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DECADES OF ARTIFICIAL INSEMINATION: BITTERSWEET EXPERIENCES ON CATTLE BREEDING IN BHUTAN

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ABSTRACT: The main objectives of the study were to determine the number of inseminations performed and progenies born between 1987 and 2016, compare Artificial Insemination (AI) performance in different regions, among districts and AI Outreach Stations (AIOSs), and estimate contribution of AI program to total milk production and national economy. Data was collected in 2016, covering 20 districts and 106 AIOS. Establishment of 106 AI Out Reach Centre in 20 districts provided uninterrupted AI services, enabling AI performed to exceed 160,070, resulting in birth of 50,808 improved calves since 1987. Western region had the highest number of progenies born (35%). East Central Region had the lowest with 15% of total calves born in the region**.** Among 20 districts, Paro was the best performer with 16,360 inseminations done with 5,829 progenies born. Gasa district performed poorly with 24 progenies born out of 73 inseminations performed. The average number of inseminations per month and corresponding progenies born was highest for AIOS located at Veterinary Hospital (VH) in Paro, followed by Veteninary Hospital (VH) in Tsirang, Extension Centre (EC) in Chaskhar, VH in Thimphu and EC in Deothang. VH in Gasa, EC in Tashiding, EC in Bjemina, EC in Goshi had less than one insemination per month. At the national level, the average number of AI performed was about seven times per month but only 50% of the AIOS exceeded this minimum recommended number of AI to be performed per AIOS. The national average success rate was 37% and the corresponding total progenies born should have been 56,910. However, due to lack of proper recording, the number of progenies born stands underestimated by 14.2%. The study concluded that, for higher output of National AI Program, there is a need to improve progeny recording system, improve skills of AI Technicians, train community AI Technicianss, relocate or close under-performing AIOS and take joint ownerships by all stakeholders at national, regional and district level.

Keywords: Artificial Insemination; breed improvement; economy; progeny.

1. INTRODUCTION

Artificial Insemination (AI) is the most efficient reproductive technology accepted by the scientific community for breed improvement and enhancement of dairy productivity. AI is considered as a primary breeding tool for genetic upgradation of cattle (Wardena et al. 1998). In Bhutan, the AI program has been implemented in a planned manner since 1987. In areas where AI is not feasible, quality breeding bulls were supplied from government cattle farms and through contract heifer and bull

production programme to disseminate superior genetic trait of selected elite males for breed improvement (Tshering 2017). The number of inseminations and progenies recorded has increased over the years. Although the improvement has not been very drastic, the trend of steady increase is an indication of success, taking into account the convergent factors called the chain of fertility. The chain of fertility includes the sexual health of the bull, frozen semen quality, expertise of AI Technician and the ability of the farmers to detect the animal in heat and take the animal at the right time for insemination. Nevertheless, since the commencement of AI programme, there has been steady increase in AI coverage. It was due to innovative approaches such as initiation of Contract Heifer, Bull Production Program in 2000 and use of progeny tested semen for this program, which triggered formation of 194 Dairy Farmers' Groups and five Dairy Farmers' Cooperatives across the country (NDRC 2016).

To take AI services closer to farmers' door-steps, over 82 Community AI Technicians were trained and deployed since 2010 to complement and supplement AI Technicians (Tshering et al. 2016). Since 2015, to meet the changing needs of farming communities, sex sorted semen was tried in village herds to ensure higher number of female born (Tshering 2015). To harness the opportunity existing in science and technology, Embryo Transfer Technology was vigerously pursued for faster multiplication of elite germplasm since 2015. By 2017, the Progeny Testing Scheme was initiated to develop resilient cattle breed for Bhutan and AI in Buffaloes was introduced for the first time in the country.

With increasing urban demand for dairy products in the country, AI technology played an important role in gradual transition from subsistence to a market-oriented production system over the years. However, a comprehensive review of National AI Program and its impact on dairy development and national economy has not been undertaken. Therefore, a study was conducted to review AI program since its inception. The study objectives were to evaluate the number of inseminations done and progenies born between 1987 and 2016, compare AI performances in different regions, districts and AIOS, and estimate contribution of AI program to total milk production and national economy.

