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The project team visits a local shepherd's flock, where a ewe carrying one copy of the *FecB* mutation has given birth to twin lambs

Harnessing genetics to increase sheep production on the Deccan plateau

Sheep rearing is an important income-generating activity for traditional shepherding communities in India. The sheep population in India is estimated to be around 61.5 million, and of this 19.1 million (31 per cent) are considered to be of the Deccani breed. It is estimated that close to half a million families depend completely or partially on Deccani sheep rearing for their livelihood. Deccani sheep flocks are maintained by smallholders (flock size ranging from 20 to 200) by grazing them on crop residues, fallowlands, and hilly areas

Like most other breeds of sheep in India, Deccani sheep have a comparatively low reproductive rate, producing one lamb every 10 to 12 months. Sale of 3 to 4 month-old lambs for meat is a major source of income for the shepherd. Female lambs not needed for replacement are also sold. The small

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Shepherd shows preference for sheep with narrow foreheads'



quantity (600 gm per year) of coarse, hairy fleece produced by Deccani sheep is of low value, which is not enough to even cover the cost of shearing

The Australian Centre for International Agricultural Research (ACIAR), Canberra has funded two collaborative research projects in India to increase the

Bengal. The Garole is the only prolific breed in India, and the project established in 2001 that its prolificacy is associated with the Booroola fecundity (*FecB*) mutation. This single gene for prolificacy, called the Booroola or *FecB* gene, was introgressed from the Garole into the Deccani breed. The project scientists also discovered that the Garole sheep have superior

resistance to internal parasites compared to the Deccani. Epidemiological studies of internal parasite infestation in sheep were carried out to establish sustainable parasite control protocols using a minimum quantity of deworming medicines. The small size of the Garole, its lack of adaptation to the hot, dry climate of the

Phaltan area of Maharashtra, inferior mothering ability, and physical appearance were not acceptable to the sheep owners. To ensure that the crossbred ewes would retain the capacity to have twin lambs but have appearance of the Deccani, it was necessary to backcross them to the Deccani while ensuring that the *FecB* mutation was not lost.

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output and efficiency of sheep production and to reduce losses due to gastrointestinal parasitism. The first project, on 'Prolific, Worm-resistant Meat Sheep for Maharashtra, India', was initiated in 1998. In continuation of the above project, ACIAR funded another five-year project (2002-07), this one on 'Improving productivity, profitability, and sustainability of sheep production in Maharashtra, India through genetically enhanced prolificacy, growth, and parasite resistance'. This was a collaboration between Indian and Australian scientists from the Nimbkar Agricultural Research Institute (NARI), Phaltan, Maharashtra; the National Chemical Laboratory (NCL), Pune, Maharashtra; the University of New England (UNE), Armidale, New South Wales; and the University of Melbourne, Victoria. Both projects have yielded encouraging results.

In the first project, Deccani ewes were crossbred with Garole, a small but prolific sheep breed from West

Backcrossing was started at NARI in 2000. There was no way, however, of detecting which of the crosses possessed the *FecB* mutation. This problem was solved in 2001 when the *FecB* mutation was identified almost simultaneously by researchers in New Zealand, France, and the UK and a direct DNA test was developed. This test was established at the National Chemical Laboratory in Pune in 2002 to provide valuable information for the selection of lambs in the breeding programme. Ram and ewe lambs from each generation with the desired characteristics were selected systematically and retained for further breeding to ensure that the crossbred sheep retained the toughness and resilience of the Deccani and the high reproductive ability of the Garole.

In the follow-on project, lambs were selected for faster growth, adaptation to harsh environment, and as per the appearance preferred by local sheep owners. A new, more productive strain of Deccani sheep, the

Project N E W S

NA RI Suwana, has been developed at NA RI. NA RI Suwana ewes give birth to twin lambs at least every alternate lambing. The increase in the average litter size of the flock is therefore only about 0.5 per ewe lambing. This is a modest and manageable increase for a small flock but substantial enough to increase income and profit. Although twin lambs are slightly smaller than single-born lambs (their weight at three months being about 2 kg less), their combined weight is at least 25 per cent higher. In 2002, NA RI started to disseminate *FecB* carrier rams to the flocks of local smallholder shepherds for breeding so that field testing of carrier progeny born in those flocks could be carried out.

Winning the confidence of deeply traditional smallholder sheep producers was a difficult task. The concepts of introducing twinning in sheep and ongoing genetic improvement were new to them. They did

owners have sold their own rams, preferring to use the NA RI breeding rams instead. Others are rearing male progeny of NA RI rams carrying the *FecB* mutation to use as breeding rams in the future. There are now about 150 *FecB* carrier NA RI Suwana adult ewes in 15 local flocks linked to the programme. Their performance is being monitored intensively as part of the field-testing strategy before wider dissemination. More than 100 pairs of twin lambs and 10 sets of triplet lambs have been born and reared successfully in the flocks of local shepherds.

The project team at NA RI has developed a close relationship with local shepherds by training them in basic veterinary skills (wound dressing, injections, vaccinations, drench use) and animal husbandry (lamb care, ewe nutrition). A socio-economic survey conducted in 2007 showed that the shepherds' general perception is that they can get one and a half times as

The combination of genetic improvement, which is permanent and transmitted to future generations, and improved management has the potential of raising the incomes of sheep rearers substantially



Shepherds feeding nutritious Lucerne to their flock to attain higher body weight of lambs

not like the horns and wide foreheads of the first few generations of rams because of the high proportion of Garole genes in them. Project scientists learned gradually about the shepherds' preference for certain facial features, colour, and other physical characteristics and included these preferences in selecting breeding animals. The results have been encouraging, some flock

much income if a ewe has twin lambs rather than a single. They also realize that giving extra feed to twin-bearing ewes and twin-born lambs increases profit. The cost of providing supplementary feed to the ewe and its two lambs is about Rs. 200 while the extra weight gained can be worth as much as Rs. 400 or more.

On the basis of information received from the participating shepherds, the project team will recommend formal introgression pathways for the improved genotypes within the current project area and beyond. The combination of

genetic improvement, which is permanent and transmitted to future generations, and improved management has the potential of raising the incomes of sheep rearers substantially.

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