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NATIONAL DAIRY RESEARCH AND DEVELOPMENT CENTRE
DEPARTMENT OF LIVESTOCK
MINISTRY OF AGRICULTURE & FORESTS
YUSIPANG, THIMPHU

DoL

ANNUAL CENTRE REPORT
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FROM THE PROGRAM DIRECTOR'S DESK

This is the 4th Annual Centre Report of NDRDC Yusipang, published to highlight progress made and challenges faced while implementing National Dairy Research & Development Program during the fiscal year (FY) 2019-20.

During this FY, NDRDC Yusipang has achieved yet another milestone in Technological Innovations. Sexed Semen Technology (SST) well tested in field is released by HE Sanam Lyonpo, MoAF along with user guidelines and Package of Good Practices on improved dairy farming. Release of this technology is very timely in view of growing demand of heifers and need for such technology to accelerate dairy heifer production across the country. Accordingly, intensification of Heifer Production Program using sexed semen was initiated nationwide in this FY. This is augmented with capacity building of field staff through refresher course on proficient application of Artificial Insemination Techniques in all regions involving 101 field staff (cumulative), sensitization DLO/staff and Farm Managers, Govt. farms on sexed semen use; and procurement of over 8500 doses of sexed semen from abroad to speed-up application of SST.

Review of Progeny Testing Scheme with Thai Holstein semen (four sire lines) has indicated a major setback in the success of the program as about 54% male birth which is not desired by farmers. Switching over of sexed Holstein semen in the near future is a way forward.

To facilitate setting of product standards, dairy products laboratory could be set up during this FY. Capacity building on dairy value chain management is also on going. A total of 230 participants were trained in Good Manufacturing Practices (101 Clean Milk Production, 14 Quarg cheese, both at Sarpang, and training 115 at Haa on dairy product diversification). NDRDC also technically supported establishment of a dairy processing plant at Gelephu.

The Centre besides publishing Annual Centre Report, four technical guidebooks/Standard Operating Procedure was developed and five scientific papers published in Bhutan Journal of Animal Science.

Arrival of a new vehicle to facilitate dairy input supply happened at the end of this year. This indeed is a bright light at the end of tunnel; the kind gesture of Royal Government to ease LN_2 transportation problem to field is appreciable. Besides, sizable amount of fund provided to NDRDC for this FY for purchase of sexed semen, essential dairy equipment and facilities is testimony of high priority given by Ministry and Department to enable NDRDC to achieve greater height. NDRDC gratefully acknowledge the support.

Tashi Delek and wish you a happy reading!

(Dr. N.B.Tamang)
PROGRAM DIRECTOR

EXECUTIVE SUMMARY

National Dairy Research & Development Centre (NDRDC), Department of Livestock is gearing to enhance dairy product self-sufficiency through organized and focused approach to Dairy Research and Development (R&D) in the country.

NDRDC is publishing the Annual Report (2019-20) to share success stories and lessons learnt while implementing Dairy R&D activities, in its mission to fulfill the aspiration of Royal Government of Bhutan to achieve economic self-reliance.

Dairy input production and distribution is very crucial for success of cattle breeding program in the country. Inputs produced at the Centre include liquid nitrogen (LN_2) and frozen semen. During the FY 17651doses of semen was produced despite COVID disruption. Similarly 33,217 liters of LN_2 was produced and distributed to Dzongkhags and farms.

Embryo transfer trials are going on well. During the FY, the centre carried out six embryo flushing trials in eighteen ET donor cows (9 Thrabam and 9 JX). A total of 62 embryos were recovered and five viable (1Thrabum & 4JX) embryos successfully cryopreserved.

To maintain the health of donor bulls and ET cows (41 heads), fodder unit has established around 8.5 acres of improved pasture, renovated 24 acres of existing pasture and conserved 210 MT of winter fodder in the form of hay/silage. Technical manpower support was also provided to Royal cattle herds, Ramtokto, and 8.5 acres of new pasture was established for the Royal Chipta Farm at Taba.

Heifer Production Scheme (HPS) using sexed semen was initiated during this FY to intensify heifer production adopting a cluster village approach. It is augmented by adequate guidelines and awareness on meaningful utilization of sexed semen. The Scheme is implemented in 15 Dzongkhags, covering 19 cluster villages and will be expanded to all potential geogs in near future.

Progeny Testing Scheme with Thai Holstein Friesian (THF) Semen resulted in 86 progenies from four sire lines in three AEZ, of which 46 were male (54%) which is discouraging farmers. Success rate also is poor 18% (86 progenies out of 478 inseminations). Switching over/ replacement of THF semen with imported to sex sorted semen (HF) will be next step to produce higher number of heifers.

During the FY seven additional AI centers were opened, which make a total of 120 functional AI centers in the country. As of June 2020, a total of 8333 AI were performed and recorded 2665 progenies (1147 male and 1518 female). Cumulative AI report as of June 2020 (from 1987) is 184736 and progeny record is 62224.

This FY also oversaw the completion of dairy products laboratory within the premises of the NDRDC office to assist in investigation of samples for setting of local standards. Efforts to strengthen dairy value chain are continued through training on Good Manufacturing Practice for milk and milk products. Of the 230 participants involved, 101 were trained on Clean Milk Production, 14 involved in trial production and training on Quarg cheese, both at Sarpang, and training on dairy product diversification imparted to 115 dairy farmers/milk processors of Haa. Technical specification was also provided by NDRDC for the set up of a dairy processing plant at Gelephu.

During the FY, three batches of Artificial Insemination refresher Course was conducted with total of 55 participants (eastern 19, east central 16, Sarpang/Dagana, 20) in support of breed intensification program. This adds to 46 AI Technicians (21 from Western and 25 AITs from Western Central regions) trained in previous years. Cumulative total extension agents provided with refresher course as of 30 June 2020 is 101 participants. Besides NDRDC organized Community AI Technicians Training at Thangrong Monger involving 23 participant in this FY. Since its inception in 2010, 149 CAITs are trained as of 30 June 2020.

For exchange of knowledge and information the Centre published Annual Centre Report, four technical guidebooks / Standard Operating Procedure developed. Besides the Centre contributed five scientific papers to Bhutan Journal of Animal Science, Vol. (4) , March 2020.

This FY set a new record in history of Dairy Cattle Breeding and Biotechnology in Bhutan. Much awaited Sexed Semen Technology along with user guidelines was launched by HE Minister, Ministry of Agriculture and Forests for its national wide application to accelerate heifer production in the country. With this, NDRDC Yusipang has achieved yet another milestone in Technological Innovations front to match with the changing times & to fulfill farmers' Aspirations.

Along with substantial physical progress made, overall financial progress made in this FY was also impressive. Out of the Nu. 40.846 Million allotted to the Centre, Nu. 40.457 Million is gainfully utilized, giving financial achievement of 99.68 percent.

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1. **BACKGROUND**

As part of the institutional strengthening strategy of the Department of Livestock, the erstwhile National Livestock Breeding Programme had been reinstituted as the National Dairy Development Centre (NDDC) with the additional mandate to serve as the technical authority for the planning, coordinating, implementing, monitoring and evaluation of dairy development activities of the country. However, with the organizational development exercise conducted by the RCSC, the NDDC has been renamed the National Dairy Research and Development Centre (NDRDC) with the mandate for need based dairy research for dairy development in the country. The centre is located at Yusipang, 14 km away from Thimphu.

The major focus of dairy research consists of consolidation and strengthening breed improvement programs, dairy product diversification, strengthening dairy post-harvest technologies and production of high quality specialized inputs for breed improvement. For faster genetic gain in indigenous and exotic cattle breed research on the use of progeny tested sex sorted frozen semen and embryo transfer technology is also initiated.

2. **PROFILE OF THE NATIONAL DAIRY RESEARCH & DEVELOPMENT CENTRE**

2.1 **VISION**

- Generate knowledge through quality research that supports dairy development thereby contributing to sustainable economy of dairy farmers

2.2 **MISSION**

- Improve food and nutritional security through research to enhance productivity of dairy products.
- Develop and strengthen innovative dairy research programs that align well with government plans and priorities to ensure equitable socio-economic development
- Provide coherent mechanisms to efficiently disseminate knowledge and technologies to the end user

2.3 **DEVELOPMENT OBJECTIVES**

- Produce high yielding dairy cattle for sustainable green economy
- Promote income generation capacities of dairy farmers by creating employment opportunities
- Facilitate private sector investments in dairy enterprise

2.4 MANDATE

- Co-ordinate and conduct need based dairy research and establish sound technical information and technology for dairy development in the country
- Produce and meet demand for high quality specialized inputs to accelerate dairy breed improvement in the country
- Package and transfer technologies generated through research to the end users

2.5 MAJOR FUNCTIONS

- Develop and execute screening mechanism to standardize research proposals for its soundness, relevance and benefits to the country
- Coordinate and conduct need based research for dairy development in the country
- Conduct needs analysis based on published research findings for introduction of new dairy breeds in the country
- Develop and disseminate Standard Operating Procedures & Good Manufacturing Practices to enhance dairy production and post-production
- Produce and or procure high quality specialized breeding inputs to meet the demand for breed improvement
- Manage database of National Cattle Identification System (NCIS), Contract Breeding Program, AI and Dairy Technology as tool for research and development.
- Prepare annual budget, targets and performance management for the center
- Coordinate and conduct meetings and stakeholder workshops
- Support the Research and Extension Division, DoL in formulation of policies, strategies and guidelines
- Liaise with national and international agencies for technical collaboration

3. **ORGANIZATIONAL SETUP**
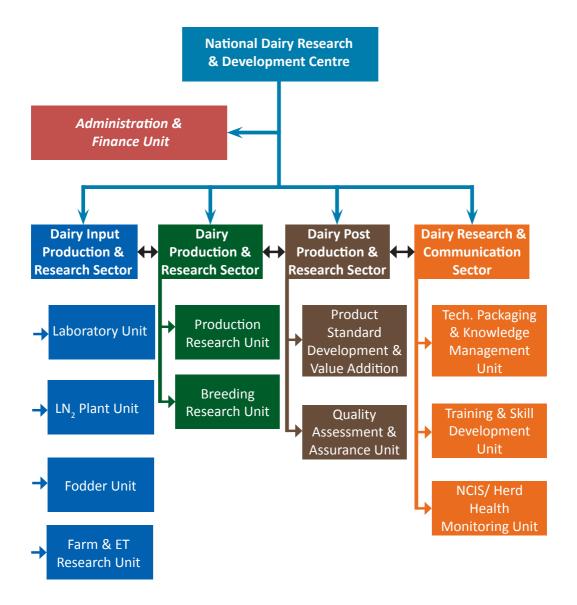
Figure 1: Centres organogram

INPUT PRODUCTION RESEARCH & DEVELOPMENT

4. PROGRESS AND ACHIEVEMENTS

4.1 INPUT PRODUCTION RESEARCH & DEVELOPMENT SECTOR

4.1.1 LIQUID NITROGEN (LN$_2$) PLANT UNIT

The Liquid Nitrogen Unit operates a Sterling Cryogenic LN$_2$ plant with a production capacity of 10 litres per hour. The LN$_2$ distribution meets the scheduled supply of AI Centres in the Western, West Central and East Central regions covering 14 Dzongkhags, while the LN$_2$ Plant at Kanglung, Trashigang caters to the distribution of LN2 for the Eastern region for 6 Dzongkhags and has the production capacity 6 – 7 litres per hour. The details of LN$_2$ produced and distributed to three RLDCs are presented below (Table 1). A total of 9748.9 litres was distributed to RLDC, Tsimasham, 6893.5 litres to RLDC Wangdue and 6232 litres to RLDC Zhemgang which total to 22944 litres.

The LN$_2$ production as well as distribution was greatly hampered due to the major break down of the LN$_2$ Plant since March, 2020. The Centre tried to rectify the problem after consulting with Service Engineers from the Contract Firm, Kolkata, India. However, due to the Covid-19 pandemic we could not bring Service Engineers from India to repair the Plant. As an interim measure, procured 1996 litres from RLDC, Kanglung and procured 1854 litres from Quality Gases, Pasakha for refilling of Semen Banks maintained at the Centre and for frozen semen processing from fund support received from the Department.

Table 1: Liquid Nitrogen produced &distributed

Sl No	Activities	Quantity (Litres)
1	LN$_2$ Production	33217
2	LN$_2$ Distribution	22944
3	LN$_2$ for Semen Bank refilling	9695
4	LN$_2$ for S. Processing & freezing	3472
5	LN$_2$ Evaporation losses	1521.4

4.1.2 FROZEN SEMEN PROCESSING LABORATORY UNIT

Semen Production at NDRDC

The laboratory unit produces frozen semen from three cattle breeds (Jersey, Mithun and Nublang) and distributes to all AI Centres in the country. During the fiscal year, a total of 17651 doses of frozen semen were produced from different donor bulls and 5095 doses were distributed to various Dzongkhags (Table 2). The production of Jersey semen accounted was 17651 doses and 4555 doses were distributed to various Dzongkhags. Similarly, 540 doses of Mithun Semen was distributed to various Dzongkhag. There was no production of Mithun and Nublang frozen semen because donor bulls of the two breeds are quite young and are

undergoing training. Around 28.8% of the semen produced was distributed to Dzongkhags through RLDCs during the fiscal year.

Table 2: Locally Produced Frozen Semen & Stock Balance

Species	Opening balance	Production	Distribution	Balance
Jersey	88422	17651	4555	101518
Mithun	18478	0	540	17738
Nublang	29053	0	0	29,053
Brown Swiss Cross	1772	0	0	1772
Total	**137725**	**17651**	**5095**	**150281**

Semen Imported

The Centre imported 11090 doses of Progeny tested / Genomic selected frozen bovine semen of different breeds. The details of imported frozen semen is presented in (Tables 3).A total of 5530 doses of semen were distributed to Dzongkhags and nucleus farms as per their demand. The imports progeny tested semen/ Genomic selected frozen bovine semen are distributed Government nucleus farms and Contract Heifer and Bull Production Program for maintaining quality of animals at in the country.

Table 3: Detail of imported Progeny tested Bovine Frozen Semen

Species	Opening Balance	Imported	Distribution	Balance
Jersey Conventional	4076	4300	3459	4917
Jersey (Sex sorted)	3665	8640	1071	11234
Brown Swiss	440	0	127	313
Black Angus	350	0	0	350
Tropical Holstein Friesian	1388	0	160	1228
Holstein Friesian (Conventional)	1902	950	705	2147
Holstein Friesian (Sex sorted)	0	600	0	600
Karan Fries	300	0	0	300
Scottish Highland Cattle	100	0	3	97
Buffalo Nilli Ravi	220	0	5	215
Buffalo (Murrah)	0	0	0	0
Total	**12441**	**14490**	**5530**	**21401**

Table 3.1: Detail of Progeny tested Bovine Frozen Semen on the way from UK

Species	Import	Distribution	Remarks
Jersey Pure Conventional Semen	1000	0	Total 5350 doses of sexed and conventional frozen semen on the way from UK, disrupted due to unavailability of flight
Jersey Pure (Sex sorted)	3400	0	
Holstein Friesian Conventional semen	450	0	
Holstein Friesian (Sex sorted)	500	0	(Covid 2019)
Total	**5350**		

4.1.3 FODDER DEVELOPMENT UNIT

Fodder unit besides managing pastures at NDRDC also provides technical supports on pasture development to Royal Cattle Herd in Ramtokto and Royal Horse Farm at Taba. The detail is elaborated and given in table 4.

CENTRE'S PASTURE DEVELOPMENT, RENOVATION & FODDER CONSERVATION

The Fodder unit has renovated around 15 acres of existing pasture, established 0.5 acre of improved temperate pasture, cultivated 8.5 acres of fodder maize and conserved around 135 MT of winter fodder in the form hay and silage (grass & maize) along with the procurement of 6,000 bundles of paddy straw to supplement with other forages. Further, 20 acres of existing pasture field has been irrigated through surface irrigation and manure 30 acres of pasture field by FYM compost. The mandate of Fodder unit is to carry out the above activities in time/season to fulfill the requirement of forages to feed the semen donor bulls and ET animals as per the herd strength.

ACTIVITIES AT ROYAL CATTLE HERD RAMTOKTO

The Fodder unit provides technical support including, farming machineries and man power to Royal cattle herd at Ramtokto, to carry out the pasture/fodder development activities as

and when require. The seasonal activities normally like- new pasture development, existing pasture renovation, fodder conservation and winter oats cultivation has to be carry out as per the herds strength/requirement. During the financial year 2019-20, around 4 acres of existing pasture has been renovated, cultivated around 12 acres of fodder maize and 6 acres of winter oats and conserved around 75MT of winter fodder in the form of maize silage to supplement with others forages.

ACTIVITIES AT ROYAL CHIPTA FARM TABA

Likewise, the similar activities has been carry out at Royal Chipta farm at Taba, during the financial year 2019-20, around 8 acres of new improved temperate pasture has been established, 5 acres of existing pasture was renovated and 16 acres of previous established pasture was top dress with chemical fertilizer.

