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## **A village goat cross-breeding project in Maharashtra, India**

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The Nimbkar Agricultural Research Institute (NARI) was established with a private endowment as a registered public trust in 1968, in Maharashtra, India, with the objective of undertaking research in a wide range of agricultural activity to improve the quality and quantity of agricultural produce. The Animal Husbandry Division of NARI was started in 1990 with the aim of bringing about genetic improvement in local goats and sheep to increase their productivity and efficiency. A comprehensive project proposal to enhance the income of rural goat-keeping women in Phaltan taluka (shire) by improving the productivity of their goats was submitted in 1991 to a Government of India funding agency, the Council for Advancement of People's Action and Rural Technology (CAPART). This proposal comprised eight modules, out of which, CAPART agreed to fund two, e.g. cross-breeding of local goats and provision of goat health care under their scheme 'voluntary action in rural development.' The mammalian species involved was goat.

Local goats not recognised as belonging to any particular breed, were cross-bred with bucks of the Sirohi breed from Rajasthan, Alpine x Sirohi and Toggenburg x Sirohi bucks.

Goat-keeping in south central Maharashtra where Phaltan taluka is situated, is a low input production system. The usual practice is for women to keep small flocks of one to three goats which are tied up in front of the house. There are some larger flocks of ten or more goats. The women take the goats out to the fields with them every day, tie them on the boundary of the field where they work and feed them weeds, grass and acacia or prosopis pods. Goats also get kitchen scraps and leftovers from family meals. Concentrates or oilseed cakes are fed occasionally after kidding. Sometimes goats are vaccinated against enterotoxaemia and haemorrhagic septicemia in camps specially organized by the Maharashtra Government department of animal husbandry. In recent times, private veterinarians

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### **Introduction**

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### **The breeds of goat involved**

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### **The approximate overall input level of the production system concerned**

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have started practising in a lot of villages and goat-keepers avail of their services in emergencies. However, on the whole, there is hardly any expenditure on purchasing feed, medicines or other inputs.

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**The approximate number of goats**

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Thirty-four villages within a 15 km radius of Phaltan town formed the target area for the cross-breeding project. The estimated number of breeding does in these villages was about 15 000 and about 60 000 in Phaltan taluka. Thirty-one Sirohi, five Alpine x Sirohi and four Toggenburg x Sirohi bucks were placed in 34 villages; one per village with 200 to 500 local does and two in each of the six villages with >600 does each. These bucks had been selected on their own growth rates and their mothers' milk yields.

The local goats in the 34 project villages were targeted for improvement.

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**The approach through which the breeding goal was established**

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A preliminary survey of goat-keeping practices and economics in the villages near Phaltan showed that women rear goats for milk for home consumption and meat for sale. The kidded doe provides a little milk for the family after kids are weaned and the male kids are sold or slaughtered at the age of five to six months. Thus both milk yield and growth rates are economically important traits.

However, the village women goat-keepers generally do not keep a breeding buck. Most of the goats in the village are mated by the breeding buck specially reared by one goat owner. Little or no care goes into the selection of the breeding bucks. There is also a tradition to let buck kids loose as an offering to God. These bucks roam around and even graze people's crops and grow big and hefty. They then dominate the other bucks in the village and mate with the majority of the goats in the village. It is thus likely that generations of breeding bucks in a particular village hail from one individual with the possible consequence of severe accumulated in-breeding.

NARI thought that supplying breeding bucks of an improved breed for cross-breeding would reduce in-breeding and lead to genetic improvement.

A cross-breeding programme was preferred as selection would take too long to be effective and would need substantial facilities and funds that were not available. Moreover, cross-breeding at village level could be monitored readily because the cross-bred progeny would be easily distinguishable.

The Sirohi breed from Rajasthan was recommended by “the Central Advisory Committee for the development of sheep, goat and rabbit” for use in up-grading non-descript goats. The Indo-Swiss Goat Development and Fodder Production Project (ISGP), in performance recording of Sirohi goats from 1988-91, found their production potential to be much higher than reported earlier. They reported the average milk production of Sirohi does in village conditions to be 250 kg in 180 days. The average weights of male and female Sirohi kids at the age of six months were reported to be 19.6 and 18.6 kg respectively. The Sirohi and Sirohi cross bucks also fulfilled the local goat-keepers’ criterion that the breeding buck should be large, e.g. weigh at least 40-50 kg. The Sirohi breed is from hot and arid Rajasthan and was expected to adapt well to a similar climate of the Phaltan area. Before the start of the village cross-breeding programme in 1991, NARI purchased 13 Sirohi bucks selected on their individual growth rates and their mothers’ milk yields, ten Alpine x Sirohi and ten Toggenburg x Sirohi bucks from the ISGP. CAPART refused to fund the purchase of the cross-bred bucks which were therefore purchased with NARI’s own funds. Twenty more Sirohi bucks were purchased from the Central Institute for Research on Goats of the Indian Council of Agricultural Research. Out of these 53 bucks, two Sirohi, five Alpine x Sirohi and six Toggenburg x Sirohi bucks had to be culled due to lack of libido and the remaining 40 bucks were placed in the villages.

