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The definition of breeding objectives in the Latxa dairy sheep breed

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SUMMARY – The aim of this work is to study the economic importance of different genetic improvement objectives in the Latxa dairy sheep breed through correlation and multiple regression analysis between technical and economic indexes. The analysed data belong to a total of 110 flock-year observations in flocks that are under milk recording and that follow a technical and economic advisory programme. Milk production is the trait that most uniformly affects the sheep activity economic margins, however neither fat nor protein content show significative influence. The reproduction traits are less uniform in their effect on these margins, being lambing date and fertility relevant for farmers that transform all the milk into cheese at the farm. Concerning the expenditure on concentrates, the increase in milk production occurs at the expense of the consumption of concentrates, although the higher the milk production the more efficient their use seems. From the analyses performed, it can be deduced that milk yield is the top priority trait for genetic improvement in the Latxa breed.

Key words: Breeding objectives, Latxa, sheep, economics

RESUME – *"Définition des objectifs d'amélioration chez la race ovine laitière Latxa". L'objectif de ce travail est d'étudier l'importance économique des différents objectifs d'amélioration génétique chez la race ovine laitière Latxa à travers une analyse de corrélation et de régression multiple entre les indices technique et économique. Les données analysées correspondent à 110 observations troupeau-an chez des troupeaux qui sont dans un système de contrôle laitier et qui suivent un programme consultatif économique et technique. La production laitière est un caractère qui affect le plus uniformément les marges économiques de l'activité ovine ; cependant, ni la teneur en matières grasses ni en protéine ne montrent une influence significative. Les caractères reproductifs sont moins uniformes en ce qui concerne l'effet sur les marges, et la date d'agnelage ainsi que la fertilité sont d'importance pour des producteurs qui transforment tout le lait en fromage à l'exploitation. Concernant les dépenses en concentrés, l'augmentation de la production laitière se fait au détriment de la consommation de concentrés, mais plus la production laitière est élevée, et plus leur utilisation semble efficace. D'après les analyses effectuées, on peut conclure que la production laitière est le caractère à priorité maximale pour l'amélioration génétique chez la race Latxa.*

Mots-clés : *Objectifs d'amélioration, Latxa, ovin, économie.*

Introduction

The definition of genetic improvement objectives is the corner stone which must be put in place in order to establish a breeding programme properly. However, very often these objectives are fixed by intuition, copying other breeds or species, without a rigorous analysis of their repercussions on the profitability of the production systems and without consideration of the social and economic evolution.

In November 1998 a work programme was defined for the "Animal Resources Sub-Network of the FAO/CIHEAM Cooperative Research Network on Sheep and Goats" consisting in the revision and definition of the genetic improvement objectives for sheep and goats in different countries and productive situations of the Mediterranean area and in other non-Mediterranean European countries and in the analysis from the technical and economic points of view of the potential breeding programmes to be applied in the sheep and goat breeds of these countries.

In the working programme it was stated that an example of the first two points (Description of production systems and Analysis of the results of technical and technical-economic management programmes in sheep and goat flocks and definition of the genetic improvement objectives) should be

provided by the coordinator by May 1999. This document is the example performed in the Latxa dairy breed of sheep of the Basque Autonomous Region of Spain.

Origin of data

The analysed data belong to flocks of the Latxa dairy breed in its two ecotypes (Black faced and Blond faced) that are under milk recording and that follow a technical and economic advisory programme during the years 1996 and 1997. The total number of flock-year observations is 110.

Milk recording is performed for selection and technical advisory purposes. Milk yield is recorded individually for each ewe following the AT method, while milk composition has been recorded in the milk collection tank and with less precision than the quantities. Lactations are estimated by the Fleischmann method calculating the total lactation yield (from lambing to drying off) and the typical lactation yield (from lambing to day 120 after lambing). The means for the fat and protein content have been estimated as the mean of all the measures taken in each farm each year weighted by the milk quantity measured in the tank for the respective control. Reproductive results (lambing date, litter size, mortality of lambs) are also recorded in the milk recording programme.

Sheep activity income is calculated taking into account the sales of milk and cheese, lambs for slaughter, ewes and rams sold to other farmers, culled ewes and rams and inventory and storage variations. Variable expenditures are calculated taking into account all feed and forage expenses, veterinary fees, bedding, marketing expenses and others. The margins are calculated by deducting the variable expenses from the sheep activity income.

Description of production systems

The productive objectives of the flocks whose data is analysed are the milk and meat production. Most of milk is processed to Idiazábal cheese, either by the own farmer or by the industry to which the farmer sells the milk. The processing of milk at the farm is a major factor to class flocks given that the added value obtained with milk is very dependent of this factor and therefore can influence the relative economic importance the milk production. Typical meat product are milk lambs that are slaughtered with less than one month and around 11 kg of liveweight.

