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EADY S.J., PRAYAGA K. C.

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Rabbit Farming for Meat Production in Australia: Profitability in the industry and Economic Values for Production Traits

EADY S.J., PRAYAGA K. C.

Pastoral Research Laboratory, CSIRO Animal Production, Armidale, NSW 2350
Email: s.eady@anprod.csiro.au

ABSTRACT

Rabbit farming is a growing rural industry in Australia following a sustained decline in the harvest of wild rabbits for meat. A profit function was used to derive the economic values for various production traits of farmed rabbits. The mean values of variables affecting the profit function were derived from literature and a rabbit farmer survey. The profit function was calculated as a deviation of costs from returns. Litter size at birth, mortality from birth to weaning, post-weaning growth rate and feed conversion were identified as suitable traits for a breeding objective. Initial estimates of an economic value for each trait is given.

INTRODUCTION

The world rabbit industry in 1998 produced nearly 1 million tonnes of rabbit meat for human consumption, of which 56% came from intensive rabbit farms (FAO 1999). In the same period, the Australian farmed rabbit industry produced around 106 tonnes of rabbit meat, 0.02% of the world farm rabbit production (Foster 1999). Wild rabbits have caused enormous environmental and ecological damage in Australia, and all rabbit farming was banned until 1987, when Western Australia changed its legislation to allow farming of rabbits in that state. New South Wales and Victoria followed suit in 1995 and 1997 respectively. Despite the ban on farming, Australia has had an established rabbit meat industry for many years based on harvesting wild rabbits. In the early 1990s, over 2.7 million wild rabbits per annum were sold for meat (Foster 1999). With the release in 1996 of rabbit haemorrhagic disease (RCD) as a biological control agent, the population of wild rabbits was dramatically reduced, with now only 100,000 being harvested per annum (Bowen and Read 1998).

Decreased availability of wild rabbit meat has created an opportunity for rabbit farming to fill the gap in an established meat market. Although the farmed rabbit industry is still relatively small, there has been consistent growth. An estimate of the number of commercial operations in Australia is 115, 80 in NSW, 32 in Victoria and 3 in WA with an average size of 57 breeding does (Foster 1999). The industry is expanding; over 300 licenses have been issued in NSW over the last 12 months (Licensing Officer Agriculture NSW, pers. com.).

As rabbit farming is a new industry in Australia, many aspects of production, health, nutrition and breeding need research support. Because the industry is intensive, much of the research from overseas is relevant, but due to limited genetic resources in Australia (rabbit imports are currently banned) there is a particular need for research to establish an appropriate population structure for breeding programs. In collaboration with the Rural Industries Research and Development Corporation, we have commenced a program of research, which includes the development of a breeding objective. This paper reports initial estimates of profit for rabbit farming and economic values for unit changes in production traits affecting profit.

MATERIALS AND METHODS

Functions developed by Armero and Blasco (1992) were used to calculate profit per breeding doe per year. These functions estimate returns from sale of offspring and culled breeding stock, and fixed and variable costs associated with the production of these animals. The economic values of 4 production traits, to be considered for use in a selection index, were estimated as partial derivatives of the profit function. Profit rather than gross margin was used so that some assessment of the overall profitability of rabbit farming could be made. When expressed on a per doe per year basis, fixed costs affect profit but have no effect on the relativity of economic values for individual production traits. Traits considered were litter size at birth (LSB), mortality from birth to weaning (%, MORTW), growth rate post-weaning (g/d, ADG) and feed conversion post-weaning (g of feed/g growth, FC). The economic value of changing each trait by 1 phenotypic standard deviation was calculated. In the profit function used by Armero and Blasco (1992), the traits varied were LS, WM, DGF and DCF to obtain economic values for LSB, MORTW, ADG and FC respectively (see Table 1 for description of variables from Armero and Blasco 1992).

Mean values for the variables used in the profit function represent the present average rabbit enterprise in Australia. These values were from a survey of rabbit farmers and, where there were no available data, Armero and Blasco's (1992) values were used. The survey data included responses from 19 farmers with an average herd size of 50 does (range 12 to 158 does). Mean values for mortality rates, prices, weights, litter size and number of parities per year were taken from the survey. Figures for daily weight gain and feed consumption were drawn from Armero and Blasco (1992). The fixed cost component was estimated from the cost of establishing a rabbit research facility for 120 does at Armidale in 1999. This included capital costs of $A22,000 for building and $A8,000 for water, rabbit cages, feeders and ventilation. To calculate annual depreciation, a life of 40 years was assumed for the building and 10 years for equipment. Interest on capital investment was assumed to be 8% per annum. An amount of $A500 was assumed for insurance and rates and, although not strictly a fixed cost, an amount of $A500 per annum was assumed for electricity and water. All of these costs were totaled and expressed per doe per year, rather than split between classes of breeding stock as in Armero and Blasco (1992). Labour costs were not included in the profit function, profit being considered in this case to be the return to the farmer for labour contributed to the enterprise. Over a medium term of 10 years, change in labour inputs associated with improvement in LSB, MORTW, ADG and FC were considered to be negligible. Likewise, change in pen space due to faster turnoff and increased numbers of grower rabbits would be small and have not been accounted for.