In each village, one or two families willing and able to maintain a breeding buck (with assistance from NARI in the form of supply of concentrates at 300 g per day per buck and complete free health care of the buck) were identified and an agreement was entered into between NARI and the head of the buck-keeper household. A breeding buck was then allotted to each such family. Each buck-keeper family was provided with chain-link fencing to make a pen for the buck and specially designed notebooks for recording the services given by the buck and the details of each goat serviced. Bucks were insured in the name of NARI to protect the buck-keepers against financial loss if the bucks were to die. Buck-keepers were allowed to charge service fees only at the normal rate in each village so as to induce goat-keepers to get their does bred by that buck. However, if a doe served by the buck returned to oestrus, another service would be given for free. Efforts to persuade the villagers to get rid of wandering bucks succeeded in some villages.

The plan to achieve the breeding goal did not differ from that actually followed.

Traits included in the breeding goal were liveweights/growth rates of kids up to six months of age.

The selection criteria followed: no selection was made.

## **Choice of breed for cross-breeding**

## **The plan designed and followed to achieve the breeding goal**

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**The methods used for the dissemination of improved males/females**

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As indicated in the section entitled "The plan designed and followed to achieve the breeding goal", improved bucks were placed in the villages for cross-breeding of local goats. No efforts were made for the dissemination of cross-bred males and females generated in the course of the project.

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**The population breeding structure: Cross-breeding**

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Local goats maintained by village goat-keepers were cross-bred under the project. Breeding bucks were sent out to selected buck-keepers in the villages at the onset of the breeding season in late May. At the end of the major breeding season in December-January, when the number of goats exhibiting oestrus dwindled, if the buck-keepers had a shortage of feed, the bucks were brought to the NARI farm. In the next breeding season, these bucks were sent to different villages to eliminate the possibility of in-breeding even though some buck-keepers had strong personal preferences for the bucks they had originally kept. The goat-keepers who were given Sirohi goats (see the chapter "Government support"), were encouraged to breed these with the project's Sirohi bucks in their village and some well-grown Sirohi buck kids from such matings were purchased by NARI to replace aged bucks and those without adequate libido.

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**Farmer involvement**

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The active participation of a local farmer who cared for the buck in each village was an important factor in the acceptance of the scheme by goat-keepers and the success of the programme.

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**Levels of acceptance over time**

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The number of goats mated by the project's breeding bucks increased from 1 193 in the first year to 1 814 in the second year (a 52 percent increase) and 1 990 in the third year, a total of about 5 000 goats in three years. Increased acceptance of the project by local goat-keepers could also be attributed to the fact that the goat-keepers did not have to go far to obtain superior germplasm and they could see the cross-bred kids thriving in the same conditions as local goats. An important incidental benefit of the project was that goat-keepers became aware of the importance of weighing their goat kids and correlating the sale price with the kids' weights.

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**Government support**

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CAPART, a Government of India funding agency sanctioned a grant of Rs. 1 million over three years for the project but did not disburse the last instalment of Rs. 0.2 million.

The Central Institute for Research on Goats which is a Government institute, made 20 Sirohi bucks available for the project at a reasonable price.

It was a condition of CAPART that part of the funding for the project come from local Government agencies. NARI, applied accordingly to the Satara District Rural Development Agency for funds to construct a shed with feeder and waterer for the breeding buck in each village and to purchase goat Artificial Insemination (AI) equipment, microscopes for semen evaluation and veterinary first aid boxes for use in the villages. It was envisaged that these items would be handed over to the grampanchayat (village council) for long-term use for the benefit of the village goat-keepers. It is noteworthy that the Government has financial provisions to keep veterinary health care kits in villages and to distribute 'improved' goats and sheep to beneficiaries. However, in spite of constant correspondence with Government officers up to the highest level and frequent visits to the concerned offices, the Government realised its written financial commitment given to this project. However, the Maharashtra State Animal Husbandry Department provided enterotoxaemia and haemorrhagic septicemia vaccines free-of-charge for goat health camps organized by NARI, every six months in every village where a breeding buck was kept. Some drug companies provided small quantities of free dewormers for these camps.

In the third year of the project, NARI implemented a sub-project to provide additional goats to below-poverty-line families in five of the project villages. This was to help goat-keepers take advantage of the Central Government scheme of a 33 percent subsidy (50 percent to backward class households) on bank loans for income-generating activities to families from the list of those existing below the poverty line. (An annual income of US\$200 per family is considered to be the poverty line.) Since good goats were not available in large numbers locally, NARI purchased Sirohi goats from Rajasthan and 125 goats were distributed to women beneficiaries under the Government scheme.