The number of data available for each variable (flock-year), means, CV and range of the most relevant technical and economic indexes are presented in Tables 1 and 2. The reproductive system is based on one mating season per year in each flock. The ewe lambs have a low fertility and are normally mated in late autumn. Milking starts after the lamb(s) are slaughtered or weaned. Replacement ewe lambs are weaned late in many cases and therefore their dams are not milked; this explains the low percentages of ewes milked in comparison to the total number of ewes that have lambed. Milked ewes are normally dried off at the beginning of the summer with total lactation length (from lambing to drying off) of about five months. Milking is mechanical in most of the flocks that are included in this database.

The nutritional calendar has two very differentiated periods. Most flocks practise transhumance to the mountains after they are dried off, from the beginning of the summer until late autumn. During this period, the feeding of ewes is exclusively based on natural pastures. When ewes return to the farm they start receiving feed in the manger (forage and concentrates) about one month before lambing and continue to receive the feed throughout lactation.

When milk is transformed into cheese on the farm, cheese is sold directly by the producers on the farm, in markets or shops or through intermediaries. The farmers that sell milk do so to the cheese-making industries, although in some cases milk is sold directly to restaurants and to the public to make the typical curd dessert of the Basque Country. The lambs are also sold in various ways ranging from directly from the farm to through intermediaries or sales cooperatives.

Typology of farmers according to their economic objectives

Although within a population or breed the production systems are usually relatively homogeneous, there may be different groups according to productive specialization or according to the products sold

or forms of sale. When defining the objectives for the improvement of a breed, it is important to take this diversity into account in order for the objectives to be of interest for the whole breed or, to define different objectives according to the farmers, production specialities.

Table 1. Number of flock-year observations, mean, coefficient of variation, minimum and maximum for technical indexes

Variable	N	Mean	CV	Minimum	Maximum
Total ewe number (ewe nb)	92	328.11	57.20	31.96	943.66
Ewe lamb number	88	66.22	48.95	15.00	181.00
Replacement rate	88	17.80	77.34	5.74	138.10
Yearling number	88	65.32	52.16	6.00	178.00
Forage surface (ha)	92	24.77	76.52	4.50	91.00
Man power units (MPU)	92	1.58	38.54	0.35	3.00
Ewe nb/MPU	92	213.99	48.74	21.31	664.29
Mean lambing date	88	21 January	105.9	9 November	26 February
Ewe lamb fertility (%)	88	39.31	69.22	0.00	96.15
Fertility ewes >1 year (%)	88	87.85	13.16	10.00	99.40
Litter size	88	1.28	9.72	1.05	1.57
Lamb mortality (%)	88	4.64	50.13	0.00	9.55
Numerical productivity	41	1.10	6.90	1.00	1.30
Milked ewes/ewe nb (%)	87	54.05	29.70	16.66	94.64
Milked ewes/ewe lambed (%)	87	67.41	22.25	32.70	96.36
Lactation length (days)	87	154.80	10.80	112.00	196.00
Total lactation yield (l)	87	154.63	21.44	70.00	257.00
Typified lactation yield (l)	87	131.09	21.63	55.00	208.00
Daily yield (l)	55	1.15	16.20	1.00	2.26
Milked production/ewe (l)	91	75.90	59.09	16.43	323.90
Fat content (%)	60	6.51	11.02	3.36	8.36
Protein content (%)	60	5.52	8.65	2.47	6.26
Concentrate feed/milked ewe/year (kg)	98	113.72	61.28	5.72	439.02
Concentrate feed/milked liter (kg)	93	1.69	50.09	0.27	4.54

The production systems in the Latxa breed are relatively uniform. As we have commented previously, possibly the most important factor when differentiating farmers according to the economic importance of different traits, is the destination of the milk.

Therefore we have divided the farmers into three groups:

- Group 1: do not sell milk, only cheese
- Group 2: do not sell cheese, only milk
- Group 3: sell milk and cheese

Through an analysis of variance, we have compared the technical and economic indexes in order to determine in which indexes there are differences between these three groups, Table 3 showing the variables for which the differences between groups were significative or close to signification. Logically, the greatest differences were observed between groups 1 and 2.

Table 3 shows that the flocks specialized in cheese production (group 1), tend to be bigger, with more manpower and higher fertility despite a smaller numerical productivity, more milked ewes and with greater production, and greater administration of concentrates. The total sales of group 1 are much higher than those of group 2 and the milk specialization is much higher. The sheep activity margins per ewe, per hectare or per manpower unit of group 1 are also much higher than those of group 2; by 54%, 230% and 51% respectively.