Table 4: Detail of pasture development and fodder conservation

Unit	New pasture established (Acre)	Existing pasture renovated (Acres)	Conserved winter fodder (Metric tons)	Cultivation of fodder maize
NDRDC Yusipang	0.5	15	135	8.5
Royal herd Ramtokto	0	4	75	12
Royal Horse Farm, Taba	8	5	0	0
	8.5	**24**	**210**	**20.5**

APPLICATION OF ET TECHNOLOGY

During the fiscal year, the Centre carried out six Embryo flushing programs in eighteen (9 Thrabam and 9 JX) elite ET donor cows maintained at the Centre. A total of 62 embryos (5 viable embryos, 19 degraded embryos, 13 two to eight cell stage embryos & 25 UFOs) were recovered. During the FY, **five viable** (1 from Thrabum & 4 from JX donors) embryos were successfully cryopreserved from three donors. The non-recovery of embryos from other donors could be attributed to factors such as non-responsiveness to hormonal protocols, sub-fertile cows, low Body Condition Score, health status rather than the flushing technique.

The ET team has already conducted 30 ET trials and successfully cryopreserved 32 viable embryos from eleven elite Thrabum and two JX donors as on now. To confirm viability and success rate of the viable embryos, the Centre planned to transfer the viable embryos in suitable donors. Further, the Centre planned to conduct embryo flushing programs in the field in close collaboration with National Biodiversity Centre (NBC, Serbithang) and National Nublang Breeding Centre (NNBC, Tashiyangphu). However, the planned programs could not be executed due to the Covid-19 pandemic.

EMBRACING EMERGING REPRODUCTIVE TECHNOLOGIES: MATCHING WITH THE TIME

Rapid Visual Pregnancy Test Kit

Accurate and timely detection of pregnancy is an essential component of today's reproductive management program. Early detection of non pregnant (open) cows enables faster re-breeding and shorten calving interval thereby maximizing milk production and income to farmers. The Rapid Visual Pregnancy test kit is an enzyme linked immunoassay for the detection of Pregnancy Associated Glycoproteins (PAG) in whole blood (EDAT), Plasma (EDTA) or serum of cattle. The visual test kit is an important tool for early and accurate detection of pregnancy as early as 28 days post breeding.

Bovine endoscopic Artificial Insemination (AI) Technology

Bovine endoscopic artificial insemination (AI) technology a tool designed for providing assistance on reproduction and AI management. The device is equipped with endoscopic waterproof camera, a light source and easy to use mobile app which allow easy visualization of cervix. It is an essential tool for veterinarians, AI technicians and training/education institutions. The length of rectal palpation during insemination is reduced which limits technician's arm fatigue and reduce risk of musculoskeletal pain / discomfort to the animals. This promotes comfort of use and animal wellbeing reducing animal stress and boosts user confidence during insemination thereby perform inseminations very easily and safely. Further, the device allows the operator to carry out diagnosis like cervical anomalies, pus, metritis, uterine involutions, vaginitis etc. prior to the insemination process.

On- test application of the above technologies the team carried out including detail examination of twelve (7 Thrabum & 5 Jersey cross) ET Donors using Bovine endoscopic AI device and PAG test kit. The PAG test kit was used to confirm pregnancy after pre rectal examination while endoscopic device was used to examine reproductive tract esp. cervix and examine any abnormalities. The details of the findings are summarized in the table 5:

Table 5: Detail of animal examined

Sl #	NCIS Ear Tag	Breed	Rectal Examination	IDEXX Test kit	Endoscopic AI device
1	15000656	Thrabum	Negative	Negative	Normal
2	15004361	Thrabum	Negative	Negative	Normal
3	15000616	Thrabum	Positive	Positive	Structures not clearly visible
4	05005101	Thrabum	Doubtful	Positive	Structures not clearly visible
5	05004347	Thrabum	Negative	Negative	Normal
6	05004357	Thrabum	Positive	Positive	Normal
7	14091159	Thrabum	Negative	Negative	Structures not clearly visible
8	02003139	JX	Positive	Positive	Structures not clearly visible
9	02003136	JX	Negative	Negative	Normal
10	02010340	JX	Negative	Negative	Normal
11	02003143	JX	Negative	Negative	Structures not clearly visible
12	02003142	JX	Positive	Positive	Structures not clearly visible

The testing of new technologies was conducted by team from NDRDC, Yusipang from 8-9 April 2020.

4.1.4 FARM & ET RESEARCH UNIT

The Farm Section maintains elite semen donor bulls and Embryo Transfer donor cows (Thrabum & Jersey cross). There are 42 animals in the farm detail in table 6.

Table 6: Detail of cattle maintained in the farm

Cattle Type	Numbers	Cattle Type	Numbers
Semen Donor bulls	*13*	**Young / future donors**	29
Jersey pure	7	Nublang/Jersey cross calves	6
Nublang	3	Mithun young bull	2
Mithun	3	ET Donors (Thrabum)	8
Brown Swiss cross	0	ET Donors (Jersey Cross)	8
		Thrabum Heifer	5

Revenue generated

A total of six bulls (4 adult and 2 young) were disposed as these bulls were unfit for semen collection, chances of inbreeding and difficult to manage as it was very ferocious and posed

risk to attendants. The total amount earned was Nu. 95012.00. Similarly Nu. 33760 was generated from the sale of 844 litres of milk.

Repair and maintenance work of the Farm Section

Semen Donor bulls, Nublang, ET Trial shed and Jersey Crossbred ET trial shed are three sheds available which can house 60 animals. The Bull shed which is used for keeping different breed of bulls for semen production was in pathetic condition with no electricity, broken doors, plank floor were all broken and worn out and CGI sheet were rusted with big holes in most part of the roof. Repair work of three sheds and feed store, electrification/ rewiring and addition of light points were also carried out in all animals shed apart from office, laboratory and LN2 plant and main office building
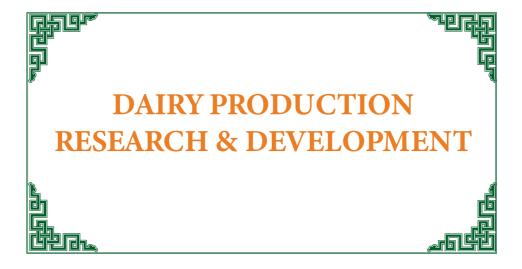
Repair work was done in-house by the Drivers/GSP/ESPs. The materials were purchased from the approved budget under maintenance of the property building. Beside this, signboards installation in the farm premises and Laboratory were also carried out. The individual bull information sheet were also laminated and pasted in front of the individual bull for visitor's quick information.

His Excellency Sanam Lyonpo with official of Department of Livestock during the launching of sexed semen, Bhutan Journal of Animal Science, Guidelines for Apiculture and Disease Control & Document for Animal Health

DAIRY PRODUCTION RESEARCH & DEVELOPMENT

4.2   DAIRY PRODUCTION RESEARCH & DEVELOPMENT SECTOR

Dairy production is gaining momentum over the years. Annual milk production increased from 29,625MT (2012) to 57846 MT (2019). Gross income generated by farmers (if all milk is sold @Nu 40/kg) is Nu.2.26 B annually. Per capita milk availability increased from 113gm (2012) to 187gm /day (2017). Milk self sufficiency increased from 63% in 2012 to 84% in 2017.

The target set for milk production by end of 12th FYP (2022-23) is 56,300 MT to achieve 91% self sufficiency in domestic milk production, but expectations are to produce milk and milk products beyond 12th FYP target. Therefore, dairy production and breed improvement programs are intensified in 12th FYP with focus on formation of more Dairy Farmers Groups (DFG) and Cooperatives, application of sexed semen technology under Heifer Production Scheme (HPS), Cattle Infertility management, intensification of AI program with establishment of AI centres wherever feasible, training and deployment of Community based AI Technicians (CAIT), providing AI refresher courses to livestock field staff and implement Progeny Testing Scheme (PTS) for development of climate resilient dairy cattle breed for Bhutan in a longer run.

4.2.1.   PRODUCTION RESEARCH

Reproductive Waste Management

Animals that do not reproduce within the stipulated/ expected time or age are not always infertile but they may be posed with reproductive disorders owing to various reasons. The treatment of infertility or reproductive disorders can be done via use of one or more hormonal drugs such as progesterone injections or a Progesterone Releasing Intra-vaginal Device (PRID), GnRH, PGF2α, etc., depending on the ovarian status of the animal upon per-rectal examination. However, the success of such intervention is determined by the diagnostic precision of reproductive status by the examining veterinarian and health status of the animal.

During the financial year 2019-20, NDRDC, Yusipang attended animals presented with infertility and reproductive disorders from Regional Cattle Breeding Centre, Bumthang and Tsirang Dzongkhag only. A total of 197 animals were actually presented for infertility investigation and treatment (Table 7). The animals in Regional Cattle Breeding Centre (RCBC), Bumthang were Brownswiss and Jersey, whereas in Tsirang the animals were Thrabum and they were included in the Progeny Testing Program in Barshong (67 nos) and Sergithang (42 nos).

Table 7: Animals with infertility/ reproductive disorders treated & AI done

Sl	Dzongkhag	Animal examined	Treated for infertility/ reproductive disorders	AI Done	Remarks
1	RCBC, Bumthnag	45	40	27	
2	Tsirang (PTS areas)	109*	92	67	
3	Tading (PTS areas)	43	24	-	LEA to follow-up
Total		**197**	**156**	**94**	

* Additional animals (Thrabum) included in the PTS Program

Of the animals presented for examination, 156 animals were found with reproductive disorders and treated using GnRH or PGF2 alpha based on ovarian status upon per-rectal examination. The response rate to treatment was 61%, which indicates that the treatment measures adopted are very effective.

Dairy Farmers Groups and Cooperatives

The formation of formal Dairy Farmers' Group (DFG) in village and geog level began in 2006, and dairy cooperative at Dzongkhag level in 2010. As of June 2020, there were 221 DFGs (Figure 2) with 6060 members (Figure 3). spread across 20 Dzongkhags and 10 dairy cooperatives with 438 members (Figure 4). During the financial year 2019-20, DFGs has increased by 25 groups and 576 members across 20 Dzongkhags. Similarly, Dairy cooperatives has increased by 4 number but Cooperative members have decreased by 89 members.
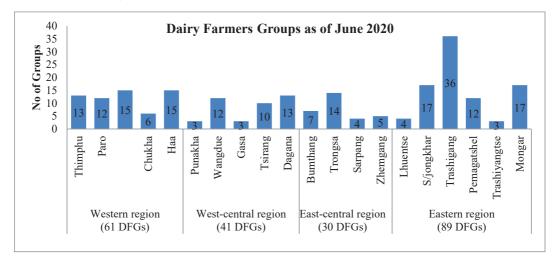
Figure 2: Dairy farmers' group by Dzongkhag and Region

DFG members by Dzongkhag as of June 2020
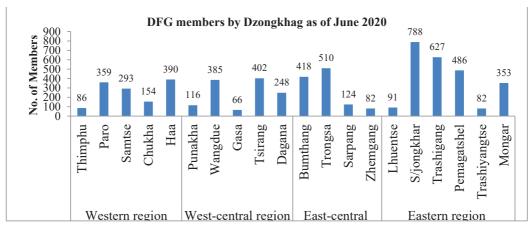
Figure 3: DFG members as of June 2020
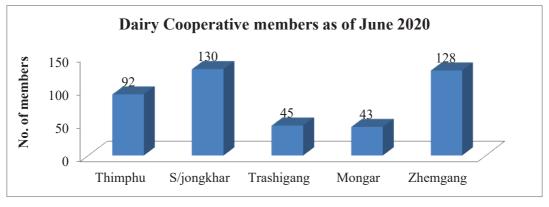
Figure 4: Cooperative members by Dzongkhag dairy cooperatives

Implementation of Heifer Production Scheme using Sexed Semen

The demand for dairy cattle in the country is ever increasing. In 11th FYP, over 2800 animals were sourced from India and supplied to dairy farmers (NDRDC, 2018). But import of cattle was not without hitches. There are incidences of incursion of diseases into the country, besides poor adaptability of cattle imported to new farming environment. Despite restrictions imposed by ministry/ department on import small scale import is continuing to fulfill the demand for heifers. But sourcing and supply of dairy cattle is a short term venture which is not sustainable. Therefore, Heifer Production Scheme (HPS) was planned to intensify heifer production within the promising CHBPP and Dairy Farmers groups on a pilot scale in 12th FYP through wider use of sexed semen. The semen has 89.6% assurance in female birth. The initiative is supported by adequate guidelines and awareness on meaningful utilization of sexed semen to produce and meet the rising demand of heifers, reduce the import
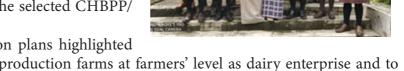
of dairy cattle from across the border with associated risks, strengthen community participation in breed improvement programme, reduce the burden of rearing male calves born in village farms and ultimately achieve greater self-sufficiency in dairy production in the country.

The Scheme was implemented with a protocol for its implementation and proper breeding plan (Annexure 4) including sensitization on judicious use of sexed semen as the semen is seven times expensive than progeny tested semen. During sensitization, following activities were carried out;

- Stakeholders concerned were made fully aware of the HPS initiated on pilot scale including adherence to the protocol of the scheme during its implementation

- Shared the gist of technology involved in production of sexed semen, cost implication, limitations and findings on its usage in different breeds of cows and heifers abroad as well as in Bhutan so that sexed semen is judiciously used as recommended
- Selection of CHBPP/ geog in the Dzongkhag finalized for pilot scale intervention based on performance efficiency of field AI technician and AI performance itself of the AI centre.

- AI technicians were made aware of the implication of misuse of sexed semen
- Issued AI consumables including Sexed frozen semen for immediate kick start of the Scheme in the selected CHBPP/ geogs.
- Collaborative action plans highlighted to promote heifer production farms at farmers' level as dairy enterprise and to up-scale breeding services in the country.

In 2019, the Scheme was implemented in 15 Dzongkhags, covering 19 CHBPP/ geogs (Table 8). The pilot areas were selected based on performance of AI centres (min. 37% AI success rate), availability fluent AI technician and breedable heifer population in the CHBPP/geog. The selection of CHBPP/ geogs was endorsed during presentation and discussion of the protocol at the time of sensitization meeting with the key officials from Dzongkhags expected to be involved directly or indirectly in implementation of the Scheme.

Table 8: Selected Dzongkhags and CHBPP/ geogs with sexed semen AI under HPS

Sl. no.	Dzongkhag	CHBPP/ Geog	Sensitization	Implementation AI done
1	Chukha	Darla	Aug. 2019	13
2	Samtse	Yoseltse/ Ugyentse	Aug. 2019	13
3	Thimphu	Giemina- Tshaluna	Sept. 2019	43
4	Paro	Wangchang/ Shari	Sept. 2019	12
5	Punakha	Guma	Oct. 2019	20
6	Wangdue	Tshogom	Oct. 2019	5
7	Tsirang	Kilkorthang/ Gosarling	Nov. 2019	21
8	Trongsa	Tangsibji	Dec. 2019	18
9	Mongar	Mongar	Dec. 2019	10
10	Trashigang	Pam	Dec. 2019	8
11	S/jongkhar	Deothang	Dec. 2019	18
12	Dagana	Tsendagang-Gozhi	Jan. 2020	2
13	Haa	Katcho	June 2020	0
14	Central units	RCBC, Wangkha	Oct. 2013	37
		RCBC, Bumthang	May 2018	74
				294

The Scheme will be implemented in the Dzongkhags for three years and evaluated on fifth year of 12th FYP for cost effectiveness of heifer production using sexed semen vis-a-vis live animal import from outside.

4.2.2   BREEDING RESEARCH UNIT

Artificial Insemination Performance and Progeny Record

In the year 2019-20 seven additional AI centres were opened, which make a total of 120 AI centres in the country. During the FY, a total of 8333 AI were performed and recorded 2665 progenies (1147 male and 1518 female) marking AI success rate of 32% (Table 9). The birth of male progenies is 43% and that of female is 57%. Cumulative AI report as of June 2020 (from 1987) is 184,736 and progeny record is 62224.

Table 9: Summary of AI and Progeny record (July 2019- to June 2020)

Region	Dzongkhag	AI centre	Total AI	Male	Female	Total progeny	AI success rate (%)	Average AI/ month
Western region (34 AIC)	Thimphu	5	318	42	60	102	32.1	5.3
	Paro	9	770	86	142	228	29.6	7.1
	Haa	2	98	13	9	22	22.4	4.1
	Chukha	5	433	46	50	96	22.2	7.2
	Samtse	13	942	136	164	300	31.8	6.0
	Sub- total	34	2561	323	425	748	29.21	6.28
West central region (26 AIC)	Gasa	2	82	19	18	37	45.1	3.4
	Punakha	8	877	111	108	219	25.0	9.1
	Wangdue	7	226	53	69	122	54.0	2.7
	Tsirang	6	482	110	149	259	53.7	6.7
	Dagana	3	105	6	11	17	16.2	2.9
	Sub- total	26	1772	299	355	654	36.91	5.68
East-central region (17AIC)	Bumthang	4	504	47	60	107	21.2	10.5
	Trongsa	5	337	36	63	99	29.4	5.6
	Zhemgang	3	131	33	49	82	62.6	3.6
	Sarpang	5	397	49	90	139	35.0	6.6
	Sub- total	17	1369	165	262	427	31.19	6.71
Eastern region (43AIC)	Lhuntshe	5	105	0	5	5	4.8	1.8
	Mongar	9	1104	157	149	306	27.7	10.2
	Trashi-yangtshe	4	104	11	10	21	20.2	2.2
	Trashigang	11	504	85	118	203	40.3	3.8
	P/gatshel	9	498	67	95	162	32.5	4.6
	S/jongkhar	5	316	40	99	139	44.0	5.3
	Sub- total	43	2631	360	476	836	31.8	5.1
Grand- Total		120	8333	1147	1518	2665	32.0	5.8
Male:Female %				43%	57%			

During the financial year, only eight Dzongkhags had performed above national average of 5.8AI/month/centre, with highest AI performance record in Bumthang, Mongar and Punakha (Table 9). Remaining 12 Dzongkhags' performance was recorded to be below the national average. However, there is not a single Dzongkhag where all AI centre in the Dzongkhag had AI performance above the national average. Thus, 37% of AI centre (n=44/120) had performed above the national average of

5.8AI/month during the reporting year, with highest performance record of LEC, Chaskar with 41.6AI/month, followed by LEC, Yoseltse with 23.5AI/month and DVH, Mongar with 23.2AI/month (Annexure 2).The remaining 76 AI centres which performed below national average warrants close scrutiny in their functioning in 12FYP from concerned Dzongkhags and RLDCs.