2. MATERIALS AND METHODS

2.1 Data collection and analysis

The locations of AIOSs are presented in Figure 1. Data collection was carried out in 2016, covering 20 districts and all 106 AIOS. The study team visited all AIOS. AI done and progeny records maintained at the AIOS from 1987 to 2016 were reviewed. The individual records were evaluated. Informal discussions were held with all AI technicians to understand the constraints faced. Impressions and observations from the field were described. Data obtained from the records were entered in Microsoft Excel sheet and analysed using MS Excel and SPSS. The percentage of AI done and progeny born in each

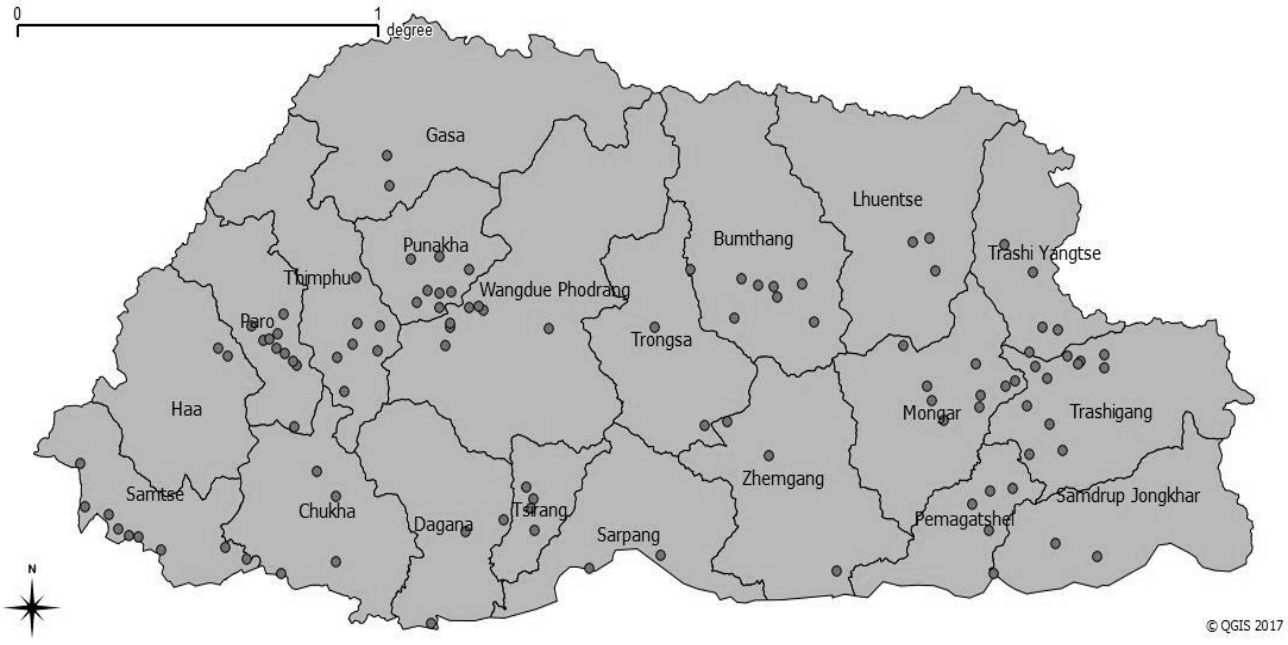

Figure 1: Artificial Insemination Outreach Stations(AIOSs) in the country as of June 2017 (Black dots represent AIOSs).

regions of the country were calculated. Descriptive and inferential statistics were used.

3. RESULTS AND DISCUSSION

3.1 Comparison of AI technology application in four regions of the country

Comparison of AI technology application in four regions of the country revealed that western region was ahead in adopting the AI technology with highest number of progenies recorded (17,725) (Figure 2). East-central region lagged behind with 7,739 progenies born. This could be because western region is more accessible with motorable road; farmers are innovative and forthcoming to embrace the technology in view of better market for fluid liquid milk. The success rate of AI is reported to vary from province to districts depending on AI coverage (Wardena et al. 1998).

3.3 AI done and calves born in Districts

Figure 4 presents the details of AI and projenies born in 20 districts. Records from 1987 to 2016 showed that, across 20 districts of the country, Paro was the best performer with 16,360 inseminations done with 5,829 progenies born. Gasa performed poorly with 24 progenies born out of 73 inseminations done. The remoteness of Gasa district, coupled with cold weather could have had adverse effects on technology adoption.

