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

DoL

ANNUAL CENTRE REPORT
2021 - 2022







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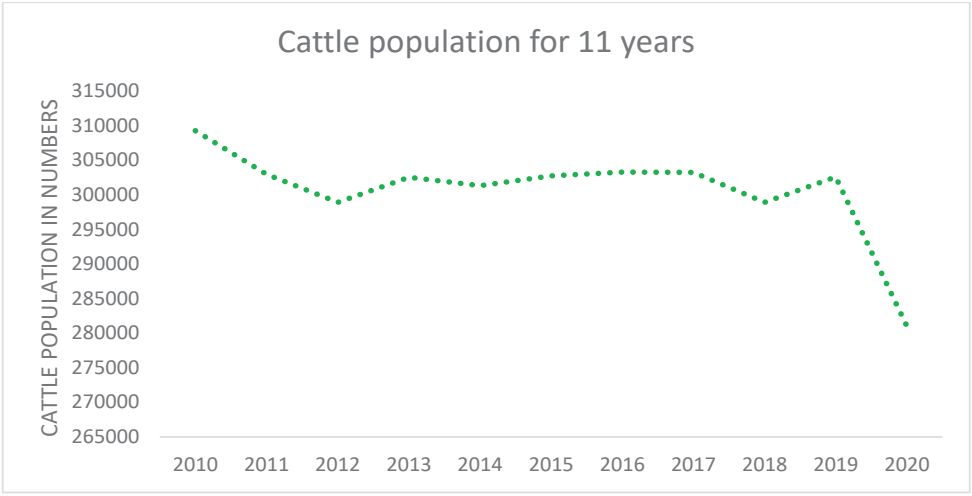
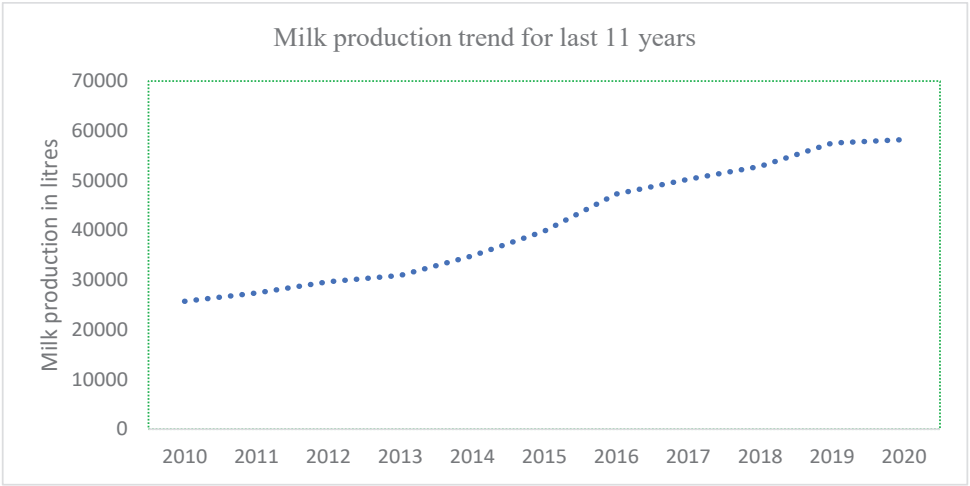
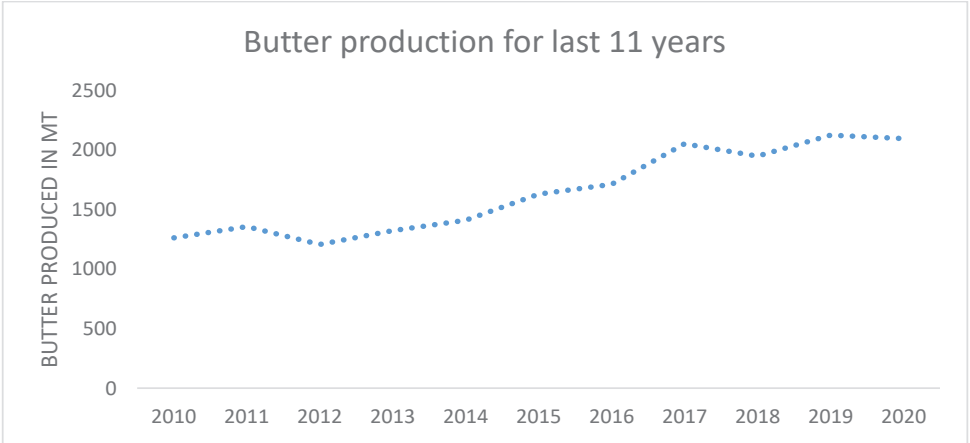

Cattle population for 11 years
CATTLE POPULATION IN NUMBERS
315000
310000
305000
300000
295000
290000
285000
280000
275000
270000
265000
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020


Milk production trend for last 11 years
Milk production in litres
70000
60000
50000
40000
30000
20000
10000
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020

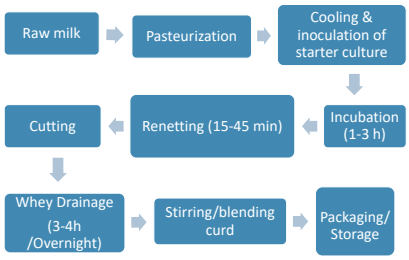

Butter production for last 11 years
BUTTER PRODUCED IN MT
2500
2000
1500
1000
500
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020

QUARG

INTRODUCTION

Quarg (or Quark) is an acid coagulated fresh unripened variety of cheese generally made from pasteurized skim milk with addition of lactic acid starter culture and small amount of rennet. Quarg can also be made from partially skim milk or whole milk. It contains high moisture content of 82%w/w and has a shelf life of 6-10 days when stored under refrigeration condition.

PRODUCTION PROCESS



APPLICATIONS/END USE

The mild flavor and smooth texture of Quarg compliments various dishes.

- Can be substituted in place of sour cream, cottage or ricotta or cream cheese
- Serves as a flavor carrier
- Can be blended with seasoning to be used as toppings or as a dip
- Used as a filling in variety of pasta dishes
- Adds viscosity to variety of products, can be blended with sauce and dressing
- Due to high moisture content can be baked cakes and brownies keeping the product moist

CHARACTERISTICS

Quarg is similar to that of yogurt and cottage cheese with the following characteristics:

- Unripened, fresh, and very smooth in texture unlike cottage cheese (distinct curd)
- Mildy acidic in flavor in comparison to yogurt
- Milky white in color or slightly yellowish
- There should not be appearance of water or whey
- No bacteriological deterioration, over acidification, or bitter flavor during storage

NUTRITIONAL BENEFITS

Quarg is of high nutritional value.

- High content of **milk protein**
  - Protein is an important building block of bones, muscles, cartilage, skin, and blood
- High content of **minerals and vitamins**
  - Mostly rich in calcium helps to keep teeth and bone healthy.
  - Vitamin A (great for eyesight) and vitamin B which helps support our nervous systems.
- Contains various **essential amino acids**
  - Vital for body functioning such protein synthesis, tissue repair and nutrient absorption
- **Gut friendly**
  - Helps in improving and maintaining a healthy gut/digestive environment.

QUALITY CONTROL

In order to maintain quality Quarg must be produced with utmost care.:

- Raw milk should be of high quality with low microbial load. Thus, ensure clean milk production at the farm level
- Ensure cold chain facility at all levels starting from the farm, at manufacturing, marketing and at retail level
- Quality control and quality assurance during manufacturing processes should be ensured (Good Manufacturing Practices and Good Hygienic Practices)

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From The Program Director's Desk

This is the 6th Annual Centre Report of NDRDC Yusipang, published to highlight progress and challenges while implementing National Dairy Research &Development Program during the fiscal year (FY) 2021-22.

Nationwide AI performance review was done for 2011 to 2021 to assess the AI performance level and same was validated by visiting AI centres in western region. Study have found that highest performance was from west central region with 43.7 percent followed by West with 33.8 percent, East with 33.1 percent and East Central region with 33 percent.

During the fiscal year, Artificial Inseminations (AI) were performed nationwide with the success rate of 43.65 percent and with female birth was recorded to 67.40 percent. Similarly, through the usage of sexed semen, the female birth was recorded to 89.6 percent and the technology have reached to 18 Dzongkhags 44 selected AI centres.

To facilitate setting of product standards, samples of local dairy products is tested to facilitate initiation of quality based milk pricing system in near future. Besides, Training of Trainers (TOT) for the extension officials yak dairy products development and dissemination standards as per Bhutan Standards (BSB) specification to extension officials. Additionally, seven BAFRA officials trained on main dairy products processing to assist them in implementing products testing and inspection.

During FY, the Centre published Annual Centre Report, three technical guidebooks/Standard Operating Procedure and contributed two scientific papers to Bhutan Journal of Animal Science Vol: 6 (issue1) to keep the momentum of research alive.

Despite challenges faced due to on- going COVID-19 crisis, NDRDC managed to deliver the required research and development services to the best of the capacity and will continue with same vigor in days ahead.

Tashi Delek!

(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 (2021-22) to high light progress made and challenges faced while implementing Dairy R&D activities during the fiscal year.

Dairy input [Liquid Nitrogen (LN_2) and Frozen Semen] production and distribution is very crucial for success of cattle breeding program in the country. During the FY, 18550 doses of frozen semen and 29073.7 liters of LN_2 was produced for distribution to Dzongkhags and Govt. farms.

To maintain the health of donor bulls and ET cows (52 heads including calves), around 3.5 acres of improved pasture established, 19 acres of existing pasture renovated, cultivated 20 acres of fodder maize and conserved 230 MT of winter fodder (silage). Technical and manpower support was also provided to Royal Soelbam Herd, Ramtokto, and Royal Chipta Farm, Taba to maintain pasture and manage farm animals.

Heifer Production Scheme applying Sexed Semen Technology was intensified, adopting a cluster village approach. During the FY a total of 1827 AI were performed using sexed semen and recorded 801 progeny born; 78 male and 723 female, leading to 90.3% female birth and AI success rate of 43.8%. The technology has now reached to 44 AI centres in 18 Dzongkhags.

A total of 120 AI centres were operational in the country and performed a total of 7612 AI and recorded 3323 progenies (1083 male & 2240 female), leading to AI success rate of 43.65% and female birth rate of 67.40%

To set local dairy products standards, over 300 samples from various locations were tested to facilitate initiation of Quality based Milk Pricing System. In efforts to modernize, keep abreast of new technological advances and leverage digital technologies, laboratory equipment such as automatic colony counter; automatic media dispenser; equipment for the rapid detection of antibiotic residues and aflatoxin M_1 in milk samples.

In capacity building front, 20 Farmers group representatives from Katsho and Samar geogs, Haa were trained on Whey based energy drinks and cereal bars in collaboration with OGOP and TICA, Thailand; 22 youths were trained on Dairy Post Production Technologies at Lamigonpa, Bumthang in collaboration with RDTC and MoLHR and trained 25 livestock personnel from different highland areas in the production of Tomme and Gumdel Cheese at Haa.

During FY, the Centre published Annual Centre Report, three Technical Manual/Guidelines and contributed two scientific papers to Bhutan Journal of Animal Science Vol: 6 (Issue 1). Similarly the Centre familiarized National Dairy Information System to Extension staff and more than 2300 animals were registered online in Chukha, Dagana, Pema Gatshel and Haa Dzongkhags.

Along with substantial physical progress made, overall financial progress made in this year was also notable. Out of Nu.34.935 M allocated to the Centre, Nu. 34.930 M was utilized, giving financial achievement of 99.98%.

1

Background

As part of the institutional strengthening strategy of the Department of Livestock, the erstwhile National Livestock Breeding Programme had been renamed as the National Dairy Development Centre (NDDC) with the 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 reorganised as the National Dairy Research and Development Centre (NDRDC) with the mandate to carry out need based action 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(Liquid Nitrogen and Frozen semen) for breed improvement. For faster genetic gain in indigenous and exotic cattle breed, research on the use of progeny tested sexed semen is popularized and embryo transfer technology is initiated.

2 Program Profile

2.1 Vision

- To be the Centre of Excellence/Knowledge Hub on dairy to ensure livelihoods security of farming communities

2.2 Mission

- Enhance productivity of dairy cattle for improved National Food and Nutrition Security
- Develop and strengthen innovative Research and Development(R&D) programs
- Provide coherent mechanisms to efficiently generate and disseminate knowledge and technologies on dairy farming

2.3 Mandates

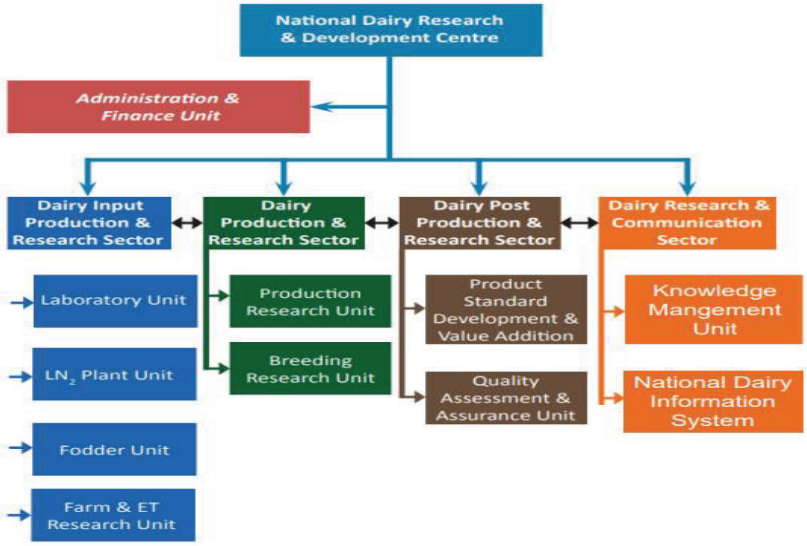
- Serve as the apex arm of department of livestock for dairy research and development in the country
- Co-ordinate and conduct need based dairy research to establish knowledge and generate technologies in support of dairy development in the country
- Meet demand for high quality specialized inputs (*frozen semen and Liquid Nitrogen*) to accelerate dairy breed improvement in the country
- Package and transfer appropriate technologies and good practices to the end users
- Conduct trainings to impart skills on specialized field of dairy breeding and management