- The average AI performance in 2019-20 was 5.8AI/month/ centre same as in 2018-19. The under performing 76 AI centres during the year warrants closer attention and intervention of the concerned Dzongkhags and the RLDCs.
- The AI success rate recorded during the financial year was 32%, which is lower than the average success of 37% reported in 11th FYP. This could be attributed to either poor follow-up on progeny born by the concerned staff owing to lack of dedicated staff for AI or poor AI skills or multi-tasking responsibilities of AI technicians.
- Therefore, to boost dairy production via AI services, more emphasis need to be given on training and deployment of CAIT, improve skills of existing AI technicians, relocate or close under-performing AICs and take joint ownership of the AI programme by the concerned stake holders at all levels.

Implementation of Progeny Testing Scheme in Samtse and Tsirang Dzongkhags

The Progeny Testing Scheme (PTS) in Samtse and Tsirang Dzongkhag was executed in phase-wise manner as per its protocol for implementation. The 1st phase PTS was initiated at Tading geog, Samtse in Dec. 2017 and at Barshong and Sergithang geogs, Tsirang in Jan. 2018. Subsequently, the 2nd phase PTS implementation was executed a year later. The 3rd phase PTS, as a part of follow-up action of 1st and 2nd phases PTS implementation and expansion, was executed in Jan. 2020 only at Barshong and Sergithang, Tsirang owing to COVID-19 pandemic situation.

The follow-up action included identification of the progenies born out of 2nd phase PTS and its body weight recording including progenies of 1st phase as required under the protocol, as well as treatment of infertility cases and inclusion of 109 animals in the PTS program in Barshong and Sergithang, Tsirang (Table 2 above). Further, performance of CAITs trained and deployed in the PTS areas was reviewed during the trip.

Follow-up on AI and progeny born from 1st and 2nd phases of PTS

All animals included in the PTS were identified via ear-tagging as per National Cattle Information System (NCIS) including progenies. The progenies born of 2nd phase implementation were identified during the trip as it was done for progenies born of 1st phase implementation during the 2nd phase. The overall AI success and conception rates were calculated. A total of 117 progenies were actually born and

recorded, leading to overall AI success rate of 20.1% only; 24.1% in Tsirang and 16.5% in Tading, Samtse. The AI conception rate in 2nd phase was almost double than in 1st phase, and accounts to overall conception rate of 23.4% (Table 10).

In Tsirang, with the deployment of CAIT for insemination in natural heat the AI success rate increased from 17.2% in 1st phase (AI in synchronized heat) to 31.6% in 2nd phase (AI in synchronized + natural heat). In Tading, Samtse the progress was similar in 2nd phase PTS; AI success rate increased from 11.1% in 1st phase (AI in synchronized heat at 48 hr protocol) to 27.7% (n=47) when inseminated in synchronized heat at 52 hr protocol and 34.5% (AI in synchronized heat and natural heat by CAITs).

Table 10: Progeny born and AI success rate under PTS area

PTS area	1st phase					2nd phase					Total AI (no)	Total Progeny (no)	AI success rate (%)
	Total AI	M	F	Calves Born	AI success rate (%)	Total AI	M	F	Calves born	AI success rate (%)			
Barshong	74	6	8	14*	**18.9**	84	16	7	23	**27.4**	158	37	**23.4**
Sergithang	71	7	4	11**	**15.5**	49	11	8	19****	**38.8**	120	30	**25.0**
Tading	153	6	11	17***	**11.1**	150	17	16	33+ 19*****	**34.7%**	303	50+19	**22.8**
	298	**19**	**23**	**42**	**14.1**	**283**	**44**	**31**	**75 + 19**	**33.2%**	**581**	**117+ 19**	**23.4**

* 1 male progeny sold with dam and 1 female progeny died

** 3 male progenies died

*** 1 male progeny died

**** 1 male progeny sold with dam

***** found pregnant on pregnancy diagnosis

Beside, the male : female ratio of progenies born out of THF bulls were also worked out. The THF bulls' insemination has led to birth of more male than female progenies. In total, 63 males and 54 female progenies were recorded (Table 11). The THF bulls gave birth of 46.2% female and 53.8% male.

The overall results obtained were very poor, particularly for THF bulls Push and Puzzle when compared to Pound and Popular.

Table 11: AI and progeny born by THF bulls under PTS

PTS area	THF Bulls	1st phase AI Done	1st phase Progeny M	1st phase Progeny F	2nd phase AI Done	2nd phase Progeny M	2nd phase Progeny F	Total AI done	Progeny M	Progeny F	Progeny Total	Total AI success rate by bull (%)
Barshong	Push	20	2	1	21	1	1	41	3	2	5	12.2
	Puzzle	19	0	1	7	2	0	26	2	1	3	11.5
	Pound	23	2	6	32	4	2	55	6	8	14	25.5
	Popular	12	2	0	34	9	4	46	11	4	15	32.6
Sergithang	Push	16	1	1	10	4	1	26	5	2	7	26.9
	Puzzle	19	2	1	7	1	2	26	3	3	6	23.1
	Pound	16	3	0	17	2	2	33	5	2	7	21.2
	Popular	20	1	2	15	4	3	35	5	5	10	28.6
Tading	Push	41	1	3	47	3	3	88	4	6	10	11.4
	Puzzle	37	3	3	27	0	0	64	3	3	6	9.4
	Pound	29	1	3	36	5	6	65	6	9	15	23.1
	Popular	36	1	2	40	9	7	76	10	9	19	25.0
Total	*Push*	*77*	*4*	*5*	*78*	*8*	*5*	*155*	*12*	*10*	*22*	14.2
	Puzzle	*75*	*5*	*5*	*41*	*3*	*2*	*116*	*8*	*7*	*15*	12.9
	Pound	*68*	*6*	*9*	*85*	*11*	*10*	*153*	*17*	*19*	*36*	23.5
	Popular	*68*	*4*	*4*	*89*	*22*	*14*	*157*	*26*	*18*	*44*	28.0
	Total	**288**	**19**	**23**	**293**	**44**	**31**	**581**	**63**	**54**	**117**	20.1

Growth rate of progenies born in PTS areas

The body weight measurement of progenies born during the 1st and 2nd phases of PTS implementation were followed-up to determine growth rate. The overall average daily weight gain of the progenies was 213 gm, which was observed slightly higher in Tading geog than in Barshong and Sergithang geogs (Table 12).

Table 12: Average daily weight gain of progenies born in PTS area in Tsirang

PTS area	1st phase *Avg. daily weight gain (gm)*	2nd phase *Avg. daily weight gain (gm)*	Avg. daily weight gain (gm)
Barshong	210	230	220
Sergithang	190	170	180
Tading	246	236	241
Avg. daily weight gain (gm)	**215**	**212**	**213.7**

Performance review CAITs deployed in PTS areas, Tsirang & Samtse

In order to overcome the poor uptake and success of the Progeny Testing Scheme using tropical THF semen, Community AI Technicians (CAITs) were trained and deployed in the PTS areas viz Tading, Barshong and Sergithang for insemination of animals in natural heat and use of THF bulls on rotation basis to ensure equal no. of insemination from each bull. A total of 13 CAITs were trained in two batches from the PTS areas; 6 from Tading in the month of Februray 2019 and 7 from Tsirang (4 from Barshong and 3 from Sergithang) in the month of April 2019.

The review was carried during the follow-up action. A total of 190 AIs were performed; 77 AIs in Tsirang and 113 AIs in Tading. The Conception Rate (CR) determines success/ failure of AI Technician, and the performance of CAITs were compared with the concerned Staff AI Technician based at LEC, Barshong and LEC, Tading. The overall CR achieved by the CAITs was 46.6%, where as it was 31.8% only for staff AI Technicians. The CR achieved was much better in Tsirang than in Tading for both the groups; CAITs and Staff AITs.

In Tsirang, the CR achieved by CAITs was 57.6% and by the staff AIT was 42.9% (Table 13). In Tading, Samtse, the CR achieved by the CAITs was 36.1% and by the Staff AIT was 25% (Table 14).

Table 13: AI done and conception rate of AIT/CAIT in PTS areas, Tsirang

Sl No	Name (AIT/ CAIT)	AI Done	Confirmed Pregnant	Not Confd	Re-peated	Conception Rate (%)	Remarks
1	RB Chuwan (Staff-AIT)	8	3	1	4	42.9 (3/7)	LEC, Barshong
2	Sunil Monger (CAIT)	8	3	2	3	50 (3/6)	Barshong
3	Krishna Tamang (CAIT)	4	0	0	4	0	
4	Karna Bdr. Adhika-ri (CAIT)	17	7	5	5	58.3 (7/11)	
5	Karna Bdr. Tamang (CAIT)	5	4	0	1	80.0 (4/5)	
6	Harka Dhan Rai (CAIT)	8	5	1	2	71.4 (5/7)	Sergithang
7	Tula Bir Rai (CAIT)	5	4	0	1	80.0 (4/5)	
8	KP Sanyasi (CAIT)	22	14	0	8	63.6 (14/22)	
		77	40	9	28	57.6	

Table 14: AI done and conception rate of AIT/CAIT in PTS areas, Tading, Samtse

Sl #	Name (AIT/ CAIT)	AI done	Calved	Pregnant	Repeated	CR (%)	Chiwogs
1	Ugyen Wangchuk (Staff- AIT)	16	3	1	12	25	LEC,Tading
2	Rajkamal Thing (CAIT)	4	1	1	2	50	Jenchu-barbotey
3	Sang Dorji Tamang (CAIT)	6	2	1	3	50	Gairegaon
4	Karma Singh Tamang (CAIT)	3	1	1	1	66.7	Titring
5	Chandra Bdr. Bhujel (CAIT)	20	3	2	15	25	Panbari-Thunuwa
6	Lek Bdr. Ghalley (CAIT)	21	3	3	15	28.6	Khempagaon
7	Deo Raj Ghalley (CAIT)	43	7	10	26	39.5	Lapchakha
		113	20	19	74	34.5* 36.1**	

* Overall Conception rate, ** CR of CAITs only

Development of Breeding strategies for THF progenies born in PTS areas in Samtse and Tsirang

The Progeny Testing Scheme (PTS) using tropical Thai Holstein Friesian (THF) semen was initiated in December 2017 with a long term objective of developing suitable dairy cattle breed for Bhutan with appropriate combination of local and exotic inheritance for its resilience to climate change. The Scheme was implemented in Tading geog in Samtse, and Barshong and Sergithang geogs in Tsirang. The THF semen (2000 doses) of four sirelines was donated by Dairy Promotion Organization (DPO), Thailand. With the semen, the Scheme was implemented in the selected areas in phased manner. The progenies born from 1st phase of implementation have reached breedable age, and thus breeding strategy was required. For development of the Strategies, details of progeny born in the PTS areas were inventoried (Annexure 3).

The purpose of the strategy is to facilitate systematic breeding of THF progenies born in the PTS areas with desired traits to avoid inbreeding and tri-hybridization in field, as well as support breed stabilization in the HF breeding areas.

The overall objectives of the strategies were;
- Promote cross-breeding with local cattle for higher productivity and income to farmers
- Avoid inbreeding in the PTS areas
- Avoid tri-hybridization via indiscriminate breeding in field with other breeds

The strategies covered the following issues;

- Regular updating of inventory and pedigree of THF progenies in PTS areas
- Procurement and sale of THF cross bull for breeding propose
- Sell individually by farmers themselves
- Procurement and supply through Dzongkhag Livestock Sector for breeding purpose
- Adoption of sound breeding/mating scheme in the field
- Breeding/mating with local Thrabam cows/heifers
- Breeding/mating with HF cross cows/heifers
- Breeding/mating of THF female progenies

The expected outcomes were that the breeding of THF progenies executed systematically with desired traits for better productivity, ease in management, and at the same time avoided inbreeding and tri-hybridization in field.

Semen Quality Assessment and Certification

The NDRDC, Yusipang has the mandate of frozen semen produced and distribution to AI centres (120 AICs in 2019-20) across the country for field AI program.

As mandated the centre produces frozen semen from different semen donor bulls of different breeds maintained at the centre. However, before its distribution to field the semen produced are kept in quarantine semen bank for at least a month as per OIE requirement, which then quality is tested/ checked by the competent veterinarian based on Post Thaw Motility (PTM) and certified for field use or discarded. The semen having minimum of 40% PTM is certified for field use, which can be stored in the Semen Bank, whereas any semen having PTM below 40% are discarded.

A total of 35,682 doses of semen were produced and kept in the quarantine semen bank at the centre. The semen was assessed for its quality and certified 27,246 doses for field use and discarded 8,436 doses (Annexure 4). However, the discarded semen can be used during CAIT training and AI refresher courses.

DAIRY POST-PRODUCTION RESEARCH & DEVELOPMENT

4.3   DAIRY POST-PRODUCTION RESEARCH & DEVELOPMENT SECTOR

1.1.1   PRODUCT STANDARD DEVELOPMENT AND VALUE ADDITION UNIT

Product Standard Development and Value Addition Unit

1. Technical Support for Establishment of a Processing Plant at Gelephu

Upon request from the Sarpang Dzongkhag Livestock Sector, the sector carried out field survey and provided technical specification and equipment requirement for the setup of a dairy processing plant at Gelephu, Sarpang Dzongkhag. The Dzongkhag stated their intent to establish a processing plant capable of processing multi products from pasteurized milk to ice cream. To ascertain the quality of raw milk prior to the establishment of the plant, the sector carried out compositional and microbial analysis of milk supplied by the Gelephu Om Detshen.

2. Microbial and Compositional Quality

A total of 41 random samples of milk were collected for compositional analysis from individual farmers and bulk milk supplied to the MPU. Results indicated in (Table 14):

Table 14: Compositional Analysis of Milk Samples

Fat : 5.06%	SNF : 7.54%	Density : 25.32
Lactose : 4.15 %	Protein : 2.75%	Salts : 0.63%
Freezing Point : (0.485)	Added Water : 6.89%	

The compositional quality of milk available at the MPU showed prevalence of rampant water adulteration ranging from 0 – 19.23 % with only 7% of the samples with zero water adulteration. A total of four random samples were analyzed for microbial count at the Thromde Veterinary Laboratory, Gelephu with results showing an average microbial count of 6.9×10^6 CFU/ml indicative of poor quality milk.

Furthermore, 20 random samples were subjected to CMT to screen for subclinical mastitis. Of the 20 samples, 18 samples tested positive and only two samples tested negative. The results indicate that the milk supplied to the MPU is of poor microbial quality with significant mastitis prevalence in herds. Supply of such quality milk for production of dairy products will result in poor quality products with very short shelf life and will also pose a risk to human health.

Drastic improvement in the quality of raw milk is required to be able to diversify production as well as improvement in the screening of mastitis at herd level and rejection of milk from cows suffering from mastitis should be initiated.

3. Training on Clean Milk Production

As a follow up to the findings, the sector in collaboration with the Dzongkhag Livestock Sector, Sarpang conducted a 3 days training on Clean Milk Production for 101 group members of the Gelephu Om Detshen and interested non group members. Participants were trained on production of clean milk, health of animal, shed cleanliness, milking environment, milking procedures, cleanliness of milking utensils and basic milk quality tests. The training was aimed at improving raw milk quality through implementation of clean milk production practices at the farm level.

4. Training on Product Diversification

For production of new diversified products, the sector conducted a 3 days trail production and training on Quarg cheese to the Dzongkhag Extension staffs from 12 Geogs and two plant workers of the Louten Om Detshen (LOD) Yoghurt plant, Sarpang. The participants were also trained on the production of Rasgulla and flavored set type of yogurt.

Additionally, the two plant staffs were also advised on proper housekeeping procedures and standards as the plant was found to lack good housekeeping practices.

Furthermore, the sector in collaboration with Haa Dzongkhag livestock sector conducted 3 day training on dairy product diversification to 115 dairy farmers and milk processors of Bjee Gewog, Haa with the financial support from GEF LDCF project. The training was aimed at imparting practical knowledge and skills on dairy product processing to the farmers. The training comprised of theoretical, practical demonstration and hands-on-training on platform milk tests, clean milk production and dairy product processing such as set yoghurt, frozen yoghurt, flavored yoghurt, paneer, ghee, rasgulla and gulabjamun.

