An economic analysis of communal goat production

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ABSTRACT

The economic impact of different extension messages used was calculated using enterprise budgeting (gross margin analysis). Input data were gleaned from the literature, from participatory appraisals, as well as a field study, spanning 12 months, of small-scale communal goat farming systems in Jericho in the Odi District of North West Province. The number of offspring weaned per annum, as a proportion of does owned, was selected as the desired output for analysis. This study has shown that small-scale communal goat farmers are not adopting or implementing extension messages to improve production capacity. In south Africa the majority of goats are slaughtered in the informal sector. If the informal sector is to be persuaded to market goats commercially through formal channels, then knowledge of the economics of goat farming on communal lands should be provided. The economic aspects of extension messages are probably an important factor in determining acceptance and sustainability yet appear to be seldom investigated. The probable reason for lack of adoption of standard extension messages, which promote improved nutrition, parasite control, vaccination and treatment of goats, was economic. In other words, the so-called 'poor management practices' used by communal farmers appeared to be economically more profitable than the 'good management practices' suggested to increase production. The price of communal goats was not related to their mass. A higher level of inputs would probably have resulted in a heavier kid, however it was established that this would not have influenced the price received as a majority of the goats were slaughtered for ritual purposes where age, colour and sex were more important to the purchaser than body mass. It is standard practice in commercial farming systems to evaluate the economic benefits of all management practices before they are implemented. Production animal veterinarians use veterinary economics to compare different scenarios to control diseases or select management practices in commercial herds. It is suggested that the inputs and outputs of small-scale farming systems should be carefully analysed and that veterinary economics should also be used to evaluate the probable impact of extension messages formulated by veterinarians and animal health technicians.

Key words: communal grazing, enterprise budgeting, impact assessment, farming systems research, goats, small-scale farmers, veterinary economics, veterinary extension.

Sebei P J, McCrindle C M E, Webb E C **An economic analysis of communal goat production**. *Journal of the South African Veterinary Association* (2004) 75(1): 19–23 (En.). Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, 0110 South Africa.

INTRODUCTION

In South Africa, there is a so-called 'dual economy', where highly developed commercial farmers and subsistence level animal owners exist side by side[3,4]. A perception exists that the commercial farming systems are characterised by 'good' management whereas stock management by communal and small-scale farmers is considered to be 'poor'[13]. Between 1996 and 1999, veterinary needs appraisals were done in low-income rural, peri-urban, urban and settlement areas in South Africa[14,15,16,17]. These rapid appraisals described the communal farming systems for livestock in these areas, including goats.

Stock management strategies are perceived as being 'poor', amongst others reasons because communal farmers do not use technological advances or implement extension messages. Tawah (1998)[33] suggested that the reasons why communal farmers in Africa seldom implement the advice given by extension workers is that this advice usually implies full exploitation of biological capacity under ideal production conditions. Such ideal conditions do not exist in communal systems, which are characterised by a lack of resources such as land, labour and capital. He maintains that as small-scale farmers are prepared to accept partial or intermediate solutions, the aim should rather be to review and modify technologies to meet the needs of specific farming systems[33]. Economic considerations may be more important in communal goat farming systems than is the case with cattle, which also have a high social status[22,26]. Traditional societies that use communal grazing systems in Africa, are inclined to be very adverse to risk and thus tend to prefer low-input systems[11].

In the North West Province, where it is estimated that there are approximately 700 000 goats, only 315 were slaughtered at abattoirs in 1997[29]. This indicates that the great majority of goats are slaughtered in the informal sector. It is the latter category where investigation is needed to determine how to build capacity and optimise productivity, rather than just aim for high production.

The National Department of Agriculture states on its web-site (http://www.nda.agric.za), that the priorities with regard to small stock farming are disease and pest control, extension and marketing. If the informal sector is to be persuaded to market goats commercially, then the economics of goat farming on communal lands must be considered. The economic aspects of extension messages are probably important factors determining acceptance and sustainability yet appear to be seldom investigated[3] . Reynolds *et al.* (1987) suggested that any improvement or method that is to be recommended to small-scale farmers must be 'tested initially, be shown to work and be realistic to the available resources'[28]. On-farm evaluation of small-stock farming systems is logistically difficult and on-station testing does not reflect the numerous constraints of communal grazing. Therefore a systems approach is suggested[33], including economic analysis[2,9,22] so as to predetermine the likely impact of proposed interventions.