Average insemination per month and corresponding progenies born were highest for the AI station located at the Veterinary Hospital (VH) in Paro. The lowest AI per month and projenies born were observed for VH in Gasa, Extension Centre (EC) in Tashiding, EC in Bjemina, EC in Goshi,

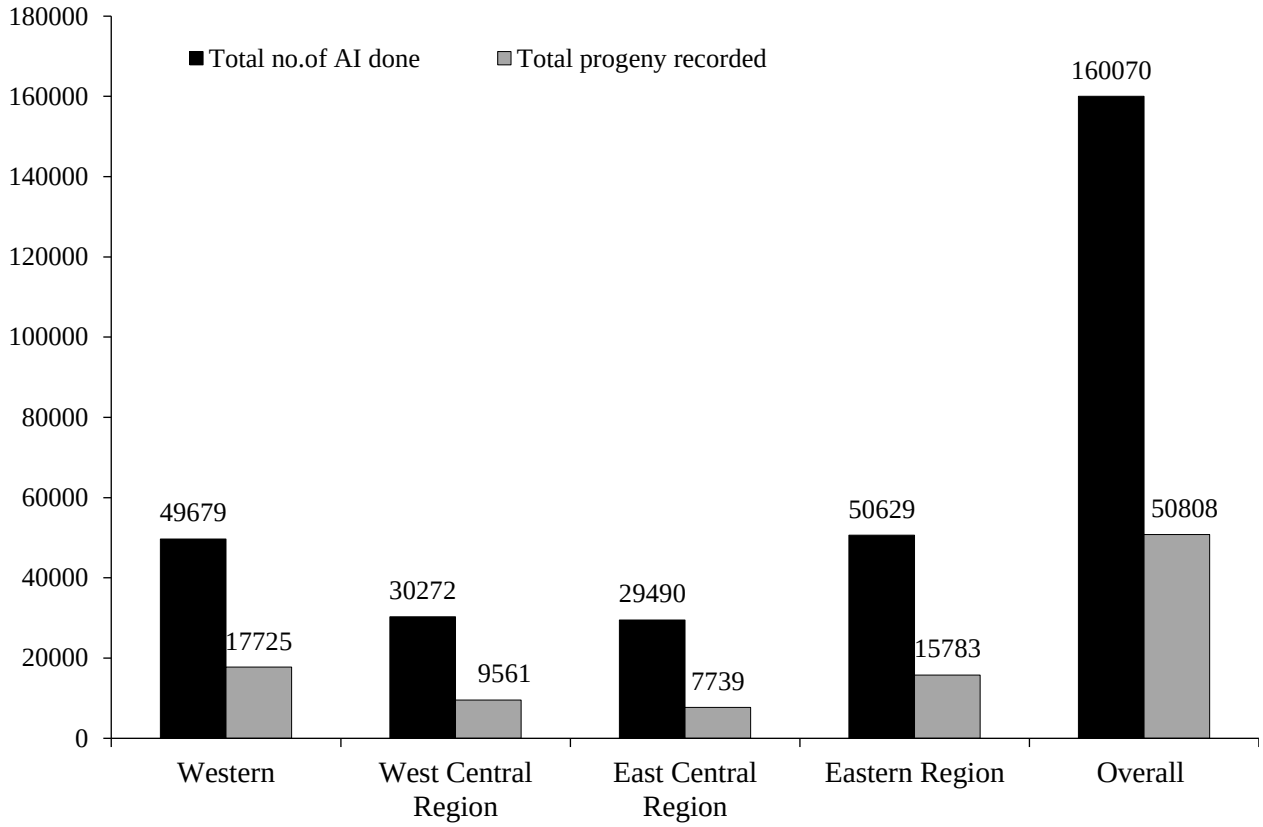

Figure 2: Region-wise comparison of AI technology uptake (1987-2016).

3.2 Regional share of progenies born through AI

The share of progenies born out of AI in four regions is presented in Figure 3. Western region had the highest share of progenies born (35%) through application of AI technology, followed by eastern region (31%). East-central region had lower adoption of technology, resulting in only 15% of total calves born in the country. Hence, east-central region needs to provide extra efforts to take advantage of the technology for upgradation of local cattle population in the region.

where average insemination per month is less than one.