RESULTS AND DISCUSSION

Mean values for different variables affecting profit in the rabbit enterprise are given in Table 1, along with the respective source of information. The impact on profit (in absolute value) of a 10% change in each variable is also given in Table 1.

Table 1. Mean value for variables affecting meat rabbit profit for Spanish and Australian enterprises and the absolute effect on profit of varying the Australian figures by 10%.

Variable Name	Variable Description	Spanish (Armero & Blasco 1992)	Australian	Absolute effect of 10% change in variable on profit ($A)
WM	Mortality rate - birth to weaning (MORTW)	0.13	0.21[a]	4.59
FM	Mortality rate from weaning to slaughter	0.05	0.082[a]	2.19
MM	Mortality rate for adult rabbits	0.05	0.05	0.00
P1	Price/kg of live young rabbits	300 pts	$A2.41[a]	29.58
P2	Price/kilo of culled rabbits	60 pts	$A2.00[a]	0.14
P3	Price of bucks and does	2000 pts	$A20.00[b]	1.14
P4	Price/kilo of food	30 pts	$A0.37[a]	16.51
L	Days of lactation	35	35	2.05
G	Days of pregnancy	30	30	0.34
MBW	Live weight at maturity (kg)	3.5	4[b]	0.14
WS	Live weight at slaughter (kg)	1.85	2.79[a]	16.29
BW	Weight at birth (kg)	0.05	0.05	0.07
WW	Weight at weaning (kg)	0.5	0.5	1.67
FMM	Maintenance requirements of a male during its reproductive life (kg/yr)	60.8	60.8	0.16
CREP	Feed consumption of rabbits for replacement from 2 – 4 months (kg)	12	12	0.25
PRM	Maintenance requirements during pregnancy (kg/d)	0.160	0.160	0.63
LRM	Maintenance requirements during lactation (kg/d)	0.190	0.190	1.82
ERRG	Extra requirements for each gestated rabbit (kg/d)	0.005	0.005	0.34
ERRL	Extra requirements for each suckled rabbit (kg/d)	0.025	0.025	1.76
DCL	Feed intake per young rabbit during lactation (kg/d)	0.0103	0.0103	0.64
DCF	Feed intake per young rabbit post-weaning (kg/d)	0.135	0.135	10.91
DGL	Daily gain during lactation (kg/d)	0.0128	0.0128	0.58
DGF	Daily gain post-weaning to slaughter (kg/d) (ADG)	0.0482	0.0482	9.92
LS	Litter size (no. of rabbits)	9.25	8.2[a]	15.93
DY	Number of parities per year	7.3	7.4[a]	15.64
RR	Replacement rate of the farm	1.2	0.5[a]	1.25
HC	Health costs per adult rabbit	730 pts	$A2.60[a]	0.15
NM	Proportion of slaughtered adult rabbits not commercialized	0.35	0.35	0.32
RATIO	Ratio of bucks to does	1/7	1/7	NA
FFC/MFC	Female and male fixed costs	4656 pts	$A40.92[b]	4.68
FC rep	Fixed costs for replacement	859 pts	na	0.00
FCF	Fixed costs at fattening	33.75 pts	na	0.00

[a] From farmer survey; [b] from authors' estimates; no superscript - variables taken from Armero and Blasco (1992). na – all fixed costs expressed per doe per year.

Profit per doe per year was $A72.41 ($A1 = $US0.66, approximately). For a 300 doe unit (considered to be a full-time occupation for one person), this represents an annual return for

labour of $A21,723. The Federal Pastoral Award rate in 1998-99 for an operator/manager is $A22,700, so at current profit levels income from rabbit farming is close to basic farm wages.