2.4 Major functions

- Conduct need based research to trigger dairy development
- Produce or procure high quality specialized breeding inputs needed for breed improvement
- Develop Standard Operating Procedures, Good Manufacturing Practices and Better Farming Methods to enhance dairy production, dairy product development and value addition
- Manage National Dairy Information System- to captures real time data for a decision support system
- Prepare annual work plan and budget and manage performance of the center
- Create platform to coordinate and effectively implement Research and Development (R&D) activities
- Coordinate with National (NJBC/NNBC)and Regional Cattle Breeding Centers (RCBC) and other cattle farms and provide expertise to upheld technical efficiency of farms operation
- Support the Department of Livestock to formulate policies, strategies and guidelines
- Liaise with national and international agencies for technical collaboration for exchange of knowhow

3 Organizational setup

NDRDC has four sectors supported by Management & Directions Services to implement National Dairy Research & Development Program



INPUT PRODUCTION RESEARCH & DEVELOPMENT

4 Progress &Achievements

4.1 Dairy Inputs Production Research & Development Sector

4.1.1 Liquid Nitrogen (LN_2) production and distribution

The sole Liquid Nitrogen (LN_2) Plant with a production capacity reduced to 3-4 litres/hr has to meet LN_2 demand of three region (Western, West Central and East Central regions) while the LN_2 Plant at RLDC, Kanglung caters LN_2 needs of Eastern region. A total of 29073.7 litres of LN_2 was produced and 21878.9 litres was distributed to field during the FY (Table 1). The LN_2 production/distribution was disrupted due to the major break down of the water chiller unit and the Cryo Motor Unit of the LN_2 Plant. With budget support from Livestock Enterprise Development in Bhutan (GOI Project),Department of Livestock (DoL, Thimphu); the Centre could procure and install new Water Chiller Unit (Nu. 0.665 M) and Cryo Regenerator (Nu. 1.463 M) of the Cryo Motor Unit of the LN2 Plant during the FY. Further, the Centre has placed supply order to procure and install a new compact LN_2 Plant with production capacity of 5 litres/hr worth Nu.11.5 M. The Centre has placed supply order and the new mini LN_2 Plant will be installed and commissioned within August, 2022. Besides the global Covid-19 pandemic situation and frequent lockdowns in the country, the Centre managed to bring in the Service Engineer from our contract Firm (M/s ADDCool, Kolkata, India). The Service Engineers visited the Centre twice during the fiscal year. The first visit was from 5th to 22nd November, 2021 to carry out regular servicing and maintenance works. The second visit by the Service Engineers was from 21st June to 15th July, 2022 to resolve the current problems of both the LN2 Plants under our Department.

Table 1. Liquid Nitrogen produced &distributed

Sl. #	Activities	Quantity (Litres)
1	LN_2 Production	29073.7
2	LN_2 Distribution	21878.9
3	LN_2 for Semen Bank refilling	7636.9
4	LN_2 for S. Processing & freezing	3129
5	LN_2 Evaporation losses	1617.8

4.1.2 Bovine Frozen Semen processing & distribution

The Semen Processing Unit produces frozen semen from three breeds of cattle (Jersey, Mithun and Nublang) and distributes to all AI Centres in the country. During the fiscal year, a total of 18550 doses of frozen semen were produced from different donor bulls. A total of 4920 doses (26.53 % of pedigree selected semen produced)is distributed to various Dzongkhags during the FY (Table 2).

Table 2. Pedigree selected Pure Jersey Frozen Semen Produced, Distributed & Stock Balance

Species	Opening balance	Production	Distribution	Balance
Jersey	116040	14170	4800	125410
Mithun	18513	4380	20	22873
Nublang	29383	0	100	29283
Brown Swiss Cross	1772	0	0	1772
Total	165708	18550	4920	179338

The Centre could not imported any Progeny tested (PT) / Genomic selected (GS) frozen bovine semen during the fiscal year as we could not get support from non GOI projects. The details of imported frozen semen are presented in (Table 3). A total of 10042 doses (4920 pedigree selected, 4616 imported conventional semen & 506 sex sorted) were distributed to Dzongkhags and nucleus farms as per their demand.

Table 3. Detail of imported Progeny tested Bovine Frozen Semen

Species	Opening Balance	Imported	Distribution	Balance
Jersey Conventional	3565	0	3309	256
Jersey (Sex sorted)	9889	0	506	9383
Brown Swiss	243	0	100	143
Black Angus	350	0	0	350
Tropical Holstein Friesian	928	0	105	823
Holstein Friesian (Conventional)	1408	0	1102	306
Holstein Friesian (Sex sorted)	710	0	0	710
Karan Fries	300	0	0	300
Scottish Highland Cattle	97	0	0	97
Buffalo Nilli Ravi	200	0	0	200
Buffalo (Murrah)	0	0	0	0
Total	17690	0	5122	12568

4.1.3 Farm Management & Embryo Transfer (ET) Research

Animal strength in the farm

The Farm Unit maintains elite semen donor bulls and Embryo Transfer donor cows (Thrabam & Jersey cross) cattle. There are 52 animals in the farm. Out of the total animals, 16 are adult donor bulls of three breeds and 5 are young bulls and 20 are ET Donor cows (Table 5)

Table 5: Detail of cattle maintained in the farm and mortality

Cattle Type	Nos.	Cattle Type	Numbers	
Semen Donor Bulls	21	ET cow/heifer/calves	31	
Jersey pure	8	Jersey cross calves	1	
Nublang	8	Nublang calves	8	
Mithun	5	ET Donors (Thrabum)	13	ET donor cows
Brown Swiss cross	0	ET Donors (Jersey X)	7	
		Thrabum Heifer	2	

Embryo Flushing Trials

During the fiscal year, the Centre carried out 4 Embryo flushing trials in twelve (6 Thrabam and 6 Jersey cross) ET donor cows maintained at the Centre. A total of 13 embryos (5 degraded embryos, 1 two to eight cell stage embryos & 7 UFOs) were recovered. However, no viable embryos could be recovered for cryopreservation.

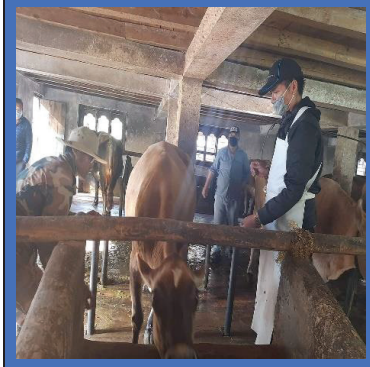
insertion of CIDRB for ovulation

Examination of ova with microscope

Vaccination and Deworming

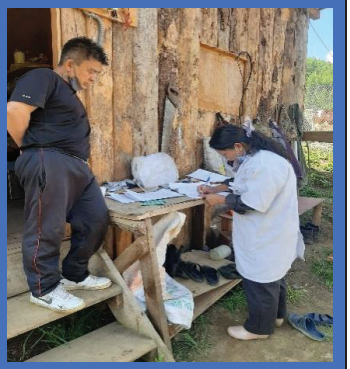
To protect the herd from diseases, economic and welfare reasons, regular and timely vaccination and deworming were carried out with 100 percent to all the elite Semen donor bulls and ET animals maintained at the Farm Unit of the Centre. Further, the Centre carried out with 100 percent for schedule vaccination and deworming of all animals maintained at Royal Soelbum herd, Ramtokto. The details of the vaccination and Deworming carried out are in appendix 10 appendix and appendix 7 and 11 for deworming respectively. Some of the glimpse of the vaccination and deworming carried out in action are produced below.

Two times faeces sample submitted to NCAH Serbithang and report received (Appendix 10). Animals dewormed according to the report



Deworming of Donor bull

Restraining & vaccination



Record keeping of activity

Medicine usage& Storage

Medicines are essential for ensuring animal welfare and preventing zoonotic diseases along with protecting our food supply. Medicines at the farm were judiciously used and indented as per the need and budget availability. FMD vaccination are done biannually while BQ vaccination done once a year. The Centre procured vaccines from NCAH and demand are placed as per the number of animals in the farm. The Centre received medicines on 6th December, 2021 and 7th May, 2022 from the Central store, Phuentsholing. There are no expired drugs at present in the Centre.

Vaccine and Medicine

Medicine segregation

Non Patent Drugs storage

Following are the major group of drugs that were used in our Centre and the usage of the drugs. Hundred percent of the vaccine brought were used for vaccinating the NDRDC Yusipang & Royal Herd, Ramtokto however with regards to drugs and vaccine usage, the detail is given in Table 6 and Table 7 and appendix 3

Table 6: Detail of medicine wastage reduced

Sl	Drugs group	Volume used	Balance	Used where	Remarks
1	Antimicrobial	80%	20%	NDRDC, Royal Herd	20% left
2	Anthelmntics	80%	20%	-do-	20% left
3	Analgesics	80%	20%	-do-	20% left
4	Antiprozoal	50%	50%	-do-	50% left
5	Hormones	60%	40%	-do-	40% left
6	Minerals &vitamins	70%	30%	-do-	30% left
7	Ectoparasite	90%	10%	-do-	10% left

Table 7. Percentage of vaccine used

Sl.	Name of vaccine	Received date	No. of doses	Remarks
1	FMD	2/8/2021	200	100% used and
2	FMD	13/04/2022	150	100% animals vaccinated
3	BQ/HS	13/04/2022	150	

Herd mortality

During the Fiscal Year in 2021-2022, there is no dead of any animals. Herd mortality percent is 0%. The average herd strength is 52 animals.

Bio-security compliance

Effective biosecurity and cleanliness go hand in hand in the Centre. The Foot baths are filled with pp solution 1% and changed three times in a week. Cleanliness of farm is maintained with attendants briefed on routine activities and critical aspects of farm bio-security. The routine activities were carried out with regular monitoring. Following activities were carried at the farm for bio-security measures at the farm:

i. The ET II shed was renovated with new flooring and maintenance of ceiling along with the light. Floor and drainage were also maintained in the needy areas of the shed. Installation of new crate was also done in ET shed II.

Floor and drainage maintained

Shed 2 renovation

AI Crate

ii. The ***foot bath*** was constructed in front of each animal shed and the attendants were advised to fill with disinfectants to change the solution three times a week with 1 percent pp solution.

Foot deep at the entrance

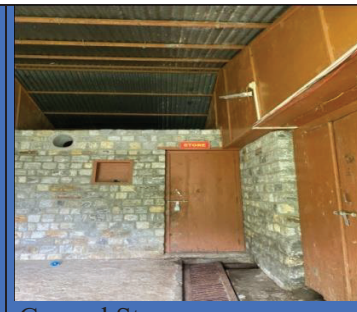
Foot deep at the entrance

Foot deep with PP solution

iii. ***Sign boards*** with labeling both in Dzongkha and English was put up for the medicine and feed store and a general store for the sheds.

Feed Store

Medicine Store



General Stores

iv. ***Manure pit*** for each animal sheds were widened and deepened for proper management of manure. The dung are put in pit and covered for decomposition and application in pasture field.

4.1.4 Pasture Development Section

Pasture Section besides managing pasture development activities at NDRDC, also provides technical support and man power to carry out the pasture related activities to Royal Soelbam Herd at Ramtokto and Royal Chipta Farm at Taba. The detail is elaborated and given in table 8.

Table 8: Detail of pasture development and fodder conservation

Sl#	Unit	New pasture estd. (acres)	Existing pasture renovated (acres)	Conserved winter fodder (metric tons)	Cultivation of fodder maize (acre)
1	NDRDC, Yusipang	3.5	12	135	8
2	Royal Soelbam Ramtokto	0	4	85	12
3	Royal Chipta farm Taba	0	3	10	0
Total:		**3.5**	**19**	**230**	**20**

Pasture Development, Renovation and Fodder Conservation on station

The Pasture Section has renovated around 12 acres of existing pasture, established 3.5 acres of improved temperate pasture, and cultivated 8 acres of fodder maize and conserved around 135 MT of winter fodder in the form of hay & silage. Further, 25 acres of existing pasture field has been irrigated through surface irrigation and manure 40 acres of pasture field by FYM compost. The mandate of Pasture section 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 Chipta Farm, Taba

Likewise, the similar activities has been carry out at Royal Chipta farm Taba, during the year 2021-22, 3 acres of existing pasture was renovated and 18 acrages of previously established improved pasture has been top dress with chemical fertilizer and spreading FYM compost. Further, the winter fodder conservation also initiated to feed the Chipta during the lean season and conserved around 10 MT of hay.

Activities at Royal Soelbam Herd, Ramtokto.

The Pasture Section also provides technical support, farming machineries and man power to Royal Soelbam herd at Ramtokto, to carry out the pasture/fodder development activities as and when require. The seasonal activities like- new pasture development, existing pasture renovation, fodder conservation and winter oats cultivation has to be carry out as per the herd's strength/requirement. During the year 2021-22, around 4 acres of existing pasture has been renovated, cultivated around 12 acres of fodder maize and 3 acres of winter oats and conserved around 85 MT of winter fodder in the form of maize silage to supplement with others forages.

Overall 250 MT of silages prepared; 230 MT of grass silage and 20 MT of maize silage.

Process of winter fodder conservation

		
Improved established pasture	Pasture harvesting	Fodder maize harvesting
		
Transporting of pasture	Compact silage preparation	covering silage by plastic sheet

DAIRY PRODUCTION RESEARCH & DEVELOPMENT

4.2 Dairy Production Research and Development Sector

4.2.1 Dairy Breeding Research

Sexed Semen Technology popularization

APPLICATION OF SEXED SEMEN TECHNOLOGY FOR HEIFER PRODUCTION

The sexed semen was imported and conducted field trial from August 2014 to March 2018. The trial resulted in AI success rate of 44.4%, with female birth assurance of 89.6% (Rai et al., 2019). With the promising result obtained during the trial, the **"Heifer Production Scheme"** was initiated through application of sexed semen technology in 12th FYP. The technology was officially launched on 3rd July 2020 by the Hon'ble Minister, MoAF.

During the FY 2021-22, a total of **2005 AI** were performed using sexed semen and recorded **876 progeny born** (**Table 9**)**;** 91 male and 785 female, leading to **89.6% female birth**. The AI success rate recorded was **43.7%**, which could be attributed to supply of sexed semen in best performing AI centres manned by fluent AI technicians and proper follow-up on progeny born after AI and as reported by the farmers.

