NATIONAL DAIRY DEVELOPMENT BOARD

APPROACHES AND EXPERIENCES OF NDDB IN DEVELOPMENT OF Gir

a promising Indigenous milch breed

FOREWORD

As a part of NDDB's initiative to promote indigenous dairy breeds of our country, breed improvement programmes in the breeding tracts of indigenous dairy breeds of cattle and buffaloes have been taken up to identify elite germplasm for propagation not only in the breeding tracts but all over the country.

As of now, breed improvement programmes for six indigenous breeds of cattle: Sahiwal, Gir, Tharparkar, Rathi, Kankrej and Hariana and five breeds of buffaloes: Murrah, Mehsana, Jaffarabadi, Nili Ravi and Pandharpuri are being carried out in their native tracts.

We are bringing out a series of booklets on each of these breeds to showcase their importance and potential particularly in the context of climate change. I hope that the booklet "Approaches and Experiences of NDDB in Development of GIR breed" will be informative and useful to all stakeholders.

Dilip Rath
Chairman, NDDB
Anand, Gujarat

September 2017

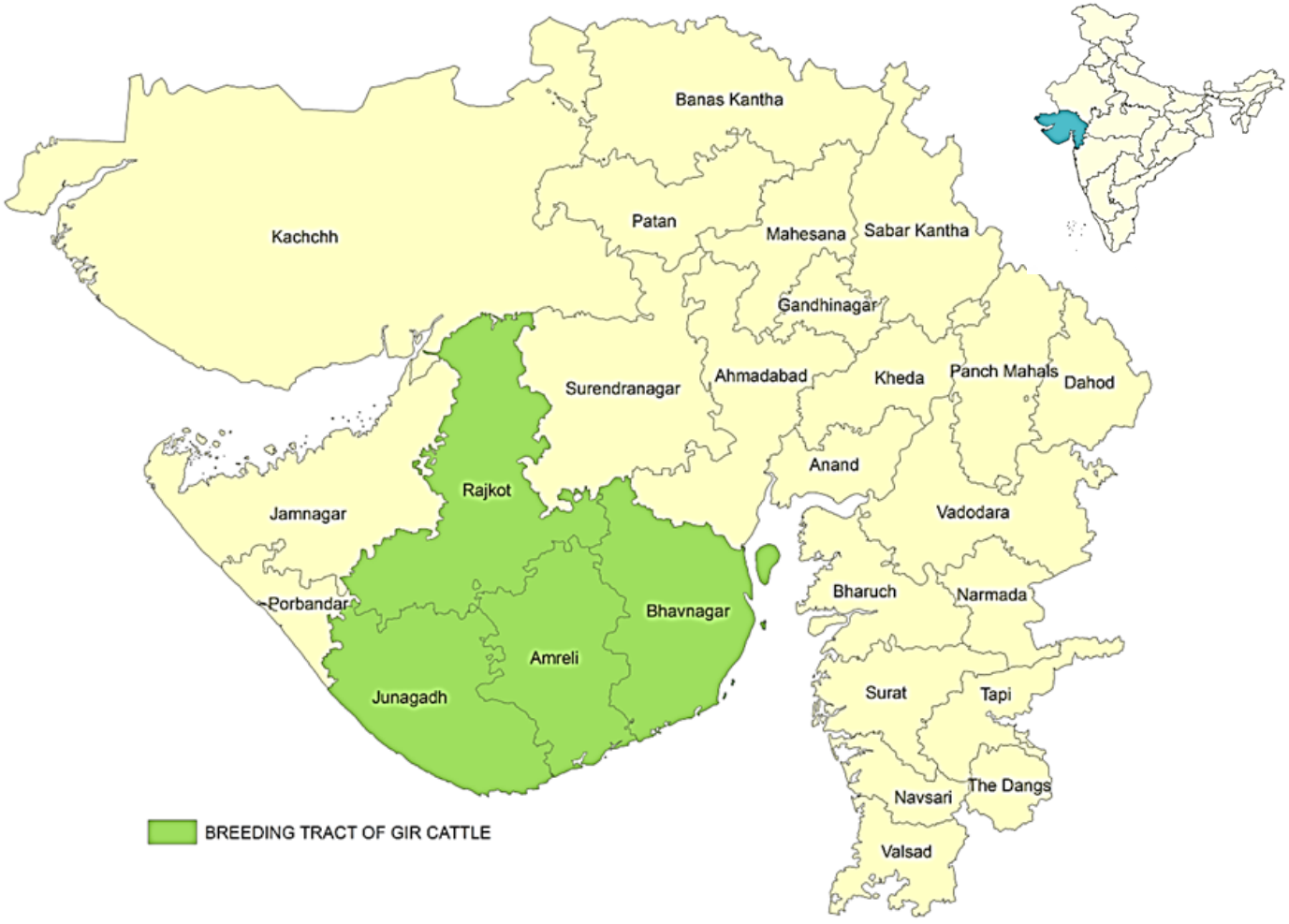
CONTENTS

1. Introduction

Gir is an excellent dairy cattle breed well-known among the milk producers for its milk producing ability, good fertility, heat tolerance, easy maintenance, resistance to diseases and longevity. The name of the breed is derived from its place of origin, the "Gir" forest of Gujarat. Gir is also known as Bhodali, Desan, Gujarati, Kathiawari, Sorthi and Surati in different parts of the breeding tract. The main breeding tract of Gir cattle is furnished in Figure 1 which comprises Amreli, Bhavnagar, Junagadh (including recently formed Gir-Somnath district) and Rajkot districts of Saurashtra region of Gujarat.

Gir holds a promising place among 39 phenotypically characterized Indian cattle breeds (NBAGR, 2015). Other promising cattle breed in Gujarat is Kankrej. Both Gir and Kankrej have been evolved through centuries of breeding efforts of farming and mostly pastoral, migratory communities of Gujarat *viz.* the Rabari, Bharwad, Maldhari and Charan.

Figure 1: Main breeding tract of Gir cattle



2. Gir cattle and its cultural importance

Like all cows in India, Gir also occupies a prime position since ancient times and has social, religious and cultural importance.

Gir cows are considered as one of the best milk producing indigenous cows in the country.

3. Geographical parameters

The breeding tract of Gir lies between 20.5˚-22.6˚ latitude and 70.0˚-72.0˚ longitude and is at an average of 400 m (ranging from 125 to 600 m) from sea level. The soil is medium black, temperature ranges from 7 ˚C to 45 ˚C, humidity varies from 20% to 80% and annual rainfall ranges from 500-1500 mm with maximum during the months of July-August.

The major cereal crops grown in the area include bajra, jowar and wheat and the major pulses are grams and pigeon peas. Other crops grown in the area include ground-nut, castor, cotton, onion, sugar-cane and garlic. The important trees prevailing in the area are: banyan, rain-tree, neem and acacia (Maradiya, 2016).

4. Physical characteristics

4.1 General physical characters:

Table 1 provides general physical characters of Gir.

Table 1: General physical characters of Gir (NBAGR, 2015)

Sr. No.	Feature	Male	Female
1	Height (avg. cm)	159.84	130.79
2	Body length (avg. cm)	137.51	131.40
3	Heart girth (avg. cm)	201.41	166.47
4	Weight (avg. kg)	544.00	310.00
5	Birth weight (avg. kg)	20.77	

4.2. Typical breed specific characteristics:

- **Colour:**

Gir has the widest range of coat colour patterns amongst all indigenous cattle breeds.

