

TOPIC: Gene-based technologies applied to livestock genetics and breeding

Evaluation of the utility of the *FecB* gene to improve the productivity of Deccani sheep in Maharashtra, IndiaC. Nimbkar^{a,b}, V.C. Pardeshi^c^a Nimbkar Agricultural Research Institute, Phaltan, Maharashtra, India^b University of New England, Armidale, NSW, Australia^c National Chemical Laboratory, Pune, IndiaE-mail: cnimbka2@une.edu.au

The Booroola fecundity gene (*FecB*) is an autosomal gene in sheep with a large effect on ovulation rate and consequently, litter size. The Nimbkar Agricultural Research Institute (NARI) at Phaltan, Maharashtra, India (latitude 18°N and longitude 74°E) has embarked upon a breeding program to introgress the *FecB* gene from the Garole breed of Sunderban, West Bengal, into the local Deccani breed. Garole sheep, the probable original source of the *FecB* gene, are small-sized (average adult live weight 15 kg) and adapted to hot humid conditions. The Deccani are the native sheep of the semi-arid Deccan plateau and adult ewes weigh about 27 kg.

The reproductive performance of 188 ewes with ¼ Garole genotype (progeny of Deccani ewes mated to Garole x Deccani F1 rams), 97 of which were heterozygote carriers of the *FecB* gene (*FecB*^{B+}) and 91 were non-carriers (*FecB*⁺⁺), was analyzed to quantify the advantage in lamb production conferred by the gene. The percentage of abortions/stillbirths among maiden ewes was compared between ewes of the two *FecB* genotypes using a Z test. Other traits analysed were litter size (lambs born alive) and lambs weaned per lambing (weaning age being 120 days) as traits of the ewe. Fixed effects fitted for both traits were *FecB* genotype of ewe, birth year of ewe, year and season of lambing with age of ewe at lambing as a covariable. The interaction of ewe genotype and litter size was also fitted for lambs weaned. In addition, another model was fitted for the trait lambs weaned per lambing, with litter size instead of ewe genotype as a fixed effect. A random sire effect was fitted for both traits. A repeated measures analysis was done for both traits, using data from 1–3 lambings per ewe. Sire variance was found to be very low for both traits.

The proportion of abortions/stillbirths among heterozygote maiden ewes (0.21) was significantly higher ($P < 0.05$) than that among non-carrier ewes (0.11). At the second and third parities, the proportion of abortions (0.04 and 0 respectively) was similar in both groups. Birth year of ewe, year-season of lambing and age of ewe at lambing were not significant for litter size or lambs weaned. *FecB* genotype of ewe had a highly significant ($P < 0.001$) influence on litter size, as expected. The least squares mean litter size of non-carrier ewes was 1.00 and that of heterozygote ewes increased from 1.44 at the first lambing to 1.88 at the third lambing. These results are similar to those reported earlier [1] for a larger dataset including the ewes considered here.

Of the lambing ewes carrying one copy of the *FecB* gene, 54.5% , 44.4% and 25% had single lambs at the first, second and third lambings respectively (Table I). One heterozygous ewe at the second lambing and three heterozygous ewes at the third lambing had triplets. One non-

carrier ewe had twins at the first and second lambing while none had twins at the third lambing. The interaction between litter size and *FecB* genotype was significant for lambs weaned per lambing (P=0.03 at first lambing, P<0.01 at subsequent lambings). Table I below shows that lamb production of ewes bearing twin lambs is 65 to 112% higher than those bearing singles while heterozygote ewes produce 37 to 45% more weaned lambs than non-carrier ewes.

TABLE I: Least squares mean number of lambs weaned per lambing (LW) by 25% Garole ewes for the fixed effects of litter size and *FecB* genotype

Fixed effect	First lambing			Second lambing			Third lambing		
	No. of ewes	LW	S.E.	No. of ewes	LW	S.E.	No. of ewes	LW	S.E.
Litter size									
Single	123	0.66	0.11	74	0.82	0.11	26	0.96	0.12
Twin	35	1.09	0.19	29	1.74	0.19	15	1.71	0.17
Triplet	No triplets born			1	2.99	0.47	3	2.87	0.33
<i>FecB</i> status									
<i>FecB</i> ^{B+}	77	0.90	0.05	54	1.33	0.07	24	1.45	0.11
<i>FecB</i> ⁺⁺	81	0.90	0.05	50	0.97	0.08	20	1.00	0.12

There are indications that the proportion of heterozygote ewes bearing twins is likely to increase substantially at the third and later parities when they reach peak production and they are therefore likely to produce significantly higher number of weaned lambs than non-carrier ewes. Lamb production performance of heterozygote ewes will be evaluated in local shepherds' flocks in the next two years.

Further reduction in the proportion of Garole genes beyond 25% is likely to yield additional benefits since Deccani sheep have been observed to have higher milk production and consequently better ability to rear lambs compared to Garole sheep. These preliminary results of performance of ewes on NARI's farm suggest that the introduction of the *FecB* gene into the Deccani under the more efficient management of native shepherds may prove successful and lead to an increase in lamb production. However, this will depend to some extent on the reproductive performance of Deccani ewes homozygous for the *FecB* gene, and this is an issue we are currently investigating.

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Reference:

- [1] NIMBKAR, C., GHALSASI, P.M., MADDOX, J.F., PARDESHI, V.C., SAINANI, M.N., GUPTA, V., WALKDEN-BROWN, S.W., Expression of the *FecB* gene in Garole and crossbred ewes in Maharashtra, India, Submitted to the 15th AAABG conference, Melbourne, Australia (2003).