Table 9: AI and Progeny born from Sexed semen during the year 2021-22

Region	Dzongkhag	Total AI	Progeny			AI success rate (%)
			Male	Female	Total	
West	Thimphu	102	8	41	49	48.0
	Paro	19	0	5	5	26.3
	Ha	61	7	34	41	67.2
	Chukha	77	3	49	52	67.5
	Samtse	26	1	15	16	61.5
	Sub-total	***285***	***19***	***144***	***163***	***57.2***
West-Central	Punakha	64	3	18	21	32.8
	Wangdue	8	0	2	2	25.0
	Tsirang	271	5	124	129	47.6
	Dagana	47	4	18	22	46.8
	Sub-total	***390***	***12***	***162***	***174***	***152.2***
East-Central	Bumthang	52	1	7	8	15.4
	Trongsa	26	0	17	17	65.4
	Zemgang	58	0	7	7	12.1
	Sub-total	***136***	***1***	***31***	***32***	***23.5***
East	Lhuentshe	77	2	19	21	27.3
	Mongar	232	12	76	88	37.9
	T/yangtshe	75	3	14	17	22.7
	Trashigang	231	8	108	116	50.2
	Pemagatshel	342	16	137	153	44.7
	S/jongkhar	237	18	94	112	47.3
	Sub-total	***1194***	***59***	***448***	***507***	***42.5***
	Total	**2005**	**91**	**785**	**876**	**43.7**

As of June 2022, the technology was reached to 53 AI centres in 18 Dzongkhags Annexure 6. It has been planned to reach the Scheme in all 20 Dzongkhags covering 72 AI centres among CHBPPs/ DFGs by end of 12 FYP, considering breedable Jersey and HF heifers' population as well as efficiency of AI centres.

AI performance and Progeny record

In the year 2021-22, a total of 120 AI centres were operational in the country. During the FY, a total of 7612 AI were performed and recorded 3323 progenies (1083 male and 2240 female), leading to AI success rate of 43.65% (Table 10). The birth of male progenies is 32.59% and that of female is 67.40%, which could be attributed to use of sexed semen (F) in 44 AI centres. The detail of the study is reflected is appendix 2 and 7.

Table 10: Summary of AI performance (July 2021 - June 2022)

Region	Dzongkhag	AI performed	Progeny recorded			Success rate (%)
			Male	Female	Total	
Western	Thimphu	428	34	96	130	30.4
	Paro	590	130	151	281	47.6
	Had	134	15	42	57	42.5
	Chukha	372	64	150	214	57.5
	Samtse	252	49	74	123	48.8
	Sub-total	1776	292	513	805	45.3
West Central	Gasa	55	19	15	34	61.8
	Punakha	734	105	169	274	37.3
	Wangdue	161	32	51	83	51.6
	Tsirang	801	104	298	402	50.2
	Dagana	280	38	70	108	38.6
	Sub-total	2031	298	603	901	44.4
East Central	Bumthang	419	81	109	190	45.4
	Trongsa	221	32	62	94	42.5
	Zhemgang	149	35	50	85	57.1
	Sarpang	144	17	26	43	29.9
	Sub-total	933	165	247	412	44.2
Eastern	Lhuntshe	139	12	31	43	30.9
	Monggar	733	89	162	251	34.2
	Trashiyangtshe	167	14	34	48	28.7
	Trashigang	647	113	286	399	61.7
	Pemagatshel	783	66	248	314	40.1
	Samdrupjongkhar	403	34	116	150	37.2
	Sub-total	2872	328	877	1205	42.0
	Total	7612	1083	2240	3323	43.65

Cumulative AI performed as of June 2022 (from 1987) is 197882 (190272+7612) and progeny born recorded is 64918 (61595 +3323).

REVIEW OF NATIONAL AI PERFORMANCE FOR LAST 10 YEARS AND ANNUAL AI PERFORMANCE ANALYSIS

Review report circulated to stakeholders vide NDRDC/TEC-43/2021-22/542, dated 29/06/2022;

Summary

The national Artificial Insemination (AI) performances in the country was reviewed for a period of ten years from 2011-12 till 2020-21, with the objectives to assess the AI performance trend at different levels, and make recommendations for enhancing AI coverage and efficiency. The AI data compiled at NDRDC, Yusipang were analyzed for the review and same was validated by visiting AI centres (AIC) in Western region.

The review revealed that the average AI coverage during the period was low vis-à-vis overall breedable cattle population (BCP). AI coverage in total BCP, BCP in AI areas and BCP accessible to AI facilities was 8.9%, 11.6% and 35% respectively. Among the BCP accessible to AI facility, the maximum AI coverage was found in west-central region with 43.7%, followed by west, east and east-central region with 33.8%, 33.1% and 33% respectively. A total of 83,357 AI were performed and 30,172 progenies were recorded in ten years, leading to average AI success rate (AISR) of 36.1% as national average. Similarly, the average AI performed was 74AI/center/year as national average. At regional level, the average AI done in west, west-central, east-central and east region was 64, 68, 79 and 75 AI/Centre/year respectively. Similarly, the average annual AISR achieved in west, west-central, east-central and east region was 37.2%, 36.8%, 36.3% and 34.5% respectively. At Dzongkhag level, three Dzongkhags; Tsirang, Bumthang and Mongar, had achieved the national average AI and AISR. Among 130 operational AICs, only 21.2% of AICs had achieved both the national averages.

The low performance in terms of AI done was attributed to poor awareness on benefit of AI to the public, lack of mobile AI facility, inadequate monitoring of AICs performances and mating of cattle accessible to AI facility by free roaming uncertified/ scrub bulls among others. Similarly, the poor AISR was attributed to poor follow-up on progeny born after AI. Nevertheless, the supply of sexed semen in best performing AICs had recorded increase in no of AI done as well as AISR. Accordingly, a set of recommendations were furnished for compliance by the stakeholders in view of enhancing AI service delivery and efficiency.

IMPLEMENTATION OF PROGENY TESTING SCHEME USING TROPICAL THAI HOLSTEIN-FRIESIAN SEMEN IN TSIRANG AND SAMTSE DZONGKHAG

Review report circulated to stakeholders vide NDRDC/TECH-43/2021-22/304, dated 18/02/2022

The Progeny Testing Scheme (PTS) in Bhutan was initiated in 2017 using tropical Thai Hostein-Friesian (THF) Semen in Samtse and Tsirang Dzongkhags. Three geogs were selected; Tading in Samtse and Barshong and Sergithang in Tsirang, and categorized into three agro-ecological zones (AEZ) according to altitude, temperature and rainfall. A total of 568 animals were selected and identified initially from the areas. The THF semen of four sire-lines was distributed equally in all PTS areas. The Scheme was implemented in phase-wise manner, inseminating the selected animals in induced heat (1st & 2nd phases) and in natural heat by the Community AI Technicians (CAITs) later.

During the financial year, the review of PTS implementation was undertaken only in Tsirang Dzongkhag owing to hindrances posed by COVID-19 pandemic situation (Appendix 1). However, overall report from all PTS areas were compiled and presented here under.

A total of 868 AI were performed and recorded birth of 239 progenies; 116 males and 123 females (Table 11).The overall AI success rate (AISR) obtained was 27.5% in the PTS areas. The AI success rate obtained from insemination in induced heat was 18.1% (n=431), whereas in natural heat it was and 36.8% (n=437).

Table 11 Progeny born and AI success rate under Progeny Testing Scheme using Tropical Thai Holstein-Friesian Semen

PTS area	**AI in induced heat (1st + 2nd Phase)**					**AI in natural heat**					**Grand total (Induced + Natural)**				
	Total AI	Progeny born			AISR (%)	Total AI	Progeny born			AISR (%)	Total AI	Progeny born			AISR (%)
		M	F	Total			M	F	Total			M	F	Total	
Barsong-Tsirang	138	19	12	31	22.5	109	24	30	54	49.5	247	43	42	85	34.4
Sergithang-Tsirang	93	10	7	17	18.3	129	32	35	67	51.9	222	42	42	84	37.8
Tading-Samtse	200	11	19	30	15.0	199	20	20	40	20.1	399	31	39	70	17.5
Total	431	40	38	78	18.1	437	76	85	161	36.8	868	116	123	239	27.5

The uptake of PTS was recorded very poor despite of training and deployment of CAITs. The AI services provided by the CAITs were disrupted due to non-remuneration by the beneficiaries and shortage of LN_2 owing to frequent breakdown of LN_2 plant at Yusipang. Hence, there is a need to establish LN_2 plants in each RLDCs with replacement of old LN_2 plants, and devise a mechanism to incentivize the CAITs for overall success of AI program in the country.

REPRODUCTIVE WASTE MANAGEMENT IN CATTLE

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; embryonic mortality, cystic ovaries, persistent CL or non-development of follicles on ovaries, etc. leading to repeat breeding, irregular heat or no heat signs at all.

During the financial year 2021-22, the Reproduction experts from NDRDC, Yusipang attended animals presented with infertility cases but commonly confronted with reproductive disorders. A total of 55 animals were actually presented for examination; pregnancy diagnosis as well as infertility, and treatment (Table 12). The animals were treated against infertility or reproductive disorders employing hormonal drugs such as GnRH and/ PGF2α depending on the ovarian status of the animal upon per-rectal examination. The success of such interventions is determined by the diagnostic precision of reproductive status by the examining veterinarian and health status of the animal.

Table 12. Animals presented for gynecological investigation, treatment of infertility and AI

Dzongkhag	Geog/ Area	Animal Examined	Treated for Disorders/ estrus synchronized	Responded to treatment And AI done
Wangdue	Gangtey	15	10	8
Tsirang	Barshong	11	10	8
Thimphu	Mewang	30	13	12
Dagana	Tashiding	25	20	16
Total		**55**	**33**	**44**

Overall, 83% of animals that were treated for reproductive disorders/ estrus synchronized had responded to treatment/ synchronization and AI done subsequently, which concludes that the diagnosis and treatment measures adopted were very effective.

DAIRY POST-PRODUCTION RESEARCH & DEVELOPMENT

4.3 Dairy Post–Production Research Sector

4.3.1 Product Standard Development and Value Addition Unit

The personnel from the DPPR sector attended virtual Training of Trainers for Whey based energy drinks and cereal bars organized by the OGOP in collaboration with TICA, Thailand. The sector personnel were then involved in the training of 20 farmers group representatives from Katsho and Samar geogs, Haa on the same subject.

A total of 22 youths comprising of university graduates and out of school youths entering the labor market were trained on Dairy Post Production technologies at Lamigonpa, Bumthang. The training was organized by the Rural Development Training Centre, Zhemgang in collaboration with the Ministry of Labor and Human Resources with the DPPR sector personnel serving as resource persons for the training. The training involved both theoretical and hands on practical demonstration of dairy post production technologies including the manufacture of yogurt and mozzarella cheese.

The Department of Livestock for the EU Bhutan Trade Support Project, funded by the European Union organized a Master Trainers capacity development and Training of Trainers on Yak Cheese Product Diversification at SoiYaksa, Paro. A total of 5 Master Trainers including personnel from the NDRDC and 13 yak herders were trained in the manufacture of Tomme and Gumdel Cheese by a consultant recruited by the project. Following the on-site training at SoiYaksa, the Master Trainers and the consultant further trained a total of 25 livestock personnel from different highland areas in the production of cheese at Haa.

To ensure construction of dairy infrastructure in compliance with Good Manufacturing Practices and Good Hygiene Practices, the DPPR sector developed the "Guidelines for Establishment of Dairy Infrastructure" to serve as a guide for the construction requirements of various dairy infrastructure in the Dzongkhags. As an extension training material for application in the field developed 2 posters

Personnel of the DPPR sector was also involved as committee member for the Bhutan Standards Bureau, TC 02 Food and Agriculture Technical Committee for the development of Bhutan Standards for food and agriculture products.

Furthermore, personnel of the DPPR sector was also involved as Trainer and Counselor (TcCs) for EU Bhutan Trade Support Project to support assigned SMEs (Laykha Dairy Delights and OGOP) in implementing the requirements of Codex Food Hygiene. The TcCs was involved in facilitating the assigned SMEs in the drafting and development of HACCP plan and other related documents.
As part of the project activities, the TcCs attended:

1. Workshop on understanding Codex HACCP principles and requirements for implementation in ginger/turmeric, mushroom and yak dairy product manufacturing/processing from 3-5, November 2021 at Paro.
2. Training workshop on understanding and implementing requirement of ISO 22000:2018 from 1-4 June, 2022 at Paro.
3. Virtually attended a half day workshop on facing the Audit on 16th June, 2022.

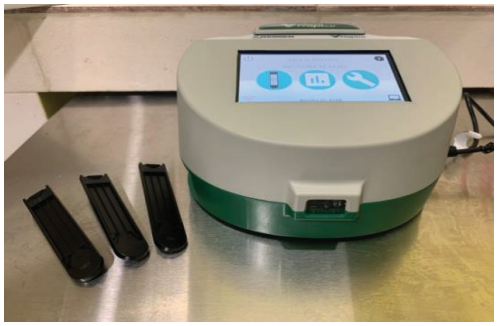
In addition, the TcCs assisted the assigned SMEs in the development of Food safety management system manual (FSMS) and simultaneously conducted internal audit verification of the SMEs to identify non conformities before external audit. Also accompanied the international consultant to the SMEs for internal audit by the international consultant (IC) and discussed the IC's observation with the Management of the respective SMEs.

The sector conducted monitoring of the Tashiding Dairy Group, Dagana and Balamna Milk Processing Unit at Haa, Samar Geog, to assess the overall functionality of the MPUs in terms of Good Manufacturing Practices and plant hygiene. The monitoring and evaluation report inclusive of the findings and recommendations have been submitted to the Dzongkhag Livestock Office.

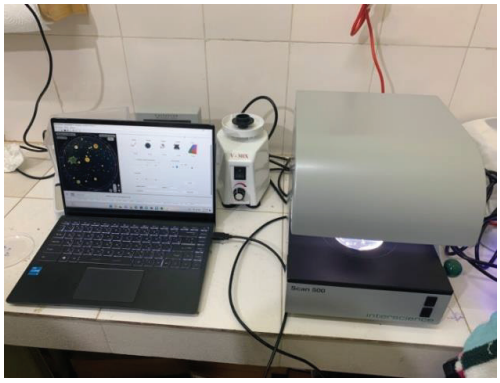
4.3.2 Quality Assessment and Assurance Unit

a) Technological advances

In efforts to modernize, keep abreast of new technological advances and leverage digital technologies, the DPPR sector through fund support from the GoI Livestock Enterprise Development in Bhutan procured laboratory equipment and consumables for use in the DPPR sector laboratory.