Red colour is predominant – about 80% of animals have red body colour. Yellowish light to dark red colour is also common in Junagadh/Gir-Somnath district and its adjoining regions. Majority of Gir cows in Bhavnagar and Surendranagar districts and to some extent in Rajkot district are red in colour with white spots over the body. Animals with completely white coat colour and red spots over the body are also found near Surendranagar district.

Completely white, completely black and yellowish red coat colours are extremely rare in Gir. Males are darker in shades as compared to females. Depending on coat colour, several local terminologies to describe Gir animals are used which have been summarized in Table 2 (Maradiya, 2016).

➢ **Horns**

Horns start at the base and take a sideways downward and backward curve and again incline a little upward and forward taking a spiral inward sweep. They end in a fine taper giving a half moon-like appearance (NBAGR, 2015).

Gir is the only cattle breed in which horns emerge from below the head region.

Based on the shape of horns, several local terminologies are used for describing Gir animals such as Machiya, Muthiya, Bhila, Patti, Kundha, Boda, etc. (Maradiya, 2016).

➢ **Ears**

Ears are pendulous and folded like a leaf. Ears hang all the time and their inside face forward (NBAGR, 2015).

The length of ears is the longest amongst all cattle breeds (around 30 cm).

At the end of the ear, a notch is visible, which is also characteristic feature of the breed. The point of ear is faced inwards. Based on the shape of ears, different local terminologies are used for description such as Bhungadiya, Fafada, Gediya, etc. (Maradiya, 2016).

Table 2: Local terminology for Gir cows with different coat colour patterns

Sr. No.	Name	Characteristic coat colour pattern
1	Gadakadi	Light red or red colour with white spots on the brisket region with slight white shades on the abdomen region
2	Kabari	White colour with spots/patches of red or yellowish red colour over the body
3	Makadi	Yellowish red
4	Bavadi	Evenly distributed patches of red and white colours with light red coloured udder
5	Gauri	Dark red
6	Pingad	Golden patches
7	Suvarna Kapila	Body coat colour is golden and hoof as well as horns are marble coloured
8	Liladi	Greyish white with light blue coloured patches. Internal colour of ear and udder is purple
9	Bagali	Off-white or greyish white with mix of red or yellowish red colour
10	Telami/ Koyal/ Shamadi	Reddish black coat colour, udder is red and tail is black in colour

➢ **Head, face, eyes and nostrils**

The head is capacious, heavy and convex, like an inverted clay pot, which becomes very narrow below the eyes. The face is typically long. However, a few livestock owners prefer a short face. Eyes are almond-shaped.

As eyelids cover almost a half of the eyes, the animals have a sleepy appearance.

More distance between the eyes is desirable. Yellow eyes as well as white eyelashes are not desirable. Black nostril is another characteristic feature of Gir. Yellow nostrils are not preferred (Maradiya, 2016).

➢ **Brisket, skin and tail**

The brisket is proportionately large, but with thin skin. It is soft and swinging in appearance. It plays an important role in thermoregulation. The skin is loose, smooth, oily and shining in appearance. The switch of tail is clustered and black in colour. A few animals have tails which touch the ground level (Maradiya, 2016).

➢ **Hump**

Ideally, a vertical imaginary line through the mid-point of hoof should meet the middle portion of hump above. Hump not bending on either side is considered desirable (Maradiya, 2016).

The hump of Gir is the largest amongst all indigenous cattle breeds.

5. Population dynamics of Gir

Gir cattle are found primarily in the Saurashtra region of Gujarat, but are also found in lesser numbers in other districts of Gujarat and further still in lesser numbers in adjacent states. At the state level, spread of germplasm mostly occurred due to **migration** of animals for grazing during January to June, when sufficient fodder is not available in the pastures in the home tract. Renowned for milk production, the breed has also been inducted to other states for **upgradation** of local breeds as well as for maintaining them as pure Gir cows by some interested livestock owners. A summary of Gir population in the states is provided in Table 3.

Table 3: State-wise Gir population

Sr. No.	State	Population (in no. of animals) as per 18th Livestock Census, DADF, GoI
1	Gujarat	1399677
2	Rajasthan	506096
3	Maharashtra	101845
4	Madhya Pradesh	71909
5	Chhattisgarh	44873
6	Daman and Diu	1104
7	Andhra Pradesh	657
8	D&N Haveli	260
	Total	**2126421**

Various semen stations in India maintain Gir bulls. Table 4 gives a summary of Gir bulls maintained at semen stations being strengthened under National Dairy Plan I (NDP I) of DADF, GoI, implemented by National Dairy Development Board (NDDB).

Table 4: Summary of Gir bulls maintained at semen stations under NDP I

(As on March 2016)

Sr. No.	Semen Station	No. of bulls	Bulls under collection	FSD Production during 2015-16 (in lakhs)
1	Salboni, West Bengal	57	43	11.66
2	SAG, Bidaj, Gujarat	27	18	6.41
3	GLDB, Gujarat	26	11	3.68
4	Haringhata, West Bengal	10	7	2.24
5	Bhadbhada, Madhya Pradesh	22	4	1.77
6	Bassi, Rajasthan	2	2	1.16
7	ARDA, Gujarat	10	5	0.83
8	BAIF, Maharashtra	7	1	0.04

Interestingly, several cross-country gene flows have occurred in the past, most notably to Brazil and USA. Between 1910 to 1930, Brazil had developed a breed called **Indubrasil** by crossing Gir and Kankrej with a later admixture of Nelore. This breed later contributed to the development of **Brahman** in the USA. **Bonsai Brahman, Minivaca** and **Bonsai Zebu** are names given to dwarf variety of Indubrasil developed in Mexico (Mason, 2016).

Girolando breed was also developed by Brazil through controlled crossbreeding projects using Gir (Madalena *et al*., 2012). **Brahman** breed was utilized to develop other breeds like **Brangus** (Agfact A2.3.12, 1997). Thus, Gir germplasm, though not in pure form, has been widely disseminated at an international level.

6. Present status of Gir in its native tract

Though Gir germplasm has proliferated far, the native breeding tract currently faces some issues leading to breed deterioration. Following could be the major reasons:

- **Indiscriminate breeding among native breeds:**

  Naturally, during seasonal migrations, Gir is crossed with other breeds, mostly Kankrej. This has led to mixed/degraded Gir-type germplasm with varying levels of inheritance of Gir (Please refer Figure 2 which depicts Gir and Gir-type animals in the native tract).

  The notable feature is the orientation of horns in the mixed or downgraded animals when compared to pure animals. As described earlier, horns of Gir orient backward, downwards and then upwards at the tip. While, horns of Gir-type cattle orient upwards but again not to the level of typical lyre shaped horns of Kankrej. Most Gir-type cattle have horns which are intermediate between Gir and Kankrej. Moreover, brownish dark red color, which is a typical characteristic of Gir, diminishes in Gir-type cattle and an admixture of pale red and grey color patterns develop. The stature of Gir-type cattle tends to be shorter than pure Gir. Pendulous dewlap, massive udder and elongated teats, which are typical characteristics of Gir, are fairly found in Gir-type cattle. Such degradation has been continuing, which affects overall breed purity.

Figure 2: Differentiating features of Gir and Gir-type cattle

- **Non-availability of dependable Artificial Insemination (AI) delivery services:**

  This has led to farmers adopting to Natural Service using "Stray" bulls without breed purity. This has been one of the major reasons for deterioration of Gir breed in the native tract.

- **Crossbreeding of pure animals:**

  As first generation of crossbreds produce higher quantity of milk than Gir, Crossbreeding with exotic cattle has been attempted by some AI service providers. This practice leads to production of crossbred males and later when these bulls breed with pure Gir animals, they lead to breed deterioration and this practice is now one of the major constraints in Gir development efforts through artificial insemination.