**Farmer support.** Two veterinarians were hired, who visited each project village one morning a week to deliver a week's concentrate supply for the bucks, monitor the health of the bucks and provide free medical treatment to the bucks, if necessary, and to any sick goats in the village. They also brought back the records of services given by the bucks and ironed out any problems encountered by the buck-keeper and goat-keepers. This regular communication link was necessary and useful;

**Research and development.** The veterinarians were entrusted with the task of visiting all the goats served by the NARI bucks in the week in which they were due to kid and recording the date of kidding, the number of kids born, sex and birth weights. Thereafter, they recorded the liveweights of all cross-bred kids every month until they were sold for slaughter or up to the age of six months. For comparison, liveweights of contemporary local goat kids were also recorded;

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**Type and nature of technical support, including extension, involved**

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**Training.** Ten groups of ten women goat-keepers each were given a three-day training course in goat management with funds from a Central Government scheme. These courses were held at an agricultural science centre in the adjoining district. Some women clearly benefited a lot while others, mainly the illiterate ones, did not gain very much from the training.

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### The main reasons for introducing the scheme

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- i) The activity of goat-keeping provides supplementary income to poor rural families and produces much-needed animal protein. Genetic improvement of goats has been neglected by the Government;
- ii) Breeding bucks were provided to some villages where there were no breeding bucks and goats had been taken long distances to be mated;
- iii) Goats are usually reared in small numbers and individual goat-keepers do not keep breeding bucks. In most, but not all villages, there may be one or two breeding bucks. These are not changed for years. There is, therefore, a high probability of severe accumulated in-breeding. The cross-breeding scheme was introduced to counter the in-breeding;
- iv) Sirohi bucks selected for growth rates and mother's milk yield and crosses of Sirohi with the Alpine and Toggenburg breeds, were introduced into the local goat population under this project. The expectation was that cross-breeding with these bucks would lead to increased productivity of the cross-bred progeny through additive genetic effects and heterosis.

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### The most significant activities and design peculiarities that enabled the scheme to be initiated and maintained over time

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They are:

1) *Technical factors:*

- i) the scheme fulfilled a need of village goat-keepers and they approved of the physical characteristics of the breeding bucks;

2) *Operational factors:*

- i) NARI was highly motivated to bring the scheme into practice and was able to ensure active participation of village goat-keepers;
- ii) The supply of feed and veterinary care for the bucks, freedom to charge fees for buck services, vaccination and deworming facilities made available to the village goats and other incentives including insurance of the bucks, all played a positive role in the initiation of the scheme as well as its maintenance over time.

3) *Policy factors:*

- i) In the present goat-keeping scenario in this part of Maharashtra, only a relatively simple and unsophisticated breeding scheme is practical; such as the supply of bucks whose offspring can be readily identified.

There is no sophisticated recording system in place at the goat-keeper level and a selection programme would be too long-term and would require funds and facilities which are not available.

1) *Economic evaluation*

An economic assessment of the activity of goat-rearing comparing the use of local bucks with improved bucks, should be made. However, this is difficult to carry out because goat-rearing is a part-time activity using family labour, inputs and outputs are not quantified and the age at sale/slaughter of the goat kids produced is not likely to be optimum because it depends on considerations such as the family's need for cash in an emergency;

2) *Estimates of heterosis*

It is important to know the relative importance of heterosis and additive effects in order to make a decision about whether to continue cross-breeding the local goats with bucks of the chosen breed or cross or to 'up-grade' by backcrossing or to create a synthetic. In this project, no estimates of heterosis could be obtained from the data on the progeny produced. It was not possible to create a sufficiently large female population of the buck breed-type in the same (village) conditions. Efforts should therefore be made to produce sufficient numbers of backcrosses (both by crossing the cross-bred kids with local bucks and Sirohi/Sirohi cross bucks) and  $F_2$  level crosses by doing *inter se* mating, to get an estimate of heterosis for this set-up;

- 3) The ISGP reports the average litter size of the Sirohi, Alpine x Sirohi and Toggenburg x Sirohi to be in the range of 1.05 to 1.07 whereas the local goats have an average litter size of 1.63. It is likely that the cross-bred female progeny of local goats would have lower prolificacy than the local goats. Prolificacy is an essential element of an efficient meat production system and this factor will need to be included in the choice of the crossing breed. Unfortunately this was not considered a priority for this project.