The Sector procured an automatic colony counter for the enumeration and identification of spoilage and pathogenic microorganisms in milk and milk products. The use of the equipment reduces human errors in the enumeration and identification of microbes while accelerating the time required in assessing the microbial loads in samples analyzed by laboratory personnel. The equipment also enables the user to leverage digital technology through the installation of software for rapid storage and analysis of data.



To accelerate the time involved in preparation of media for microbial analysis the sector procured an automatic media dispenser for serial dilutions and filling of plate media. The equipment enables the user to program the required quantity of media to be dispensed thereby reducing human error in serial dilutions dispensed for microbial cultures as well as dispensing of accurate quantity of media required for petri plates. The use of the equipment is expected to enhance the accuracy of results in microbial analysis as well as ensuring higher repeatability in samples analyzed.

To enhance the scope of activities at the dairy laboratory and introduce new intervention for the development of the dairy sector in the country, the DPPR sector procured equipment for the rapid detection of antibiotic residues and aflatoxin M_1 in raw and commingled milk samples.

The antibiotic residue detection kit is designed for the detection of beta-lactam, tetracycline, streptomycin and chloramphenicol antibiotics while the aflatoxin kit is for the quantitative analysis or simple screening of aflatoxin M1 in milk and dairy products.

Furthermore, the sector procured high quality autoclave for sterilization of sample media, incubation oven for incubation of microbial plates and other laboratory equipment and consumables for microbial and chemical analysis of milk and milk products.

The sector is in process of conducting research on the microbial and compositional quality of milk in Thimphu Dzongkhag with the aim to introduce intervention measures to improve milk quality and introduce a quality based milk payment system. The introduction a quality based milk payment system is deemed necessary as the current pricing of raw milk does not consider any quality factors (composition or microbial) for the payment and is based entirely on the volume of milk supplied irrespective of milk quality. This system does not incentivize producers to enhance or improve the quality of milk supplied and leads to the stagnation of milk quality improvement and supply of poor quality milk.

b) Sample collection and testing

A total of 300 milk samples were collected from dairy farmers groups in Namseling, Kasadrupchu, Bjimina, Tshuluna, Begena and Yusipang for analysis of the Standard Plate Count, Somatic Cell Count and milk composition along the entire supply chain. The results analyzed from the findings will serve to identify priority intervention areas for improvement of milk quality as well as for the institution of a quality based milk payment system.

As part of ongoing research into the microbial and moisture analysis of local butter and datshi, samples were collected from Dagana and Gasa Dzongkhag and submitted to National Food Testing Laboratory, BARFA, Yusipang for analysis.

Furthermore, raw milk samples from Tsirang and Dagana were analyzed for research on compositional analysis of raw milk. The Compositional analysis of raw milk was assessed using Lactoscan Milk Analyzer and the mean results are presented below in Table 13

Table 13 Compositional analysis of raw milk report from Tsirang & Dagana

Parameters	Tsirang Dzongkhag	Dagana Dzongkhag
Fat (%)	4.15	4.38
SNF (%)	8.10	8.18
Density	26.86	27.21
Protein (%)	2.96	2.99
Lactose (%)	4.49	4.51
Added Water (%)	2.46	2.62
Freezing Point (-)	0.521	0.527
Salt/Minerals (%)	0.67	1.22
Temperature (°C)	30.5	34.0

Director's visit to the Centre


DAIRY RESEARCH COMMUNICATION

4.4 Dairy Research Communication Sector

4.4.1 Knowledge Management Unit

a) **Research Proposal approved by DoL**

Two research proposals were endorsed by the LTAC and the details is given Appendix 8 page number 71. The detail are as follow

i) Effectiveness of services delivery by Community Artificial Insemination Technician for breed improvement and employment generation

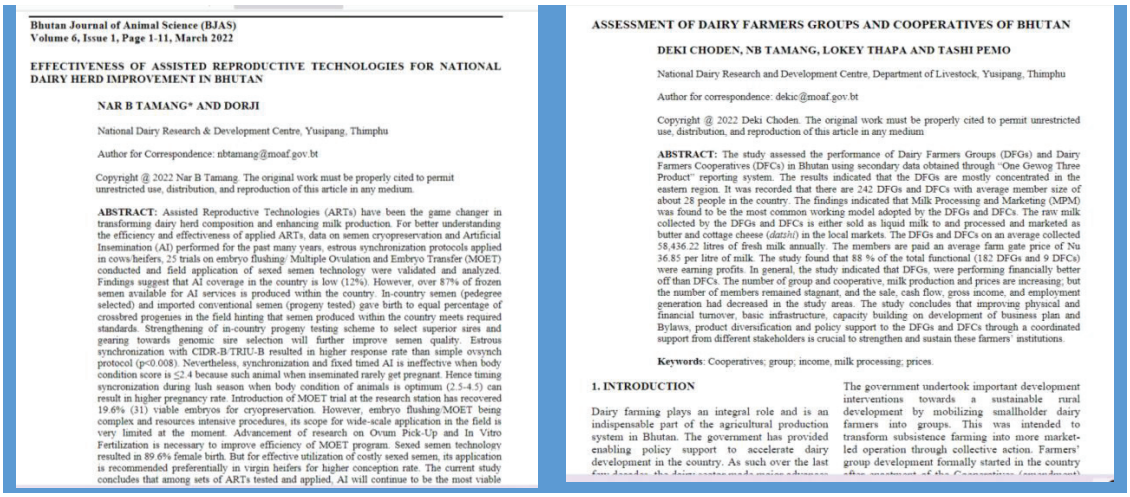
ii) Gender engagement in Dairy Farming in Bhutan

b) Research conducted/ papers published in Bhutan Journal of Animal Science Vol. 6, Issue

Two research papers were published in this Fiscal Year is contributed by NDRDC to Bhutan Journal of Animal Science and the abstract of the same is reproduced below. The papers published in 2021 are:

i) Effectiveness of Assisted Reproductive Technologies for National Dairy Herd Improvement in Bhutan

ii) Assessment of Performance, Trends and Issues of Dairy Farmers Groups and Cooperatives of Bhutan



Bhutan Journal of Animal Science (BJAS)
Volume 6, Issue 1, Page 1-11, March 2022

EFFECTIVENESS OF ASSISTED REPRODUCTIVE TECHNOLOGIES FOR NATIONAL DAIRY HERD IMPROVEMENT IN BHUTAN

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ABSTRACT: Assisted Reproductive Technologies (ARTs) have been the game changer in transforming dairy herd composition and enhancing milk production. For better understanding the efficiency and effectiveness of applied ARTs, data on semen cryopreservation and Artificial Insemination (AI) performed for the past many years, estrous synchronization protocols applied in cows/heifers, 25 trials on embryo flushing/ Multiple Ovulation and Embryo Transfer (MOET) conducted and field application of sexed semen technology were validated and analyzed. Findings suggest that AI coverage in the country is low (12%). However, over 87% of frozen semen available for AI services is produced within the country. In-country semen (pedegree selected) and imported conventional semen (progeny tested) gave birth to equal percentage of crossbred progenies in the field hinting that semen produced within the country meets required standards. Strengthening of in-country progeny testing scheme to select superior sires and gearing towards genomic sire selection will further improve semen quality. Estrous synchronization with CIDR-B/TRIU-B resulted in higher response rate than simple ovsynch protocol ($p<0.008$). Nevertheless, synchronization and fixed timed AI is ineffective when body condition score is ≤2.4 because such animal when inseminated rarely get pregnant. Hence timing syncronization during lush season when body condition of animals is optimum (2.5-4.5) can result in higher pregnancy rate. Introduction of MOET trial at the research station has recovered 19.6% (31) viable embryos for cryopreservation. However, embryo flushing/MOET being complex and resources intensive procedures, its scope for wide-scale application in the field is very limited at the moment. Advancement of research on Ovum Pick-Up and In Vitro Fertilization is necessary to improve efficiency of MOET program. Sexed semen technology resulted in 89.6% female birth. But for effective utilization of costly sexed semen, its application is recommended preferentially in virgin heifers for higher conception rate. The current study concludes that among sets of ARTs tested and applied, AI will continue to be the most viable

ASSESSMENT OF DAIRY FARMERS GROUPS AND COOPERATIVES OF BHUTAN

DEKI CHODEN, NB TAMANG, LOKEY THAPA AND TASHI PEMO

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ABSTRACT: The study assessed the performance of Dairy Farmers Groups (DFGs) and Dairy Farmers Cooperatives (DFCs) in Bhutan using secondary data obtained through "One Gewog Three Product" reporting system. The results indicated that the DFGs are mostly concentrated in the eastern region. It was recorded that there are 242 DFGs and DFCs with average member size of about 28 people in the country. The findings indicated that Milk Processing and Marketing (MPM) was found to be the most common working model adopted by the DFGs and DFCs. The raw milk collected by the DFGs and DFCs is either sold as liquid milk to and processed and marketed as butter and cottage cheese (*datshi*) in the local markets. The DFGs and DFCs on an average collected 58,436.22 litres of fresh milk annually. The members are paid an average farm gate price of Nu 36.85 per litre of milk. The study found that 88 % of the total functional (182 DFGs and 9 DFCs) were earning profits. In general, the study indicated that DFGs, were performing financially better off than DFCs. The number of group and cooperative, milk production and prices are increasing; but the number of members remained stagnant, and the sale, cash flow, gross income, and employment generation had decreased in the study areas. The study concludes that improving physical and financial turnover, basic infrastructure, capacity building on development of business plan and Bylaws, product diversification and policy support to the DFGs and DFCs through a coordinated support from different stakeholders is crucial to strengthen and sustain these farmers' institutions.

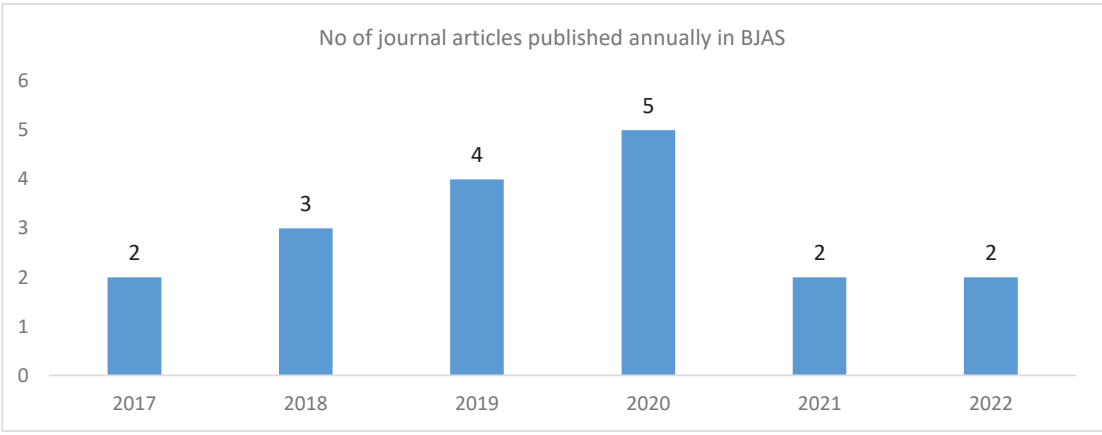
Keywords: Cooperatives; group; income, milk processing; prices.

1. INTRODUCTION

Dairy farming plays an integral role and is an indispensable part of the agricultural production system in Bhutan. The government has provided enabling policy support to accelerate dairy development in the country. As such over the last

The government undertook important development interventions towards a sustainable rural development by mobilizing smallholder dairy farmers into groups. This was intended to transform subsistence farming into more market-led operation through collective action. Farmers' group development formally started in the country

Number of dairy journal article published annually by the Centre.

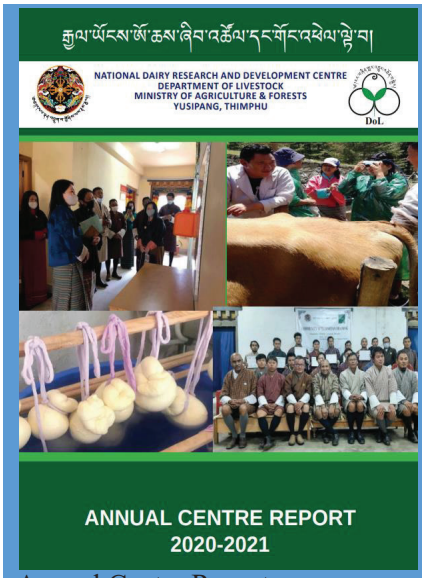


c) Publication of booklets, reports and guidelines

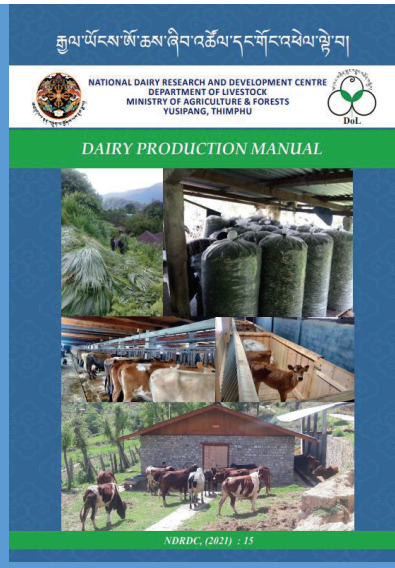
The Centre prepared and published five booklets during the fiscal year. The published booklets are as follow and the cover page of each displayed below.

i) Annual Centre Report for 2020 – 2021
ii) Cost of Production for Dairy Products
iii) Guidelines for Establishments of Dairy Infrastructure
iv) Package of Good Practices and Recommendation for published research
v) Standard operating Procedures of the Dairy Products

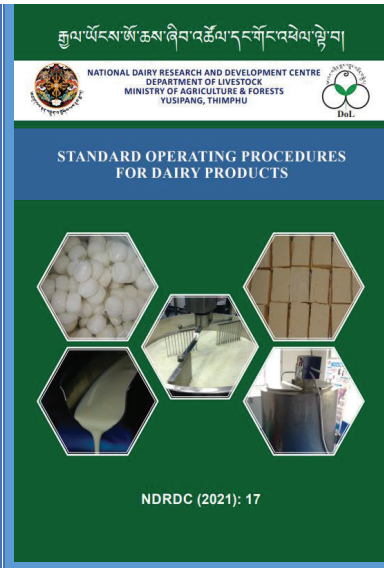
Publication of Reports, Standard operating Procedures, Guidelines and cost of production