7. A project for Pedigree Selection

It is a known fact that unless genetic improvement efforts are not put in place for increasing milk production potential of animals available with the farmers in the native tract, **the breed would be endangered**. Genetic improvement in any population could be brought about by systematic selection of bulls and their use through AI for breeding the animals of the target population.

Progeny testing (PT) is the best and proven way for selection of bulls. However, this requires extensive AI network. Since the native tract of Gir lacks such a network, for initiating genetic improvement efforts, it is necessary first to build an infrastructure for AI and set up an appropriate data collection mechanism.

Considering these constraints, it was thought appropriate to implement first a project to promote AI, identify individual animals by applying ear tags with a unique numbers, build an infrastructure for milk recording to identify high producing animals and put in place effective extension systems to improve current management practices.

It all started when Sabarmati Ashram Gaushala (SAG) having a vast experience of implementing breed development programs in Gujarat started a Pedigree Selection (PS) project for Gir breed in its native tract, under NDP I of DADF, GoI.

The project was approved in September 2012 with a total outlay of ₹ 743.99 lacs.

7.1 The objectives of the project are:

- Popularizing AI in the native breeding tract.
- Improving the genetic potential of Gir for milk production in its native tract.
- Producing genetically superior quality High Genetic Merit bulls for use by all semen stations in the country.
- Ensuring active participation of the farmers in development of Gir breed.

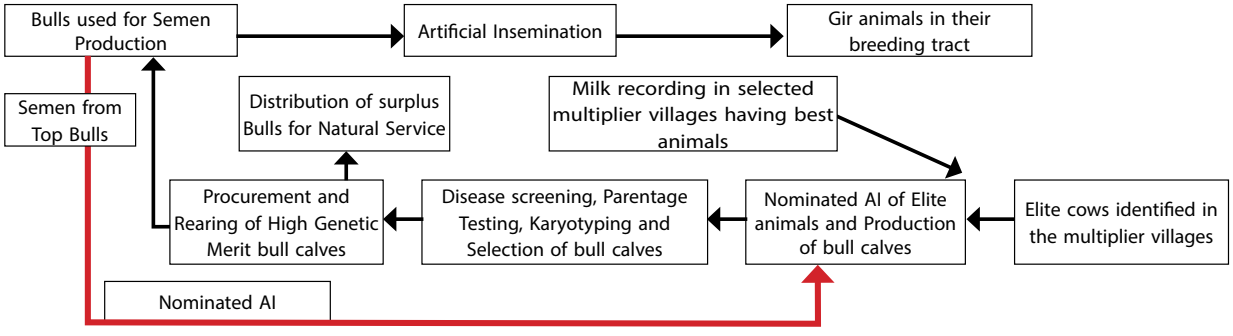
7.2 Design of the project

The project targeted the Gir population in Amreli, Bhavnagar and Junagadh (including recently formed Gir-Somnath) districts of Gujarat, scattered in about 150 villages. These villages were proposed to be covered through 50 AI centres by SAG.

PS project activities were undertaken as per the Standard Operating Procedures (SOP) and Minimum Standards (MS) notified by DADF, Govt. of India (GoI) and other guidelines from the Project Monitoring Unit located at NDDB, Anand, Gujarat. The Information Network for Animal Productivity and Health (INAPH) Application developed by NDDB was used for collection and analysis of data as well as for providing feedback.

A schematic representation of the project is provided in Figure 3.

Figure 3: Schematic representation of Gir PS project



7.3 Targeted activities under the project

Various activities proposed to be undertaken by the project during the project period (2012-13 to 2017-18) are as below (with Figure nos. 4-7 on major activities):

- Identification of around **150** multiplier villages and development of infrastructure to provide doorstep AI services through **50** AI centres with appropriate ear tagging and registration. Follow-up of AI done as per SOP notified by DADF, GoI, for subsequent pregnancy diagnosis (PD), calving and registration of daughters.

The project aims to carry out total of 88800 AIs during the project period.

Figure 4: AI done by a mobile AI technician at farmer's doorstep

- Ear tagging, registration and milk recording of animals in the area of operation and identification of high yielding Gir (known as "Elite animals") based on their 305-days milk yield (305-DMY). Regular supervision of recordings by exclusive supervisors through surprise checks and validation checks is a key component.

The project has a target for recording 2800 elite Gir cows during the project period.

Figure 5: Ear tagging and Registration of the animal

Figure 6: Milk recording done by Milk recorder at the farmer's household

- Insemination of elite animals with top pedigreed bulls (this type of AI is known as "Nominated AI") for production of next generation High Genetic Merit (HGM) bulls.
- Follow-up of nominated AIs till calves are born, ear tagging of calves and their registration. It is targeted to produce 60 HGM disease-free bull calves by the end of project period.
- Procurement of HGM bull calves after successful parentage and preliminary disease testing, as per the prescribed health protocols.
- Undertaking quarantine of HGM bull calves for a minimum of 60 days for further disease testing as well as karyotyping and genetic disorder screening as per the prescribed health protocols.
- Distribution of HGM bull calves to eligible semen stations based on their requirements (after successful completion of quarantine and disease screening) as per directions from the Bull Distribution Committee of DADF, GoI.
- Dissemination of frozen semen doses produced from these HGM bulls (upon maturity) in multiplier and base population for production of genetically improved progenies and also providing remaining surplus bulls to other surrounding villages (outside the purview of project) for natural service.
- Monitoring the improvement in milk production over generations through recording animals on a continuing basis.

Figure 7: Screening of animal for Tuberculosis

- Create awareness regarding improved animal husbandry practices through extension and training of the farmers in project villages.
- Organization of infertility camps in the project villages.
- Organization of calf rallies in the project villages to educate and encourage the farmers through interactions.

7.4 Achievements under the project

The achievements of PS project since inception till March 2016 on some of the major key performance indicators are furnished in Table 5.

Table 5: Achievements of PS project on major key performance indicators till March 2016

Sr. No.	Key performance indicator	Achievement (nos.)
1	No. of functional AI centres	50
2	AI done	34408
3	Animals completed Milk Recording	1486
4	Nominated AI done	4525
5	HGM bulls made available for distribution	15
6	Average dam's yield (in kg) of 15 HGM bulls made available for distribution	3746

7.5 Data analysis

Under the PS project, elite Gir cattle are inducted for milk recording for production of HGM bulls. For further analysis as detailed below, data up to September 2015 has been used. Since inception till September 2015, 1417 pure Gir animals spread over an area of 272 villages in 19 tehsils of 3 districts of Gujarat state were inducted for milk recording in different lactations varying from first to ninth lactation. Till September 2015, 305-DMY records were available for 1118 animals based on minimum 5 monthly records, calculated by Test-interval method as recommended by International Committee for Animal Recording (ICAR), of which 704 animals had completed their lactation.

➢ Lactation-wise distribution of animals

Table 6 provides a summary of lactation-wise distribution of animals with data on their 305-DMY. The majority of animals had their records between 1st and 4th lactation.

Table 6: Lactation-wise distribution of animals

Lactation no.	No. of animals	% animals
1	301	27 %
2	366	33 %
3	284	25 %
4	109	10 %
≥ 5	58	5 %
Total	**1118**	**-**

➢ Milk yield

305-DMY ranged from 752.05 kg to 5956.45 kg across different lactations, with an average of 2573.19 kg and a standard deviation of 726.66 kg.

The number and percentages of animals in different levels of production based on values predicted, after adjusting for factors affecting milk yield, are presented based on Least Squares (LS) analysis at Table nos. 7-8 and Figure nos. 8-11.