Economic evaluations can be used to assess the impact of postulated extension messages prior to their implementation[*]. Economic projections of potential profit or loss are conventionally used in commercial farming systems by production animal veterinarians, prior to implementation of changes to management systems.

Veterinary economics (animal health economics) emerged as a specific area of

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Received: August 2002. Accepted: December 2003.

interest in veterinary medicine in the late 1960s[8,34]. The basic economic principle for determining marginal returns is known as the equimarginal principle[1,8].

Enterprise budgeting, where only the variable costs of different enterprises on a commercial farm are compared, uses this principle. Enterprise budgeting has also been used to compare different enterprises within a communal farming system[22,23]. In longer-term situations, where the enterprise is carried on over several years, cost–benefit analysis is preferred. Decision analysis is usually used where there are multiple possible outcomes of a proposed course of action. Data inputs for decision analysis include literature references, field data and expert opinion. Spreadsheet models can be built to compare the economic data electronically[8]. In the case of Microsoft Excel® software, using spreadsheets for decision analysis is called 'Scenario planning'. This paper considers the economic aspects and calculates the economic impact of standard extension messages to improve the management of goats in communal systems.

METHODS

The methods used in this study were based on participatory rural appraisal and farming systems research and extension[2,18,29,36,37]. Initially 20 small-scale farmers were subjected to a structured interview. Two-stage cluster sampling[34] was done, where farmers were the primary unit and goats the secondary unit. The allocation was based on purposive selection of goat herds on communal grazing around Jericho, in the Odi district of North West Province, South Africa. Thirteen farmers remained in the trial for the duration and farms were visited once a month to assess goat-farming practices that influenced the survival of kids to weaning age. Economic data were gathered initially from structured interviews with farmers and thereafter from informal interviews and field observations made over a 12-month period.

A farming systems approach implies that the diagnostic phase of research into animal production should include all aspects intrinsic and extrinsic to the production system[33]. A production system showing inputs and outputs for small-scale communal goat farming is illustrated in Fig. 1.

Productivity is the ratio between system outputs and system inputs[2,12]. This relationship does not exist for 'production' as high production (*e.g.* high kidding percentage) may exist where inputs exceed outputs[3]. In Fig. 1, specific inputs and outputs that are known to impact on the productivity of the communal goat farming system, are listed. These inputs and outputs were observed during rapid appraisals[14,15,16,17] and were also observed during the 12-month field study[29].

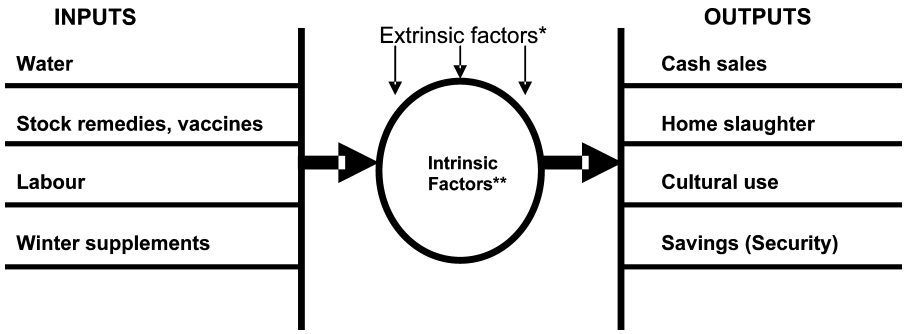

Fig. 1: **Diagram illustrating input–output analysis of a small-scale goat production system** (modified after McCrindle *et al.*, 1996). ***Extrinsic factors influencing the system such as socioeconomics** (*e.g.* high unemployment, lack of land tenure), **climatic influences** (*e.g.* droughts). ****Intrinsic factors: communal grazing, indigenous goats, small-scale farmers and their families, cultural practices, informal marketing.**