There are notable differences between the Spanish and Australian production systems. Rabbits in Spain are marketed at a much lighter live weight than in Australia. This most likely reflects the influence of market demands in each country. In Australia, the most common slaughter weights required to meet customer demand are 1.0 to 1.25 kg for whole carcass butcher shop trade to the general public, and 1.4 to 1.7 kg for carcass portions to the restaurant trade. The difference in slaughter weight means that post-weaning, grower rabbits stay on the farm for much longer in Australia (approx. 48 days versus 28 days for Spain).
Mortality rates on Australian farms are also much higher - 21% compared to 13% from birth to weaning and 8% compared to 5% from weaning to slaughter. This is understandable given the maturity of the industry in Spain and the lack of experience in Australia. However, the Spanish figures give a sound target for us to work towards, and should we achieve such improvements in survival, the profit per doe would lift to $99.35, a significant improvement in financial returns to our farmers.
There is also a difference in the ratio of feed cost to returns for market rabbits- 10:1 for Spain and 6.5:1 for Australia. Given that the cost of feed comprises 72% of the total cost of Australian production (including fixed costs of 18%), buying feed is the major outlay for rabbit farmers and profit is correspondingly sensitive to feed prices (Table 1). Due to the size of the industry, production of rabbit feed is a minor component in the business of livestock feed manufacture. Manufacturers have to deal with small orders, make limited runs of feed to ensure fresh product, and supply feed in bags rather than in bulk. Some of these inefficiencies should be removed once individual farms attain production units in the order of 100 does, and manufacturers have indicated that feed cost could drop by as much as 18% (Ridley Agriproducts Pty Ltd, Tamworth). Even when offset by the additional capital requirement for bulk handling facilities, such a reduction in cost would be significant.
This raises the issue of which traits should be improved through changes to management and which are most appropriate for genetic improvement. In formulating breeding objectives we assume that resources are already being used efficiently and that inefficiencies, if they exist, are not included as costs (Smith *et al*. 1986). At this stage of our investigation, it is difficult to predict how much change could be made to variables such as mortality and feed cost by adjusting management or enterprise size. However, it is possible to assess the sensitivity of economic values to changes in such parameters to determine the risk in constructing a breeding objective based on current production data. In due course, the mean values we have used may need to be changed and economic values recalculated as the industry improves the efficiency with which it uses resources.
Our first task is to decide which traits should be included in the breeding objective and which should be omitted because they have little effect on profit. The impact on profit of a 10% change in each variable can be seen from Table 1. This can be used as a rough guide as to where to start. However, some variables with large effects, such as price paid for feed and market rabbits, are external influences; others, such as number of parities per year and live weight at slaughter, are determined by management and are easily adjusted. In order of magnitude of effect, this leaves us with changes in litter size, mortality rate from birth to weaning, daily gain post-weaning and feed intake per young rabbit post-weaning. Hence these 4 traits have been selected to make up a breeding objective.
The change in profit, or economic value, from 1 phenotypic standard deviation change in litter size born, mortality from birth to weaning, post-weaning live weight gain and feed conversion is given in Table 2. Estimates of phenotypic variance and heritability have been

drawn from the literature.

Table 2. Mean phenotypic variance and heritability from the literature, and economic value for traits in the breeding objective.

Trait	$\sigma\sigma^2_p$	h^2	Source	EV ($A)
Litter size at birth (no. of rabbits)	6.38	0.114	Ferraz and Eler 1994, Blasco et al. 1992, Baselga et al. 1992, Afifi et al. 1992, Ferraz et al. 1992, Zhang et al. 1992, Argente et al. 1997, Gomez et al. 1998	49.05
Mortality rate from birth to weaning (%)	517	0.068	Khalil et al. 1986, Ferraz and Eler 1994,Afifi et al. 1992, Ferraz et al. 1992	49.66
Post-weaning growth gain (g/d)	27.0	0.397	Moura et al. 1997, Ferraz and Eler 1994, Lukefahr et al. 1996, A.S. Moura pers comm.	10.61
Feed conversion ratio (g feed/ g gain)	0.720	0.290	Moura et al. 1997	33.04

The economic values for the 4 traits suggest a similar weighting should be given to LSB and MORTW, followed by a lower weighting for FC and a substantially lower weighting for ADG. The contribution of each of these traits to a selection index will primarily be a function of the product of the economic value and the heritability for each trait (Smith 1983). Published heritability estimates are given in Table 2 to give some indication of the likely contribution of each trait to an index.

If the phenotypic variances used for these 4 traits are significantly different in Australian rabbit populations, the economic values presented here may be incorrect. In the absence of any Australian estimates, a simple sensitivity analysis can be used to assess the impact of using errored parameters. If we assume the parameters for litter size have the highest accuracy and set the economic value for litter size to 1, then the relative economic value for the other 3 traits can be expressed as a proportion of the value for litter size (Table 3).

Table 3. Change in relativity of economic values for MORTW, ADG and FC compared to LSB when phenotypic variance is changed by plus or minus 10%.

Trait	Change in phenotypic variance by plus or minus 10%						
	Current[a]	+MORTW	-MORTW	+ADG	-ADG	+FC	-FC
LSB	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MORTW	1.01	1.11	0.91	1.01	1.01	1.01	1.01
ADG	0.22	0.22	0.22	0.24	0.20	0.22	0.22
FC	0.67	0.67	0.67	0.67	0.67	0.74	0.61

[a] using $\sigma\sigma^2_p$ from Table 2.

This analysis shows that a plus or minus 10% error in phenotypic variance for ADG has little impact on its relative economic value (0.20 to 0.24) compared to the larger impact that the same error has on the relative economic value for FC (0.61 to 0.74) or MORTW (0.91 to 1.11). Therefore, before we proceed to use the economic values presented in this paper it would be wise to gain further estimates of genetic parameters for MORTW and FC, and if possible, from rabbit populations that reside in Australia.

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