Table 7: Number and percentage of animals in different production levels

Production category	No. of animals	% animals
Less than or equal to 2000 kg	130	15.13
2001 – 3000 kg	614	71.48
3001 – 4000 kg	101	11.76
Greater than 4000 kg	14	1.63

Figure 8: Village-wise 305-DMY LS means

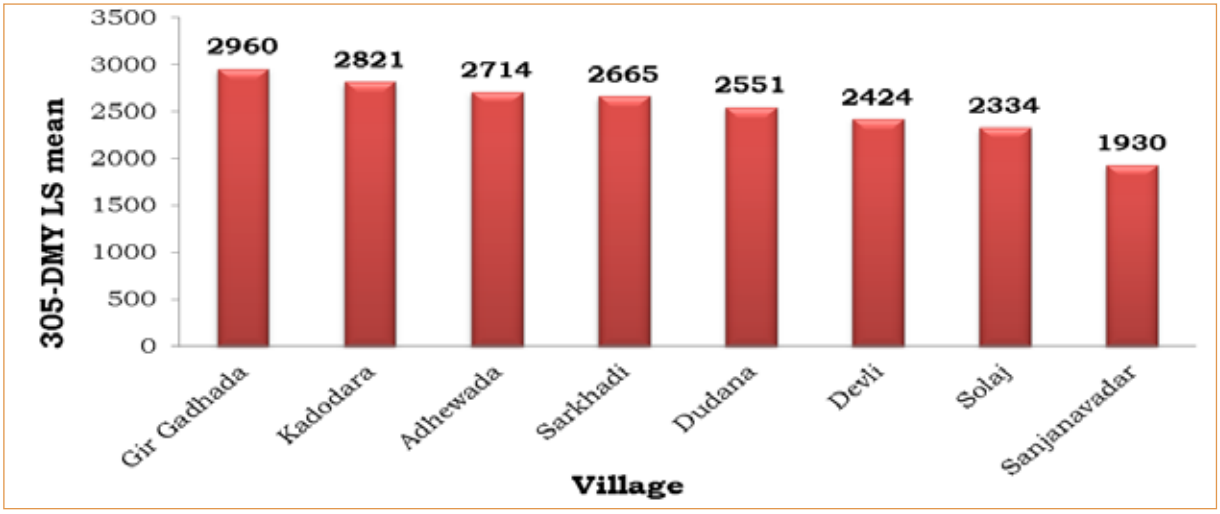


Table 8: Lactation-wise 305-DMY LS means

Lactation No.	305-DMY Least Squares means	No. of observations
1	2535.05	212
2	2711.28	278
3	2686.88	235
4	2655.89	90
5	2627.62	35
6	2113.05	9

Figure 9: Different feeding and management practices

A. Loose housing system
B. Tie-Stall housing system
C. Pastoral rearing system

Figure 10: Standardized lactation curve in recorded animals

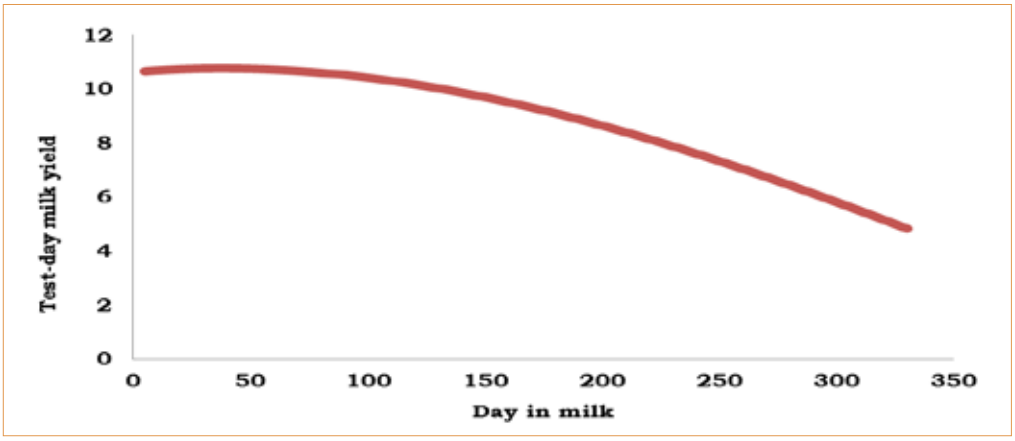
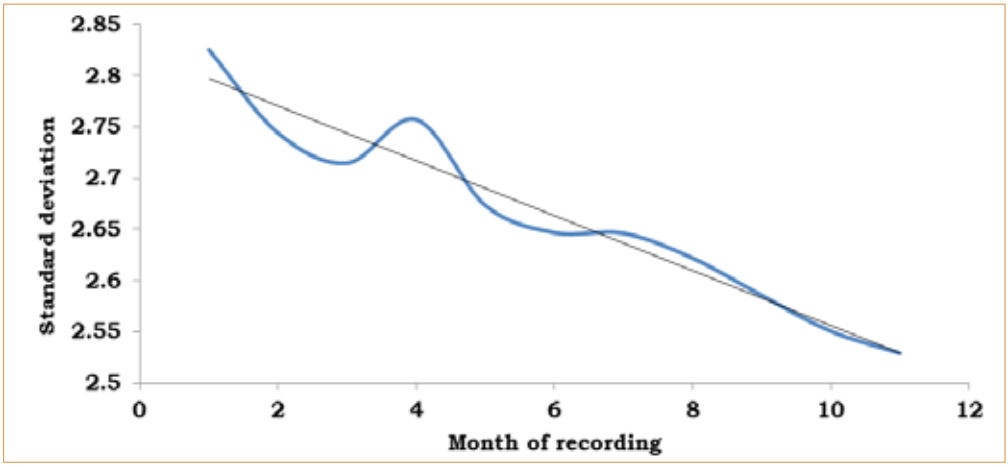


Figure 11: Month-wise standard deviations of standardized test-day milk yields



➢ Milk Fat%

Average milk fat% overall lactations was 5.08% based on 7207 test-day fat% records.

➢ Reproductive performance

Average AI technician CR% achieved under project was 46% on follow-up basis (5855 pregnancies out of total 12756 inseminations). Table 9 and Table 10 indicate season-wise CR% and district-wise CR%, respectively. Figure 12 compares month-wise CR%. Detailed studies on reproductive traits would be possible after sufficient data is generated in due course of time. Currently, it was possible to study the Conception Rate % (CR%) for animals inseminated.