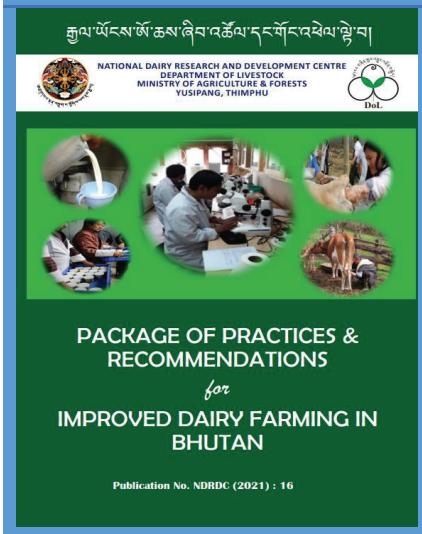
Annual Centre Report



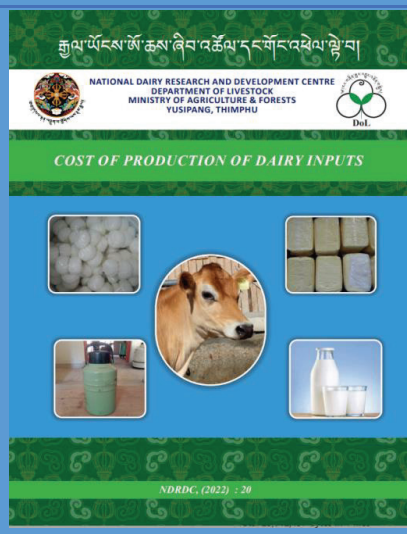
Dairy Production Manual



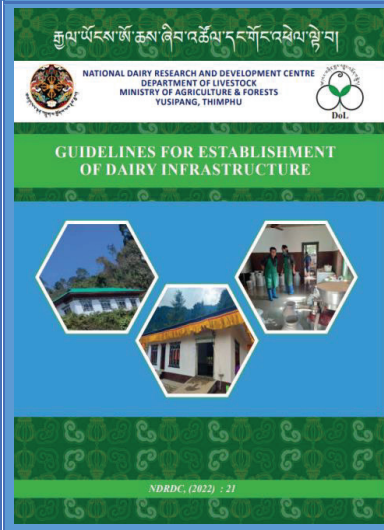
SoP for Dairy Products



Packages of Practices & Recommendations



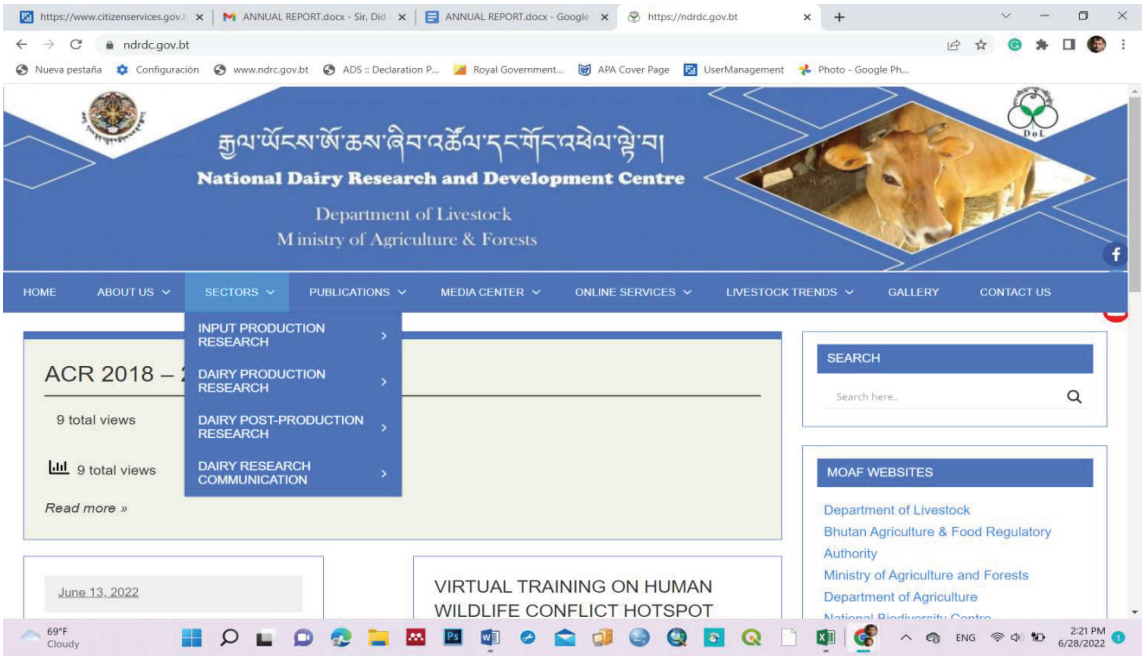
Cost of production for Dairy products



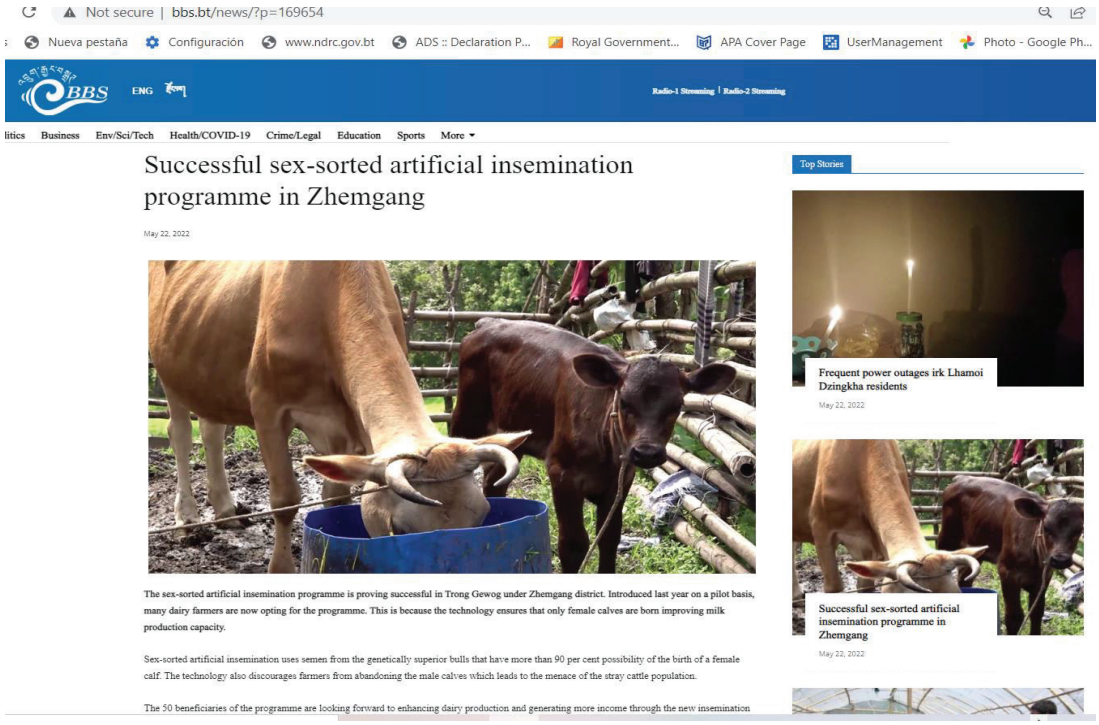
Guidelines for establishment of Dairy infrastructure

Website enhanced

NDRDC website was designed in 2017 with domain name www.ndrc.gov.bt and was hosted outside the country. It was working smoothly till May 2021. After than the website stopped working and was dormant. With the technical assistance from the Information and Communication Technology Division, the website was redesigned and enhanced. The website is now hosted at the server of the ICTD, MoAF. The new domain is now www.ndrdc.gov.bt and is functional now.



Paper published in social media



RNR NEWSLETTER

A bimonthly publication of the Ministry of Agriculture & Forests

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Agriculture interventions picking -up in the far-flung hamlet

Page 4

The Ministry's Week

Page 6

Dairy farmers' groups and cooperatives and its working modalities

Deki Choden, National Dairy Research and Development Centre, Yusipang

The development of Dairy Farmers' Group (DFG) in the country started in the early nineties by the Highland Livestock Development (HLDP) project. After the first ever group (known as Deothang Milk Collection Society) established in 1993 successfully functioning, many groups came into existence. The farmers' groups and cooperatives formation gained momentum from 2010 after enactment of Cooperative Act (amendment) of Bhutan 2009 and institution of Department of Agricultural Marketing and Cooperative (DAMC). As of June, 2020 there were 242 dairy groups and cooperatives (Figure 1).

4.4.2 National Dairy Information System

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 supported with 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 web based NDIS is working fine is accessible online in areas where there is good mobile network. It enables data entry at Geog level by Geog extension offices and government farms. The report are produced for Geog, Dzongkhags, Regional and at National levels.. 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 has three modules as follow:

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

However, in remote area where net and mobile connectivity is poor online accessibility is difficult, which has to be done offline manually and later uploaded when network is good.

TRAINING ON EXPANSION OF CONTRACT HEIFER & BULL PRODUCTION PROGRAM (CHBPP) & INITIATION OF WEB-BASED NATIONAL DAIRY INFORMATION SYSTEM (NDIS) IN CHUKHA & DAGANA DZONGKHAGS

Introduction

The Regional Livestock Development Centre, Wangdue in close collaboration with National Dairy Research & Development Centre (NDRDC, Yusipang) and Dzongkhag Livestock Sector (Dagana) conduct CHBPP farmers training to Dairy Farmers Group members to create awareness of on expansion of Contract Heifer & Bull Production Program (CHBPP) on 27th & 28th May, 2022 at the GYT Conference hall, Tshendagang Gewog, Dagana Dzongkhag. Power point presentation, discussion and question answer session were carried out among the resource persons and members. Question answer session made it very lively with lots of doubts raised with regards to new dairy farming technology as the members have long experience on dairy farming.

Familiarization and implementation of National Dairy Information System (NDIS) was also explained to the participants its advantage on data retrieval and data entry using online mobile Apps. A total of 77 interested Dairy Farmers Group members from four Geogs attended the training program. The field program for CHBPP expansion and ear tagging in four geogs was carried from 29th May to 9th June 2022. The potential farmers having potential heifer / bull mothers based purely on the phenotypic characteristic of the animals, interest of the farmers and other conditions were applied to select the farmers for the CHBPP. A total of 471 numbers of animals were ear tagged and record updated in the NDIS database.

A Total of 471 animals were registered of which more than 99 percent were female. Three male animals registered were the breeding bulls which are used in the respective Geogs. The details of the animals registered are given in Table 14.

Table14. Animal ear tagged under NDIS database from 4 Geogs, Dagana Dzongkhag

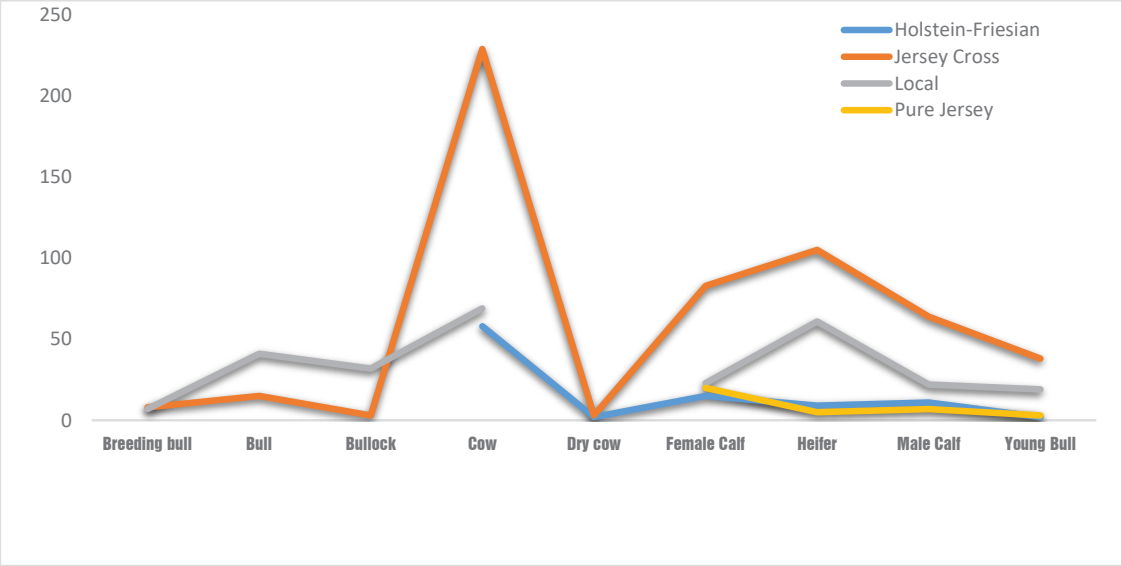
Geog	Cow	Heifer	Female calf	Breeding bull	Total	No of CHBPP
Geserling	50	10	22	0	82	53
Goshi	72	25	23	1	121	76
Tashiding	95	34	17	0	146	69
Tshendagang	75	24	21	2	122	67
Total	**290**	**92**	**83**	**3**	**471**	**265**

Similarly the ear tagging and CHBPP expansion program was carried out in Sampheling Geog from 15th May to 30 May 2022 and approximately 1000 numbers of animals were registered. The detail of the animals by different category is included herewith in table 15.

Table 15: Detail of animal registered under Sampheling Geog, Chukha Dzongkhag

Category	Holstein-Friesian	Jersey Cross	Local	Pure Jersey	Total
Breeding bull	0	8	7		15
Bull	1	15	42	1	57
Bullock	0	3	32		35
Cow	58	229	69	36	391
Dry cow	2	3			5
Female Calf	15	83	23	20	141
Heifer	9	105	60	5	178
Male Calf	11	64	22	7	101
Young Bull	2	38	19	3	62
Grand Total	98	549	244	72	991

Graph showing different category is cattle ear tagged and data entered in NDIS.



Animal Ear Tag number issuance

During the Fiscal year more than 3000 tags were printed or empty ear tag distributed to Dzongkhags and Government farms as per their requirement to implement National Cattle Identification System (NCIS) via ear tagging and recording (Table16). The laser printing machine broke down and still under repair, hence the numbers were manually written on plastic ear tags.

