
	N Tvl	215.49	228.21	397.09	228.14	N.A.
	Natal	201.56	97.07	277.86	194.07	259.42

part in the mail-in record scheme, realised positive net incomes every year. Their average net incomes per R100 capital investment were, however, consistently below current interest rates (South African Reserve Bank, 1987, Tables S 29 and S 30). Turning attention to the 10 game farmers, it appears that of those for whom data are available for three or more years, only two consistently yielded positive net incomes; these incomes were comparable to those of the beef farmers. The other four experienced losses in some years. This tends to create an impression that game farming is financially more risky than beef production.

One may also conclude that game farming can under good management and favourable conditions yield net incomes and profits comparable to those obtained in beef production. In another study involving three farms belonging to De Beers consolidated Mines in the Northern Cape (Berry, 1986) positive net revenues were obtained from game farming. It was concluded that a widely based wildlife utilization strategy combining trophy hunting, non-trophy hunting, live animal sales and venison production yielded the highest return. This is however possible only on very large farms. It must also be borne in mind that since these ten farmers are among the few who kept useful- although not invariably ideal- records, they may possibly be regarded as top game farmers. The relationship between record keeping and financial success in farming has already been well documented (cf Burger, 1971; Jansen *et al*, 1972; De Wet, 1988). If in a select group of 10 game farmers only two realise results comparable to the average of larger groups of beef producers who also keep acceptable records, the economic and financial viability of game farming in general is rather questionable under present conditions.

Table 6 also provides averages and coefficients of variation of those cases where more than two years observations are available. Comparisons of these averages and coefficients of variation cannot be regarded as reliable yardsticks: They do not involve the same years and in addition, the beef farmer data has already been presented as averages. This will probably reduce variance. These figures nevertheless indicate that the beef farmers have on the average realized positive net incomes. Two of the seven game farmers included realised positive net incomes. If average net incomes (per R100 capital) are computed for the game farmers of which data are available for a specific year they appear to be comparable to those of the Northern Transvaal beef producers (but not to those of the Natal beef producers) while that of one exceeds the average for the Natal producers. The coefficients of variation of only two game farmers are comparable to those of beef producers. The coefficients of others vary between 155 per cent and 491 per cent, thereby indicating large oscillations in profitability. This strengthens the view that game farming can involve serious financial risk.

It is remarkable that the two game farmers with the relatively small coefficients of variation (Farmers 1 and 12) both combine game and livestock. So does farmer 3, who realised the highest coefficient. The others are specialised game farmers. This creates the impression that a combination of game and livestock farming is less risky than pure game farming. It also tends to dispel the notion that game reduces financial risk in livestock production.

Net farm income does not provide a complete view of profitability, since it excludes debt servicing expenses (interest payable plus loan capital redemption). The low return to capital investment is therefore a legitimate cause for concern.

In view of the low net incomes per R100 capital shown in table 6 and the high interest rates prevailing in South Africa, it is very doubtful whether the average beef producer or any of the 10 game farmers involved in this analysis could sustain their farming activities if debts exceeded 30 per cent of their total investment.

Table 6. Net incomes per R100 capital investment over five years.

Category	Farm No	1981/82	1982/83	1983/84	1984/85	1985/86
		Rand per R100 capital				
A. Venison production	1	N.A.	6.80	4.77	7.37	10.26
B. Biltong hunting	3	N.A.	N.A.	5.15	4.99	-12.20
	8	N.A.	1.16	-0.05	-1.85	2.05
	9	1.32	0.29	-1.63	-3.87	2.44
	10	N.A.	-4.26	7.15	1.15	N.A.
	11	N.A.	N.A.	N.A.	9.15	N.A.
C. Trophy hunting	4	N.A.	-5.77	4.79	12.93	-1.96
	6	N.A.	N.A.	N.A.	4.89	8.59
	7	N.A.	N.A.	N.A.	8.39	5.21
	12	3.32	4.08	1.68	3.85	N.A.
D. Beef cattle:	N Tvl	4.47	2.31	2.01	2.06	N.A.
	Natal	4.54	3.40	5.25	5.47	4.53

High capital costs involved with a conversion from livestock to game farming (game fencing, housing facilities and game purchase) also render it doubtful whether a farmer who already has to contend with a substantial debt burden will be able to improve his financial position by doing such a conversion. It may, on the contrary, lead to financial ruin especially if the high level of risk is borne in mind.