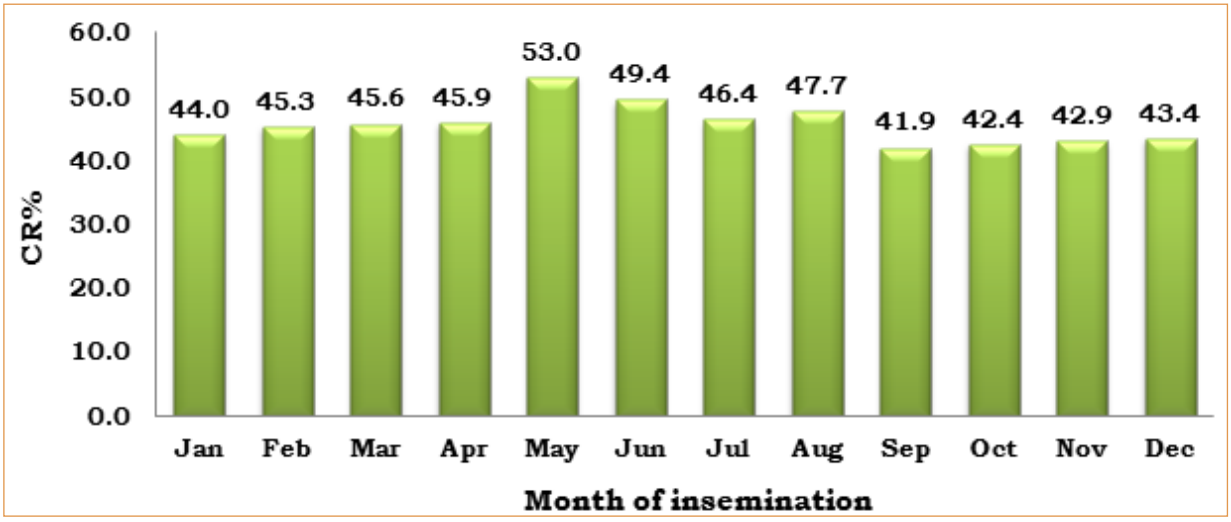
Table 9: Season-wise conception rate

Season of AI	Pregnant cases	Non-Pregnant cases	Total inseminations	CR%
Winter	1980	2515	4495	44.0%
Summer	2504	2695	5199	48.2%
Monsoon	1371	1691	3062	44.8%

Table 10: District-wise conception rate

District	Pregnant cases	Non-Pregnant cases	Total inseminations	CR%
Junagadh and Gir-Somnath	3951	4833	8784	45.0%
Bhavnagar	1793	1964	3757	47.7%
Amreli	111	104	215	51.6%

Figure 12: Month-wise conception rate



8. Management and Breeding Practices of Gir in its native tract

A field survey was conducted by project officers covering **224 farmers in 40 villages** in the native tract having together around **900 Gir cattle** to review the management practices being followed by the farmers. A summary of the findings of the survey has been furnished below.

- The family size of the farmers surveyed ranged from **1 to 5** members with a very few families having more than 5 members. Agriculture was the main source of their income and was entirely dependent on rains.
- **Landholdings ranged from completely landless farmers to a few having over 5 acres of land.** 67% farmers had 2-5 acres of land.
- **Open farm grazing** was the main source of feeding practiced by 90% farmers, while only 10% farmers preferred stall feeding. Animals are let loose for grazing either for the whole day (90% cases) or during morning or evening (10% cases). Amongst the farmers who preferred stall feeding, 85% farmers tied their animals round the day, whereas **15%** farmers never tied their animals. **Concentrate feeding was rare**; the major concentrates fed included a mix of cotton-seed and ground-nut cake with an equal amount of water. More than 90% farmers reared calves through suckling and the rest practiced weaning.
- **56%** farmers were rearing animals for the purpose of milk for their own household consumption, whereas other 44% farmers were rearing animals either for sale of milk, agricultural operations or breeding purposes.
- About 90% farmers kept animals at their farms, whereas the other 10% kept them near to their household. **65%** animal houses had Kachha floor, 30% had Pukka floor and 5% had both the types of floor. **65%** animal houses were open-type, 25% were closed-type and 10% were a mix of both.
- A meager **20-25%** farmers were interested to breed Gir at their own farm with an intention to conserve the breed and/or preferred the use of improved bull/bull semen for production of next generation high yielding replacers.
- **The proportion of farmers who kept either buffaloes or crossbred animals was more than those who reared Gir.** 47% farmers kept Gir, 23% kept Jaffarabadi buffaloes and 30% kept crossbred cows. Adoption of AI was also found to be low.
- About 25% farmers adopted AI, **40% preferred natural service and 35% opted either AI or natural service**, whichever is available and feasible. AI services were provided at farmer's doorstep in 96% of the cases by local AI service providers. Identification of animals with ear tagging having unique identification number was rare prior to project implementation in the area.
- Sale rate of Gir cattle was to the tune of **15-20%.** 95% farmers purchased animals reared by other farmers. Some of these dealings were on account of a social custom and does not involve any financial transactions. Only 5% farmers purchased animals from brokers/ middlemen.

9. Challenges faced during implementation of the project

9.1 Resistance from farmers for animal registration and ear tagging

As per the recommended SOP, identification of all animals using a unique numbered ear tag is mandatory. Ear tagging being a new concept for the farmers, there was resistance from the farmers. The reasons for resistance have been summarized below:

- Ear tagging would cause injury to the animals and more so to young calves.
- Ear tagging have social implications: a tagged animal is considered as purchased after availing loan from bank which indirectly reflects on financial soundness of the owner.
- Ear tagging diminishes the beauty of the animal.
- Ear tagging would reduce sale value of their animals
- Some were simply adamant not to ear tag.

However, with continuous meetings and extension activities as well as educating and supporting them through village awareness and infertility camps, the project has made a clear dent in convincing the farmers to ear tag and register their animals.

9.2 Resistance of farmers for adoption of AI

Convincing farmers to go for AI was a daunting task, where natural service is a common practice. Farmers believed AI is not a natural activity and it decreases milk production of their animals. A few farmers resist AI, as they are unaware of the bull whose semen is being used. Farmers also have misconception that conception rate through AI would be less than that of natural service. Stray bulls are available in villages in high numbers and it is practically difficult to remove them or even castrate them.

9.3 Milk recording and sample logistics

Milk recording is an integral part of any productivity/genetic improvement programme. It is to be carried out twice (or thrice, if animal is a high yielder) a day at monthly intervals at the household of the farmers and during the time of milking. Conventionally, as most of the animals are kept on farm away from their residence outside the village, milk recording becomes a difficult task for milk recorders. Besides, villages in the project area are scattered. As milk procurement by organized milk cooperatives is less established in the area, transporting the milk sample from villages to estimate milk components like fat% is also a major challenge.

9.4 Higher rates of animal trading

Sale rate of Gir was as high as 15-20% per year. Urbanization, being a general problem for animal husbandry, is a major contributing factor. Younger generations prefer to migrate to cities and towns and avoid rearing of animals for livelihood. A few others are leaving animal husbandry due to social reasons. Others find rearing animals non-profitable due to low productivity and rising prices of related inputs. Low returns from milk business due to involvement of unorganized sector in procurement activity, also contributes to loss of interest in rearing of animals. These are major factors for very high sale rate of animals in the project area.

9.5 Grazing of animals

Grazing is a normal practice followed by farmers in the native tract. Project activities such as follow-up of animals for AI, PD, calving, milk recording etc. and supervision and monitoring of field activities becomes very challenging tasks as animals are not found at farmers' houses. These activities, therefore, have to be done either when animals are available at the farm (in the afternoon hours) or at the fields.

10. Strategies adopted by the project team to overcome the challenges

10.1 Concerted efforts by project officers

Initially, the challenge was to overcome the resistance for ear tagging and registration as well as for adopting AI. AI technicians, being the first point of contact with the farmers, were first utilized by the project to educate farmers on the importance of ear tagging and the benefits of AI. In places where desired results were not forthcoming, the concerned supervisors were brought into action to explain the project concepts to the farmers. In some places, even the area coordinator and the project coordinator took initiative to educate the farmers. Following this hierarchy, the project has achieved remarkable success in convincing farmers to go for ear tagging and AI. From the beginning, the project stuck to the rule: **No tagging, no AI**. Despite initial resistance, the policy paid dividend soon (See Box 1 and 2 for project success stories).

Box 1: Gaushala adopts 100% ear tagging and AI

In Saurashtra region, many Gaushalas traditionally keep excellent animals of Gir breed. Rajmoti Gaushala, located in Kodinar area of Gir-Somnath district, is one such Gaushala. Here, the animals are maintained under good management practices. The Gaushala has around 100 Gir cattle; a few of them produce around 18-21 liters of milk per day. Like other Gaushala, they were also breeding their Gir cows through natural service. The Gaushala keeps few high pedigreed Gir bulls which are used for providing natural service to all the cows in the Gaushala.

