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Economic values for New Zealand dairy goats

J Solis-Ramirez*, N Lopez Villalobos and HT Blair

Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North 4442, New Zealand

**Corresponding author. Email: j.solisramirez@massey.ac.nz*

Abstract

A deterministic bio-economic farm model was developed to estimate economic values (EVs) for important milk production traits affecting profitability and to define a breeding objective for New Zealand dairy goats. Costs, revenue, metabolisable energy requirements for maintenance and activity, pregnancy, lactation and growth of replacements were included in the farm model. Three payment systems were investigated; Current scenario: Total milk-solids; Scenario 1: Ratio 1:2 for fat (F) and protein (P) and Scenario 2: ratio 2:1 for F and P. A price of \$13.00 per kg milk solids (MS) was assumed to calculate daily revenue per milk-solid component. A penalty of \$0.04 per litre of milk was applied in the last two scenarios. Assumed values of 3.7%, 3.2%, 4.4% and 0.7% for fat, protein, lactose and minerals, respectively, were used to estimate price per kg of F and P in Scenarios 1 and 2. For the Current scenario, the EVs for fat, protein, lactose and volume were \$11.64, \$12.27, \$12.39 and -\$0.10, while the estimations in Scenario 1 were \$14.49, \$31.09, -\$0.76 and -\$0.14, respectively and in Scenario 2 were \$28.92, \$14.37, -\$0.76 and -\$0.14, respectively. The EV for live weight was -\$2.16 across scenarios. The EVs estimated can be used to establish breeding objectives for New Zealand dairy goats.

Keywords: economic values; production traits; milk-solids; dairy goats; farm model

Introduction

Demand for dairy goat milk products produced by the New Zealand Dairy Goat Cooperative of New Zealand is increasing and a comprehensive genetic improvement scheme is being developed. The implementation of a genetic improvement scheme will not immediately increase milk production components, but will help to meet demand in the longer term.

Currently, there is no national breeding objective or national genetic improvement system for dairy goats, as there is for dairy cows, sheep or beef cows in New Zealand. In the absence of a national genetic improvement scheme, achieving and monitoring genetic gain of dairy goat herds is very difficult. Implementing a genetic improvement scheme is an important part of the development and progress of the dairy goat industry in New Zealand. Definition of a breeding objective and calculation of economic values are important aspects in this process.

The breeding objective indicates the direction of an animal genetic improvement programme. It can be defined as profit per animal, or profit per hectare, or profit per unit of dry matter intake and is the combination of genetic and economic values of important traits affecting costs and revenue. Hazel (1943) defined the economic value of a trait as the amount by which net profit per animal may be expected to increase for each unit of improvement in that trait holding the other traits constant. Dairy cattle animal breeding programmes are typically based on a multi-trait selection scheme of milk production including milk, protein yield and fat yield, live weight, fertility and health traits to improve

efficiency, sustainability and profitability (Visscher et al. 1994; Spelman & Garrick 1997; Gibson & Wilton 1998; Coleman et al. 2010). In New Zealand, previous studies on genetic parameters for dairy goats suggested that milk volume, fat yield, protein yield and somatic cell count should be included in a breeding objective (Singireddy et al. 1997; Morris et al. 2006; Apodaca-Sarabia et al. 2009.). However, there is a lack of well-defined breeding objectives in New Zealand and therefore comprehensive genetic improvement programmes to optimise the genetic gain.

The objectives of the present study were to calculate EVs for important traits affecting profit per milking doe to help into the definition of a breeding objective for New Zealand dairy goats.

Materials and methods

Information from a farmer survey (Solis-Ramirez et al. 2011) was used to develop a deterministic bio-economic farm model (Ponzoni 1986; Wolfova et al. 2009) to enable the estimation of EVs for milk production traits for dairy goat herds of New Zealand Dairy Goat Cooperative. Daily metabolisable energy requirements for maintenance and activity, pregnancy, and lactation including milk, fat, protein and lactose yield, as well as growth of replacements, were included in the farm model. Animals were kept indoors and feeding was based on fresh grass, grass hay and concentrates. Daily feeding was assumed to consist of 30% fresh grass, 10% grass hay and 60% concentrates at prices of \$0.10, \$0.15 and \$0.45, respectively. Milk was used to produce milk powder for export to international markets.

Table 1 Relative price for milk associated with three milk pricing scenarios and the economic values (NZ\$ per milking doe) per unit increase of production traits for New Zealand dairy goats under each milk pricing scenario. Current scenario for the milk payment system is based on total milksolids, Scenario 1 is based on a 1: 2 ratio between fat and protein and Scenario 2 is based on a 2:1 ratio between fat and protein. A penalty of \$0.04/L of milk was applied for volume in both Scenarios 1 and 2.