Table16: Detail of ear tag issued to different Dzongkhags and Farms

Dzongkhag	Geog	Tag No from	Tag No to	Total (nos)	Date of issue
Bumthang	Brown Swiss farm	101899999	101900099	100	02/09/2021
SamdrupJongkhar	BLDC, Samrang	1109900061	1109900161	100	03/09/2021
Zhemgang	Trong	2008001001	2008002001	100	5/9/2021
Trashigang	RLDC, Kanglung	empty tags		800	3/9/2021
Tashiyangphu	Khaling	15016150	15016190	40	7/10/2021
Dagana	Drujegang	302003001	302003100	100	7/10/21
Dagana	Trashiding	311011001	311011100	100	7/10/2021
Tsirang	Barshong	1801001001	1801001125	125	7/10/2021
Tsirang	Sergithang	1810005001	1810005100	100	7/10/2021
samtse	NJBC	Empty tags		100	14/10/2021
Trashigang	NNBF, Tashiyangphu	1505899999	15059000099	100	14/10/21
Haa	Bjee (Yak farm)	501899999	5019000249	250	18/11/2021
Trongsa	Drateng	1701001001	170101250	250	19/11/2021
Trongsa	Tangsibjee	1705005001	1705005100	100	8/11/2021
Trongsa	Nubee	1704004001	1704004100	100	9/11/2021
Punakha	Guma	1005004425	1005004525	100	29/11/2021
Punakha	Toedwang	1011011001	1011011100	100	03/12/2021
Punakha	Talog	1009009001	1009009050	50	03/12/2021
Haa	Bji	501002001	501002144	144	10/9/2021
Tsirang	Tsirangtoe	1812012001	1812012008	8	8/01/2022
Tsirang	Phuentenchu	1807008001	1807008005	5	8/01/2022
Dagana	Goshi	304005001	304005100	125	25/5/22
Dagana	Tsendagang	313012001	313012100	125	25/5/22
Dagana	Trashiding	311011101	311011200	125	25/5/22
Dagana	Gesarling	303004001	303004100	125	25/5/22
Grand Total				3011	

The number of household under NCIS increased to 8750 from 7750in previous year. The number of animals with NCIS increased to 15486,an increase of 2300 during the fiscal year. As of now the NCIS is carried out in 118 Geogs and CHBPP in 55 Geogs of all 20 Dzongkhags.

Activities carried out in the field for online National Dairy Information System

NDRDC team visited RLDC Kanglung on invitation of the Offtg. RD and breeding focal to discuss on the dairy activities, LN2 plant and online database as cattle registration and CHBPP program was being undertaken in Pema Gatshel Dzongkhag. The team participated for two days in Nanong Geog and the awareness on the database was demonstrated who were carrying out the registration activities. About 300 numbers of cattle were registered in the NDIS database from Shumar and Zobel Geog under Pema Gatshel through data migration from excel format by the developer.

On the invitation of the National Highland Research & Development Program, Bumthang, the team also presented the online database program to the Highland Coordination Meeting in Haa. Subsequently a joint ear tagging and registration program was organized between NHRDC & NDRDC Yusipang and 205 number of yaks were registered belonging to Yak Farm Haa by visiting different herds in the month of November 2021. However, most of the time the records were maintain in the hard copy and later entered in the online database. Ofline version of mobile apps is also ready but due to various logistic problem, it is not always possible to record at the site.

A final presentation of the G_2C Dairy database was presented by the Developer to the management of the NDRDC at Yusipang conference hall on 14 May 2022. Both the website database and the mobile apps was presented. The database includes the Registration module which is the improved version of earlier National Cattle Identification System, The Breeding module which includes both Artificial Insemination Services and Natural Services and the Farmers Organization which includes Dairy Farmers Groups and dairy post production and sale. During the meeting, it was told that the comments received from the Regional offices and the issues that came across while carrying out in the field data entry were discussed and requested to enhance for the proper functioning of the system

After the presentation, the management felt that few yet very important features and reports were still not completed for which the developers was asked to complete before the user acceptance test could be conducted by the Information Communication and Technology Division, Ministry of Agriculture & Forests. The NDRDC Yusipang has proposed the meeting with ICTD, NGN & NDRDC to come up making ready the database for rollup and way forward. The management has also given the standard format of the summary report at different level besides having different report requirement for different modules.

RLDC Tsimasham invited the team from NDRDC on the expansion of the Contract Heifer and Bull Production Program in Sampheling Geog. As decided all the animals in the Geog was proposed for ear tagging from the disease control point of view. Accordingly about 1000 animals were ear tagged segregating CHBPP and non CHBPP. All the detail of the cattle were entered online everyday by the team including the PD, NDRDC, RD, RLDC and other team members. The field reality are different and the problem with connectivity is greatly going to predict the success of the online database.

As per the request, ICTD have proposed the meeting on 25th May 2022. The meeting was attended by the relevant software developers from NGN office, six IT official from ICTD, MoAF and Program Director & Database focal from NDRDC. During the meeting as per the SoP of database role out, the way forward was planned out and NDRDC was ask to test the system and identify the

bugs and error not working and record google sheet designed by ICTD in till 15th June 2022. The next meeting was scheduled on 21st June where all the team was asked to meet.

PD explaining the importance to Dzongkhag & Regional offices

Awareness program on NDIS Livestock staff in Pemagatshel

Yak ear tagging at Haa Yak farm

Meeting with farmers in Dagana on CHBPP and NDIS

Ear tagged air drying

Ear tagging in Dagana for CHBPP expansion

As per the directives of the Department, from 26th, the team visited the Dagana Dzongkhag for the CHBPP expansion program and ear tagging. The training was conducted and about 77 farmers attended the training. The Geog staffs and CAIT were also trained on the data entry using website and mobile apps. However, due to Dog sterilization program, most of the staff were not available. About 450 cattle were registered which included mostly improved cattle which are mostly belonging to dairy farmers groups in four Geogs.

Meeting on 21st June 2022

As per the earlier way forward, the meeting was convened on 21st June 2022 at the office of the ICTD with 6 participants from ICTD, two from NGN and focal person of the NDRDC Yusipang. As per the report/bugs presented by the NDRDC there about 30 bugs which need to be corrected by NGN and the approximate time required for the correction was asked. NGN software engineer have asked for one week time and 30th June was the agreed time. NDRDC Yusipang will continue testing till 10th July 2022. The meeting decided that ICTD will carry out the user acceptance test from 11 to 15th July 2022.

As of date more than 2300 cattle were registered covering Government Cattle farms and four Dzongkhag; Pema Gatshel, Haa, Dagana and Chukha Dzongkhag. A total of 205 Yaks were also ear tagged and registered in Haa Dzongkhag.

5 Operation and Management /Directives

5.1 Accounts Section

5.1.1 Budget utilization

Annual budget utilization is Nu. 34.930 Million out of allocated Nu. 35.935 Million with the achievement percentage of **99.98%**, which is excellent as per guidelines (*For details refer to ACR Expenditure Report Annex 3*).

5.1.2 Revenue generation

NDRDC is mandated to produce and supply LN_2 and frozen semen which as per the existing policy is provided free of cost. As mostly donor bulls and bull calves are maintained for semen production and cows used for ET research, revenue generated is mostly from sale of small volume of milk and sale of culled animals if any. During the FY, against the target of Nu. 0.170 M the revenue generated was 0.285888 m. The revenue generated from the sale of milk was Nu. 134688.00 and from the sale of 7 culled animals Nu, 151200. Detail of the Sale of animals with amount is reproduced below

5.2 Administration Section

5.2.1 Asset declaration

All the assert declaration are done as before the end of the extended time line

5.2.1 Other activities

Dzongkha Correspondence

Forty five correspondence in Dzongkha was done were made pertaining to office orders, promotion orders, increment orders etc. This was basically done to increase proficiency in National Language.

Staff Promotion, recruitment retired and demise, for the fiscal year 2021-2022

A total of five staffs were promoted to their next higher grade, one staff transferred and three staff resigned excluding one staff demise and five new staff were recruited

5.2.2 Correspondences in Dzongkha

Thirty six number of office order in Dzongkha pertaining to tour order order, increment order, promotion order were prepared during the fiscal year.

Under operation and management all reports including annual report are submitted as scheduled. Meetings were held regularly at least once in three months to discuss plans and programs of the Centre.

Annexure 1: Review of Progeny Testing Scheme Implementation in Tsirang Dzongkhag

Introduction

The implementation of Progeny Testing Scheme (PTS) in Tsirang Dzongkhag, covering Barshong and Sergithang geogs, was initiated in Jan 2018 using tropical Thai Holstein Friesian (THF) breed of four sire-lines. A total of 2000 doses of semen (500 each of a sire-line) were received in 2017 as gift from Dairy Promotion Organization, Thailand under the cooperation programme between Ministry of Agriculture and Forests, Bhutan and Ministry of Agriculture and Cooperatives, Thailand. In the selected geogs, local cattle (*Thrabam*) of breedable age were selected, identified, synchronized and inseminated in induced heat initially and later in natural heat. All four THF sire-lines were distributed in both the geogs and inseminated equally in order to have equal no of inseminations and progenies from each bloodline.

In 1st phase of implementation in January 2018, animals were inseminated in observed heat following 48 hr protocol and yielded AI success rate of 17% only (n=145). During the 2nd phase of implementation in Dec. 2018, animals were inseminated in induced heat following 52 hr protocol and resulted in AI success rate of 27% (n=86). For better uptake of the Scheme and to strengthen Public – Private Partnership (PPP) in breed improvement programme, Community AI Technicians (CAITs); four in Barshong and three in Sergithang, were trained and deployed in April 2019 for insemination of animals in natural heat. In order to avoid inbreeding in PTS implemented areas, THF breeding strategy was developed and circulated in 2020. The preliminary review of the Scheme in January 2020 revealed the AI success rate of 21% (n=231) in induced heat and 52% (n=77) in natural heat. The review of the Scheme, as per its protocol for implementation, was though an annual event it could not be conducted in the year 2021 owing to COVID-19 situation in the country. Therefore, this review was conducted from 11 – 18 January 2022 to assess progress made in accordance to the objectives of the Scheme.

Objectives

Short-term

1. Utilize THF semen and increase crossbred population in targeted areas
2. Increase household milk production by the farmers for home consumption/sale.
3. Promote community participation in breed improvement programme.
4. Control inbreeding by injecting fresh bloodline in free grazing herd.

Long-term

1. Identify superior young sires for semen production and future crossbreeding.

2. Facilitate steady genetic progress in cattle population for milk, fat/ protein yield and environmental adaptation including disease resistance.
3. Test and identify resilient dairy cattle breed with appropriate combination of local and exotic inheritance level for its resilience to climate change in long run.

Field activities and findings

- ***Consolidation of information on THF AI and progeny born***

The information on THF AI and progeny born were collected and consolidated.

While implementing the Scheme, animals were inseminated in induced heat as well as in natural heat ensuring equal no of inseminations from all four sire-lines. The animals inseminated with THF semen were ear tagged, identified as per National Cattle Identification System (NCIS) under National Dairy Information System (NDIS) and included in the Scheme. The insemination of selected animals in induced heat during first year of implementation yielded AI success rate of 21%, whereas insemination in natural heat thereafter yielded AI success rate of 49% (Table 17). All THF progenies born were part of the Scheme by default and registered as per NCIS.

Table 17: Progeny born and AI success rate under PTS area in Tsirang

PTS area	AI in Induced heat (1st+ 2ndphase)					AI in natural heat				
	Total AI	*F*	*M*	*Calves Born*	***AI success rate (%)***	*Total AI*	*F*	*M*	*Calves Born*	*AI success rate (%)*
Barshong	138	12	19	31	**22.5**	106	29	24	53	**50.0**
Sergithang	93	7	10	17	**18.3**	119	29	28	57	**47.9**
	231	**19**	**29**	**48**	**20.8**	**225**	**58**	**52**	**110**	**48.9**

Overall, a total of 158 progenies were born out of 456 inseminations, resulting in gross AI success rate of 35% thus far. Among the progenies born, 49% were female (Table 18), which actually is required for breeding value estimation of the THF sire-lines under the PTS. However, the AI success rate (progeny born) was comparatively low for *Puzzle* and *Push* than *Pound* and *Popular.* The AI success rate with THF semen turned out to be proportionate to their semen quality that was checked for post-thaw motility (PTM) at arrival of the consignment. The PTM of semen for *Puzzle, Push, Pound* and *Popular* was 30%, 35%, 45% and 55% respectively.

Table 18: Progeny born by geog, THF bull and year of PTS implementation

		2018		2019		2020		2021		Progeny		
Geog	THF bull	F	M	F	M	F	M	F	M	**F**	**M**	**Total**
Barshong	Pound	6	2	2	4	3	3	4	3	15	12	**27**
	Push	1	2	2	1	4	1	4	0	11	4	**15**
	Puzzle	1	0	0	0	0	3	7	4	8	7	**15**
	Popular	0	2	1	9	6	9	0	0	7	20	**27**
	Sub-total	***8***	***6***	***5***	***14***	***13***	***16***	***15***	***7***	***41***	***43***	***84***
Sergithang	Pound	0	3	1	1	2	1	8	0	11	5	**16**
	Push	1	1	0	0	2	7	4	3	7	11	**18**

	Puzzle	1	2	0	0	2	4	2	2	5	8	**13**
	Popular	2	1	2	2	2	5	7	6	13	14	**27**
	Sub-total	***4***	***7***	***3***	***3***	***8***	***17***	***21***	***11***	***36***	***38***	***74***
	Pound	6	5	3	5	5	4	12	3	26	17	**43**
Tsirang Dzongkhag	**Push**	2	3	2	1	6	8	8	3	18	15	**33**
	Puzzle	2	2	0	0	2	7	9	6	13	15	**28**
	Popular	2	3	3	11	8	14	7	6	20	34	**54**
Total		**12**	**13**	**8**	**17**	**21**	**33**	**36**	**18**	**77**	**81**	**158**

Besides, in line with the THF progeny breeding strategies circulated in 2020, the female progenies on reaching the breedable age were inseminated using different sire-lines. Some of the female progenies have given birth to F2 generation (75% THF blood). The Livestock In-charges and the concerned CAITs including the farmers were advised to initiate milk recording of F1 THF progenies upon calving once a month on the same day (±1 day) every month for a complete lactation using the prescribed milk recording format.

- ***Performance survey of CAITs trained in Tsirang Dzongkhag***

In Tsirang, a total of 13 CAITs were trained in two batches; seven in April 2019 and six in March 2021, to strengthen the PTS initiated at Barshong and Sergithang using THF breed and initiate new PTS with Jersey breed at Doonglagang, Semjong, Phuentenchu and Tsirangtoe. The information related to performance of the CAITs as well as feedbacks on their performances from the beneficiaries were collected using structured survey questionnaire. The report on performance of CAITs will be compiled, analyzed and published separately including its on-going survey in other areas nationwide.