4.3.2 QUALITY ASSESSMENT AND ASSURANCE UNIT
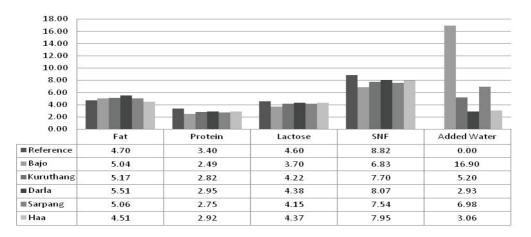
1. Post Production Research Laboratory

The Dairy Post Production Research Sector for the FY 2019 – 20 oversaw the completion of dairy products laboratory within the premises of the NDRDC office. This laboratory will serve as a research laboratory to assist in investigation of samples for setting of local standards and for quality assurance of local products. The laboratory aims to undertake microbial, chemical and physical investigation of milk and milk products. The renovation

of the laboratory was supported by the RGoB while the equipment is procured through fund support by the EU RDCCRP. However, due to the current global COVID 19 situation the delivery of equipment for the establishment of a functional laboratory has been delayed.

2   Compositional Analysis of Market Milk

The sector completed compositional analysis of market milk from Bajo (Wangduephodrang), Kuruthang (Punakha), Darla (Chukha), Gelephu (Sarpang) and Haa. 40 samples each from all outlets were analyzed with the preliminary findings presented in figure 5:

Composition

	Fat	Protein	Lactose	SNF	Added Water
■ Reference	4.70	3.40	4.60	8.82	0.00
■ Bajo	5.04	2.49	3.70	6.83	16.90
■ Kuruthang	5.17	2.82	4.22	7.70	5.20
■ Darla	5.51	2.95	4.38	8.07	2.93
■ Sarpang	5.06	2.75	4.15	7.54	6.98
■ Haa	4.51	2.92	4.37	7.95	3.06

Figure 5: findings of the milk Composition in different Dzongkhags

The average fat content of milk analyzed was found in the range of 5.04 % - 5.51% which was higher than the reference fat composition. Average protein and lactose content was found to be lower than the reference composition and was analyzed in the range of 2.49% - 2.95% for protein and 3.70% - 4.38% for lactose. Water adulteration was detected in majority of the samples analyzed in the range of 2.93% - 16.90% indicating water addition remains the most common source of milk adulteration for economic gains.

3   Microbial and Moisture Analysis (Butter and Datshi)

A total of 74 butter and 93 cheese samples from Tsirang, Trongsa, Dagana and Chukha was collected and analyzed for moisture and microbial composition at the NFTL, BAFRA, Yusipang. Preliminary findings indicate average moisture composition in the range of 17.56 – 19.68% moisture for butter samples and 56.87 – 64.98% for datshi samples. Microbial analysis has also detected presence of yeast, mould, E.coli, Staph. Aureus and Salmonella in majority

of butter and datshi samples indicative of poor hygiene practices during and post production.

The unit initiated study on the compositional quality of market milk in Wangdue and Punakha. Milk samples from Wangdue is procured from the Bajo milk sales counter and the Kuruthang milk sales counter in Punakha. Majority of the samples from Bajo was found to be adulterated with water while fewer samples from Kuruthang were found to be water adulterated. Study on milk samples from the Darla dairy group has also been initiated.

DAIRY RESEARCH COMMUNICATION

4.4   DAIRY RESEARCH COMMUNICATION SECTOR

4.4.1   TRAINING & SKILL DEVELOPMENT UNIT

1   CAPACITY ENHANCEMENT ON DAIRY POST PRODUCTION TECHNOLOGIES

The Sector in collaboration with the Regional Livestock Development Centre, Wangduephodrang conducted training for the extension agents of GEF project areas. A total of 20 extension agents from Wangduephodrang, Tsirang, Haa, Paro, Punakha and Thimphu Dzongkhags participated in the training.

The training "**Capacity Enhancement on Dairy Post Production Technologies (Farm-To-Table)** provided the participants with theoretical and practical knowledge on dairy post production technologies with hands on practical production of set yogurt, flavored yogurt, flavored drinking yogurt, paneer, rasgulla and mozzarella. The theory session was conducted at the RLDC conference hall and the practical session was held at the Milk Processing Unit in Kuruthang, Punkaha.

The training funded by the GEF-LDCF is expected to enhance post production knowledge of the participants and facilitate transfer of technologies to their respective dairy farmer groups in their geogs. Further, it is expected that the participants will impart knowledge on hygienic milk production to the farmers with view of producing and supplying good quality hygienic milk from the dairy farmers groups.

2   REFRESHER COURSE ON ARTIFICIAL INSEMINATION

Since 2017, 5th batch of AI refresher course were conducted to retrained and upscale skills of field technician for proficient application of AI Techniques. Since 2017-18, 101 Field staff are provided refresher courses. In the current years three refresher courses were provided:

i) Refresher course on Artificial Insemination for Sarpang and Dagana Dzongkhags

Refresher Course on Artificial Insemination (AI) and Reproductive Biotechnology was successfully conducted for the Livestock Extension Staff of Sarpang and Dagana Dzongkhags. The course was jointly organized and funded by Regional Livestock Development Centre (RLDC, Zhemgang) and Dzongkhag Livestock Sectors of Sarpang and Dagana with resource persons from National Dairy Research & Development Centre. The refresher course was conducted from 10-2323 February, 2020 at RNREC, Samtenling Geog, Sarpang Dzongkhag. The course also provided platform to discuss and resolve field issues related to cattle breed improvement. A total of twenty (20) participants (Sarpang 17 & Dagana 3) attended the refresher course.

ii. Refresher course on Artificial Insemination for Eastern region

Two weeks refresher course for **19** AI Technicians of Eastern region was held from 25th Oct to 7th Nov, 2019 at Thangrong Geog, Monggar Dzongkhag. The training was organized by RLDC Kanglung with fund support from CARLEP Project in close collaboration NDRDC, Yusipang.The AI refresher courses for field AITs is aimed at making AI program more viable, for better performance and improve delivery of AI services.

iii. Refresher course on Artificial Insemination for eat central region

A 14 Days "Refresher Course on Artificial Insemination (AI) and Reproductive Biotechnology was successfully conducted for Livestock Extension Staff in East Central region. The course refined skills, advanced knowledge and keep abreast with latest techniques in cattle reproductive biotechnologies for participating field staff. The course provided opportunity for field staff to get hands on training on latest insemination procedures, proper semen handling and thawing, proper AI gun loading, application of right techniques for AI, proper care / handling of Liquid Nitrogen and discuss / resolve field issues related to cattle breed improvement.

The refresher course was conducted from 18th to 31st December, 2019 at RLDC, Zhemgang through fund support from RD CCRP Project, MoAF, Thimphu. Sixteen (16) participants from Zhemgang, Trongsa and Bumthang Dzongkhags under East Central region attended the course.

3 .COMMUNITY AI TECHNICIANS TRAINING

Currently there are over 120 Artificial Insemination Centres (AIC) covering all 20 Dzongkhags of the country. Most of the AICs in the country are manned by one AI Technician / Technical staff who has to cater AI services besides various other duties. To support government Technicians, Community AI Technicians (CAIT) training to reach AI technology further towards the farmers and giving more impetus to AI technology for cattle breed improvement is the most viable and scientific way forward. The CAIT training aims to mitigate

the shortage of AI Technicians in the field provide uninterrupted AI services to the public through involvement of local community participation in cattle breed improvement, generate employment opportunities and sustainable livelihood to the school dropouts / educated farmers.

The 13[th]Batch CAIT training programme was conducted at Lingmithang in this FY with resource persons from NDRDC (Yusipang) in July, 2019 with fund support from CARLEP Project. There were 23 participants in total from Eastern Dzongkhags participated. Since the first batch of CAIT Training was conducted in collaboration with Rural Development Training Centre (RDTC, Zhemgang) in 2010, so far cumulative number of CAIT trained to date is 149.

4.4.2. TECHNOLOGY PACKAGING AND KNOWLEDGE MANAGEMENT

Publication of Booklets on:

A total of five report/booklets were published during the fiscal year and are the following:
- ✓ Annual Centre Report for 2018 – 2019
- ✓ Guidelines for the Establishment of Contract Heifer & Bull Production Program
- ✓ Guidelines for the use of Sexed/Conventional Semen and Implementation Modalities for Heifer Production using Sexed Semen Technology
- ✓ Guideline for training & deployment of Community Artificial Insemination and Establishment & Operation of new Artificial Insemination Centre
- ✓ Standard Operating Procedures for Bovine Artificial Insemination in Bhutan.

Three Guidelines and one SoP prepared and released and covered pages as below.
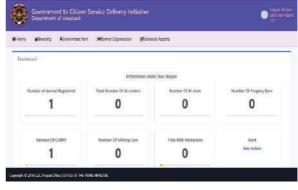
Five Research articles published in Bhutan Journal of Animal Science Volume 4.

1. Effect of body condition, season of estrous induction and fixed time artificial insemination   on calving rate of local Thrabam cattle in Bhutan
    NAR B TAMANG, DHAN B RAI AND ABI N KOIRALA

2. Assess milk production of cattle breeds in different agro-ecological zones of western Bhutan
    DEKI CHODEN, LOKEY THAPA AND NB TAMANG

3. Breed improvement, milk production and socio-economic benefit of contract heifer and bull production program in west and west-central region of Bhutan
    DHAN B RAI, NAR B TAMANG, LOKAY THAPA AND ABI N KOIRALA

4. Assessment of milk production and income from traditional and improved

management system of small dairy farmers in Bhutan
LOKEY THAPA, DEKI CHODEN AND NAR B TAMANG

5   Compositional analysis of market milk in Thimphu & Paro districts

PHUNTSHO T NORBU, KINLEY CHOKI AND SONAM YANGCHEN

With the release of the above booklets, it is expected that different stakeholders will benefit and the above released booklets are available for download by visiting at:

http://www.ndrc.gov.bt/downloads/

4.4.3   NCIS/ HERD HEALTH MONITORING

National Cattle Identification and Information System (NCIS)

The number of household under NCIS increased to 6426 from 6270 an increase of 156 households. The number of animals with NCIS increased to 12010 an increase of 304 during the fiscal year. As of now the NCIS is carried out in 118 Geogs and CHBPP in 55 Geogs covering in all 20 Dzongkha.

National Cattle Identification & Recording System (NCIS) Unit laser printed 6523 ear tags and distributed to Dzongkhags & Cattle Nucleus Farms during the Fiscal Year. However, the record received from Dzongkhag is only 340 numbers.

Development of online database with mobile Apps

National Dairy Research and Development Centre, Yusipang in collaboration with Information & Communication Technology Division, Ministry of Agriculture Forests and Department of Information Technology & Telecom under the Ministry of Information and Communication have developed the National Dairy Information System (NDIS) with mobile Apps. The system is a web based database system developed under Government to Citizen Project (G2C) which keep records of all the data and information related to dairy development in the country. The system enables data entry at Geog level by Geog extension offices and government farms and report produced for Geog, Dzongkhags, Regional and at National levels. Through this online system, it is expected that all the cattle in the country are registered, breeding and AI carried out are captured instantly through mobile apps, updates of production and post-production products produced by groups and cooperatives information are available online monthly. The database have three modules as follow:

1) Cattle Identification and Registration
2) Breeding and Artificial Insemination
3) Groups, Cooperatives and Post Production

With this database functional, it is expected that reports on dairy development in the country are available to all the relevant stakeholders, meet the government objectives to go paperless and also reduce the reporting layers and time taken to process paper to reach at commodity Centres and at the Department.

SEXED SEMEN TECHNOLOGY & PACKAGE OF GOOD PRACTICES AND RECOMMENDATIONS LAUNCHED

His Excellency Minister, Ministry of Agriculture & Forests released Sexed Semen Technology on 3rd July 2020 along with user guidelines and its implementation modalities to intensify heifer production program. This technology was validated since 2014 through applied research conducted on-station (Govt. farms) and on-farm at Dzongkhags which resulted in 89.6% female birth (168 females out of 187 progenies born) under Bhutanese farming environment. Thus, release of this technology is very timely in view of growing demand of heifers and need for such technology to accelerate dairy heifer production across the country.

With the priority accorded by the Ministry on this technology, National Dairy Research and Development Centre (NDRDC) carried out series of groundwork on proficient application of Artificial Insemination Techniques in all regions involving 101 field staff. Further, consultative meeting with Dzongkhags Livestock Officers, Breeding Focal Officers/staff of Dzongkhags and Farm Managers, Govt. farms were conducted; and procured over 8500 doses of sexed semen from abroad in the recent past to speed-up application of sexed semen technology.

Since October 2019, 1060 doses of imported frozen bovine sexed semen are distributed to 15 dzongkhags. As of June 2020, 285 animals have been inseminated. Adjoining villages with progressive Dairy Farmers /contract breeders were involved in a *Cluster Village Approach* to ease in

The ap..gkhags in the country with the potential for dairy entrepreneurship, in next three years. The

intervention is expected to produce estimated 6757 heifers by end of 12th FYP.

The Centre has attempted to produce the Package of Good Practices from the research carried out by the Centre for the last three years. The salient findings of 13 research papers published in Bhutan Journal of Animals Science and other International Journals is synthesized as "Package of Good Practices and Recommendations" for use by Extension staff. This knowledge dissemination mechanism to translate research findings into extension messages is expected to improve dairy farming practices in Bhutan.

Some of the Technology released and published in National Newspaper, Kuensel

Adulteration of milk common in Thimphu and Paro: Study

Choki Wangmo

Local milk sold in Thimphu and Paro was found adulterated and mixed with water, according to an agriculture ministry's study.

The analysis of its composition revealed variation in milk components and consistent adulteration with water.

Officials of the National Dairy Research and Development centre in Yusipang, Phuntsho T Norbu, Kinlay Choki and Sonam Yangchen conducted the study last year. It was published in the Bhutan

measurements below three percent, which is considered lower than reference milk fat content of 4.7 percent.

Considering that the dzongkhags have high breed animals to produce high-fat milk with an average fat content of 3.72, the study concluded that either the producers or retail outlets were practising skimming of milk for cream and butter for commercial purposes.

Researchers also found irregular protein content. The majority of the samples had low protein content below the average value of 3.4 percent.

Fat content

3-6%
Normal milk

Milk

Below 3%
Local milk sold in Thimphu & Paro

The study concluded that the adulteration with water caused variations in the milk components, reduced nutritional value of the milk, and increased the risk of introducing microbes through the use of unsafe adulterant.

"Further study is required to identify the source of adulteration for corrective action," the study states.

The packaging was also a cause of concern. The milk procured for the study was packaged in recycled plastic mineral water bottles. All samples in Paro had the distinctive odour of areca and

be tainted due to improper washing of the reused bottle. "Such practices increased the risk of potential sources of contamination and should be discouraged," the study recommended.

Lack of systemic monitoring had encouraged such practices, therefore, putting the lives of consumers at risk, the report stated.

On average, solid components in milk—fats, proteins, lactose, and minerals—constitute 13.4 percent and 86.6 percent water.

The milk samples were analysed using the Lactosan

Sexed semen technology expected to boost dairy farming

Choki Wangmo

With the introduction of sexed semen technology (SST) yesterday, the country is expected to see more heifers and boost in dairy production by the end of the 12th Plan.

The SST is specially-processed semen of bulls from which 'Y' chromosomes in sperm cells — which lead to the birth of a male calf—is either removed through a 'sorting' process or killed.

Semen that has only 'X' chromosomes can ensure that female calf is born, increasing the genetic progress in a herd by increasing the num-

on trial in the country since 2014, has shown 90 percent success rate. The applied research on government farm and on-farm in dzongkhags resulted in 89.6 percent of female birth under the Bhutanese farming environment.

Programme Director of National Dairy Research Centre, Nar B Tamang, said that with increasing demand for heifers in the country among dairy farmers, choices of cattle breeds had become more important. But the imported breeds couldn't adapt to the Bhutanese climate. "SST will intensify dairy breeding programme without having to

Since October last year, 1,060 doses of imported frozen sexed semen were distributed to 15 dzongkhags. As of last month, 285 animals were inseminated across the country.

With 8,500 doses of sexed semen, 6,757 heifers are expected to be produced by the end of 12th Plan. A single dose of sexed semen imported from the US, UK, and Denmark cost USD 20 compared wither other imported conventional semen at USD 5.

Last year, Nu 8.5 million was allocated for the programme.

About 25.25ml of sexed

stored under liquid nitrogen at extreme frozen temperature of -196°C. During the breeding, the temperature is maintained at 37°C and inseminated artificially.

The improved breeds' milk production is as high as 12 litres a day compared to two litres produced by the indigenous breeds. This, Nar B Tamang, said would reduce dairy import.

According to the records with agriculture ministry, the import of dairy product increased to 4,944.22 MT in 2019 from 3,597.12 MT in 2018, an increase by 37 percent.

semen resulted in production of male progenies, considered a financial burden to farmers. SST would also help reduce the increasing number of stray cattle by removing the male chromosomes, said Nar B Tamang.

The application of the technology, however, will be expanded in planned manner in all dzongkhags in the next three years. A guideline for use of SST modalities for heifer production was also launched.

George E. Seidel, a reproductive physiologist at Colorado State University in the US is credited for his pio-

5   Research paper published in BJAS with abstract completed

5.1   Research paper completed and ready for publication BJAS

Cost of Milk Production in Bhutan: A Prerequisite for Policy Making

DEKI CHODEN, LOKEY THAPA, NAR. B. TAMANG AND D.B. RAI

Abstract

Economics analysis on cost of milk production was carried out in selected cattle rearing dzongkhags of four agro-ecological zones (AEZ) of the country. A total of 320 dairy units, 80 from each AEZ/region were randomly sampled. The primary data were collected through personal interview.