Paro, Bumthang, Mongar, Punakha, Tashigang, Thimphu, Samtse and Samdrup Jongkhar districts performed extremely well whereas Gasa, Lhuentse, Dagana, Sarpang, Haa were far below average. AI performances of AIOSs that are not upto the mark need close monitoring by respective Regional Livestock Development Centres and appropriate

remedial measures must be taken to accelerate the technology uptake.

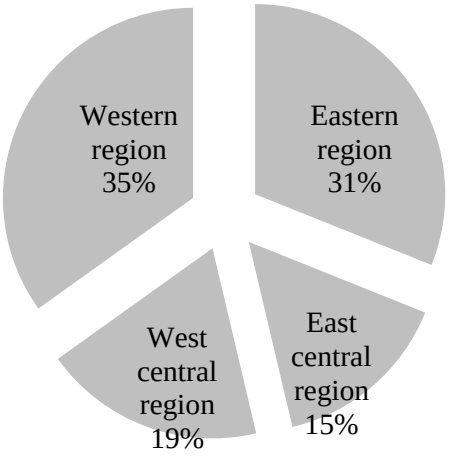

Figure 3: Share of progenies born out of AI in four regions.

3.4 Trend in application of AI technology

The yearwise linear trendline of adoption of technology showed an upward trend indicating that technology application by farmers increased steadily over the years (Figure 5). Technology usage picked up well and peaked in 2003-2004 with about 6000 inseminations done but failed to rise further in the subsequent years and remained more or less constant. This could be because the push to popularize the technology, facilities and support for the program could have remained static and the awareness level amongst famers could also have remained the same.

3.5 Trend in adoption of AI Technology in four regions of the country

The assessment of AI technology adoption across four regions of the country revealed that west central region, after a fall in 1999-2000, saw a steady rise in AI technology adoption. In east central region, the AI technology adoption declined since 1998, which could be due to gradual withdrawal of donor fund support to AI program. Hence, the financial support

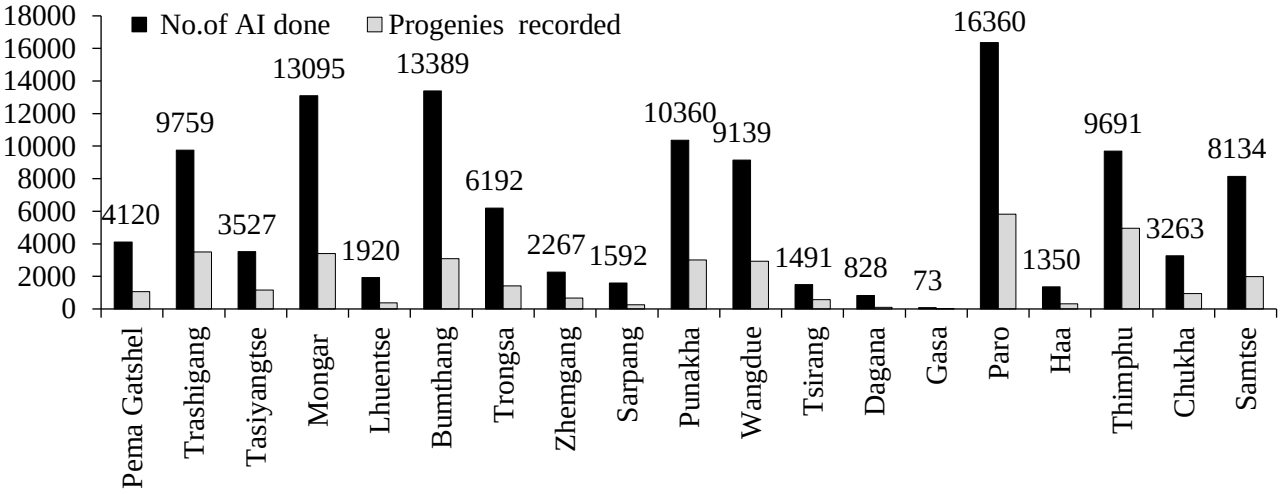

Figure 4: Districtwise comparison of inseminations done and projenies born.