Table 2. Mean, coefficient of variation, minimum and maximum for economic indexes

Variable	N	Mean	CV	Minimum	Maximum
Variable expenses/ewe/year (Euros)	92	49.77	70.09	5.82	232.44
Feed expenses/ewe/year (Euros)	92	24.17	67.30	1.09	108.90
Forrages expenses/ewe/year (Euros)	92	15.53	87.25	0.65	78.13
Feed/total expenses (%)	92	50.10	27.33	18.78	82.26
Forrages/total expenses (%)	92	30.71	46.58	1.71	67.96
Milk sales (Euros) a†	91	8006.46	134.04	0.00	43227.66
Milk sold (l)	91	9084.84	135.73	0.00	56447.00
Average milk price (Euros/liter)	62	1.01	27.78	0.69	1.72
Cheese sales (Euros) b†	91	16861.86	109.45	0.00	66830.74
Cheese sold (kg)	91	1831.98	107.57	0.00	6867.00
Average cheese price (Euros/kg)	57	9.16	12.81	4.45	10.95
Lamb sales (Euros) c†	92	7431.31	57.55	811.85	26529.16
Average lamb price (Euros/kg)	59	10.93	41.51	1.38	17.98
Sheep activity sales (Euros)	92	35205.13	53.98	4357.34	74599.27
Milk specialization† (%)	91	74.4	14.66	45.8	94.5
Subsidies/ewe (Euros)	91	38.58	57.77	2.62	117.88
Sheep activity margin/ewe (Euros)	92	76.12	65.85	0.75	226.82
Sheep activity margin/ha (Euros)	92	1314.78	88.18	2.09	6836.52
Sheep activity margin/MPU (Euros)	92	13944.32	61.54	73.64	40138.43

† Milk specialization = (a+b) / (a+b+c).

Table 3. Index means for groups 1, 2 and 3

Variable	Group 1	Group 2	Group 3
Total ewe number (ewe nb)	456.2	375.1	370.8
Man power units	1.71 a	1.40 b	1.68
Ewe nb/MPU	207.8	230.1	201.2
Mean lambing date	29January a	28January a	10January d
Fertility ewes >1 year (%)	92 a	84 b	88
Litter size	1.32 a	1.31a	1.23 c
Numerical productivity	1.077 b	1.14 a	1.083
Milked ewes/Ewe nb (%)	57.5	51.8	53.3
Milked ewes/Ewe lambed (%)	70.9	65.0	66.7
Total lactation yield (l)	161.6	152.0	151.7
Concentrate feed/milked ewe/year (kg)	127.7	94.5	120.1
Concentrate feed/milked liter (kg)	1.73	1.37b	1.99 a
Forages/total expenses (%)	31.8	34.0a	25.76
Sheep activity sales (Euros)	43707 a	26932 d	36403 e
Milk specialization (%)	81.3 a	66.3 d	76.9 a
Sheep activity margin/ewe (Euros)	88.6 a	57.6 b	85.4 a
Sheep activity margin/ha (Euros)	2054 a	892 d	1071 d
Sheep activity margin/MPU (Euros)	16853 a	11166 c	14293

a>b= P<0.05; a>c= P<0.01; a>d= P<0.001; e>d= P<0.05.

Relationship between economic results and technical indexes

This section comprises the core of the work to be carried out. First, an analysis has been made of the correlations existing between the economic results (sales and margins) and some of the relevant inputs, especially those regarding feed and the technical indexes that reflect some traits that are

potential selection criteria, such as lambing date, which can express the sexual seasonality, fertility, litter size and milk production. This correlation analysis has been carried out for all data and separately for the three groups of flocks.

Likewise, a multiple regression analysis has been performed for the total data set and per group using as dependent variables the gross margins per sheep, per Ha and per manpower unit and as predictive variables lambing data, lambing percentage, litter size and real lactation.

In Table 4, it can be observed that milk production is the trait that is most uniformly correlated with the sheep activity margins, however neither fat nor protein content show significative correlations. The reproduction traits are less uniform in their influence on these margins. Concerning the expenditure on concentrates, the increase in milk production occurs at the expense of the consumption of concentrates, although the higher the milk production the more efficient their use seems.