Under Bhutanese smallholder system, overall average capital investment per dairy unit in a year was Nu. 27,258.00 and cost of cow purchase constituted the highest (38.08%) followed by farm machineries and equipment (33.63%). Overall average variable cost per dairy unit was Nu. 2,14,052, of which labour cost constituted highest (65%) followed by feed cost (31%). Both fixed and variable cost were significantly higher in cooler and dryer zone than warm and wet zones ($p<0.05$) suggesting that latter two zones are more favorable for dairy farming than former two zones.

The overall average cost of production (CoP) per litre of milk stands at Nu. 26.85. With average farm gate price of Nu. 38.71/ litre, dairy farmers made a profit margin of Nu 11.86/ litre, indicating dairy farming as a profitable venture in Bhutan.

The study revealed that CoP differed significantly between AEZs ($p<0.05$), with higher CoP in cooler and dryer zones and lesser profit than in warmer and wetter zones. Further, CoP differed significantly between herd type ($p<0.05$). CoP in smaller herd type (1-5 cows) was three times higher than bigger herd type. This indicates that up scaling business volume to have economies of scale can reduce the cost and maximize profit.

The cost analysis confirms that the expenses in a dairy unit particularly dairy cow purchase, farm machineries, labour and feed constituted the most of milk production costs. Minimizing these costs effectively through strategies such as in-house production of replacement stock, improvement in feed and fodder availability and efficient utilization of labour or application of labour saving devices can make dairy farming a more lucrative enterprise.

The study concludes that besides increase in business volume and cost cutting measures, to improve profitability of dairy enterprises, under Cool temperate and Dry Subtropical zones increasing the farm gate price of milk is suggested while other two zones can maintain the current price.

Key words: cost of production, dairy farming, economic analysis, milk production, profit margin

6   Administration & Finance Sector

6.1   FINANCIAL BUDGET AND EXPENDITURE

Table 15: Budget and expenditure statement

ACT	OBC	Title	Budget	Expenditure	Percent
001		**DIRECTION SERVICES**			
		PERSONNEL EMOLUMENTS			
	01.01	Pay and Allowances	10.706	10.705	100.00
	02.01	Other Personnel Emoluments	2.582	2.549	98.73
	24.03	Contributions - Provident Fund	1.590	1.502	94.43
	25.01	Retirement Benefits	0.710	0.706	99.39
		OPERATION & MANAGEMENT SERVICES			
	11.01	Travel – In country	2.500	2.500	100.00
	12.01	Utilities -Telephones, Telex, Fax, E-mail, Internet	0.186	0.186	100.00
	12.02	Utilities -Telegram, Wireless Transmission, Postage	0.015	0.015	100.00
	12.03	Utilities - Electricity, Water, Sewerage	0.194	0.194	100.00
	14.01	S & M - Office Supplies, Printing, Publications	0.121	0.121	100.00
	14.06	S & M - Uniforms, Extension Kits, Linens	0.196	0.196	100.00
	15.01	Maintenance of Property – Buildings	0.120	0.118	98.47
	15.02	Maintenance of Property – Vehicles	1.079	1.079	100.00
	15.05	Maintenance of Property – Equipment	0.050	0.050	100.00
	15.07	Maintenance of Property – Computers	0.050	0.050	100.00
	15.09	Maintenance of Property - Water supply, Sewerage, Playfield	0.020	0.020	99.34
	17.01	Op. Exp. – Advertising	0.060	0.060	100.00
	17.02	Op. Exp. - Taxes, Duties, Royalties, Fees, Handling Charges, Bank Charges	0.008	0.008	100.00
	18.01	Hospitality & Entertainment	0.024	0.024	99.17
	54.03	Computers & Peripherals	0.209	0.209	100.00
002		**Input Production & Research For Breed Improvement Services**			
		Schedule Production & Distribution Of Liquid Nitrogen (Ln2)			
	11.01	Travel – In country	0.100	0.100	100.00
	12.03	Utilities - Electricity, Water, Sewerage	0.201	0.201	100.00

	12.05	Utilities – Fuel wood	0.002	0.002	94.10
	14.02	S & M - Medicines & Laboratory Consumables	0.050	0.050	100.00
	15.05	Maintenance of Property – Equipment	0.210	0.210	100.00
	17.06	Op. Exp. - Items for Processing/ Manufacturing	0.332	0.332	99.96
		Procurement Of Progeny Tested Conventional And Sex Sorted Frozen Semen			
	14.02	S & M - Medicines & Laboratory Consumables	0.427	0.427	100.00
	15.05	Maintenance of Property – Equipment	0.050	0.050	100.00
	52.06	Plant & Equipment – Livestock	9.238	9.238	100.00
		Quality Donor Animal Maintained For Semen / Embryo Production			
	14.05	S & M - Animal Feeds	1.500	1.500	100.00
	15.05	Maintenance of Property – Equipment	0.100	0.100	100.00
	17.06	Op. Exp. - Items for Processing/ Manufacturing	0.400	0.400	99.98
		Research & Professional Service Support For Embryo Transfer (Et) Technology			
		Conduct Priority Research And Package Technology To Enhance Production Efficiency For Ipr Sector			
	14.01	S & M - Office Supplies, Printing, Publications	0.020	0.020	100.00
		Pasture And Fodder Production For Farm Animals			
	14.03	S & M - Fertilizers, Chemicals, Manures, Innoculants	0.098	0.098	99.98
	14.04	S & M - Seeds, Seedlings	0.020	0.020	100.00
	15.06	Maintenance of Property – Plantations	0.096	0.096	99.99
		Procurement Of Ai And Ln2 Equipments			
	52.07	Plant & Equipment - Hospital/Lab. Equipment	4.000	4.000	100.00
		Development Of Web Based Dairy Breed And Breeding Information Management Sysytem			
	55.01	Professional Services	0.762	0.762	100.00
003		**Dairy Production Research Services**			
		Coordinate And Conduct Priority Dairy Production Researches And Package Technology To Enhance Production Efficiency			
	11.01	Travel – In country	0.150	0.150	100.00

	14.01	S & M - Office Supplies, Printing, Publications	0.050	0.050	100.00
	17.08	Op. Exp. – In country Meetings and Celebrations	0.050	0.050	100.00
004		**Dairy Post Production Research Services**			
		Coordinate And Conduct Dairy Post Production Research And Technology Packaging			
	11.01	Travel – In country	0.150	0.150	100.00
	14.01	S & M - Office Supplies, Printing, Publications	0.030	0.030	100.00
	14.02	S & M - Medicines & Laboratory Consumables	0.050	0.050	100.00
	15.01	Maintenance of Property – Buildings	0.500	0.500	100.00
	17.08	Op. Exp. – In country Meetings and Celebrations			
005		**Research Communication Services**			
		Technology Packaging And Popularization			
	11.01	Travel – In country	0.117	0.117	100.00
	14.01	S & M - Office Supplies, Printing, Publications	0.050	0.050	100.00
	17.08	Op. Exp. – In country Meetings and Celebrations	0.033	0.033	100.00
	17.09	Op. Exp. - Survey/Census	0.080	0.080	100.00
		Training To Community Ai Technicians And Ai Refresher Course To Field Staff.			
	45.02	Training – Others	1.000	1.000	100.00
		Total	**40.286**	**40.158**	**99.68**

Fund utilized is (40.158/40.286 *100) = 99.68 percent

Table 15.01: Sector wise budget and expenditure statement

Sectors	Current	Expenditure	Capital	Expenditure
Directorate Service	15.588	15.462	0.00	0.00
Operation & Management	4.623	4.621	0.209	0.209
Input Production Sector	3.606	3.606	14.00	14.00
Research Sector	0.250	0.250	0.00	0.00
Post Production Sector	0.730	0.730	0.00	0.00
Communication Sector	0.280	0.280	1.00	1.00
Total	**25.077**	**24.949**	**15.209**	**15.209**

6.2   ADMINISTRATION SECTOR

Table 16: Details of staffs by different sectors

Sl. #	Name	Designation	Sector
1	Dr. N. B Tamang	Program Director	Accounts & Administration Sector
2	Mr.Jigme Tenzin	Acct. Asst IV	Accounts & Administration Sector
3	Mr. Pema Dorji	Adm. Asst II	Accounts & Administration Sector
5	Mr. Durga Chhetri	Driver I	Accounts & Administration Sector
6	Mr. Domzang	Driver II	Accounts & Administration Sector
7	Mr. Sonam Zangpo	Driver I	Accounts & Administration Sector
8	Mr. Pema Tenzin	Driver III	Accounts & Administration Sector
9	Mr Samten	Power Tiller Driver	Accounts & Administration Sector

II   Dairy Research Communication Sector

Sl. #	Name	Designation	Sector
1	Mr. Lokey Thapa	Sr. LPO	Dairy Research Communication
2	Mr. Yuraj Giri	Sr.ES II	Dairy Research Communication
3	Ms Tashi Pemo	LPO	Dairy Research Communication

III   Dairy Production Research Sector

Sl. #	Name	Designation	Sector
1	Dr.D.B Rai	Specialist III	Dairy Production Research Sector
2	Mrs. Deki Choden	Sr.LPO	Dairy Production Research Sector
3	Mr.Abi Narayan Koirala	Sr. LPS II	Dairy Production Research Sector

IV   Dairy Inputs Production Research & Development Sector

Sl. #	Name	Designation	Sector
1	Dr. Dorji	PLO	Inputs Production Research Sector
2	Mr Thinley Dorji	LPO	Inputs Production Research Sector
3	Mr.Phub Dorji	Asst. Engineer II	Inputs Production Research Sector
4	Mrs. Yudon	Sr. LPS	Inputs Production Research Sector
5	Mr. Chungsila	LPS I	Inputs Production Research Sector
6	Mr. Narapati Chapagai	Technician II	Inputs Production Research Sector
7	Mr. Kanti Ram Chhetri	LPS III	Inputs Production & Research Sector
8	Mr. Nima	Lab Asst. I	Inputs Production & Research Sector

V   Dairy Post Production Research & Development Sector

Sl. #	Name	Designation	Sector
1	Mr. Phuntsho T Norbu	Principal LPO	Research Post Production
2	Mrs. Kinley Choki	Sr.LPO	Research Post Production
3	Ms. Sonam Zangmo	Dairy Officer	Research Post Production

6.2.1   STAFF INCOMING AND OUTGOING

STAFF RESIGNED

Sonam Zangpo, Driver resigned

Sonam Zangpo, Driver resigned from the Government Service from NDRDC Yusipang after serving for less than one year in the Centre. NDRDC fraternity wishes Sonam Zangpo a very healthy and happy retired life.

Kul Bdr Pradhan, Animal Attendant resigned.

Kul Bdr Pradhan, Farm Attendant Working in NDRDC, Yusipang was separated from the service from August 2019 after completion of the contract period. NDRDC fraternity wishes Kul Bdr Pradhan a very healthy and happy retired life..

STAFF JOIN THE CENTRE

Ms. Tashi Pemo, LPO joined the NDRDC after the completion of B.Sc Animal Science from College of Natural Resources. She will work under Dairy Communication Sector.

Ms. Yudon, Sr. ES joined the NDRDC upon her transfer from Dzongkhag Administration, Samtse. She is placed under Semen processing Laboratory

PROMOTION

The following staffs of NDRDC were promoted to their next higher grade during the fiscal year. The NDRDC family wish them Tashi Delek. The detail is given in Table 17.

Table 17: Detail of staff promoted to next higher grade.

Sl.No	Name	Promotion title	With effect from
1	Yuv Raj Giri	Sr. ES	1st January 2020
2	Thinley Dorji	Sr.LPO	1st January 2020
3	Kinley Choki	Dy. Chief LPO	1st July 2020
4	Durga Chhetri	Driver 1	1st July 2020

USE OF NATIONAL LANGUAGE IN OFFICIAL CORRESPONDENCE

Twenty one official correspondences particularly office order, increment order, promotion order were made to promote the use of national language. All the correspondence are filed in office files.

STAFF REVIEW & PLANNING MEETING

A total of five review and planning meeting were conducted in the NDRDC conference hall chaired by Program Director and discussed on the previous meeting and planned for the next month's program.

Table 18: Detail of staff meeting conducted

Sl. #	Date	Staff attended	Minute keeper	Remarks
1	19th July 2019	13 staffs	Nima	Beside 5 General staff review and planning meeting conducted, technical meetings between sector heads and technical staffs are conducted as and when required
2	13th Sep 2019	17 staffs	Pema Dorji	
3	6th Dec 2019	9 staffs	Phuntsho T. Norbu	
4	3rd Jan 2020	17 staffs	Lokey Thapa	
5	13th March 2020	19 staff	Tashi Pemo	

ASSERT DECLARATION

Eighteen staffs who are required to for assert declaration have declared their declaration within the month of March 2020. The detail of staffs required to declare is given in table 17.

Table 17: Detail of staffs who have declared the assert declaration

Sl. No	Name	Designation	Position Level	EID No	CID Number	Remarks
1	Dr. N.B Tamang	Program Director/ Specialist II	ES2A	9307050	11805000193	Declared
2	Dr. Dhan Bdr. Rai	Specialist III	ES3A	9901057	11303003331	Declared
3	Jigme Wangdi	Specialist III	ES3A	9901085	10904003438	Declared
4	Dr. Dorji	PLHO	P1/A	200201125	11409000164	Declared
5	Phuntsho Tobgyel Norbu	PLO	P1/A	200401056	10203004345	Declared
6	Lokey Thapa	Sr. LPO	P3/A	9207079	11215005775	Declared
7	Kinley Choki	Sr. LPO	P3/A	201101099	11915001216	Declared
8	Thinley Dorji	Sr. LPO	P3/A	20150105070	11703000975	Declared
9	Deki Choden	Sr. LPO	P3/A	9608066	11405000794	Declared
10	Tashi Pemo	LPO	P4/A	20200116272	10608000731	Declared
11	Sonam Zangmo	Dairy Officer	P4/A	201007317	11704002479	Declared
12	Yuvraj Giri	Sr. ES I	SS2/A	8807082	11214003106	Declared
13	Abi Narayan Koirala	Sr. LPS II	SS3/A	9007083	11805000963	Declared
14	Yudon	Sr. ES II	SS3/A	200507136	11506000812	Declared
15	Chungsila	Sr. LPS III	SS4/A	8604125	11501000475	Declared
16	Phub Dorji	Asst. Engineer II	SS3/A	8808083	10810000691	Declared
17	Jigme Tenzin	Accounts Asst. IV	SS4/A	200907159	11410008696	Declared
18	Pema Dorji	Admin. Asst. I	S3/A	200611079	10716000255	Declared

STAFF DIRECTORY

Dr.N.B.Tamang
Specialist Head/Program Director

Phuntsho T. Norbu
Head (DPPRS)

Dr. D.B Rai
Specialist III (DPRS)

Pema Dorji
Asst. Adm (A&FS)

Lokey Thapa
Sr. LPO

Dr Dorji
Head (DIPRS)

Kinley Choki
Sr. LPO

Deki Choden
Sr. LPO

Jigme Tenzin
Accountant

Yuraj Giri
LO

Thinley
LPO

Sonam Zangmo
DO

Abi N. Koirala
LO

Nima
Lab Assistant

Tashi Pemo
LPO

Phub Dorji
Asst. Engineer

Chungsila
LPS

Kanti Ram Chhetri
LPS, Pasture

Narapati Chapagai
Electrical Technician

Yudon
Sr. ES II

ANNEXURE 1: Sexed semen distribution plan for HPS in pilot areas in 12 FYP

Region	Dzongkhag	AIC/ CHBPP/ Geog selected	Initiation	Generation 1		Generation 2	
				Year 1 (2019-20)	*Year 2 (2020-21)*	*Year 3 (2021-22)*	*Year 4 (2022-23)*
West	Chukha	CRC, Wangkha	Aug-19	Jante	Promo-P	Ahlem	Ahlem
		Darla	Aug-19	Texas	Texas	Kashin	Kashin
	Samtse	Yoseltse-Ugyentse	Aug-19	Mirco-P	Mirco-P	Lemonhead	Lemonhead
	Paro	Wangchang/ Shari/ Luni	Sep-19	Mirco-P	Ahlem	Shanmar	Shanmar
	Thimphu	Mewang (Tshaluna)	Sep-19	Texas	Texas		
	Haa	Katsho/ Bji	Jun. 2020	Ahlem	Ahlem		
West-Central	Punakha	Guma	Oct-19	Nitro	Nitro		
	Wangdue	Tshogom	Oct-19	Nitro	Nitro		
	Tsirang	Kikhorthang/ Gosarling	Nov-19	Mirco-P	Mirco-P		
	Dagana	Tshendagang-Gozhi	Jan-20	Wilsonview	Wilsonview		
		Lhamoizingkha			Wilsonview	Wilsonview	
	Gasa	Damji			Sunvalley	Sunvalley	
East-Central	Trongsa	Tangsibji	Dec-19	Mirco-P	Mirco-P	Ahlem	Ahlem
	Bumthang	BS farm	Dec-19	Lemonhead	Lemonhead	Dynasty	Dynasty
		Chokor			Promo-P	Sunvalley	Sunvalley
	Sarpang	Dekiling-Sompangkha			Dynasty	Shanmar	
	Zemgang	Trong			Kilowatt	Kilowatt	
Eastern	**Sexed semen distrbution plan for RLDC, Kanglung (3440 doses from 12 bulls)**						
	Mongar	DVH, Mongar	Dec. 2019	RIVERVALLEY *		VJ Lusaka	VJ Lusaka
		LEC Chaskar	May. 2020	VJ Lusaka	VJ Lusaka	VJ Husky	
		LEC Yadi-Ngatshang	May. 2020	VJ Lusaka	VJ Lusaka	Vj Hoj	
	Lhuentshe	LEC Menjay	Jun. 2020	VJ Haley	VJ Haley	VJ Lusaka	
		LEC Tangmachu	Jun. 2020	VJ Haley	VJ Haley	VJ Lusaka	
	Trashigang	DVH T/gang- Pam	Dec. 2019	RIVERVALLEY *		VJ Rodme	VJ Rodme
		LEC Kanglung	May. 2020	VJ Haley	VJ Rodme	VJ Rodme	
		LEC Bartsham			VJ Husky	VJ Husky	
		LEC Bikhar-Samkhar			VJ Lusaka	VJ Lusaka	
	T/yangtse	DVH, Yangtshe	Jun. 2020	VJ Horst	VJ Husky	VJ Husky	