High land prices undoubtedly constitute one major reason for the low return on capital. This also renders it unlikely that either game farming or livestock ranching can in the foreseeable future be regarded as a profitable field for investment. It may however, be a hedge against inflation (under specific instances). Return on capital after tax is more important than net farm income per R100 capital.

The paucity of records, including financial records, among game farmers is another matter for concern. The relative low returns on capital put a premium on proper financial management and proper financial planning, which in their turn are impossible without good financial and physical records.

5. CONCLUSION

Game farming can probably not be expected to become a major South African agricultural enterprise in the foreseeable future. While it appears that game can yield results comparable to those of beef farming, game farming also appears to be financially more risky than livestock. Introduction of limited numbers of game may however augment farm income provided this will lead to utilization of supplementary and complementary relationships and provided it is not accompanied by large capital outlays, particularly in the form of game fencing and accommodation facilities. In a period of high and unstable interest rates, caution should be exercised by all contemplating entrance to the game farming industry.

6. NOTES

1. Based on an MSc (Agric) thesis by J Behr at the University of Pretoria. The research was funded by the Directorate of Agricultural Production Economics. The authors are indebted to Mr JB Chadwick for useful comments.

7. REFERENCES

BEHR, J and GROENEWALD, JA. (1990). Commercial game utilization on South African farms. Agrekon, Vol 29, No 1.

BEHR, J and GROENEWALD, JA. (1989). Marketing of venison by retail butchers in Transvaal. Agrekon, Vol 28, No 3.

BENSON, DE. (1986). Sources in Income. Farmers Weekly, 11 April: 10-11.

BERRY, MPS. (1986). A comparison of different wildlife production enterprises in the northern Cape Province, South Africa. South African Journal for Wildlife Res., Vol 16: 124-128.

BIGALKE, R. (1977). Natuurbewaring. 'n Handleiding vir skole. Perskor, Johannesburg.

BURGER, PJ. (1971). The measurement of managerial inputs in agriculture. III: The construction and evaluation of a scale. Agrekon, Vol 10, No 4: 5-11.

COLLISON, RFR. (1979). Production economics of impala. Beef and game management, Proceedings of the 3rd Hlabisa Soil Conservation Symposium.

CORNELIUS, PJ, and MARINCOWITZ, G. (1986). Ekonomiese verslag van Zoutpan - 1984/85 Pretoria: Departement van Landbou en Watervoorsiening, Direktoraat Landbouproduksie-ekonomie.

DE WET, PVDM. (1988). Bepaling van boerderybestuursvermoë met die oog op kredietevaluering in die bankwese. MSc (Agric) thesis (unpublished), University of Pretoria, Pretoria.

DIRECTORATE OF AGRICULTURAL PRODUCTION ECONOMICS. (1988). Postal record results of various branches of agriculture in the Republic of South Africa, 1984/85-1986/87: Large stock. Department of Agriculture and Water Supply, Pretoria.

DIREKTORAAT LANDBOUPRODUKSIE - EKONOMIE. (1986). Resultate van posrekordgroepe. Departement van Landbou en Watervoorsiening, Pretoria.

ELOFF, HP, DAFEL, GJ, LüDEMANN, CJF and LADEMANN, EE. (1973). A comparison between the growth of the impala (aepyceros melampus) and that of the dorper sheep in arid, sweet bushveld. Paper no 25:1-5, Symposium on Wildlife Conservation and Utilization in Africa, Pretoria.

FAIRALL, N. (1983). Production parameters of the impala, Aepyceros melampus. Animal Science, Vol 13: 176-179.

GOUWS, A. (1980a). Wildboere gesê ls eers met kenners. Landbouweekblad, 13 Junie:40-43.

GOUWS, A. (1980b). Snitte leer hulls wildsvleis eet. Landbouweekblad, 22 Augustus:30-31.

HOPCRAFT, D. (1970). East Africa: The advantages of game farming. Span, Vol 13, No 1: 29-32.