The CAITs at Sergithang were found providing AI services as intended in fulfillment of the training objectives. However, the CAITs at Barshong had stopped providing AI services a year after their deployment owing to shortage of LN2 in refilling their portable container from the geog centre and other reasons. Besides, among the CAITs trained in March 2021 from Donglagang, Phuentenchu, Semjong and Tsirangtoe to kick start PTS in Jersey in the geogs, the CAITs are providing AI services as intended except for CAITs at Phuentenchu geog owing to shortage of portable LN2 container. However, the geog is now equipped with the facilities required and soon the CAITs will be deployed to provide AI services. Therefore, no hitches are foreseen on initiation of PTS with Jersey breed as planned in the four geogs of Tsirang.

- **Registration of animals in NDIS**

Beside ear tagging and identification of progenies born of THF breed in the PTS areas, they were registered online using mobile Apps on web-based database that is named as "NDIS" (Nation Dairy Information System).

The livestock In-charges and CAITs of all six geogs visited in Tsirang were oriented on application of the database using mobile application. The real time data from field on animal registration, breeding and reproduction, production, post-production and others as required under NDIS can be uploaded and submitted using the database, which however requires a simple smart phone that supports installation of the software as mobile App and internet connectivity. Almost all THF progenies in the PTS areas and 100 animals (crossbred Jersey) in other four geogs were registered online while demonstrating the application of database in field to the users.

Conclusion

The PTS implementation in Tsirang Dzongkhag progressed well with the training and deployment of CAITs and insemination of animals in natural heat. The shortage of LN2 from time to time had been the hitches for non-functioning of some CAITs, towards which new LN2 plants (min. production capacity of 5L/hr) need to be established at regional level; RLDCs Wangdue, Tsimasham and Zhemgang, to fulfill the overall LN2 demand of increasing no. of AI centers annually as well as to boost mobile AI services for wider AI coverage in the country.

The insemination of local cattle in induced heat resulted in very low AI success rate (21%) as compared to AI in natural heat (49%) in the same PTS areas, and it is conclusive that the insemination of local cattle in induced heat is not recommended like in crossbred animals. With the experienced gained from the PTS with THF breed, the Scheme with Jersey breed in other areas can be implemented systematically as most of facilities required for its implementation are in place in particular the CAITs as human resource.

The CAITs not only supplemented the shortage of livestock field staff in providing AI services, but provided employment opportunities to the early school leavers at the same time in rural areas. The engagement of CAITs in breed improvement programme under PPP mode is considered at the moment as sustainable approach for dairy sector development in the country. Further, the web-based dairy information system initiated recently shall go a long way in complementing the effort of the Royal Govt. in making Bhutan digital by default in near future.

Review team members

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Appendix 2: Artificial Insemination Performance review in Bhutan

Introduction

The breeding services in cattle are provided through the provision of Artificial Insemination (AI) wherever feasible and supply of breeding bulls in AI non feasible areas. In general, dairy farmers prefer AI over natural service for many advantages. AI in cattle was initiated in 1986 with imported semen of Jersey. The production of bovine frozen semen in Bhutan started in 1994. The in-country production of frozen semen from Jersey, Brown Swiss, Mithun and Nublang offered breed of choice to the farmers and led to higher demand for AI.

For better coordination and efficiency in livestock development initiatives in the country four Regional Livestock Development Centres (RLDCs) were established at strategic locations. The RLDC at Kanglung catters to six eastern Dzongkhags; Samdrjongkhar, Pemagatshel, Trashigang, Tashiyangtshe, Mongar and Lhuentshe, the RLDC at Zhemgang caters to four east-central Dzongkhags; Bumthang, Trongsa, Zemgang and Sarpang, the RLDC at Wangdue caters to five west-central Dzongkhags; Punakha, Wangdue, Gasa, Dagana and Tsirang and the RLDC at Tsimasham caters to five western Dzongkhags; Thimphu, Paro, Haa, Chukha and Samtse.

For establishment of AI Centre, the RLDCs in collaboration with the Dzongkhag livestock Sector (DLS) conducts AI feasibility study wherever required as road accessibility to remote areas increases every year. According to feasibility, the National Dairy Research and Development Centre (NDRDC), the apex arm of the Department of Livestock (DoL) for Dairy sector development in the country, accords technical approval for establishment of AI Centre with associated AI inputs such as frozen semen, LN2 and AI accessories as required.

As of June 2021, there were **130 AI centres** (AIC) nationwide; 42 in east, 24 in east-central, 28 in west-central and 36 in western region. The critical component of AI is Liquid Nitrogen (LN2). The requirement of LN2 is met from two LN2 plants established at NDRDC, Yusipang in 2010 and at RLDC Kanglung in 2011. Currently, both the plants are operating sub-optimally with production capacity of 4.5L/hr against the installed capacity of 10L/hr. Hence, the supply of LN2 is met with great difficulty owing to the aging of plants and increasing no of AICs every year.

In order to provide uninterrupted AI services to the public as well as for wider AI coverage Community AI Technicians (CAITs) were trained and deployed under Public – Private Partnership (PPP) in cattle breed improvement programme in the country since 2010. The training and deployment of CAITs were aimed at providing employment opportunity to the early school leavers in rural areas, complementing household income generation and supplementing field staff in delivery of AI services.

The AI performances at field level were compiled as repository at NDRDC, Yusipang that were received through RLDCs and Dzongkhags according to the reporting timeline. The reports of last ten years (FY 2011-12 to 2020-21) were analyzed in view of improving AI service delivery mechanism for better coverage and efficiency. However, the analysis called for critical review of the activities at field level to take stock of implementation practices and the review process was validated in western region from 13 – 28 June 2022.

Objectives

1. Assess the trend of AI coverage and performance at different levels.
2. Make recommendations for enhancing AI coverage and efficiency

AI Coverage

The breedable cattle population (BCP) considered in this study were heifers (50%), all milking and dry cows, which were bred naturally or artificially. On an average a total of **93,449 cattle** were available for breeding annually. The BCP excludes Yaks and Mithun crosses as AI services were not available for those population. Among the total BCP, on an average 72,311 cattle were available in AI established gewogs/ areas annually, of which only 33% of them (23,863) were actually accessible to AI services that are within the radius of 5km from AIC or one hour walking distance (AIC establishment feasibility reports). Therefore, AI coverage in total BCP, AI areas and population accessible to AI facilities was 8.9%, 11.6% and 35% respectively. Though the average AI coverage for last 10 years appeared very low vis-à-vis overall BCP, the AI progeny contributes to 48% of total milk production in the country, which accumulates to annual gross return of **Nu.1.104 Billion by farmers** (Tshering and Tamang, 2018).

Table 19: Breedable cattle population (nos) and AI coverage (2011-2020)

Year	Total BCP*	BCP in AI areas (A)*	BCP accessible to AI facility =33% of (A)**	Total annual AI***	AI coverage (%) in total BCP	AI coverage (%) in BCP in AI areas	AI coverage (%) in accessible BCP to AI facility
2011	90,494	55,291	18,246	8,117	9.0	14.7	44.5
2012	90,369	61,742	20,375	9,299	10.3	15.1	45.6
2013	92,628	61,561	20,315	9,358	10.1	15.2	46.1
2014	86,345	65,016	21,455	8,455	9.8	13.0	39.4
2015	95,893	71,493	23,593	7,679	8.0	10.7	32.5
2016	104,009	74,386	24,547	7,444	7.2	10.0	30.3
2017	100,613	82,253	27,143	7,705	7.7	9.4	28.4
2018	101,701	83,707	27,623	8,217	8.1	9.8	29.7
2019	72,179	85,571	28,238	8,333	11.5	9.7	29.5
2020	100,258	82,089	27,089	8,964	8.9	10.9	33.1
Average	**93,449**	**72,311**	**23,863**	**8,357**	**8.9**	**11.6**	**35.0**

Source: *Annual livestock statistics, 2011 – 2020, ** AI establishment feasibility reports, * Annual AI report**

The BCP steadily increased over the years but the no of annual AI performed slightly decreased from 2013 till 2017 and picked up later. Accordingly, the maximum AI coverage was observed in 2012 and 2013 and decreased thereafter until 2017 and picked up later (Table 1, Figure 1).

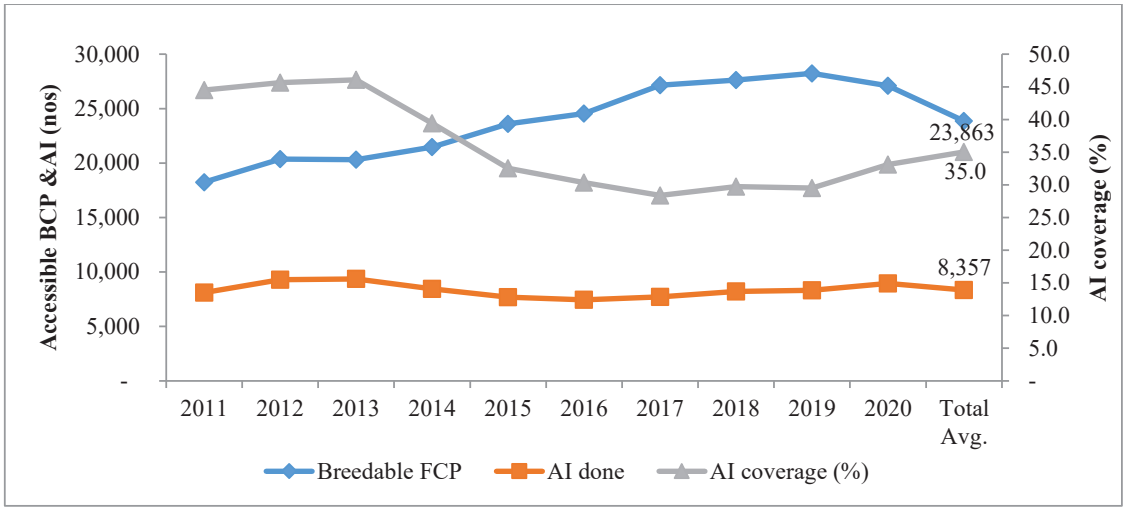


Figure 1: National AI coverage among the BCP accessible to AI facility

At regional level, among the BCP accessible to AI facility, the maximum AI coverage was observed in west-central region with 43.7%, whereas almost equal coverage was observed in other three regions (Figure 2).

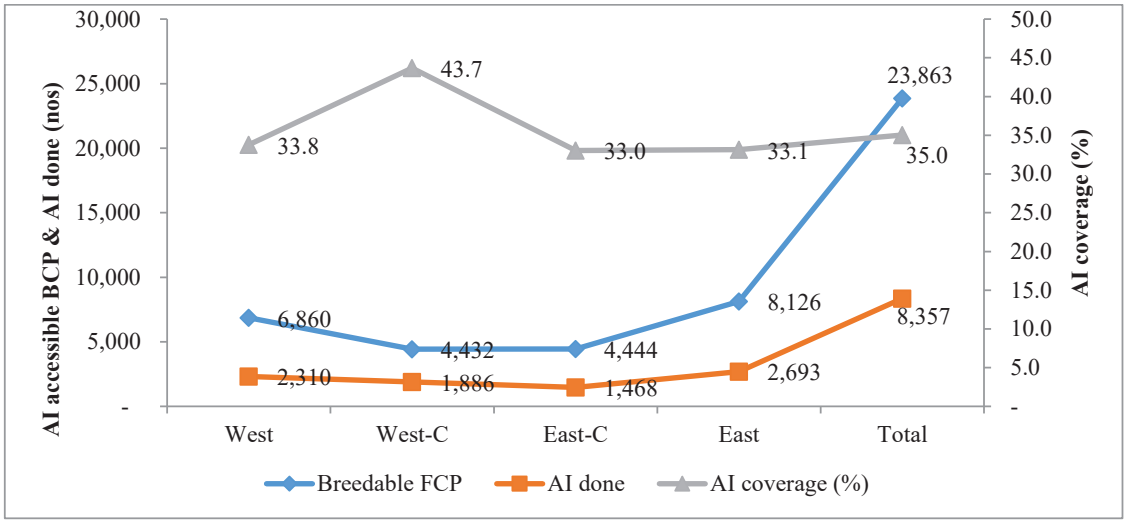


Figure 2: Average annual AI coverage by Region (2011 – 2020).

AI performance at National level

A total of 83,357 AI were performed and 30,172 progenies were recorded in ten years, leading to average AI success rate (AISR) of **36.1% as national average** (Figures 3 and 4). The AI performance increased from 2011 – 2013 and in 2020 with record of above annual average performance in 2012, 2013, 2014 and 2020 (Figure..). Similarly, AISR increased from 2012 – 2014 but observed sharp decrease in 2015 and constant performance until 2019 and increased in 2020, with above annual average AISR in 2013, 2014 and 2020. The performance in terms of AISR was yet low as compared to findings in other study wherein the AISR achieved with sexed semen was 44.4% and conventional semen was 48% (Rai et al. 2019). The low AI success rate in this nationwide study could be attributed to poor follow-up on progeny born after AI by the AI technicians.