	LEC Khamdang				VJ Rodme	VJ Rodme
P/gatshel	DVH, P/gatshel	Jun. 2020	VJ Hiwe		VJ Husky	VJ Husky
	LEC Nanong-Wangchelo (CAIT)	Jun. 2020	VJ Livius		VJ Livius	VJ Hoj
	LEC Khar - Petingma	Jun. 2020	VJ Livius		VJ Livius	VJ Hoj
	LEC Zobel-Tshelengkhor + Nangmalang	Jun. 2020	VJ Livius		VJ Livius	VJ Hoj
	LEC Yurung	Jun. 2020	VJ Livius		VJ Livius	VJ Hoj
	LEC Norbugang-Menchu + Nganglam	Jun. 2020	VJ Livius		VJ Dee	VJ Dee
	LEC Nangkhor-Shumar				VJ Dee	VJ Dee
S/jongkhar	LEC Deothang – Rikhey	Dec. 2019	HULK*		VJ Hoj	VJ Hoj
	LEC Orong	Jun. 2020	VJ Hoj		VJ Hoj	VJ Dee
	LEC Gomdar				VJ Dee	VJ Dee
	BLDC, Samrang				VJ Link	VJ Link

Note:

1. *Issued from NDRDC's stock.
2. 728 doses from bull VJ Kitman (414 doses) and VJ Stiz (314 doses) to be issued in 3rd year or in areas where doses of 0ther 10 bulls in 2nd year are not sufficient or in new potential areas

Annexure 2: AI performance and Progeny born (July 2019-June 2020)

Region	Dzongkhag	AI centre	Total AI	Male	Female	Total progeny	AI success rate (%)	Average AI/month
Western region	Thimphu	DVH - Ramtokto T/phu	149	24	31	55	36.9	12.4
		LEC Khasadrapchu	4	0	0	0	0.0	0.3
		LEC Kawang	14	1	0	1	7.1	1.2
		LEC Genekha	14	0	0	0	0.0	1.2
		LEC Tshaluna	112	11	18	29	25.9	9.3
		NDRC, Yusipang	25	6	11	17	68.0	2.1
	Sub- total	**5**	**318**	**42**	**60**	**102**	**32.1**	**5.3**
	Paro	DVH - Wangchang Paro	163	11	20	31	19.0	13.6
		LEC Tshentog	49	4	9	13	26.5	4.1
		LEC Lamgong	86	9	10	19	22.1	7.2
		LEC Shari	102	2	1	3	2.9	8.5
		LEC Dawakha	115	9	10	19	16.5	9.6
		LEC Shaba	70	3	0	3	4.3	5.8
		LEC Luni	62	11	14	25	40.3	5.2
		LEC Doteng	87	33	71	104	119.5	7.3
		LEC Naja	36	4	7	11	30.6	3.0
	Sub- total	**9**	**770**	**86**	**142**	**228**	**29.6**	**7.1**
	Haa	DVH - Tshelungkha Haa	9	0	0	0	0.0	0.8
		LEC Katsho	89	18	12	30	33.7	7.4

	Sub- total	**2**	**98**	**13**	**9**	**22**	**22.4**	**4.1**
	DVHTsimasham Chukha	2	0	0	0	0.0	0.2
Chukha	LEC Drala	85	17	18	35	41.2	7.1
	LEC Sampheling	194	7	8	15	7.7	16.2
	LEC Phuntsholing	111	15	13	28	25.2	9.3
	CRC – Wangkha	41	7	11	18	43.9	3.4
	Sub- total	**5**	**433**	**46**	**50**	**96**	**22.2**	**7.2**
Samtse	DVH – Samtse	41	14	22	36	87.8	3.4
	LEC Changmari/Norbugang	87	18	14	32	36.8	7.3
	LEC Chargarey/Sangachholing	23	9	6	15	65.2	1.9
	LEC Ugyentse	52	11	13	24	46.2	4.3
	LEC Yoseltse	270	18	39	57	21.1	22.5
	LEC Sipsu/Tashicholing	39	12	9	21	53.8	3.3
	LEC Dorokha/Dophuchen	103	0	5	5	4.9	8.6
	LEC Tendu	52	8	10	18	34.6	4.3
	LEC-Gomtu/Phuntshopelri	23	3	8	11	47.8	1.9
	LEC Buduney – Samtse	72	4	0	4	5.6	6.0
	LEC- Tading	95	30	35	65	68.4	7.9
	LEC Norgaygang/ Bara	41	3	0	3	7.3	3.4
	LEC Namgaycholing/Lareney	12	0	1	1	8.3	1.0
	NJBC- Samtse	32	6	2	8	25.0	2.7
	Sub- total	**13**	**942**	**136**	**164**	**300**	**31.8**	**6.5**
	Total	**34**	**2561**	**323**	**425**	**748**	**29.2**	**6.3**
West-central region	DVH-Petakarpo Wangdue	56	10	13	23	41.1	4.7
	LEC Gaselo/Gumina	107	19	30	49	45.8	8.9
Wangdue	LEC Phobjikha	18	8	6	14	77.8	1.5
	LEC Rubesa	10	6	10	16	160.0	0.8
	LEC Phangyul/ Katikha	10	4	8	12	120.0	0.8
	LEC Bjena	18	5	2	7	38.9	1.5
	LEC Nysho/Samtegang	7	1	0	1	14.3	0.6
	Sub- total	**7**	**226**	**53**	**69**	**122**	**54.0**	**2.7**
Punakha	DVH – Punakha	223	35	45	80	35.9	18.6
	LEC Samdingkha	236	36	22	58	24.6	19.7
	LEC Talo	68	7	6	13	19.1	5.7
	LEC Thinlaygang/Toepaisa	39	3	5	8	20.5	3.3
	LEC Kabisa	156	19	25	44	28.2	13.0
	LEC Barp	26	1	2	3	11.5	2.2
	LEC –Shengana	30	5	2	7	23.3	2.5
	LEC -Limbukha/Tshochasa	99	5	1	6	6.1	8.3
	Sub- total	**8**	**877**	**111**	**108**	**219**	**25.0**	**9.1**
Tsirang	DVH - Damphu Tsirang	180	35	61	96	53.3	15.0
	LEC- Gosarling	82	19	42	61	74.4	6.8

Region	District	Center						
		LEC- Mendrelgang	39	6	6	12	30.8	3.3
		LEC- Barsong	72	24	7	31	43.1	6.0
		LEC- Sergithang	53	12	10	22	41.5	4.4
		LEC Tsirangtoe	56	14	23	37	66.1	4.7
	Sub- total	**6**	**482**	**110**	**149**	**259**	**53.7**	**6.7**
	Dagana	LEC Dagapela/Tshendagang	42	5	3	8	19.0	3.5
		LEC Drujegang	48	1	6	7	14.6	4.0
		LEC Lhamoizingkha	15	0	2	2	13.3	1.3
	Total	**3**	**105**	**6**	**11**	**17**	**16.2**	**2.9**
	Gasa	DVH – Gasa	41	11	6	17	41.5	3.4
		LEC Damji	41	8	12	20	48.8	3.4
	Sub- total	**2**	**82**	**19**	**18**	**37**	**45.1**	**3.4**
	Total	**26**	**1772**	**299**	**355**	**654**	**36.9**	**5.7**
East-central region	Trongsa	DVH - Sherabling Trongsa	18	2	3	5	27.8	1.5
		LEC Kuengarabten	120	4	8	12	10.0	10.0
		LEC Langthel/Bayling	43	5	6	11	25.6	3.6
		LEC Tangsibji	133	21	40	61	45.9	11.1
		LEC Bemji	23	4	6	10	43.5	1.9
	Sub- total	**5**	**337**	**36**	**63**	**99**	**29.4**	**7.0**
	Bumthang	DVH – Bumthang	164	18	32	50	30.5	13.7
		LEC Chumey	27	1	5	6	22.2	2.3
		LEC Tang/ Wobthang	107	18	11	29	27.1	8.9
		BS Farm – Bumthang	215	10	12	22	10.2	17.9
	Sub- total	**4**	**504**	**47**	**60**	**107**	**21.2**	**10.5**
	Zhemgang	DVH - Trong Z/gang	109	29	45	74	67.9	9.1
		LEC Panbhang – Ngangla	6	2	2	4	66.7	0.5
		LEC Tingtibi – Trong	16	2	2	4	25.0	1.3
	Sub- total	**3**	**131**	**33**	**49**	**82**	**62.6**	**3.6**
	Sarpang	DVH Sarpang	77	5	2	7	9.1	6.4
		LEC – Gelephu	208	37	76	113	54.3	17.3
		LEC – Dekiling	22	1	1	2	9.1	1.8
		LEC- Chuzargang	32	6	9	15	46.9	2.7
		LEC- Sersong	58	0	2	2	3.4	4.8
	Sub- total	**5**	**397**	**49**	**90**	**139**	**35.0**	**6.6**
	Total	**17**	**1369**	**165**	**262**	**427**	**31.2**	**6.7**
Eastern region	Pemagatshel	DVH Shumar - P/gatshel	75	6	22	28	37.3	6.3
		LEC Khar- Tshebar	8	1	0	1	12.5	0.7
		LEC Nangkhor	43	6	6	12	27.9	3.6
		LEC Yurung	32	1	12	13	40.6	2.7
		LEC Zobel – Tshelingore	8	3	3	6	75.0	0.7
		LEC-Nanong	107	15	18	33	30.8	8.9
		LEC Khar	39	8	9	17	43.6	3.3
		LEC Norbugang- Nganglham	178	26	25	51	28.7	14.8
		LEC Chongshing	8	1	0	1	12.5	0.7

	Sub- total	**9**	**498**	**67**	**95**	162	32.5	4.6
Monger	DVH – Monggar		268	40	34	74	27.6	22.3
	LEC Chali		44	0	0	0	0.0	3.7
	LEC Ngatshang		162	37	35	72	44.4	13.5
	LEC Sherimuhung		27	0	0	0	0.0	2.3
	LEC Chaskhar		499	74	63	137	27.5	41.6
	LEC Tsakaling		32	0	0	0	0.0	2.7
	LEC Lingmithang/Thridandbi		12	0	0	0	0.0	1.0
	LEC Drepong		10	6	15	21	210.0	0.8
	LEC Tsamang		50	0	2	2	4.0	4.2
	Sub- total	**9**	**1104**	**157**	**149**	306	27.7	10.2
Lhuntshe	DVH Gangzur Lhuntshe		8	0	1	1	12.5	0.7
	LEC Khoma		36	0	4	4	11.1	3.0
	LEC Menbi		21	0	0	0	0.0	1.8
	LEC Minjey		23	0	0	0	0.0	1.9
	NPHPC Sertsham		17	0	0	0	0.0	1.4
	Sub- total	**5**	**105**	**0**	**5**	5	4.8	1.8
Tashiyangtse	DVH TrashiYangtse		60	4	4	8	13.3	5.0
	LEC Khamdang		33	7	6	13	39.4	2.8
	LEC Tongmajangsa		9	0	0	0	0.0	0.8
	LEC Jamkhar		2	0	0	0	0.0	0.2
	Sub- total	**4**	**104**	**11**	**10**	21	20.2	2.2
Trashigang	DVH – Trashigang		151	22	25	47	31.1	12.6
	LEC Radhi		32	0	1	1	3.1	2.7
	LEC Bartsham		54	11	13	24	44.4	4.5
	LEC Yangnyer		90	11	18	29	32.2	7.5
	LEC Kanglung		84	21	21	42	50.0	7.0
	LEC Khaling		14	1	3	4	28.6	1.2
	LEC Bikhar –Samkhar		28	2	12	14	50.0	2.3
	LEC Phongmaed		3	0	2	2	66.7	0.3
	LEC Bidung		21	8	6	14	66.7	1.8
	RNR-Changmay - Shongphu		22	7	14	21	95.5	1.8
	LEC Lumang		5	2	3	5	100.0	0.4
	Sub- total	**11**	**504**	**85**	**118**	203	40.3	3.8
S/Jongkhar	LEC Deothang		136	22	46	68	50.0	11.3
	LEC Orong		8	0	0	0	0.0	0.7
	LEC Phuntshothang		10	0	0	0	0.0	0.8
	LEC Gomdhar		22	1	4	5	22.7	1.8
	BLDCL Samrang		140	17	49	66	47.1	11.7
	Sub- total	**5**	**316**	**40**	**99**	139	44.0	5.3
	Total	**43**	**2631**	**360**	**476**	836	31.8	5.1
	Grand Total	**120**	**8333**	**1141**	**1518**	2665	32.0	5.8

Annexure 3: Pedigree information of THF progeny born from PTS implementation in Tsirang and Samtse Dzongkhag.

Progeny born detail from 1st Phase of PTS implementation in Barsong Geog, Tsirang

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
1	Indra Bdr. Poudel	Barsongmaed	18000095	25/10/18	M	18000049/ Ratu	(C 4902/ Poppular)	THF - 50%	19.2
2	Nar Bdr. Adhikari	Barsongmaed	18000096	31-10-18	M	18000053	(C 4902/ Poppular)	"	19.8
3	Sangay Wangmo	Barsongtoed (Saleri)	18000097	14/10/18	F	18000063/ Dawalham	(C 5009/ puzzle)	"	19.8
4	Budhi Man Tamang	Toisang Lower	18000098	23/10/18	F	18000018/ Kali	(C 5008/ Push)	"	18.9
5	Chandra Bdr. Rai	Balwani	18000099	10-11-18	M	18000072/ Ratu	(C 5008/ Push)	"	19.6
6	Nim Tshering Tamang	Gangtokha (Phirphirey)	18000100	20/10/18	F	18000012/ Dalli	(C4908/ Pound)	"	19.9
7	Lal Bdr. Tamang	Chunikhang	18000101	10-10-18	F	18000042/ Kali	(C4908/ Pound)	"	19.6
8	Nar Bdr. Tamang	Chunikhang	18000102	20/10/18	M	18000089/ Khaluri	(C4908/ Pound)	"	19.6
9	Dhan Bdr. Tamang	Chunikhang	18000103	14/10/18	F	18000040/ Gori	(C4908/ Pound)	"	19.8
10	Karma Wangmo	Chunikhang	18000104	24/10/18	F	18000044/ Machum	(C4908/ Pound)	"	19.5
11	Hasta Bdr. Tamang	Chunikhang	18000105	24/10/18	M	18000088/ Gori	(C4908/ Pound)	"	19.5
12	Jit Bdr. Tamang	Gangtokha (Phirphirey)	18000106	24/10/18	F	18000083/ Ratu	(C4908/ Pound)	"	19.5
13	Som Maya Tamang	Gangtokha (Phirphirey)	18000107	20/10/18	F	18000009/ Phurki	(C4908/ Pound)	"	19.6
14	Chandra Lal Sangraula	Barsongtoed	18000108	25/10/18	M	18000058/ Tari	(C 5008/ Push)	"	19.4

Progeny born detail from 2nd Phase of PTS implementation in Barsong Geog, Tsirang

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
1	Deki Wangmo	Barsongtaed	18000143	08-05-19	F	18000054	(C 5008/ Push)	THF - 50%	12.9
2	Lal Bdr. Subba	Barsongmaed	18000147	12-05-19	M	18000092	(C 4902/ Poppular)	"	12.8
3	Suk Mati Tamang	Chunikhang	18000156	15-07-19	M	18000087/ Gori	(C4908/ Pound)	"	10.7
4	Tek Bdr. Subba	Barsongmaed	18000146	28-07-19	M	18000145/ Kali	(C 4902/ Poppular)	"	10.2
5	R K Moktan	Gangtokha (Phirphirey)	18000149	31-08-19	M	18000007/ Ratu	(C4908/ Pound)	"	9.1
6	Jit Bdr. Tamang	Gangtokha (Phirphirey)	18000148	25-09-19	M	18000128/ Tari	(C 4902/ Poppular)	"	8.3