When the project work was initiated in Saurashtra region, the project officials approached the Gaushala authorities and requested them to enroll such high producing pure Gir animals under the project. Initially, Gaushala trustees were reluctant and refused to ear tag and register their animals. However, the project team continued their support to the Gaushala through conduct of infertility camps and veterinary aids for the animals of the Gaushala. This relationship continued for two long years. Eventually, Gaushala trustees realized the importance of the project and noted the dedication and noble cause for which the team was working. Now, all the animals in the Gaushala are enrolled and registered under the project.

Box 2 : Dependable AI service delivery - a necessity for genetic improvement

Vinodbhai Arjanbhai Kotar, a progressive farmer from Kardej village of Bhavnagar district has a different story to tell. He had 20 Gir animals in his farm. The farm has been inherited from his ancestors and he was following traditional systems of breeding, feeding and management. He was maintaining his own bull for breeding his animals through natural service. Though he started updating his knowledge about scientific breeding, feeding and management of animals and was well aware about importance of quality bulls, their role in genetic improvement and advantages of AI service for breeding the cows, due to non-availability of dependable AI delivery service with semen from quality bulls, he was unable to practice.

When the PS Project was initiated in Kardej village of Bhavnagar district, the project officials noticed that Vinodbhai is keeping good quality Gir animals in his farm and also is maintaining a bull for natural service. The project officials started interacting with him and initially Vinodbhai was not willing to participate and was resisting for ear tagging and AI. However, understanding the importance of his participation, the project officials started visiting his farm repeatedly and tried convincing him for adoption of AI. With constant persuasion, Vinodbhai decided to participate as he saw some benefits in what the project was attempting to do. To begin with, he agreed for ear tagging only two animals; one was registered for milk recording and another for nominated AI. Now, all his animals have been ear tagged and Vinodbhai has completely adopted AI for breeding his animals. His 9 Gir animals have been registered for milk recording and HGM male calves are available in his farm waiting for procurement. The AI technician regularly visits his farm and Vinodbhai also takes guidance from other project officials on a regular basis. Vinodbhai feels that due to his association with Gir PS Project, he is now on the way to fulfilling his dreams by strengthening his animal production system and also maintaining his parental wishes.

10.2 Village Awareness Programmes

Regular village awareness programmes were conducted to create awareness about the importance of ear tagging, registration, AI against natural service, and milk recording as well as about following improved animal husbandry practices. **426 village meetings**/awareness programmes have been organized by the project till March 2016. Invariably, experts from local Krishi Vigyan Kendra (KVK) are invited to such programmes to address the farmers on various topics of interest to farmers in local language.

Major focus is provided to address the challenges faced by the project. In addition, other topics such as water and fodder conservation, animal husbandry practices, breed importance and requirement for conservation, health aspects such as discussion on zoonotic diseases and their preventive measures, etc. are also discussed. Doubts and queries raised by the participants are also addressed. Progressive farmers of the particular region also receive invitation to share their experiences with other participants. This ensures wide-scale cooperation of farmers in project implementation as well as addressing the challenges mentioned earlier.

SAG under the PS project had organized a mega-workshop on Genetic improvement of Gir cattle on 02 January 2016 at Krishi Vigyan Kendra, Ambujanagar, Kodinar. Around 500 farmers participated and different subject matter specialists facilitated sessions during the workshop such as on Gir production and reproduction performance, importance of AI, ear tagging etc. and also interacted with progressive farmers.

Figure 13 depicts village awareness programmes under the project.

Box nos. 3 and 4 provide case studies on farmer participation.

Figure 13: Village awareness programmes under the project

Box 3 : Farmer participation - a case from Gir PS Project

Karsanbhai Mermanbhai Vala, a farmer in Mitiyaj village of Kodinar area of Gir-Somnath district had 3 crossbred cattle in his farm. He had to grow green fodder and majority of his hired labor was busy in maintaining the crossbred cows. Though the production was good, the crossbreds required lot of care and management. Later when he started interacting with the project officials and the field force, Karsanbhai learned more about the project and got an opportunity to understand about the improved "Gir" animals. Subsequently, Karsanbhai decided to replace his crossbred cows with Gir animals. He purchased 4 Gir animals and started rearing them. Now he is convinced and is of the view that Gir animals actually require less management efforts and can thrive well under local environment when compared to crossbreds. He uses AI for breeding the Gir animals and got all his animals ear tagged. The project AI technician was always ready to offer doorstep AI service upon a call. He has also started selling surplus milk to the neighbours of his village. After getting the first-hand experience, he started actively participating in various project activities. During village awareness programmes and while interacting with other farmers in the area, Karsanbhai even advocates them to participate in project activities and include their animals under the project. Interestingly, during the supervision visits of the project officials to his village, Karsanbhai would even accompany them to various households to validate the milk recording and other activities.

Box 4: Awareness building and team work – A case under Gir PS project

Many farmers of the Devali village of Kodinar area of Gir-Somnath district were not aware about advantages of scientific and modern animal husbandry practices like Artificial Insemination (AI), vaccinations, deworming, ration balancing etc. and were following traditional practices. Lack of breeding and veterinary services, and inadequate knowledge about scientific animal husbandry practices were few of the reasons for poor productivity of animals in the village. The women folk in the households were playing a major role in taking care of the animals. Though they were involved with the day to day management of animals, they were not aware about the scientific rearing practices. Due to these, the women were following their traditional wisdom.

When the PS project on Gir animals was rolled out on Devali Village, the project started programmes on awareness building for the farmers regarding balanced feeding of animals, importance of deworming and vaccination and their benefits, importance of genetic improvement programmes, advantages of AI, importance of indigenous cattle like Gir etc. Initially the project officials realized that there was less participation from women. However, when the project team started persuading the women folk, they started attending the awareness programmes and started learning about the scientific management practices of dairy husbandry. They even started bringing their sub-fertile animals to the infertility camps organized by the project.

Now the project officials have noted that participation of women in all project activities has overweighed the participation of men. Women have even started implementing their leanings about scientific animal husbandry practices at their household. They feel that during the span of around 1.5 years, there is improvement in productivity of their animals while the cost of production of milk has reduced. They also have noted that the incidence of infertility problems in their animals has been significantly reduced. Now, the women have formed an informal group for creating and spreading awareness about Gir animals and their care and management. The group takes guidance from the project officials whenever required. The group now plans and arranges meetings in Devali village and even have organized a calf rally in the month of February 2015. This has furthered women participation in the village and surrounding area.

10.3 Infertility camps

In dairy animals, as production depends on proper reproduction, infertility camps form an integral part of the project. The project provided support to farmers through these camps which are held on a regular basis. During such camps, the concerned AI technicians encouraged farmers to bring their animals in these camps. In fact, many farmers actively participated in such camps. Such support also built confidence amongst farmers and encouraged them to go for AI. **377 infertility camps** have been organized with the active participation of farmers till March 2016. During these camps (Figure 14), deworming tablets and mineral mixtures are also provided to the farmers and many animals were treated for other ailments. After such camps, the concerned supervisors also followed up the infertility cases, which increased confidence of farmers and encouraged them to actively participate in project activities.

