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The experience of the ANGRA farmers in prolificacy improvement by the BMP15 ovine mutation Fecx^R in Rasa Aragonesa

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Abstract. The FecX^R mutation is a variant of the ovine gene BMP15 involved in the increase of prolificacy. It was found in the breed Rasa Aragonesa, and since 2007, the National Association of Breeders of this sheep (ANGRA) included it in its genetic selection scheme under the denomination "Gene Santa Eulalia" (or GASE). FecX^R provides a sustainable molecular tool to improve productive efficiency avoiding additional treatments. Over 4000 ewes carrying this mutation are nowadays exploited by members of ANGRA. The positive effect of FecX^R on prolificacy is well known, resulting in a clear improvement of incomes and cost effectiveness. This communication reports the results of a satisfaction survey conducted among 18 producers using FecX^R in their flocks. The survey is based up on the farmers' personal perception of different questions regarding the ewes carrying FecX^R. The statistical analysis of data provides several conclusions about practical aspects that, prior to the diffusion of this variant, generated some doubt among producers. In fact, the producers do not observe differences among the FecX^R carrier and wild type ewes as it refers to general management, even if most of them consider that the mutation provides a higher fertility, prolificacy and cost effectiveness. All of them should recommend the use of FecX^R in other flocks in practice. A high degree of satisfaction with the use of FecX^R is therefore observed, confirming the results of the objective analysis of the data actually recorded by the official Control of Productions.

Keywords. FecX^R perception – Ovine farmers – Actual production data.

L'expérience des producteurs ovins associés à ANGRA utilisant la mutation FecX^R de BMP15 chez la race Rasa Aragonesa

Résumé. *La mutation FecX^R est une variante du gène ovine BMP15 impliqué dans l'augmentation de la prolificité. Elle a été trouvée dans la race Rasa Aragonesa, et depuis 2007, l'Association Nationale des éleveurs de ce mouton (ANGRA) l'a incluse dans son programme de sélection génétique sous la dénomination "Gène Santa Eulalia" (ou GASE). FecX^R fournit un outil moléculaire pour améliorer l'efficacité productive en évitant les traitements supplémentaires. Plus de 4 000 brebis portant cette mutation sont aujourd'hui exploitées par des membres d'ANGRA. L'effet positif de FecX^R sur la prolificité est bien connu, ce qui entraîne une nette amélioration des revenus et de la rentabilité. Cette communication rapporte les résultats d'une enquête de satisfaction menée auprès de 18 producteurs utilisant prolificité dans leurs troupeaux. L'enquête est basée sur la perception personnelle des éleveurs à propos de différentes questions concernant les brebis portant la mutation FecX^R. L'analyse statistique des données fournit plusieurs conclusions sur des aspects pratiques qui, avant la diffusion de cette variante, avaient suscité des doutes parmi les producteurs. En fait, les producteurs n'observent pas de différences entre les porteuses de FecX^R et les brebis de type sauvage en ce qui concerne la gestion générale, même si la plupart d'entre eux considèrent que la mutation offre fertilité, prolificité et rentabilité accrues. Tous devraient recommander l'utilisation de FecX^R dans d'autres troupeaux en pratique. Un degré élevé de satisfaction à l'égard de l'utilisation de FecX^R est donc observé, confirmant les résultats de l'analyse objective des données effectivement enregistrées par le contrôle officiel des productions.*

Mots-clés. *Perception FecX^R – Ovins – Données de production réelles.*

I – Introduction

The “Rasa Aragonesa” is an autochthonous Spanish rustic ovine breed devoted to meat production. Its mean prolificacy is 1.3 lambs/birth. In 2007, a variant of the BMP15 locus denominated $FecX^R$ was identified in this breed (Monteagudo *et al*., 2009). As other BMP15 variants known in different breeds, $FecX^R$ increases prolificacy in heterozygous ewes, improving the number of produced lambs and the profit earning capacity of the flocks. Since that year, the Asociación Nacional de Criadores de Ganado Ovino de la Raza Rasa Aragonesa (ANGRA) is including the use of $FecX^R$ in its genetic improvement programme, under the commercial denomination “Gen Santa Eulalia” (GASE). The programme is based up on the identification of the females carrying $FecX^R$ by means of DNA analysis and in a strict mating control, since homozygous $FecX^R$ ewes are sterile. The mating plan design takes into account that BMP15 is linked to the chromosome X. It is also focused to conserve the morphology of the breed by preventing crossing with other ones and to minimize inbreeding increase (Laviña, 2012).

Prior to the beginning of GASE introduction into flocks, several doubts arose among breeders, mainly about the ability of the “Rasa Aragonesa” ewes to nurture two (or even three) lambs and about the productive life expectancy. After a decade of experience, the present communication reports the current perception of the flock managers (López, 2016) and the analysis of the real data compiled on these and other aspects of the use of $FecX^R$. Both (subjective opinions and objective data) are now compared.

II – Material and methods

Among the 20 farms owning the highest amounts of $FecX^R$ carriers, 18 accepted telephone interviews in order to provide information on the present perception of the flock owners. These farms are distributed along the three provinces of the Aragón region.