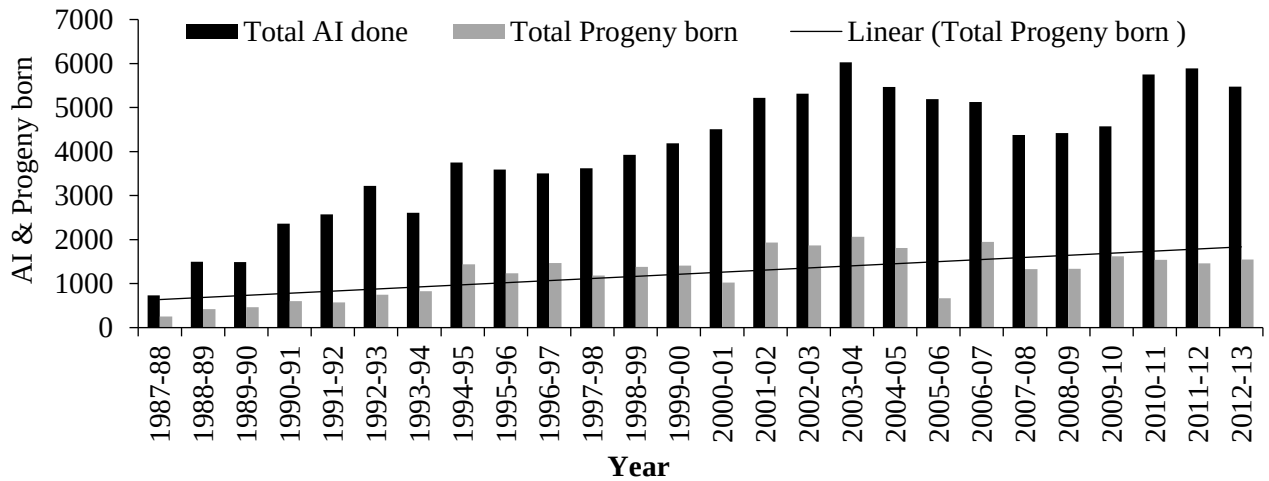

Figure 5: Yearwise adoption (1987-2013) of AI technology across the country.

and incentives for adoption of AI technology need to be continued to promote its uptake.

3.6 Comparision of AI performace in AI Outreach centres

The average number of inseminations per month and corresponding progeny born was highest for Veterinary Hospital (VH) in Paro, followed by VH in Tsirang, Extension Centre (EC) in Chaskhar, VH in Thimphu and EC in Deothang (Figure 6). On the contrary, the average inseminations per month was less than one for VH in Gasa, EC in Tashiding, EC in Bjemina, EC in Goshi, which needs to be reviewed with caution. About 50% of the AIOS performed below the national average of 7±1 insemination per month.

3.7 Success rate of AI program at national level

Success rate was measured by accounting number of inseminations done and progenies born. The overall success of 31% was recorded till June 2012 because the initial take-off of AI program in late 1980s and 1990s was slow. However, the success rate from July 2007-2012 was 36%, which steadily improved to 38% in 2012- 2016 (Table 1).

The success rate from nine years national average (2007-2016) was 37%, which is higher than the success rate of 34.3% reported from Sri Lanka (Wardena et al. 1998). This is indicative of consistent effort of National Dairy Research Centre and its allies to reach AI technology closer to dairy farming communities. Success recorded in Bhutan is mostly with one time insemination of cattle in heat brought to AIOS by farmers. However, studies have shown that success rate can be improved by about 4% if there are two inseminations in the morning and evening (Graves et al. 1997). Thus, increasing the success rate could be possible if two inseminations are followed after considering cost implications.

3.8 Contribution of AI technology to National Economy

On average, 8,398 AI was performed and 3,107 progenies were born annually. Considering 20-25 years life expectancy of cattle (Banerjee 1991), the