In the veterinary context, many of the factors within an animal production system are linked to the epidemiology of particular diseases and parasites as well as nutrition and management. These factors are ranked in importance so as to identify possible key variables that are likely to have the most impact on a desired output or outcome such as fertility, number of offspring weaned, number of animals marketed, mohair and milk production of does. For the purpose of this study, the number of offspring weaned as a proportion of does owned, was selected as the output for economic analysis. For indigenous goats, Donkin (1998)[10] recorded 150 % prolificacy and a kidding percentage of 123 % with a survival to weaning of 88.3 % (113 kids from 128 does) on-station. The survival to weaning rate of 0.883 per indigenous doe was therefore taken as the achievable output for this breed of goat under optimum conditions (Table 1).

Comparative economic analysis was used to quantify and compare the input and output, in terms of kids weaned, using enterprise budgeting[22,23].

Enterprise budgeting (gross marginal analysis) is the difference between the income of an enterprise and the direct costs associated with the enterprise. Triangulation is generally used in observational studies, therefore data on economic values and management used for enterprise budgeting (Table 1) were obtained from veterinary needs appraisals[15], structured interviews with farmers (n = 20) and informal interviews (open ended questions and observations) with farmers (n = 13) while examining goats during monthly farm visits[29]. Data on the productivity of indigenous goats were gained from the structured interviews and longitudinal study and were also taken from the literature[10,38]. The variable costs used (Table 1) included water consumption, parasite and disease prevention and treatment as well as winter feed supplementation. The number of kids that survived to weaning were considered the herd 'output'. From this, annual income was calculated for each scenario as:

Number of does × kids per doe that survived to weaning (output) × R150

The value of labour inputs was determined by its opportunity cost, *i.e.* the value of 1 hour of labour at the prevailing hourly rate in rural areas[22].

All data was entered into an Excel® spreadsheet (Microsoft Corporation, Redmond) and analysis done using the statistical software SPSS for Windows® Release 9.0.1 (SPSS Inc., Chicago).

RESULTS

During the longitudinal 12-month field study, the farmers sold or consumed approximately 20 % of the herd[29]. The number of kids that survived to weaning (n = 83) as a percentage of adult does (n = 155) was calculated as 53.3 %.

According to the farmers interviewed, the purchase and selling price (valuation) of an adult doe of the indigenous breed was R300 and a young goat (after weaning) was R150. Capital invested was therefore taken as the number of adult does × R300. It was observed that kids on communal grazing were weaned naturally at about 6 months of age (180 days). Goats were sold alive and the price was not calculated from body mass but only from a rough estimate of size and maturity. It was also found that approximately half of the farmers (n = 10) sold or slaughtered goats for ritual purposes, where age, colour and sex were more important than body mass[29].

Informal housing (called a 'kraal') for

Table 1: **Enterprise budgeting used to estimate the economic impact of extension to increase production, assuming that survival to weaning increases from 0.535 per doe to 0.883 per doe if suggested extension messages are applied.**

Items	A* Output 0.535 (rand)	B* Output 0.883 (rand)
CAPITAL		
Adult doe	300.00	300.00
Housing	0	100.00
Total capital invested	**300.00**	**400.00**
INCOME		
Income/doe @ R150/kid (*n* × value)	**80.25**	**132.45**
EXPENDITURE		
Variable costs (doe and kid)	**(n = 1.535)**	**(n = 1.883)**
Lucerne supplement for adult goats: 800g/day for 180 days @ R1.10/kg	0	158.40
Lucerne supplement for kids : 600g/day for 180 days @ R1.10/kg	0	118.80
Lick/concentrate 100g/day for 180 days @ R1.40/kg	0	25.20
Water @ 5 ℓ/day/doe @ 2c/ℓ	36.50	36.50
Extra water for kids @ 1ℓ/day/kid for 180 days	1.93	3.18
Dips @ 14c/treatment (Dazzel) × 2 for doe + kid	0	0.53
Deworming of kids @ R1.41 (Dectomax)	0	1.25
Deworming of doe @ R1.41 × 2	0	2.82
Vaccination (Heartwater I/V) for kids @ R10.61	0	9.37
Treatment (Terramycin) @ R6.00/kid	0	5.30
Jeyes fluid @ 10c/treatment/doe + kid × 2	0.31	0
Subtotal variable costs	**38.73**	**361.48**
Profit per enterprise (income – expenditure)	**41.52**	**–229.03**
Return on capital investment (%)	**13.84**	**–57.26**