7	Dhan Bdr. Kharga	Barsongtoed	18000144	02-09-19	M	18000127/ Pudi	(C 5008/ Push)	"	9.0
8	Santa Bir Tamang	Toisang Lower	18000133	23-09-19	F	18000116/ Dalli	(C 4902/ Poppular)	"	8.3
9	Santa Bir Tamang	Toisang Lower	18000132	02-10-19	M	18000115/ Pudhi	(C 4902/ Poppular)	"	8.0
10	Mon Bdr. Monger	Toisang Lower	18000137	07-10-19	M	18000030/ Lalmu	(C 4902/ Poppular)	"	7.9
11	Krishna Tamang	Chunikhang	18000154	11-10-19	M	18000121/ Kali	(C4908/ Pound)	"	7.7
12	Sangay Phuntsho	Gangtokha (Phirphirey)	18000155	07-10-19	F	18000123/ Chengamo	(C4908/ Pound)	"	7.9
13	Tilak Bdr. Tamang	Gangtokha (Phirphirey)	18000153	05-10-19	M	18000152/ Tari	(C 4902/ Poppular)	"	7.9
14	Bal Bdr. Luitel	Barsongmaed	18000138	03-10-19	M	18000126/ Pudhi	(C 4902/ Poppular)	"	8.0
15	Nim Tshering	Gangtokha (Phirphirey)	18000131	13-11-19	M	18000012/ Lalmu	(C4908/ Pound)	"	6.6
16	Santa Bir Tamang	Toisang Lower	18000134	30-09-19	F	18000114/ Tari	(C 4902/ Poppular)	"	8.1
17	Indra Bdr. Powdel	Barsongmaed	18000141	06-10-19	M	18000048/ Pudhi	(C 4902/ Poppular)	"	7.9
18	Som Maya Tamang	Gangtokha		07/02/20	M	18000009/ Phurki	(C 5009/ puzzle)	THF - 50%	4.5
19	Chandra Kumar Luitel	Barsongmaed		09/02/20	F	18000047/ Pudhi	(C 4902/ Poppular)	THF - 50%	4.5
20	Befy Singh Tamang	Gangtokha		07/02/20	M	18000150/ Ratu	(C 4902/ Poppular)	THF - 50%	4.5
21	Dal Bdr. Chamlagai	Barsonmaed		10/02/20	F	…………../ Golmu	(C 4902/ Poppular)	THF - 50%	4.5
22	Mon Bdr. Monger	Toisang		21/03/20	F	18000027/ Ratu	(C4908/ Pound)	THF - 50%	3.5
23	Karna Bdr. Tamang	Toisang		31/05/20	M	18000135/ Lalmu	(C 5009/ puzzle)	THF - 50%	3

Progeny born detail from 1st Phase of PTS implementation in Sergithang Geog, Tsirang

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
1	Shree Bela Sanyasi	Tashithang	18004080	31/10/18	F	18004029/ Gauthali	(C 4902/ Poppular)	THF - 50%	19.2
2	Harka Man Subba	Tashithang	18004081	20/10/18	F	18004052/ Patu	(C 4902/ Poppular)	"	19.6
3	Rup Narayan Sanyasi	Tashithang	18004082	19/10/18	M	18004020/ Bhagayri	(C 5009/ puzzle)	"	19.6
4	Rup Narayan Sanyasi	Tashithang	18004083	20/10/18	M	18004026/ Golmu	(C 5009/ puzzle)	"	19.6

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
5	Mana Rath Sanyasi	Tashithang	18004084	02-11-18	M	18004056/ Darpani	(C 4902/ Poppular)	"	19.2
6	Chandra Lal Giri	Tashithang	18004085	27/10/18	M	18004059	(C4908/ Pound)	"	19.4
7	Sangay	Tashithang	18004086	22/10/18	F	18004019/ Doley	(C 5009/ puzzle)	"	19.5
8	Sherpo Dukpa	Sergithangmaed	18004087	26/10/18	M	18004011/ Machum	(C 5008/ Push)	"	19.4
9	Mon Bdr. Rai	Sergithangmaed	18004088	26/10/18	M	18004053/ Tari	(C4908/ Pound)	"	19.4
10	Kinzang	Sergithangmaed	18004089	20/10/18	F	18004008/ Nakzom	(C 5008/ Push)	"	19.6
11	Bishnu Lal Rai	Sendenjong (Teuray)	18004090	20/10/18	M	18004033/ Gurasi	(C4908/ Pound)	"	19.6

Progeny born detail from 2nd Phase of PTS implementation in Sergithang Geog, Tsirang

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
1	Parti Man Sanyasi	Tashithang	18004110	09-10-19	F	18004091/ Gauthali	(C4908/ Pound)	THF - 50%	7.8
2	Krishna Lal Sanyasi	Gorujurey	18004113	04-10-19	M	18004099/ Lalmu	(C 4902/ Poppular)	"	8.0
3	Suk Man Rai	Sergithangmaed	18004114	09-10-19	F	18004061/ Pudhi	(C 4902/ Poppular)	"	7.8
4	Mon Bdr. Rai	Sergithangmaed	18004115	05-10-19	M	18004053	(C 4902/ Poppular)	"	7.9
5	Yeshi	Sergithangmaed	18004117	07-10-19	F	18004116	(C 4902/ Poppular)	"	7.9
6	Mon Maya Sanyasi	Tashithang		08-10-19	M	18004094/ Laltari	(C4908/ Pound)	"	7.8
7	Pratap Singh Rai	Sendenjong		04/02/20	F	18004111/ Pudhi	(C4908/ Pound)	"	3.9
8	Tshering Pedey	Sergithangtoed		20/02/20	F	………….../ Methom	(C 4902/ Poppular)	"	3.3
9	Bishnu Lal Rai	Sendenjong		31/03/20	M	18004033	(C 5008/ Push)	"	2.0
10	Damber Singh Rai	Sendenjong		13/03/20	F	180004112/ Gori	(C 5009/ puzzle)	"	2.6
11	Dil Bdr. Rai	Samdenjong		02/05/20	F	…………… / Ujeli	(C 5009/ puzzle)	"	0.9
12	Tika Ram Rai	Sergithangmae		15/02/20	M	18004119/ Gori	(C 5008/ Push)	"	3.5
13	Arun Rai	Sergithangmae		03/05/20	M	18004118/ Gori	(C 5008/ Push)	"	0.9
14	Bhanu Bkakta Sanyasi	Tashithang		22/04/20	F	18004106/ Chouri	(C 5008/ Push)	"	1.3
15	Pratab Singh Rai	Tashithang		01/03/20	M	18004121/ Lalmu	(C 4902/ Poppular)	"	3.0
16	Lal Bdr. Sanyasi	Tashithang		15/03/20	M	18004103/ Lalmu	(C 4902/ Poppular)	"	2.5

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
17	Krishna Prd. Sanyasi	Tashithang		25/04/20	M	18004107/ Pudki	(C4908/ Pound)	"	1.2
18	Purna Bdr. Rai	Lower Norbuthang		01/05/20	M	18004102/ Dalli	(C 5008/ Push)	"	1.0
19	Lal Bdr. Sanyasi	Tashithang		23/05/20	M	18004104/ Lalmu	(C 5009/ puzzle)	"	0.2

Progeny born detail from 1st Phase of PTS implementation in Tading Geog, Samtse

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
1	Nim Dorji Lama	Baharbotey	12013193	20-09-18	F	12013118/ Pudhi	(C 5009/ Puzzle)	THF - 50%	20.6
2	Zoma	Taba Damtae	12013197	15-09-18	M	12013021/ Ratu	(C 5009/ Puzzle)	"	20.8
3	Sanjab	Taba Damtae	12013196	18-09-18	F	12013023/ Zarma	(C 5009/ Puzzle)	"	20.7
4	Tek Bdr. Bhugel	Khempagoen (Lower)	12013212	15-09-18	F	12013050/ Kali	(C 5009/ Puzzle)	"	20.8
5	Rudra Bdr. Ghallay	Khempagaon (Lower)	12013213	17-09-18	M	12013174/ Rithu	(C 5009/ Puzzle)	"	20.7
6	Lekh Bdr. Ghallay	Khempagaon (Lower)	12013208	25-09-18	M	12013171/ Dalli	(C 5009/ Puzzle)	"	20.4
7	Tek Bdr. Bhugel	Khempagaon (Upper)	12013227	18-09-18	M	12013109/ Kathuri	(C 5008/ Push)	"	20.7
8	Bal Bdr. Ghalley	Panbari (U)	12013237	26-09-18	F	12013183/ Jilku	(C 5008/ Push)	"	20.4
9	Tanka Bdr. Ghalley	Panbari (Upper)	12013246	22-09-18	F	12013184/ Pudhi	(C 5008/ Push)	"	20.5
10	Rup Kumar Ghalley	Panbari (Lower)	12013238	23-09-18	F	12013099/ Patu	(C 5008/ Push)	"	20.5
11	Santa Bdr. Rai	Khempagaon (Upper)	12013226	21-09-18	F	12013112/ Kali	(C 4902/ Poppular)	"	20.6
12	Raj Kumar Rai	Thunuwa (Hirangtar)	12013214	25-09-18	M	12013061/ Pangri	(C 4902/ Poppular)	"	20.4
13	Lal Maya Tamang	Titring East	12013242	19-09-18	F	12013158/ Laltari	(C 4902/ Poppular)	"	20.6
14	Dhan Bdr. Rai	Thunuwa (Bichgoan)	12013225	22-09-18	F	12013074/ Tarku	(C4908/ Pound)	"	20.5
15	Chandra Man Rai	Thunuwa (Naulaygon)	12013224	21-09-18	F	12013178/ Mali	(C4908/ Pound)	"	20.6
16	Suk Man Biswa	Thunuwa (Bichgoan)	12013223	10-09-18	M	12013180/ Tilku	(C4908/ Pound)	"	20.9
17	Jai Kumar Moktan	Titring West	12013243	08-09-18	F	12013160/ Mali	(C4908/ Pound)	"	21.0

Progeny born detail from 2nd Phase of PTS implementation in Tading Geog, Samtse as on 15/07/2020

Sl #	Name of farmers	Village	Calf NBIN	Date of birth	Sex	Dam NBIN/ Name	Sire No./ Name	Breed	Age (M)
1	Lal Bdr. Tamang	Jenchu	12013271	25/08/19	F	12013002/ Gauri	(C 4902/ Poppular)	THF - 50%	11.2
2	Lapchay Tamang	Khenpagoan (L)	12013249	05/09/19	F	12013245/ Pudhi	(C 4902/ Poppular)	"	10.9
3	Lekh Bdr. Ghallay	Khenpagoan	12013251	01/09/19	M	12013029/ Zhilku	(C4908/ Pound)	"	11.0

4	Sher Bdr. Ghalley	Khenpago an (L)	12013255	03/09/19	M	12013036/ Darmi	(C 4902/ Poppular)	"	10.9
5	Dil Bdr. Rai	Thunuwa	12013256	29/08/19	F	12013221/ Lali	(C4908/ Pound)	"	11.1
6	Subbas Rai	Thunuwa-Daragaon	12013257	02/09/19	F	12013222/ Manku	(C 4902/ Poppular)	"	11.0
7	Dik Bdr. Rai (17398878)	Thunuwa-Daragaon		02/09/19	M	12013059/ Manku	(C4908/ Pound)	"	11.0
8	Tek Bdr. Bhujel	Khenpago an (U)	12013252	30/08/19	F	Kali	(C 4902/ Poppular)	"	11.1
9	Suk Bdr Rai (11215001436)	Khempa /daragaon	12013254	01/09/19	F	Pangri	(C4908/ Pound)	"	11.0
10	Lok Bdr. Ghalley (77454872)	Lapchakh a	12013264	29/08/19	F	12013230/ Pudhi	(C4908/ Pound)	"	11.1
11	Lok Bdr. Ghalley (77454872)	Lapchakh a	12013265	24/08/19	M	12013232/ Surki	(C 4902/ Poppular)	"	11.3
12	Lok Bdr. Ghalley (77454872)	Lapchakh a	12013263	27/08/19	F	12013234/ Manku	(C4908/ Pound)	"	11.2
13	Dik Bdr. Ghalley (77425051)	Panbari (Upper)	12013259	02/09/19	M	12013235/ Kali	(C 4902/ Poppular)	"	11.0
14	Dik Bdr. Ghalley	Panbari (Upper)	12013258	30/08/19	F	12013236/ Migma	(C4908/ Pound)	"	11.1
15	Lal Maya Tamang	Barbotey	12013248	14/02/20	M	Kali	(C 5008/ Push)	"	5.5
16	Prem Kumar Tamang	Titring	12013274	17/12/19	M	Tari	(C 5008/ Push)	"	7.4
17	Raju Tamang (Gairigoan)	Gairigoan	12013272	15/12/19	M	Tari	(C 5008/ Push)	"	7.5
18	Sang Dorji	Gairigoan	12013273	25/12/19	F		(C 5008/ Push)	"	7.2
19	Toran Bhujel	Pangzhing	12013276	20/12/19	F	,02009112/ Ratu	(C 4902/ Poppular)	"	7.3
20	Birkhay Bhujel	Pangzhing	12013270	22/12/19	M	Lalmu	(C 4902/ Poppular)	"	7.3
21	Birkhay Bhujel	Pangzhing	12013275	02/02/20	M	Ratu	(C4908/ Pound)	"	5.9
22	Lila Bdr Bhujel (new owner Kul Bdr. Ghalley)	Pangzhing	12013266	15/12/19	F	Pangri	(C 5008/ Push)	"	7.5
23	Ramesh Kumar Ghalley	Khempag ang	12013250	02/05/20	M	Pangri	(C 4908/ Pound)	"	2.9
24	Tshep Tshering Doya	Ramtey		12/06/20	F		(C 4908/ Pound)	"	1.5
25	Rup Kumar Ghalley	Laptsakha	12013260	16/11/19	F	Kali	(C 4902/ Poppular)	"	8.5

26	Phurpa	Pangzhing		18/10/19	M		(C4908/ Pound)	"	9.4
27	Amber Singh Ghalley	Laptsakha		15/01/20	F	Kali	(C 4902/ Poppular)	"	6.5
28	Chandra Bdr Ghalley	Laptsakha		15/03/20	M	Kali	(C 4902/ Poppular)	"	4.5
29	Nar Bdr Ghalley	Laptsakha	12013267	15/12/19	M	Tilku	(C 4902/ Poppular)	"	7.5
30	Nar Bdr Ghalley	Laptsakha	12013268	16/03/20	M	Ratu	(C 4902/ Poppular)	"	4.4
31	Rup Kumar Ghalley	Laptsakha	12013261	30/12/19	M	Pangri	(C 4902/ Poppular)	"	7.0
32	Ghanasyam Ghalley	Laptsakha	12013262	25/03/20	M	Ratu	(C 4902/ Poppular)	"	4.1
33	Rudra Bdr Ghalley	Pangzhing	12013269	01/04/20	F	Kali	(C 5008/ Push)	"	3.9

Annexure 4:Seman quality assessment and certification

Sl. no	Date of production	Bull no.	Breed	Doses produced	PTM at production	PTM at assessment (1)	PTM at assessment (2)	PTM at assessment (Avg.)	Doses used for PTM assessment	Remarks
10	06/04/2018	14001097	Nublang	500	40%	40%	40%	40%	2	Field use certified
11	18/07/2018	14001097	Nublang	280	40%	40%	40%	40%	2	Field use certified
7	23/08/2018	14001097	Nublang	400	45%	45%	45%	45%	2	Field use certified
20	21/03/2019	14001097	Nublang	370	40%	40%	40%	40%	2	Field use certified
21	28/03/2019	14001097	Nublang	310	40%	45%	45%	45%	2	Field use certified
22	23/05/2019	14001097	Nublang	390	40%	50%	50%	50%	2	Field use certified
4	06/06/2019	14001097	Nublang	1200	40%	40%	40%	40%	2	Field use certified
6	27/06/2019	14001097	Nublang	400	50%	60%	60%	60%	2	Field use certified
5	04/07/2019	14001097	Nublang	350	40%	40%	40%	40%	2	Field use certified
10	15/07/2019	12000493	Nublang	370	40%	45%	45%	45%	2	Field use certified
14	01/08/2019	14001097	Nublang	180	40%	45%	45%	45%	2	Field use certified
1	15/08/2019	14001097	Nublang	350	40%	40%	40%	40%	2	Field use certified
4	21/08/2019	14001097	Nublang	220	40%	50%	50%	50%	2	Field use certified
5	21/08/2019	14001097	Nublang	560	40%	40%	40%	40%	2	Field use certified
8	30/08/2019	14001097	Nublang	335	40%	40%	40%	40%	2	Field use certified
11	13/06/2019	14001097	Nublang	180	40%	50%	50%	50%	2	Field use certified
12	04/07/2018	14001097	Nublang	200	40%	45%	45%	45%	2	Field use certified
16	11/09/2019	14001097	Nublang	270	40%	35%	30%	30%	2	Discarded
1	26/09/2019	14001097	Nublang	280	40%	30%	35%	30%	2	Discarded
				7145					550	6595
2	13/06/2019	12000359	PJ	420	40%	50%	50%	50%	2	Field use certified
3	02/07/2019	12000359	PJ	280	40%	45%	45%	45%	2	Field use certified
				700						700
6	26/06/2018	12000401	PJ	360	40%	40%	40%	40%	2	Field use certified
7	06/08/2018	12000401	PJ	205	40%	60%	60%	60%	2	Field use certified
8	08/08/2018	12000401	PJ	620	40%	30%	30%	30%	2	Discarded
9	22/08/2018	12000401	PJ	140	40%	50%	50%	50%	2	Field use certified
12	25/03/2019	12000401	PJ	620	40%	30%	30%	30%	2	Discarded
13	09/04/2019	12000401	PJ	180	40%	40%	40%	40%	2	Field use certified
14	04/06/2019	12000401	PJ	365	40%	45%	45%	45%	2	Field use certified
15	11/06/2019	12000401	PJ	450	40%	45%	45%	45%	2	Field use certified
1	12/06/2019	12000401	PJ	390	40%	45%	45%	45%	2	Field use certified
2	12/06/2019	12000401	PJ	290	40%	30%	30%	30%	2	Discarded
3	24/06/2019	12000401	PJ	350	40%	60%	60%	60%	2	Field use certified