Figure 14: An Infertility camp under the project

10.4 Wall paintings

The project villages are quite well-scattered. Initially, it was difficult to communicate to a large number of farmers and make them participate in the project activities like identification and registration of animals, AI, awareness programmes, infertility camps, etc. To overcome this issue, the project decided to create wall paintings at strategic locations, where many farmers visit (Figure 15), such as highways, temples, common meeting places at villages, bus stops and most frequently visited shops. These wall paintings provided information about the project including project name, organizations involved, breed characteristics, contact details of project officials, etc. They played a pivotal role in enhancing project activities in many villages and created interest amongst livestock owners and ensured participation from different communities in village awareness programmes and infertility camps.

Figure 15: Wall paintings at strategic locations under the project

10.5 Calf rallies

A calf rally is an event where farmers bring their calves born under the project at one place (Figure 16). This provides an opportunity to farmers to compare calves of the same age and learn better animal management practices from farmers having well-managed calves. To encourage farmers to adopt better calf rearing practices, those farmers having better managed calves are given prizes during such calf rallies. Prizes are given based on breed characteristics, weight, age and health of calves. The project organized **107 calf rallies** till March 2016 under the project. Project officials also interact with farmers and conduct awareness sessions on scientific practices.

Figure 16: Calf rallies organized under the project

10.6 Extension materials

Communicating scientific concepts and explaining their objectives of the project to farmers at the field level in a way they can understand is a real challenge. Extension materials form a useful vector for this task. Various extension materials such as leaflets, pamphlets, banners and canopies communicating importance and benefits of scientific animal husbandry activities and project activities are being distributed to farmers at the time of village awareness meetings. Visual aids are also being used to demonstrate breeding and data recording activities to the farmers. These materials are prepared in the local language and in concise manner.

The project had also designed a directory for Gir bulls being used under the project and had provided to all AI technicians under the project. The directory contains individual photographs of bulls whose semen is being used, with other details of the bull such as its name/identification no., dam and sire name/identification no., dam's lactation milk yield and paternal grand-dam's milk yield and dam's milk fat%.

Figure 17: Extension using calendars under the project

Figure 18: Exhibition stalls to display various activities under the project

Figure 19: Bull directory for bulls used for AI under the project

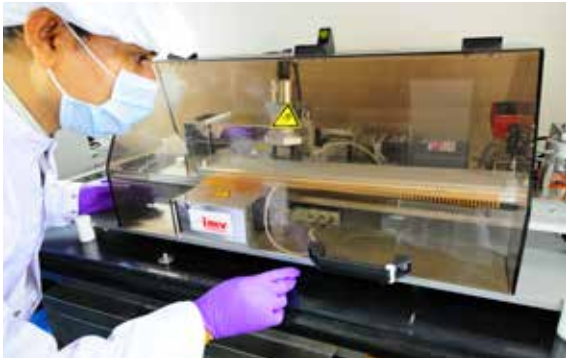
10.7 Mobile laboratory

There are a few farms, Gaushalas and temples in the Saurashtra region that have excellent Gir cows and bulls, but often it would not be possible to use such high quality bulls for semen production or cows for embryo production either because they may not sell such animals or even if they are ready to sell, the disease protocol may not allow us to buy such animals.

In order to exploit the lost germplasm by carrying out semen/embryo collection from the farmers' animals, NDDB in association with SAG has designed/fabricated a special mobile van - "Bovine Genetics on Wheels" fitted with clean room and equipment for semen processing in field conditions (Figure 20). The vehicle is equipped with all necessary equipment to process ejaculates after collection in field condition.

This may turn up in a promising and emerging area in semen and embryo production where semen from precious Gir breeding bulls owned by farmers/Gaushalas could be collected and processed using mobile facility adhering to prescribed SOP and MS for production of bovine frozen semen. Furthermore, the facility may be used for development of other important dairy breeds of cattle and buffaloes.

Figure 20: Mobile semen collection laboratory developed in association with SAG – Collection and processing of semen in field condition



11. Future strategies for development of Gir

Focused and scientific interventions are required for developing this breed. There is a need to bring together all interested Gir dairy farmers both in its native tract and outside and explain to them not only the need to develop Gir breed, but also the process that needs to be followed to increase productivity of Gir cows and thereby raise the income of farmers.

The activities that need to be strengthened and the key strategic interventions that need to be considered in developing the Gir breed are briefly described below:

11.1 Unique Identification and Registration of animals

Identification with a unique numbered ear tag and registration of animal is prerequisite for any scientific attempt to develop any breed. It, therefore, needs to be promoted extensively.

Gradually all Gir animals could be ear tagged and registered and a common database of all Gir animals could be created.

11.2 Promoting AI

Still a significant number of farmers in the area are using natural service as their preferred option to breed Gir. The other big challenge in popularizing AI is presence of large number of stray bulls in the project villages. Considering the current constraint in castration of these bulls, it would continue to be a big challenge at least for the near future. Only way is to continue to educate the farmers on the benefits of AI against natural service. Some farmers are also suspicious about bulls - physical appearance, pedigree, dam's yield etc. - whose semen is being used in the project villages as they are unable to see the bulls physically. The AI technicians should always carry with them **a bull directory with photographs, pedigree and dam's production details which may help in clearing the doubts of farmers about the bulls.**

The project need to strengthen their extension activities through village awareness programmes and farmers meetings.

11.3 Use of Gir for Upgradation of local non-descript animals

It would be prudent to breed all Gir type cows in the project area and the breeding tract with pure Gir semen to upgrade them to pure Gir in two to three generations. Apart from its native tract, areas where non-descript animals are to be upgraded, Gir semen could well be used to upgrade the local non-descript population.

11.4 Involvement of Stakeholders in breed development projects

There are many players operating in the Gir breeding tract and providing AI services such as the State Animal Husbandry department, local Gaushalas, Non-Governmental Organizations (NGOs), Cooperative dairies, Private Inseminators etc. All of them need to be involved in promoting and developing Gir breed. They should use only high quality pure Gir semen in the project area from A or B graded Semen stations, follow the SOP for AI recommended by DADF, GoI and avoid using any exotic or crossbred semen for breeding pure Gir or Gir type animals.

11.5 Creation of an Information base for the breed

For improving productivity of any breed, one must collect accurate information on the production and reproduction traits of the breed on individual animal basis through a user friendly software. INAPH is one such software developed by NDDB for capturing data related to identification and registration, AI, PD, calving, growth monitoring, milk recording and type trait recording as well as for generating required information for field force to implement their day-to-day activities, for supervisors to monitor activities of their field force efficiently and for managers, planners and scientists for their planning, research and investment decisions.

11.6 Focus on Animal Health, Disease Control and Vaccination

Overall health of the animals affects productivity of animals. Improved germplasm, produced from breed improvement projects require continued focus on health. Animal health monitoring, disease control and vaccination activities should be an integral part of the programmes. State Animal Husbandry departments could play a pivotal role in healthcare of animals under such projects And proper coordination with DAH is necessary.

11.7 Assisted Reproductive Technologies (ART)

There are a few farms, Gaushalas and temples in the Saurashtra region that have excellent Gir cows and bulls. To tap genetic potential of these high genetic merit animals, there is a need to make use of reproductive techniques such as embryo transfer, ovum pick up, IVF etc. on these animals.

11.8 Initiating PT programme

As AI becomes popular and infrastructure expands, in a few years it would be possible to initiate a PT project for Gir breed in the project area. Eventually, it would be possible to achieve a higher genetic gain and realize higher accuracy and intensity of selection for bulls and bull mothers. There is a need to include many other traits such as Type Traits, Milk components etc. in improvement strategy. It would be also advisable to collect blood sample of all performance recorded animals and breeding bulls to enable introduce Genomic Selection in the programme at a future date.