A* = output calculated using data from current management system.
B* = output achieved by Donkin (1998) on-station with indigenous goats, using recommended feeding strategies and management to increase production.

the goats on communal grazing is made from thorn branches or scrap metal and wood (Fig. 2), whereas the recommended formal housing is constructed out of concrete blocks, cement flooring and corrugated metal roofing. The cost for formal housing of goats is estimated at R100 per goat.

Table 1 shows enterprise budgeting for the small-scale communal grazing system compared with projected costs for a system where extension messages used are followed.

It was observed during the study[29] and also by McCrindle[14,15] that communal small-scale goat farmers spent approximately 1 hour per day letting the goats out of the kraal and putting them in again. Although cattle were herded, goats were not. Opportunity cost was therefore estimated as 1 hour per day at an average of R7.00 per hour at the prevailing hourly rate for labour in Jericho. Interest opportunity on capital[22] was estimated at 10 %.

The goats in the longitudinal study were grazed on communal lands owned by the State. Goats on communal lands drank from streams, vleis and dams, but this water was not available throughout the year, as it often dried up in the dry season. Water for the goats kept in the 'kraal' was bought at 2c per litre. For calculation purposes, all water consumed annually was estimated at market value, even though only a portion was actually purchased, depending on climatic variables.

Small-scale goat farmers in the study did not treat for internal parasites or vaccinate against heartwater (*Cowdria ruminantium* infection) and gave little or no winter supplementation. It was recorded during informal interviews as well as observations during monthly visits that goats were treated with diluted Jeyes Fluid (a carbolic household disinfectant) approximately twice a year, to control ticks. The cost of this application was estimated from the retail price of the product as R0.10 per animal.

Conversely, several management practices have been advocated in the literature[5,6,21,24,25,27,30,31,35] and by extension personnel, to achieve high levels of production. These included supplementary feeding during the dry season, vaccination of kids against heartwater

Fig. 2: **Goats kept in a 'kraal' made of thorn bushes, with tyres to keep goats from the mud during the rainy season and tree for shelter.**

(*Cowdria ruminantium* infection) and control of internal and external parasites. The farmers confirmed, during informal interviews, that these recommendations were used as extension messages by extension officers and animal health technicians in the study area.

In the summer rainfall area of South Africa, supplementation is required during the dry season (May to October). For the sake of calculation, this was estimated as 180 days. In the Jericho area of North West Province, lucerne hay was available locally as it was grown and dried by commercial farmers at Brits, which is less than 60 km away. At the time the study was done, the cost of lucerne was R1.10 per kg (bales weighing an average of 20 kg cost R22.00).

Data used below was calculated from zero-grazing requirements for goats[20]. Lucerne consumption per adult goat was estimated as 800 g of lucerne hay per day of supplementation. Kids average 600 g per day over the full 180-day dry period (obviously the amount varies as a new born kid eats nothing, while a rapidly growing kid will eat more than an adult.) Kids were kept in the 'kraal' at home and not given access to grazing as the owners did not want to expose them to predators such as stray dogs and jackals. Cost of lucerne supplementation was calculated as:

Cost/kg × days × (n),

where n = number of does plus kids.

Concentrate or production lick supplementation over 180 days at 100 g per goat was estimated similarly at R48.03, as a 50-kg bag of production lick or concentrate cost approximately R70 as the time of the investigation (R1.40/kg).

Several authors have indicated that helminth infestation can lower production levels in small stock[7,19,27]. Dectomax® (doramectin 1 %, Pfizer Animal Health) has been selected as representative of this group as it is available in 50 mℓ bottles, which is an affordable packaging. Oral dewormers, although cheaper per millilitre, are packaged in 500 mℓ and 1 ℓ containers and require the purchase of a dosing gun. The cost of using Dectomax strategically twice a year for adults and 1 pre-weaning dose for kids, at a dose of 0.5 mℓ for all goats weighing 0–25 kg was worked out at R1.41 per dose during the survey[32].