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	Date	Code		Qty						Status
4	15/07/2019	12000401	PJ	280	40%	40%	40%	40%	2	Field use certified
4	29/07/2019	12000401	PJ	350	40%	30%	30%	30%	2	Discarded
5	05/08/2019	12000401	PJ	300	30%	30%	30%	30%	2	Discarded
6	28/08/2019	12000401	PJ	395	40%	40%	40%	40%	2	Field use certified
				5295					2280	3015
8	27/08/2018	12000454	PJ	660	30%	30%	30%	30%	2	Discarded
				660					660	0
10	26/09/2018	12000457	PJ	770	40%	10%	10%	10%	2	Discarded
11	12/03/2019	12000457	PJ	260	40%	30%	30%	30%	2	Discarded
12	18/03/2019	12000457	PJ	575	40%	30%	25%	27%	2	Discarded
13	26/03/2019	12000457	PJ	505	40%	40%	40%	40%	2	Field use certified
14	02/04/2019	12000457	PJ	470	40%	45%	45%	45%	2	Field use certified
15	08/04/2019	12000457	PJ	575	40%	40%	40%	40%	2	Field use certified
9	16/04/2019	12000457	PJ	690	45%	50%	60%	55%	2	Field use certified
16	28/08/2019	12000457	PJ	900	45%	50%	45%	48%	2	Field use certified
				4745					1605	3140
2	26/07/2018	12000493	PJ	1180	40%	40%	40%	40%	2	Field use certified
3	31/07/2018	12000493	PJ	368	40%	40%	40%	40%	2	Field use certified
4	27/08/2018	12000493	PJ	520	45%	45%	45%	45%	2	Field use certified
5	04/09/2018	12000493	PJ	230	40%	40%	40%	40%	2	Field use certified
6	11/09/2018	12000493	PJ	230	40%	40%	40%	40%	2	Field use certified
7	24/09/2018	12000493	PJ	450	40%	50%	50%	50%	2	Field use certified
8	24/09/2018	12000493	PJ	483	40%	45%	45%	45%	2	Field use certified
9	01/10/2018	12000493	PJ	370	40%	50%	50%	50%	2	Field use certified
10	17/10/2018	12000493	PJ	800	40%	40%	40%	40%	2	Field use certified
11	01/03/2019	12000493	PJ	250	40%	60%	60%	60%	2	Field use certified
12	19/03/2019	12000493	PJ	270	40%	40%	40%	40%	2	Field use certified
13	10/06/2019	12000493	PJ	500	40%	20%	30%	25%	2	Discarded
1	09/07/2019	12000493	PJ	620	50%	45%	45%	45%	2	Field use certified
14	29/07/2019	12000493	PJ	310	45%	45%	45%	45%	2	Field use certified
15	05/08/2019	12000493	PJ	550	25%	25%	25%	25%	2	Discarded
16	02/09/2019	12000493	PJ	270	40%	45%	45%	45%	2	Field use certified
17	09/09/2019	12000493	PJ	500	40%	30%	20%	25%	2	Discarded
10	16/09/2019	12000493	PJ	180	40%	40%	40%	40%	2	Field use certified
				8081					1550	6531
19	12/01/2018	12000532	PJ	420	40%	40%	40%	40%	2	Field use certified
1	05/09/2018	12000532	PJ	370	45%	45%	45%	45%	2	Field use certified
2	08/09/2018	12000532	PJ	560	40%	20%	20%	20%	2	Discarded

3	03/10/2018	12000532	PJ	170	40%	40%	40%	40%	2	Field use certified
5	08/10/2018	12000532	PJ	256	40%	20%	20%	20%	2	Discarded
7	15/10/2018	12000532	PJ	460	40%	50%	50%	50%	2	Field use certified
8	24/10/2018	12000532	PJ	715	40%	20%	30%	25%	2	Discarded
9	14/03/2019	12000532	PJ	840	40%	40%	40%	40%	2	Field use certified
11	04/04/2019	12000532	PJ	185	40%	40%	40%	40%	2	Field use certified
18	17/04/2019	12000532	PJ	300	45%	40%	40%	40%	2	Field use certified
				4276					1531	2745
3	17/04/2019	14000113	PJ	370	40%	50%	50%	50%	2	Field use certified
15	03/06/2019	14000113	PJ	320	45%	45%	45%	45%	2	Field use certified
2	06/06/2019	14000113	PJ	300	40%	40%	40%	40%	2	Field use certified
12	19/06/2019	14000113	PJ	320	40%	40%	40%	40%	2	Field use certified
9	01/07/2019	14000113	PJ	250	45%	50%	50%	50%	2	Field use certified
6	03/07/2019	14000113	PJ	260	40%	20%	20%	20%	2	Discarded
13	08/07/2019	14000113	PJ	380	40%	45%	45%	45%	2	Field use certified
16	10/07/2019	14000113	PJ	300	45%	45%	45%	45%	2	Field use certified
7	30/09/2019	14000113	PJ	350	45%	40%	40%	40%	2	Field use certified
				2850					260	2590
14	06/08/2019	20000371	PJ	260	40%	40%	40%	40%	2	Field use certified
15	13/08/2019	20000371	PJ	300	45%	50%	50%	50%	2	Field use certified
17	20/08/2019	20000371	PJ	440	40%	40%	40%	40%	2	Field use certified
18	10/09/2019	20000371	PJ	380	40%	40%	40%	40%	2	Field use certified
13	17/10/2019	20000271	PJ	550	45%	40%	40%	40%	2	Field use certified
				1930						1930
				35,682 (produced)					**8,436 (discarded)**	**27,246 (stored)**

Note: The discarded semen is recommended to be used for CAIT training and AI refresher courses

Annexure 5: CHBPP implemented Dzongkhags & Geogs

Sl #	Dzongkhag	CHBPP Geog
1	Bumthang	Chokhor & Tang
2	Trongsa	Tangsibjee, Korphu, Langthel, Drekten& Nubi
3	Zhemgang	Trong, Nangkhor & Buli
4	Sarpang	Dekiling, Gelephu, Sompangkha, Samtenling & Gakiling
5	Lhuntse	Menbi and Menji
6	Mongar	Chaskhar, Tsamang, Mongar & Ngatshang
7	Tashigang	Shamkhar & Kanglung
8	Tashi Yangtse	Yangtse
9	Pemagatshel	Shumar, Yurung
10	Samdrup Jongkhar	Dewathang & Orong
11	Gasa	Goenkhatoe
12	Punakha	Baap & Guma
13	Wangdue	Gasetshogom & Gasetshowom
14	Tsirang	Gosaling, Kikorthang, Rangthangling & Tsholingkhar
15	Dagana	Gaserling, Goshi, Tashiding, Lhamoizingkha & Tshendagang
16	Thimphu	Chang & Mewang
17	Paro	Shari, Shari, Lamgong, Luni, Shapa Wangchang, Naja Dogar & Hungreal
18	Haa	Bjee
19	Chukha	Darla, Sampheling & Phuentsholing
20	Samtse	Samtse, Ugyentse, Yoseltse & chengmari

ANNEXURE 6: DISTRIBUTION PLAN FOR PEDIGREE SELECTED PURE JERSEY SEMEN

DISTRIBUTION PLAN FOR PEDIGREE SELECTED PURE JERSEY SEMEN (2008- 2030)

Sl #	Bull NBIN	Dam	Sire # (name)	M. g. sire	P.g. sire	2008 -11	2012 - 15	2015 -18	2018 - 21	2021 - 23	2023 - 26	2026 - 28
1	14001067 (Stock nil)	3513	185 (from Orrisa)	M g Orrisa	P g Orrisa	E						
2	14001092	3437/6	94438	Royals Greem Ella 76	Tinopai Dantes Pet SJ3	W	WC	E				
3	12000262 (Stock nil)	12000076	111480263	Molly Brook Berretta Flyer	Mason Boomer Sonner berretta		W	WC				
4	14001091	10	66547	MVF Bold Venture Danial	Bold Venture	W	E	WC				
5	12000276 (Stock nil)	12000083	111249864	Barbs MBSB Decio	Mason Boomer Sonner berretta		EC					
6	12000401	12000054	112251008	Schultz Brook Hallmark	Molly Brook Brass Major			W	E		WC	
7	01000295 (Stock nil)	01000130	112084376	H & B Alf Pargon ET	Comfort Royal Alf ET			EC (2015-16)				
8	12000359	12000054	112251008	Schultz Brook Hallmark	Molly Brook Brass Major			EC (2017-18)	WC			
9	12000454	12000384	112990549	Long Distance Barber Barkly	WF/L&M Duncan ET				EC (July -			
10	12000493	12000351	115969078	Wilderness Blueprint	ISDK Q Impulse				EC (Nov,	W		
11	12000457	12000147	111249864	Barbs MBSB Decio	Mason Boomer Sonner berretta				W		EC	
12	12000532	12000333	115547683	Forest Glen Exceed Jeweler ET	Molly Brook Beretta Fair ET					EC		
13	14000113	14010111	116908461	BW Carrier ET	Heartland Artist Salina					WC	E	
14	20000371	12000035	665616	WF-LNM Duncan Barber ET	Rocky Hill Sky Line					E	W	
15	01000386	80	112985387	Rock Ella Paramount ET	Comfort Royal Alf ET							
16	New Donor 1											E
17	New Donor 2											W
18	New Donor 3											EC

ANNEXURE 7: DISTRIBUTION PLAN FOR IMPORTED PROGENY TESTED SEMEN (JERSEY)

DISTRIBUTION PLAN FOR IMPORTED PROGENY TESTED SEMEN (JERSEY)(2012-2021)

| Sl #	Bull #	Bull code	Bull name	Distribution Plan (2012 - 2015)	Distribution Plan (2015 - 2018)	Distribution Plan (2018 - 2021)
1	112894928	014JE00408	FOREST GLEN VD JADES JIMMIE-ET	Eastern		
2	115969078	14JE00524	SR BLUEPRINT PLAN	East Central + Blood line B (NJBC)		
3	114245720	007JE00821	MAACK DAIRY SPECTACULAR -ET	Blood line C (NJBC)		
4	115479838	007JE00968	DUTCH HOLLOW GAVIN -ET	Western		
5	115547683	007JE00988	SUN VALLY JEWELER ARROW-ET	West Central + Blood line A (NJBC)		
6	UK103789 300352	J2215	SHELLEN PRECISION		Western	
7	UK927007 143183	J2216	LAGANGREEN ROY BOY		East Central + Blood line B (NJBC)	
8	UK283178 400661	J2072	PARKPLACE FLAGSHIP ET		West Central + Blood line A (NJBC)	
9	UK103789 400346	J2214	SHELLEN ENGAGE		Eastern + Blood line C (NJBC)	
10	UK030003 400852	J2276	HOME FARM STUARTS BEES KNEES		Eastern	
	C541	007JE01267	SUNSET CANYON DEPUTY-ET			EAST CENTRAL
	C564	007JE01335	SUNSET CANYON JORDACHE-ET			NJBC (Bloodline A)
	4544	007JE01219	DUTCH HOLLOW OLIVER-P			NJBC (Bloodline B)
	G650	007JE01184	GLYNN HEADLINE NEWS-ET			NJBC (Bloodline C)
	C428	007JE01150	SUNSET CANYON DIGNITARY-ET			WESTERN
	440	007JE01342	RIVER VALLEY SALINA SPEED			
	D1503	007JE01337	DP PARKER			EAST CENTRAL
	4369	007JE01173	DUTCH HOLLOW PRESCOTT {6}-ET			EASTERN
	1045	014JE00568	TOLLENAARS HEADLINE LOU-ET			WEST CENTRAL
	79422	014JE00650	JX FARIA BROTHERS CHEEZ {3}-ET			

Note
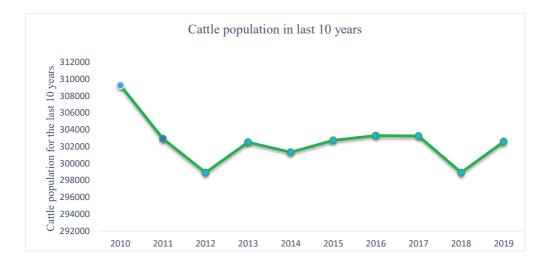
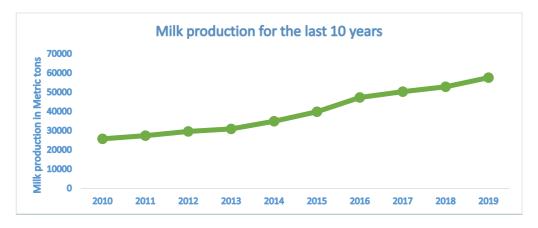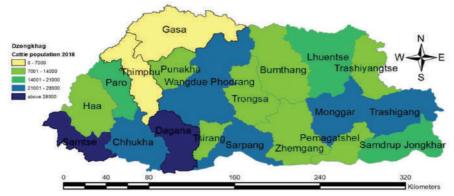1. Eastern: RLDC, Kanglung (Lhuntse, Mongar, Pemagatsel, S/Jongkhar, Trashigang, Trashiyangtse),

2. East Central: RLDC, Zhemgang (Bumthang, Sarpang, Trongsa, Zhemgang)

3. West Central: RLDC, Wangdue (Dagana, Gasa, Punakha, Tsirang, Wangdue)

Average price/ dose of imported Progeny Tested Semen US$4.7, Imported Sex Sorted Semen US$23

Cattle population in last 10 years

Milk production for the last 10 years

WHAT DO YOU KNOW ABOUT SEXED SEMEN TECHNOLOGY?

What is sexed semen?

Semen having X or Y bearing sperm to produce progenies of a desired sex either female or male (with about 80-90% accuracy). Sex sorting technology was developed by the USDA (United States Department of Agriculture) researchers in Livermore, California, and Beltsville, Maryland. The technology was patented as "Beltsville Sperm sexing technology". The commercialization of sexed semen started in United States in 2001 with a license granted to Sexing Technologies (ST), Texas. Presently,sexed semen is commercially available only for Holstein Friesian and Jersey breeds of cattle.

How Sexed Semen is produced?

Sperm are sorted by identifying differences between the X- and Y- bearing sperm. The X-chromosome (female) contains about 3.8% more DNA than the Y-chromosome (male) in cattle. This difference in DNA content is used to sort the X- from the Y-bearing sperm. Among several methods for semen sexing, flow cytometry-based sorting has emerged as most efficient. The technology is refined through the decades and finally sex sorting is possible at the purity of more than 90%. The technique is well standardized, patented and commercialized in USA, Europe and other countries.

Is it safe?

Yes, it is safe to use sexed semen for artificial insemination. But sperm concentration in sexed semen per dose is less and also theconception rate is 10 to 15 % less as compared to conventional semen.

What are the advantages of using sexed semen?

- Produce mostly female calves; increase heifers' production for replacement within herd, and increase opportunity to sell surplus heifers to other farmers/farms
- Speed up genetic improvement

Technological limitations of using sexed semen

- High cost of sex sorting machine
- Waste of approximately 50% of sperm, hence low sorting efficiency and speed
- Require highly skilled person to operate sex sorting machines
- Damage to the sperm due to shear force, electrostatic charge, could reduce freezing potential of the sorted sperm

Schematic diagram of flow cytometry method for sex sorting

1. A piezo electric crystal is undulated approximately 90,000 times/second, which breaks the stream into droplets at a particular point in time. The location of the last-attached droplet in the stream is highly controllable.
2. An X- or Y-bearing sperm is compared to a preset sort criteria.
3. After a time delay, the insertion rod is charged.
5. The charged droplets are deflected as they pass between continuously charged plates.
6. Particles not meeting the criteria pass straight down to waste.

Implementation limitations using sexed semen

- High cost of the product which include the cost of the intellectual property right
- The lower conception rate of sexed semen, critical considering low AI coverage and conception rate in field
- Sperm concentration of sexed semen ranges between 2 million/dose whereas it is 20 million/dose in conventional semen.
- Managing sex semen with lower sperm concentration will be a challenge if AI Technician donor follow prescribed SoP.

Where can we buy and what is the price?

Sexed semen is commercially available mainly from Sexing Technology, USA. But, there are other breeding companies inUSA, Canada and Europe producing sexed semen commercially using license from Sexing Technology, USA. NDRDC, DoL Yusipang procures sex semen from abroad from recognized company such as World Wide Sires, USA, Cogent Genetics, UK, Viking Genetics, Denmark. Average price of sex semen is USD 18 to 23 per dose which is higher than imported normal/conventional semen.

Is sexed semen used only for heifer?

Sexed semen is recommended to be used only in heifers (especially virgin heifers) due to high fertility rate. However, it can also be used in cows up to third lactation with excellent reproduction record.