Parameter	Trait	Payment system		
		Current scenario	Scenario 1	Scenario 2
Milk price (\$/kg)	Fat		15.83	30.17
	Protein		31.66	15.08
	Volume		-0.04	-0.04
	Total milk-solids	13.00		
Economic value (\$/kg)	Fat	11.64	14.49	28.92
	Protein	12.27	31.09	14.37
	Lactose	12.39	-0.76	-0.76
	Volume	-0.10	-0.14	-0.14
	Live weight	-2.15	-2.15	-2.15

The herd structure, costs and revenue were described in a previous paper (Solis-Ramirez et al. 2011). Briefly, the herd structure consisted of 18.6% 0–1-year-olds, 14.5% 1–2-year-olds, 12.9% 2–3-year-olds, 10.8% 3–4-year-olds, 8.8% 4–5-year-olds, 4.9% 5–6-year-olds, 2.7% 6–7-year-olds, 1.6% 7–8-year-olds, 1.2% 8–9-year-olds, 1.1% 9–10-year-olds, 0.9% 10–11-year-olds. The herd was 97.5% Saanen, or Saanen by Toggenburg crosses and the remaining 2.5% were mainly British Alpine, Nubian and Saanen by British Alpine and Saanen by Nubian crosses. Production costs were mainly associated with labour (34.8%), pasture renovation and management (21.5%), and overheads (14%).

Three payment system scenarios were investigated; the Current scenario where producers are paid a price for their milk based on the weight of total milk solids it contains such that there is a ratio of 1:1:1:1 for fat (F) and protein (P), lactose and minerals; Scenario 1: where producers would be paid a weighted price according to the ratio of 1:2 for F and P and Scenario 2: where producers would be paid a weighted price according to the ratio of 2:1 for F and P. In the last two scenarios a \$0.04 penalty per litre of milk was imposed due to cost associated with collecting, transporting and drying. Payment of \$13.00 per kg of milk solids (MS) was used to calculate daily revenue per milk component. Milk was assumed to contain 3.7%, 3.2%, 4.4% and 0.7% for fat, protein, lactose and minerals, respectively (Solis-Ramirez et al. 2011). The economic value of the trait on a per milking doe basis was calculated according with the equation (Ponzoni 1986; Wolfova et al. 2009).

$$EV_i = P_{Ai} - P_{Bi} = \Delta P_i$$

where: P_{Ai} and P_{Bi} are the profits after and before an increase of one unit in the trait on a per milking doe basis, ΔP_i is the change in profit of the trait i .

Results and discussion

Milk components and EVs for the three scenarios are presented in Table 1. Differences in price between scenarios are a reflection of the relative importance assigned to milk solid components in the payment system. Differences in the EVs between traits are a reflection of the prices and marginal energy cost needed to produce a unit of the trait. By changing the payment system from total MS to fat and protein, the price for individual components of MS becomes greater than \$13.00 per kg MS in Scenarios 1 and 2. These increases are required to maintain an overall payment equivalent to \$13.00 per kg MS.

For the Current scenario, the EVs for fat, protein and lactose were similar. Since each milk-solid component received the same price, they were expected to have the same value. However, differences in use of energy for trait synthesis makes them slightly different, reflecting lower energy costs for lactose and protein versus fat synthesis (Table 1).

When EVs for fat and protein were calculated for Scenario 1, values were higher than those in the Current scenario. This was expected since the price per kg of fat or protein received by the farmer is higher to keep the overall payment at \$13/kg MS. Similar results were observed in Scenario 2 with higher EVs for the same traits (Table 1). The differences between the payments for milk components and the EVs in Scenarios 1 and 2 demonstrate the higher energetic cost to produce fat relative to protein. For example, in Scenario 1 the payment value and EV for fat are \$15.83 and \$14.49, respectively, a decrease of \$1.34 while the equivalent values for protein are \$31.66 and \$31.09, a decrease of just \$0.57.

Lactose had negative EVs for both Scenarios 1 and 2, but a positive EV in the Current system. This apparent discrepancy occurred because under the

Current system, all milk components receive a share of the MS payment. However, when payment is for fat and protein only, the energy cost of producing lactose is not countered by any revenue, resulting in the negative EVs.