JANSEN, AA, SWANEPOEL, GH and GROENEWALD, JA. (1972). The management of managerial inputs in agriculture. IV: Application with business results. Agrekon, Vol 11, No 2: 47 - 52.

JOHNSTONE, PA. (1975). Evaluation of a Rhodesian Game Ranch. Journal of the Southern African Wildlife Management Association, Vol 5, No 1: 43-51.

LEDGER, HP, SACHS, R and SMITH, NS. (1976). Wildlife and food production with special reference to the semi-arid areas of tropics and sub-tropics. Wildlife Review of Animal Production, Vol 3, No 11: 13-37.

LIGHTFOOT, CJ. (1977). Eland (Taurotragus oryx) as a Ranching Animal complementary to Cattle in Rhodesia 1: Environmental adaptation. Rhodesian Agricultural Journal, Vol 74, No 2: 47-52.

MEISSNER, HH. (1982). Vervangingswaardes van verskillende klasse van plaasdiere en wild in terme van 'n biologies gedefinieerde grootvee eenheid. Boerdery in Suid-Afrika, Vleisbeeste C.3/1982.

O'DONOVAN, WN. (1980). Game ranching: A grand challenge with an exiting future. Proceedings of the National Nature Conservation Conference, Rustenburg.

POSSELT, J. (1963). The domestication of the eland. Rhodesian Journal of Agricultural Research, Vol 1: 81 - 87.

SCHULTZ, TW. (1974). Is modern agriculture consistent with a stable environment. In Hunt, K (editor). The future of agriculture. Technology, policies and adjustment. Oxford: Agricultural Economics Institute.

SKINNER, JD. (1966). An appraisal of the eland (Taurotragus oryx) for diversifying and improving animal production in Southern Africa. African Wild Life, Vol 20: 29 - 40.

SKINNER, JD. (1973a). An appraisal of the status of certain antelope of game farming in South Africa. Zeitschrift für Tierzüchtung und Züchtungsbiologie, Vol 90, No 3: 263 - 277.

SKINNER, JD. (1970). Game ranching in Africa as a source of meat for local consumption and export. Tropical Animal Health and Production, Vol 12: 151 - 157.

SKINNER, JD. (1984). Selected species of ungulates for game farming in Southern Africa. Acta Zool. Fennica, Vol 172: 219 - 222.

SKINNER, JD, VON LA CHEVALLERIE, M and VAN ZYL, JHM. (1971). An appraisal of the Springbok for diversifying animal production in Africa. Animal Breeding Abstracts, Vol 39, No 2: 215 - 224.

SKINNER, JD, DAVIES, RAG, CONROY, AN and DOTT, HM. (1986). Productivity of Springbok (Anatidorcas marsupialis) and merino sheep (Ovus aries) during a Karoo drought. Trans. Royal Society South Africa, Vol 46: 149 -164.

TALBOT, LM, PAYNE, WJA, LEDGER, HP, FERDCOURT, LD and TALBOT, MH. (1965). The meat production potential of wild animals in Africa. Edinbourgh: Commonwealth Buro of Animal Breeding and Genetics, Technical Communication No 16.

TAYLOR, CR. (1968). Hygroscopic food: A source of water for desert antelopes? Nature, No 219.

TAYLOR, CR. (1986). The eland and the oryx. Science America, No 220: 88 - 95.

THRESHER, P. (1980). The economics of domesticated oryx compared with that of cattle. World Animal Review, Vol 36: 37 - 43.

VAN ZYL, JHM, VON LA CHEVALLERIE, M and SKINNER, JD. (1968). A note on the dressing percentage in the Springbok (Anatidorcas marsupialis) and the impala (Aepyceros Melampus). Proceedings of the South African Society for Animal Production, Vol 8: 199 -200.

VON LA CHEVALLERIE, M. (1970). Meat production from wild ungulates. Proceedings of the South African Society for Animal Production, Vol 9: 73 - 88.

YOUNG, E. (1975). Technological and economic aspects of game management and utilization of Africa. Proceedings of the Third World Conference of Animal Production. Sydney: Sydney University Press.

SOUTH AFRICAN RESERVE BANK Quarterly Bulletin No.166.