11.9 Animal Type Classification and Genomic Selection projects

Animal Type Classification involves classification of animals on the basis of well-defined traits referred to as “Type Traits” associated with productivity and fertility of the animal. Once PT project is operational, type classification could also be initiated. In addition to traits that would be recorded from PT project, type traits, if recorded, can add value in evaluation and selection of animals based on a composite index. These traits are highly heritable and improve longevity of animals.

Simultaneously, collection of biological samples from milk recorded animals and bulls used under semen station should be initiated. These samples should be stored initially and used further for genomic selection of animals. Genomic selection involves establishing relationship between the genotype (DNA) and phenotype (production/ reproduction/type traits) of animals. Once methodologies are standardized, animals could possibly be selected based on genotype itself at an early age, even in the absence of phenotype information. This would reduce the generation interval drastically and lead to increase in genetic gains per unit of time considerably.

12. Summary

Gir is an excellent dairy cattle breed well-known for its milk producing ability, good fertility, heat tolerance, easy maintenance, resistance to diseases and longevity. There are wide variations in Gir animals with respect to certain breed-specific characteristics. Gir animals are widespread both within and outside India.

There is a concern expressed that the number of Gir animals are dwindling and their productivity levels have stagnated over many years. Besides, lack of concerted efforts by various stake holders is attributed to the present scenario in the native tract, where still a considerable number of Gir cows exist.

Experiences of NDDB in implementing a Pedigree Selection Project for Gir breed in its native tract of Saurashtra region in Gujarat through SAG have been narrated in this document. An analysis of the production and reproduction data collected under the Gir Project has revealed that Gir has potential to be developed as an economic dairy breed in many parts of the country.

The progress made by the SAG under PS project has also been described; the results obtained so far reinforces the confidence in the scientific methodology adopted for the genetic improvement of indigenous breeds. Various challenges faced by the project have also been identified along with strategies to overcome them. Future strategies have been suggested on further development of this breed.

It has been pointed out at several places that Gir breed development needs collective efforts by all stakeholders, including farmers.

It is hoped that this document will provide the basis for undertaking further collective action for development of not only Gir breed but other local dairy breeds of cattle and buffaloes in the country and achieving high productivity levels in these breeds comparable to the best in the world. It is also hoped that this document will become a reference document for undertaking breed development efforts for other indigenous breeds of the country for dairy traits.

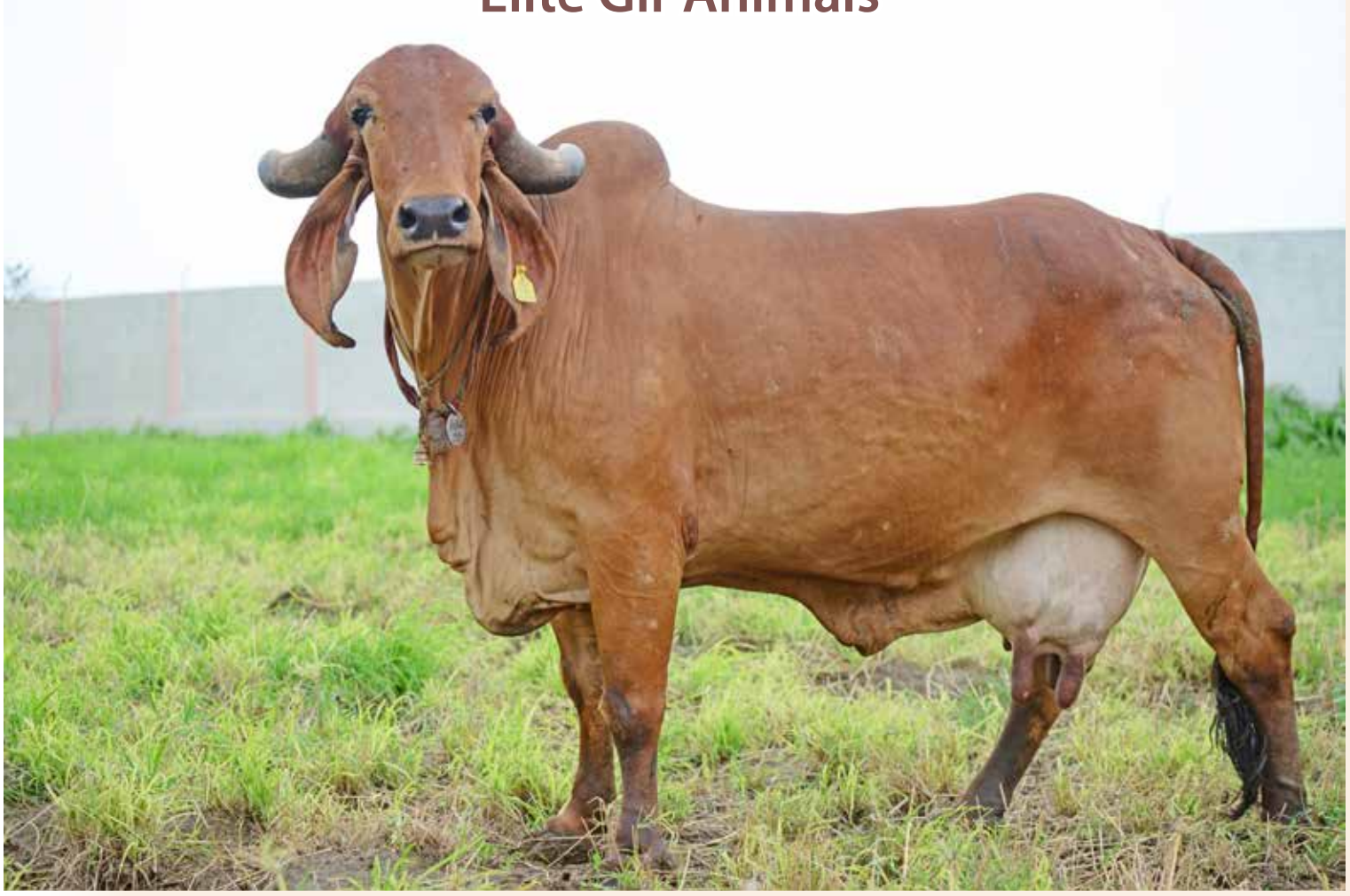
13. Literature cited:

1. Agfact A2.3.12, Second edition (1997). http://www.dpi.nsw.gov.au/content/agriculture/livestock/beef/breeding/breeds/brangus
2. Livestock Census (2007). Salient Features of 18th Livestock Census. Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhawan, New Delhi, India.
3. Madalena, F.E., Peixoto, M.G.C.D. and Gibson J. (2012). Dairy cattle genetics and its application in Brazil. Livestock Research in rural development. 24(6).
4. Maradiya, M.G. (2016). "Gir Gai Darshan" – A book on Gir cattle in Gujarati language by Dr. M G Maradiya, Gir breed expert, Retd. Zoo Superintendent.
5. Mason's World Encyclopedia of Livestock Breeds and Breeding, 2 Volume Pack, by Valerie Porter, Lawrence Alderson, Stephen J.G. Hall, D. Phillip Sponenberg
6. National Bureau of Animal Genetic Resources (2015), Karnal, Haryana, India. AGRI-IS, ICRA-NBAGR, Karnal; http://210.212.93.85/agris/breed.aspx

Acknowledgement

We gratefully acknowledge the support received from Sabarmati Ashram Gaushala PS Project team as well as Sabarmati Ashram Gaushala Management in preparing this document.

Elite Gir Animals



National Dairy Development Board
Anand 388001, Gujarat
Phone: 02692-260148, 260149 • Fax: 02692-260157, Website: www.nddb.coop