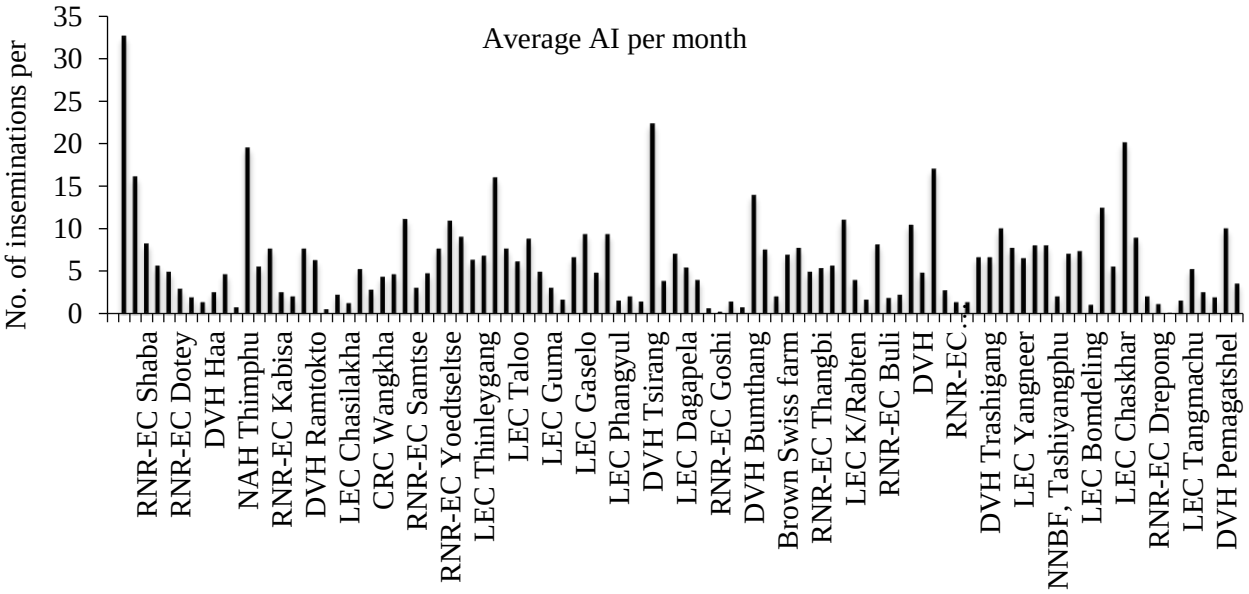

Figure 6: AI performaces of AI Outreach centres in Bhutan.

Table 1: AI success rates in 10th and 11th Five Year Plans.

Region of Bhutan	AI progress 2007-2012			AI progress 2012-2016		
	Total AI done	Progeny born	Success rate (%)	Total AI done	Progeny born	Success rate (%)
Western	9258	3530	38	8378	3221	38
West Central	6281	2357	38	7633	3068	40
East central	7219	2032	28	6866	2496	36
Eastern	9681	3851	40	10716	4037	38
Average success rate					36	38

Data source: District AI records, Success rate is progeny born devided by total AI ×100

estimated 10,312 females born out of AI were below 15 years and are still in production, producing approximately 22,583 MT milk (6kg cow^{-1} day^{-1}, (price Nu. 45 kg^{-1}), ploughing back Nu. 1.016 Billion to dairy farmers annually. Of the annual milk production of 47,270 MT in 2016 (DoL 2017), AI technology contributed 48% of total milk produced in the country. Thus, the positive impact of AI technology application for cattle breed improvement and its contribution to national economy are substantial (Figure 7).

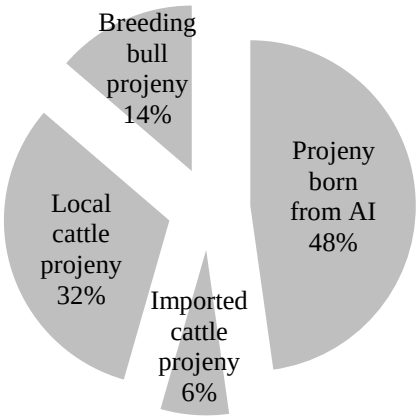

Figure 7: Contribution from AI born progeny to overall milk production.

4 CONCLUSION

Prognies born from AI have substantially contributed to milk production and national economy. However, the follow up on progenies born is inadequate in many of the AIOS and not all progenies born are eartagged and recorded. This is underestimating the success rate of the national AI program. To enhance AI performances, districts performing well should be rewarded and trailing districts should be supported. There is a need to strengthen the capacity of staff placed at AIOS. Increased development activities in the subdistricts and multi-tasking of Extension Agents are reported to be the reason for less focus on AI and progeny recording. Joint ownerships of AI and dairy breed improvement programs is a way forward to achieving higher output. Unless such collective efforts are made and backed by required resource, dairy breed improvement will continue to show low impact, compeling farmers to import cattle from outside the country.

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