If farmers use an acaricide (Dazzel N F®, diazinon 30 % m/v, Milborrow, Bayer Animal Health Division) instead of Jeyes fluid, the cost per spot treatment against ticks was R0.14[32].

As *Cowdria ruminantium* is endemic in much of the summer rainfall area, it is recommended that all kids are vaccinated intravenously to induce premunity[5]. For the sake of enterprise budgeting, it was also estimated that, under ideal management conditions to maximise production, each doe and kid would, over the course of the year, undergo a treatment against disease or for wounds or abscesses. For the sake of costing out, a single dose of injectable tetracycline (Terramycin®, oxytetracycline HCl 100 mg/mℓ, Pfizer Animal Health) was used.

DISCUSSION

Commercial farmers routinely use enterprise budgeting to make decisions[22], however, this practice does not appear to be followed when delivering extension messages to small-scale and communal farmers[4]. The economic values used for enterprise budgeting in commercial farming systems are estimated (calculated) from data obtained over the previous season. In the case of this paper, data used for the estimation (calculation) of values were taken from a field study of communally grazed indigenous goats and contrasted with published data obtained on-station with 'correctly managed' goats of the same breed and type. Such 'estimated ' or 'calculated' values are usually used for planning and evaluating management strategies by commercial farmers and production animal veterinarians. This paper suggests that the same type of planning and assessment that is used in commercial systems should be applied in communal farming systems.

There are many technical possibilities for improving production in goats but small-scale goat farmers do not appear to be adopting the strategies suggested by extension workers, animal health technicians and veterinarians. This paper emphasises the necessity for pre-evaluation of the economic impact of adoption of extension messages on small-scale goat farmers. The negative economic implications of standardised extension messages that improve production rather than productivity may be seen clearly from Table 1. It is very important that extension should be adapted to meet the actual conditions. For example, economic calculations in traditionally managed goat keeping systems should be based on the fact, as previously emphasised, that the sale price of goats is not linked to body mass but rather to the requirements for a live goat at a particular time, usually for cultural reasons rather than consumption[13,14,15,16,17].

The observed takeoff of 20 % of the animals also negates the commonly held view that goat owners want only to expand their herds and that bureaucratic (top-down) assistance is required to control and conserve the primary resource. The myth that goats on communal grazing are subject only to the 'tragedy of the commons' and that private good overrides public good to the extreme where the 'grazing' will be destroyed is also not accurate. In fact, the goat/thorn-scrub interaction, in the absence of additional feeding in the winter, results in a balanced ecosystem where goats will survive only to the stage where the thorn-scrub is depleted, as they are browsers.

Probably the optimal key variables in the communal goat farming system would be to decrease parasites by better management such as improved hygiene through removal of faeces and better drainage of the 'kraals' and elimination of old and infertile does, as the outputs, even at improved production levels cannot support the cost of supplementary feed in the dry months. The findings of this study also support the use of livestock in communal systems as 'savings'. Using the low-input/low-output goat production system observed during the survey, a return on capital of 13.84 % was achieved, which was higher than that offered at the time on savings accounts by commercial banks (10 %).

CONCLUSIONS

It is concluded that increased output does not necessarily lead to increased profit in traditional or communal goat farming systems. In fact, the extension messages used by field staff, which are based on the commercial model, could be counter-productive. The negative economic impact of these extension messages to improve production rather than productivity, is the probable reason why communal farmers are not accepting extension advice.

Possibly due to a lack of infrastructure and informal slaughter, goats are not weighed before or after slaughter and the price is not calculated per kilogram, as it would be in a commercial system. Although perceived as 'poor managers' these small-scale communal farmers are still achieving a good return of interest on their capital and thus the traditional use of goats as 'savings' is justified.

It is standard practice in commercial farming systems to evaluate the economic impact of all management practices before they are implemented. Production animal veterinarians use veterinary economics to compare different scenarios in control of disease. It is strongly recommended that economic evaluation or impact assessment should also be done before veterinarians and animal health

technicians implement extension messages to communal goat farmers.

ACKNOWLEDGEMENTS

Financial assistance from the National Research Foundation is gratefully acknowledged.

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