The poll included 27 questions. Among them, 11 were related to the characteristics of the flock exploitation (staff, management system etc.) while the rest are devoted to obtain the perception of the farmers (comparison of the $FecX^R$ carriers vs. wildtype ewe, workforce requirements, profitability etc.). For most of the questions two or three possible answers are offered (yes or no, equal, more, less, etc), while two may have free answers and six require numerical values.

Besides the answers from the farmers, the ANGRA databases provided the necessary and precise information about the flock size and the proportion of $FecX^R$ ewes. Moreover, the actual production data were obtained from the official Control of Productions in the Genealogy Book of the Rasa Aragonesa breed, managed by ANGRA. Recorded data from 23,645 individuals and 84,583 births have been used to study the following variables: **prolificacy** (number of alive or dead lambs per litter), **parturition interval** (number of days between a delivery and the following one), **proportion of deaths among the ewe**, **single, duplet or multiple birth**, **age at moment of the first delivery and productive life duration**.

Statistical analysis was carried out by means of the software IBM ® SPSS ® version 22, in order to produce descriptions of the variables (mean, standard deviation, range, histograms and different diagrams) and to perform univariate and multivariate analysis. Student’s t and ANOVA were applied to comparisons among means. The interdependence among qualitative variables was studied by chi square test, while Pearson’s correlation was applied in the case of quantitative variables for this purpose (see Petrie and Watson, 1999, for further details). The **productive life span** (difference in months between the last and the first known deliveries for a given ewe) was studied by means of survival analysis; the Breslow test allowed the comparison between the productive life span in both group of ewes.

III – Results and discussion

Table 1 summarises the results obtained in the opinion survey for the qualitative values, indicating the absolute frequencies of each kind of answer Farms using the $FecX^R$ mutation are mainly intergenerational and semi-extensive, with a mean size of 1,033.9 animals and apply high technification reproduction procedures.

Table 1. Results of the opinion survey about qualitative variables

Question	Answers	Count
Is artificial insemination used	yes	17
	no	1
Prolificacy of FecXR ewes	higher	10
	equivalent	8
Productive life span of FecXR ewes	equivalent	10
	shorter	8
Veterinary cares for FecXR ewes	more intensive	1
	equivalent	17
Workforce for FecXR ewes vs. for wildtype ewes	equivalent	18
Profitability of FecXR ewes vs. of wildtype ewes	superior	18
Would you suggest the use of FecXR by other prducers	yes	18
Plans to modify the number of your FecXR ewes?	increase	16
	decrease	1
	maintain	1

Table 2 presents the quantitative data of the farms involved in the survey; it indicates the obtained mean and standard deviation for each variable, besides its maximum and minimum values. The results in both Tables provide an approximation to the characteristics of the farms using the $FecX^R$ variant, besides an extensive view of the producers' perception of $FecX^R$ ewes.

Table 2. Description of the main quantitative variables in the flocks (rd: registered data; op: opinion)

Variable	N	%	Mean	Minimum	Maximum	Standard deviation
Flock size (rd)	18	100	1.033	344	1790	466.906
% of FecXR ewes(rd)	18	100	12.95	2.48	31.4	10.347
Age of flock manager (rd)	18	100	47.72	31	66	9.041
Staff members (rd)	18	100	1.5	1	3	0.588
Ideal % of FecXRewes (op)	13	72,2	57.3	15	100	23.1495

On the other hand, Table 3 shows the actual differences among $FecX^R$ and wildtype ewes according to the recorded data (not subjective opinion); the differences are significant for prolificacy, age at the first delivery and productive life span. Most of the results in this table are similar to those reported by Alabart *et al*. (2016).

Table 3. Comparison of the data recorded for wildtype and ewes

Character	Wild type ewes	FecXR carriers	p
Prolificacy	1.40 ± 0.003	1.75 ± 0.011	<0.005**
Parturition interval	283.31 ± 0.750	277.94 ± 1.512	0.198
Adult ewes mortality	6.36 ± 0.003	5.58 ± 0.004	0.124
Productive life span (months)	64.66 ± 0.328	74.54 ± 2.634	<0.005**

** Significant difference, p<0.01.

Our main conclusions are:

1. Most farmers do not notice clear differences as it refers to day-to-day management (workforce, required equipment, etc.) after introducing $FecX^R$ in their genetic improvement strategies.
2. Besides prolificacy, the fertility index of the $FecX^R$ ewes is perceived to be higher than this of the wildtype sheep.
3. Most of the flock managers do not appreciate a shorter life span in the $FecX^R$ ewes, or different veterinary cares.
4. For most of the farmers, profitability of the $FecX^R$ ewes is higher; as a consequence they are planning an increase of the proportion of this kind of sheep in their flocks. All of them should recommend the introduction of $FecX^R$ in other farms.
5. In all, we can therefore conclude that the producers using the $FecX^R$ mutation are highly satisfied by the obtained results.
6. The objective evaluation of the data actually recorded, confirms the perceptions declared by the flock managers: the $FecX^R$ mutation is a useful tool in the improvement of the Rasa Aragonesa breed productivity, leading to a higher profitability of the flocks.

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