Table 4. Correlations between margins and concentrates consumption with reproductive and milk production traits

		Sheep activity margin/ewe	Sheep activity margin/ha	Sheep activity margin/MPU	Concentrate/ milked ewe	Concentrate/ milk litre
Mean lambing date	Global	–0.09	0.14	–0.01	–0.06	–0.10
	Group 1	–0.28	0.12	–0.34	–0.25	0.19
	Group 2	–0.21	0.10	0.34	–0.19	–0.12
	Group 3	0.20	8.07	0.03	0.39	0.03
Ewe lamb fertility	Global	0.23*	–0.05	0.20	0.35**	–0.02
	Group 1	0.17	–0.50*	0.03	0.27	–0.04
	Group 2	0.20	0.27	0.42*	0.13	0.04
	Group 3	0.28	0.30	0.30	0.62***	–0.07
Fertility ewes >1 year	Global	0.14	0.05	0.12	–0.01	–0.23*
	Group 1	0.16	–0.18	–0.21	0.13	–0.08
	Group 2	–0.18	–0.21	–0.14	–0.26	–0.12
	Group 3	0.53**	0.64***	0.25	0.35	0.64***
Litter size	Global	0.12	0.10	0.10	0.07	–0.29*
	Group 1	0.01	0.06	–0.34	0.05	0.13
	Group 2	0.14	–0.04	0.48*	0.04	–0.27
	Group 3	0.34	0.26	0.27	–0.05	–0.42*
Real lactation yield	Global	0.52***	0.32**	0.44***	0.46***	–0.17
	Group 1	0.33	0.14	0.41*	0.40	0.11
	Group 2	0.58**	0.44*	0.42*	0.59**	0.04
	Group 3	0.65***	0.59**	0.66***	0.38*	–0.56**
Fat content	Global	–0.15	–0.05	–0.04	–0.03	0.19
	Group 1	–0.25	0.02	0.03	–0.33	–0.30
	Group 2	–0.34	–0.45*	–0.43	0.04	0.40
	Group 3	–0.11	–0.12	–0.11	0.07	0.40
Protein content	Global	–0.01	–0.11	0.00	0.12	0.17
	Group 1	0.19	–0.18	0.30	0.14	–0.19
	Group 2	–0.50*	–0.36	–0.40	–0.20	0.22
	Group 3	0.09	–0.13	–0.02	0.29	0.36

*P<0.05; **P<0.01;***P<0.001.

The regression analysis shows that milk production is the trait that most influences the economic margins when considering the data globally or considering groups 2 (only milk sold) and 3 (milk and cheese sold). On the contrary, in group 1 (only cheese sold), if the milk production is also important, lambing date and fertility also have an influence (Table 5).

Table 5. Results of the regressions of reproductive and milk production criteria on the margins by stepwise procedures

	Sheep activity margin/ewe				Sheep activity margin/ha				Sheep activity margin/MPU			
	Variable inclusion	Partial R^2	Total R^2	Regression coefficient ± standard error	Variable inclusion	Partial R^2	Total R^2	Regression coefficient ± standard error	Variable inclusion	Partial R^2	Total R^2	Regression coefficient ± standard error
Global	1. Milk yield	0.27***	0.27	0.82† ± 0.14	1. Milk yield	0.11**	0.11	15.39† ± 4.33	1. Milk yield	0.20***	0.20	117.39† ± 26.31
	2. Fertility ewes >1 year	0.04	0.30	0.91†† ± 0.43	2. Ewe lamb fertility	0.05*	0.15	–10.23†† ± 5.11	2. Fertility ewes >1 year	0.03	0.22	121.65†† ± 78.35
	3. Mean lambing date	0.03	0.33	–0.35††† ± 0.21								
Group 1	1. Milk yield	0.11	0.11	1.01† ± 0.31	1. Ewe lamb fertility	0.25*	0.25	–31.84†† ± 11.62	1. Milk yield	0.17*	0.17	195.66† ± 56.91
	2. Mean lambing date	0.17*	0.28	–2.57††† ± 0.67					2. Mean lambing date	0.25**	0.42	–262.94††† ± 84.80
	3. Fertility ewes >1 year	0.15*	0.44	4.57†† ± 2.50								
	4. Litter size	0.07	0.51	197.5†††† ± 114.1								
Group 2	1. Milk yield	0.34**	0.34	0.52† ± 0.15	1. Milk yield	0.20*	0.20	10.29† ± 4.23	1. Litter size	0.21*	0.21	9,216.06†††† ± 4,659.73
									2. Milk yield	0.08		24.10† ± 14.61
Group 3	1. Milk yield	0.42***	0.42	0.96† ± 0.34	1. Fertility ewes >1 year	0.41***	0.41	36.38†† ± 13.85	1. Milk yield	0.43***	0.43	222.82† ± 54.31
	2. Fertility ewes >1 year	0.06	0.48	2.15†† ± 1.37	2. Milk yield	0.10	0.51	7.14† ± 3.45				

*P<0.05; **P<0.01;***P<0.001.
†Euros/litre; ††Euros/lambing; †††Euros/day; ††††Euros/lamb.

Conclusions

Although these are preliminary conclusions, from the analyses performed, it can be deduced that milk yield is the top priority trait for genetic improvement in the Latxa breed. The reproduction traits had a lesser influence on the profitability of the farms. The influence of the mean lambing date in the farms that specialize in the transformation of milk into cheese would require a more detailed study.

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