There is a serious shortage of goat meat in India which is reflected in the rising prices of goat meat over the last 15 years. After the experience of the first cross-breeding project, NARI imported the Boer breed of goat which is selected for meat production performance in southern Africa, in order to assess its potential for the improvement of goat production in this area of India. These trials have started and initial results are promising. As the number of pure Boer bucks with NARI is small, artificial insemination has to be used to implement cross-breeding. This adds a further complication to the system but demand for Boer semen from local

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**Changes that should be made to the design and operation of the scheme to make it more successful and reasons for suggested changes:**

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**Future directions for development in design, operation and policy**

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goat-keepers is good. There is also a large demand for Boer crosses from all over the State which can be sold for breeding at substantially higher prices than local goats.

### Available estimates of genetic change in the population due to the scheme

Liveweights of 1 972 local and cross-bred kids were measured on spring balances and recorded from the age of one month to six months. At six months, only 805 of these kids were still available for recording due to continuous sale of kids. These liveweights were analysed by Harvey's least squares analysis of variance. Results are shown in Table 1. Liveweights of kids reared to six months were also analysed separately to see if only the slow growing kids had been retained to that age. However, this was found not to be the case. The decision to sell a kid was more a function of the family's need for cash rather than the liveweight of the kid.

There was thus a moderate increase in the growth rates of cross-bred kids with the same feeding and management as the local kids.

Most of the male cross-bred kids were sold or slaughtered while some of the female cross-bred kids were kept and reared by the goat-keepers. Their performance was assessed with the help of a questionnaire and it was found that 64 percent of the goat-keepers surveyed were completely satisfied with the reproductive and milking performance of cross-bred does and rated it better than that of local goats while the remaining 36 percent felt the cross-bred females did not come up to their expectations.

Table 1. Least square means of liveweight (kg) from one to six months of age of different genetic groups of village goat kids. (The numbers in brackets denote the number of observations available).

Genetic group	One month	Two months	Three months	Four months	Five months	Six months
Local	5.2 ± 0.2 <sup>A</sup> (189)	7.4 ± 0.4 <sup>A</sup> (171)	9.4 ± 0.5 <sup>A</sup> (156)	11.5 ± 0.6 <sup>A</sup> (116)	13.0 ± 0.8 <sup>A</sup> (87)	14.7 ± 0.9 <sup>A</sup> (42)
Sirohi x Local	5.4 ± 0.2 <sup>A</sup> (1 337)	7.9 ± 0.3 <sup>A</sup> (1 321)	10.1 ± 0.5 <sup>A</sup> (1 292)	12.4 ± 0.6 <sup>B</sup> (1 088)	14.1 ± 0.7 <sup>B</sup> (878)	15.7 ± 0.7 <sup>A</sup> (580)
(Alpine x Sirohi) x Local	5.8 ± 0.2 <sup>B</sup> (335)	8.7 ± 0.4 <sup>B</sup> (337)	11.5 ± 0.5 <sup>B</sup> (321)	13.4 ± 0.6 <sup>C</sup> (275)	15.1 ± 0.7 <sup>C</sup> (242)	15.1 ± 0.8 <sup>A</sup> (160)
(Toggenburg x Sirohi) x Local	5.2 ± 0.2 <sup>A</sup> (111)	7.5 ± 0.4 <sup>A</sup> (107)	9.9 ± 0.6 <sup>A</sup> (100)	12.5 ± 0.7 <sup>B</sup> (82)	14.2 ± 0.8 <sup>B</sup> (64)	16.5 ± 1.1 <sup>B</sup> (23)
Significance of the effect of genetic group	P < 0.01	P < 0.001	P < 0.001	P < 0.001	P < 0.01	Not Significant

Means with different superscripts differ significantly (P < 0.01).

The survey was made in the middle of the third year of the project when data on only the first kidding of the cross-bred does was available. More than 90 percent of the does surveyed gave birth to single kids. However, it is difficult to say whether this was an effect of their father's genotype since local goats usually have single kids in their first kidding.

1. Absence of libido in some bucks and variation of libido in others were major problems. It is uncertain whether any treatment is effective in such cases and the buck-keepers always considered it a prestige issue. Five of the ten Alpine x Sirohi, six of the ten Toggenburg x Sirohi and two of the 33 Sirohi bucks bought originally had to be culled at different stages of the project due to lack of libido.
2. Butchers in the area spread propaganda that the meat of cross-bred kids is not as tasty as that of local kids and offered lower prices for cross-bred animals. NARI then suggested to the goat-keepers that they slaughter a couple of cross-bred kids themselves to see if they could note any difference in the taste of the meat. Goat-keepers were convinced that the meat tasted the same and then insisted on getting the same price for cross-bred kids.
3. Some goat-keepers held a superstitious belief that if a suckling kid was weighed, the mother's milk would dry up. Initially this presented some problems for weighing kids, but this was gradually overcome.

The project was intended for three years with the hope of extension, but CAPART seemed to have other priorities. NARI kept the project going for another year with its own resources and with the buck-keepers' support but finally the project ended after four years. However, this project has provided a framework for an effective breeding programme when individual units are small and spread out over a large area.

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**Problems  
encountered**

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