Due to the absence of payment per kg of milk or per kg of meat, the EVs for milk yield and live weight traits were expected to be zero. However, the EV for milk yield in the current scenario was -\$0.10 which means that energy cost for increasing one kg of milk synthesis must still be met through feed consumption resulting in a negative value. Therefore, the EV for milk yield increases in Scenarios 1 and 2 because of the additional charge of \$0.04 for collecting, drying and transporting of milk. The EV for live weight was -\$2.15 across all three scenarios because the cost of increasing and maintaining one kg live weight was not affected by the payment system therefore did not differ between the scenarios.

There are no economic values reported in the literature for New Zealand dairy goats under similar production circumstances to this study. Bett et al. (2007) and Bett et al. (2011) reported positive EVs per doe per year for milk yield and live weight in dual purpose Kenyan goats for two farming systems, a smallholder medium-potential and a smallholder high-potential. For a third farming system of smallholder low-potential, the EV for live weight remained positive, but a negative value was reported for milk yield. Under New Zealand dairy cattle grazing conditions, Harris (1998) consistently estimated positive economic values for fat and protein and negative values for milk yield and live weight which agree with the trend found in the EVs calculated for milk yield and live weight in this study. Visscher et al. (1994) found a similar pattern of results under Australian grazing conditions, with positive EVs for milk-solids components and negative EVs for milk volume and live weight.

Conclusions

The positive EVs derived for fat, protein and lactose in the Current scenario indicates the important impact of those traits in the profitability per milking doe. However under Scenarios 1 and 2, only fat and protein had positive EVs while lactose had a negative EV. The negative EVs for lactose in Scenarios 1 and 2, and for milk yield and live weight across scenarios indicated a negative effect on the profit per milking doe when no revenue is received for these traits. These EVs can be used in a breeding objective for New Zealand dairy goats focused on profit per milking doe.

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References

- Apodaca-Sarabia CA, Lopez-Villalobos N, Blair HT, Prosser CG 2009. Genetic parameters for somatic cell score in dairy goats estimated by random regression. *Proceedings of the New Zealand Society of Animal Production* 69: 206–209.
- Bett RC, Kosgey IS, Bebe BO, Kahi AK 2007: Breeding goals for the Kenya dual purpose goat. II. Estimation of economic values for production and functional traits. *Tropical Animal Health and Production* 39: 467–475.
- Bett RC, Kosgey IS, Kahi AK, Peters KJ 2011. Definition of breeding objectives and optimum crossbreeding levels for goats in the smallholder production systems. *Small Ruminant Research* 96: 16–24.
- Coleman J, Pierce KM, Berry DP, Brennan A, Horan H 2010. Increasing milk solids production across lactation through genetic selection and intensive pasture-based feed system. *Journal of Dairy Science*. 93: 4302–4317.
- Gibson JP, Wilton JW 1998. Defining multiple-trait objectives for sustainable genetic improvement. *Journal Animal Science*. 76: 2303–2307.
- Hazel LN 1943. The genetic basis for constructing selection indexes. *Genetics* 28:476–490.
- Harris BL 1998. Breeding dairy cattle for economic efficiency: a New Zealand pasture based system. *World Congress on Genetics Applied to Livestock Production* 25: 383–386.
- Morris CA, Wheeler M, Lanuzel M 2006: Genetic trend and parameter estimates for milk yield traits and kidding date in a Saanen goat herd in New Zealand. *New Zealand Journal of Agricultural Research* 49: 175–181
- Ponzoni RW 1986. A profit equation for the definition of breeding objective of Australian Merino sheep. *Journal of Animal Breeding and Genetics*. 103: 342–357.
- Singireddy SR, Lopez-Villalobos N, Garrick DJ 1997: Across-breed genetic evaluation of New Zealand dairy goats. *Proceedings of the New Zealand Society of Animal Production* 57: 43–45
- Spelman RJ, Garrick DJ 1997. Effect of liveweight and differing economic values on responses to selection for milk fat protein, volume and liveweight. *Journal of Dairy Science*. 80: 2557–2562.
- Solis-Ramirez J, Lopez-Villalobos N, Blair HT 2011. Dairy goat production systems in Waikato, New Zealand. *Proceedings of the New Zealand Society of Animal Production*. 71:86–91.
- Visscher PM, Bowman PJ, Goddard ME 1994. Breeding objectives for pasture based dairy production systems. *Livestock Production Science*. 40: 123–137.
- Wolfova M, Wolf J, Krupova Z Kica J. 2009. Estimation of economic values for traits of dairy sheep. I. Model development. *Journal of Dairy Science*. 92: 2183–2194.