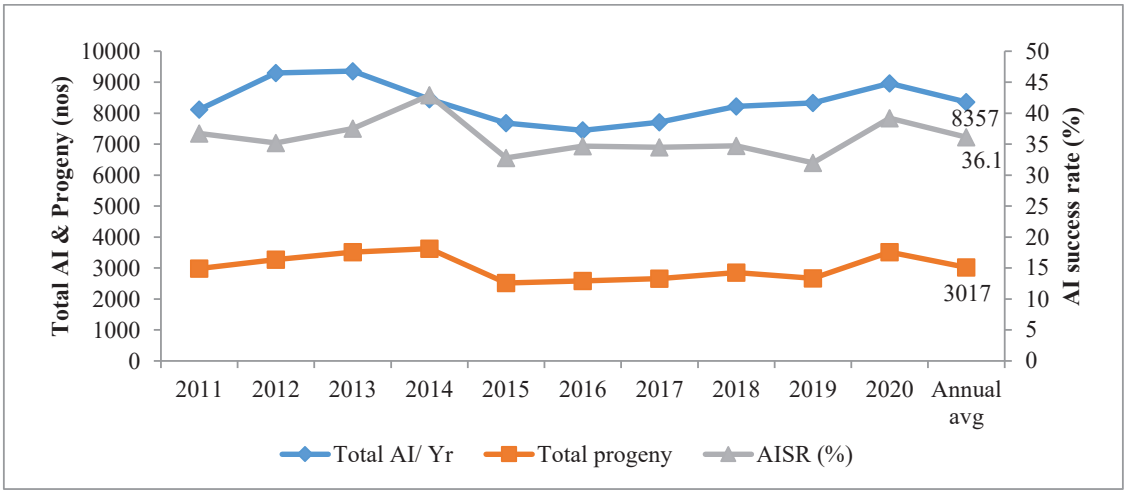


Figure 3: Average annual AI performance in the country

From 2011-2020, 10AICs were closed for various reasons despite their establishment with proper feasibility. The average AI performed was **74AI/center/year as national average** (Figure 3), which was performed by only 36 AICs. Overall, 32% of AI centers had performed ≥ national avg. of 74AI/ year, but only 21.2% of AI centers (24/113 AICs) had achieved the national averages (74AI/center/year and 36.1% AISR). Nevertheless, 51% of AICs (58/113 AICs) had achieved more than national average of ≥36.1% AISR. This indicates that the low performance in terms of AISR could be attributed to poor follow-up on progeny born after AI.

Performance at Regional level

Among the four regions, the west west-central and east-central region had achieved slightly higher AISR than the national average of 36.1% (Figure 4).

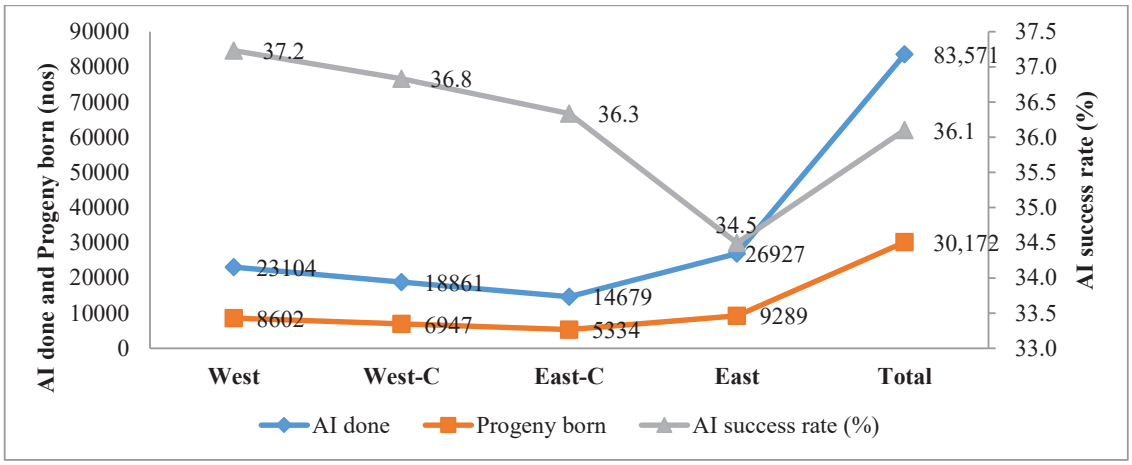


Figure 4: Summary of National AI performance by Region (2011-2020)

- ***Western region***

In the region, 36 AI centres were operational. A total of 23,104 AI were performed and 8,602 progenies were recorded in ten years. The average AI performed in the region was 64AI/center/year and average AI success rate (AISR) was 37.2% as Regional average (Figure 4). The average annual AI performed was inadequate as compared to the national average (74AI/centre/year). Among the AICs in the region, 12 of them had performed above the national average AI, and 14AICs had achieved the regional average. In the region, only NINE AICs (25%) had achieved the overall AI performance (AI done and AISR) above the national averages.

- ***West-central region***

In the region, 28 AI centres were operational. A total of 18,861 AI were performed and 6,947 progenies were recorded in ten years. The average AI performed was 68AI/center/year, with AISR of 36.8% as Regional average (Figure 4). The average annual AI performed was inadequate as compared to the national average. In the region, only 8 AICs had performed more than ≥74AI/year and 9 AICs had achieved the regional average AI done. Overall, only FOUR AICs (14.3%) in the region had achieved both the AI done and AISR above the national and regional averages.

- ***East-central region***

In the region, 24 AI centres were operational. A total of 14,679 AI were performed and 5,334 progenies were recorded in ten years. The average AI performed was 79AI/center/year and average AI success rate (AISR) of 34.5% as Regional average (Figure 4). The average AI performed in the region was slightly higher than the national average, and it was achieved by 7AICs. Overall, only FIVE AICs (21%) in the region had achieved both the AI done and AISR above the national and regional averages.

- ***Eastern Region***

In the region, 42 AI centres were operational. A total of 26,927AI were performed and 9,289 progenies were recorded in ten years. The average AI performed was 75AI/center/year and average AI success rate (AISR) of 34.5% as Regional average (Figure 4). The average annual AI performed was at par with the national average. The 9AICs in the region had performed AI more than the national (74AI/year) and regional averages. In terms of AISR, 18 AICs had performed above the national average. Overall, only SIX AICs (14.3%) in the region had achieved both the AI done and AISR above the national and regional averages.

AI performance at Dzongkhag level

Annually 8,357 AI were performed in the country. Eight Dzongkhags had performed equivalent to national average AI of ≥74AI/center/year (Paro, Punakha, Tsirang, Bumthang, Sarpang, S/jongkhar, P/gatshel and Mongar). Similarly, ten Dzongkhags had achieved national average AISR of 36.1%; (Thimphu and Chukha in western region, Wangdue, Tsirang and Gasa in west-central region, Bumthang, Trongsa and Zhemgang in east-central region, Trashigang and Mongar in eastern region (Figure 5). Overall, in terms of both AI and AISR, only Tsirang, Bumthang and Mongar had achieved the national averages.

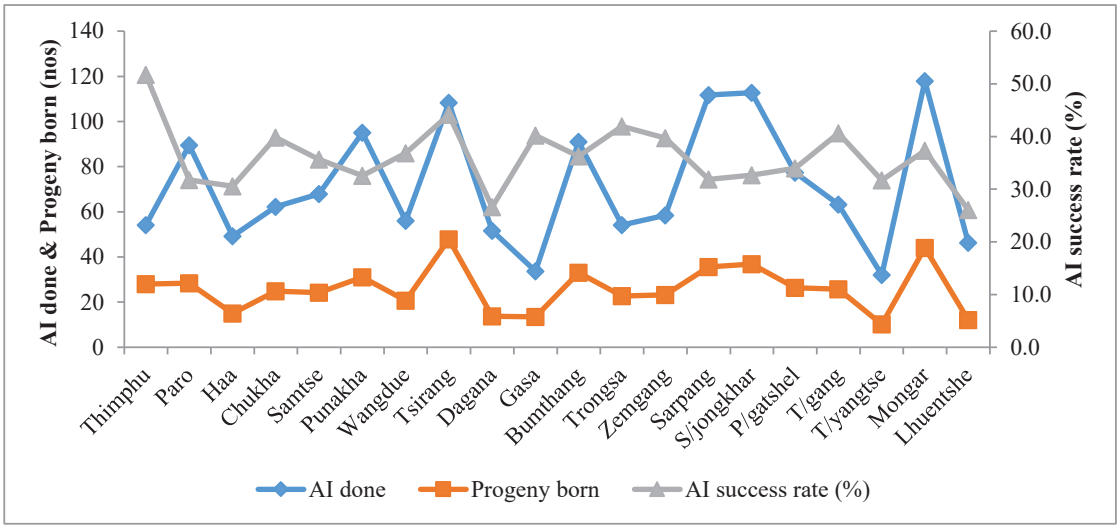


Figure 5: Average annual AI performance of Dzongkhags for 10 years (2011-2020)

- ***Thimphu Dzongkhag***

The Dzongkhag had performed on an average of 54AI/center/year and achieved AISR of 51.7%. Among the 6 operational AI centers in the Dzongkhag, the DVH, Ramtokto had performed 112 AI/year and achieved AI success rate of 68%, which is commendable whereas other AICs had grossly underperformed (Table 20). However, AISR was achieved by most of the AI centres. Therefore, proper advocacy on benefit of AI needs to be provided to the public in and around the underperforming AI centres in the Dzongkhag.

Table 20: AI centers and their performance in Thimphu Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
NAH Thimphu	358	246	36	25	68.7	Closed in 2016
AICSemtokha	26	1	3	0	3.8	Closed in 2013
AIC Kkasadrapchu	448	98	45	10	21.9	Inadequate AI & AISR
AIC Tshaluna	459	230	46	23	50.1	Inadequate AI
AIC Kabisa	341	130	34	13	38.1	Inadequate AI & AISR
AIC Genekha	186	93	19	9	50.0	Inadequate AI
NDRC Yusipang	743	342	79	37	46.5	Adequate AI & AISR
DVH Ramtokto	1123	764	112	76	68.0	Adequate AI & AISR
6	**3684**	**1904**	**374**	**193**	**51.7**	

- ***Paro Dzongkhag***

The Dzongkhag had performed on an average of 89AI/center/year and achieved AIRS of only 31.8% (Table 21). Among the 9 operational AI centers in the Dzongkhag, five AICs; LECs, Shari, Shaba, Luni, Dotey and DVH, Paro had performed as required. However, follow-up on progeny born from the DVH and LEC Shaba needs to be strengthened by the Dzongkhag. For the remaining four AICs proper advocacy on AI needs to be provided and follow-up on progeny born needs to be strengthened.

Table 21: AI centers and their performance in Paro Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Paro	2704	697	270	75	27.6	Inadequate AISR
LEC Shari	1210	490	121	49	40.5	Adequate AI & AISR
LEC Shaba	769	168	77	17	21.8	Inadequate AI & AISR
LEC Luni	872	381	87	38	43.7	Adequate AI & AISR
LEC Lango	359	116	36	12	32.3	Inadequate AI & AISR
LEC Dotey	664	324	71	35	48.9	Inadequate AI
LEC Tsento	338	89	34	9	26.3	Inadequate AI & AISR
LEC Dogar	576	146	58	15	25.3	
LEC Naja	420	43	42	4	10.2	
9	**7912**	**2454**	**796**	**254**	**31.8**	

Haa Dzongkhag

The Dzongkhag had performed on an average of 39AI/center/year and achieved AISR of 29.2% (Table 22). Both the AICs in the Dzongkhag had grossly underperformed for which proper advocacy on AI to the community needs to be provided and follow-up on progeny born needs to be strengthened.

Table 22: AI centers and their performance in Haa Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Had	347	100	43	13	28.8	Inadequate AI & AISR
LEC Katsho	589	186	59	19	31.6	
2	**936**	**286**	**102**	**32**	**30.6**	

Chukha Dzongkhag

The Dzongkhag had performed on an average of 67AI/center/year and achieved AISR of 39.8% (Table 23). All AICs in the Dzongkhag except DVH, Tsimatsham had either achieved the no of AI to be done or AI success rate. Nevertheless, follow-up on progeny born has to be strengthened in LEC, Sampheling.

Table 23: AI centers and their performance in Chukha Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Tshimasham	129	40	13	4	31.0	Inadequate AI & AISR
LEC Bongo/Drala	652	371	65	37	56.9	Inadequate AI
LEC Phuentsholing	803	319	80	32	39.7	
LEC Sampheling	927	258	93	26	27.8	Inadequate AISR
CRC Wangkha	416	177	42	18	42.5	Inadequate AI
5	**2927**	**1165**	**293**	**117**	**39.8**	

Samtse Dzongkhag

The Dzongkhag had performed on an average of 68AI/center/year and achieved AISR of 35.7%. Among the 14 AICs in the Dzongkhag, LEC Yoseltshe had adequate performance record, 6 AICs had inadequate AI performed, 5 AICs had inadequate AISR indicating poor follow-up on progeny born and 2 AICs had both inadequate AI and AISR (Table 24). Overall, good advocacy on benefit of AI needs to be provided to the communities and follow-up on progeny born needs to be strengthened.

Table 24: AI centers and their performance in Samtse Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Samtse	558	338	56	34	60.6	Inadequate AI
LEC Yoedseltse	1413	533	141	53	37.7	Adequate AI & AISR
NJBC Samtse	1128	406	113	41	36.0	Inadequate AISR
LEC Samtse	625	130	63	13	20.8	Inadequate AI & AISR
Norbugang (Chengmari)	622	215	62	22	34.6	
LEC Ugyentse	850	388	85	39	45.6	Inadequate AI
Tashicholing	820	262	82	26	32.0	Inadequate AI & AISR
LEC Tendru	455	162	46	16	35.6	Inadequate AI
Phuntshopelri	110	51	11	5	46.4	
Sangachholing	94	50	9	5	53.2	
Dophuchen	241	27	24	3	11.2	Inadequate AI & AISR
LEC Tading	531	107	53	11	20.2	Inadequate AISR
Norgaygang (Bara)	68	12	7	1	17.6	Inadequate AI & AISR
Namgaycholing	30	10	3	1	33.3	
14	**7545**	**2691**	**755**	**269**	**35.7**	

Punakha Dzongkhag

The Dzongkhag had performed on an average of 95AI/center/year and achieved AISR of 32.0% (Table 25). Among the 9 AICs in the Dzongkhag, only DVH Punakha had achieved both AI and AISR above the regional and national AI performance averages. The 3 AICs; LECs Baap, Limbukha and Segana, had grossly underperformed, which need to be closed or relocated in other feasible areas. However, proper advocacy on AI needs to be provided for improvement of overall performance.

Table 25: AI centers and their performance in Punakha Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
Thinleygang	710	165	71	17	23.2	Inadequate AI & AISR
DVH Punakha	2224	819	222	82	36.8	Adequate AI & AISR
Samadingkha	1321	458	132	46	34.7	Inadequate AISR
LEC Taloo	760	234	76	23	30.8	Inadequate AI & AISR
LEC Kabjisa	1351	462	135	46	34.2	Inadequate AISR
LEC Baap	482	118	48	12	24.5	Inadequate AI & AISR
LEC Limbukha	280	76	28	8	27.1	Inadequate AI & AISR
LEC Shengana	344	90	34	9	26.2	Inadequate AI & AISR
CNR- Lobesa	39	25	4	3	64.1	
9	**7511**	**2447**	**751**	**245**	**32.0**	

Wangdue Dzongkhag

The Dzongkhag had performed on an average of 51AI/center/year and achieved AISR of 40.4% (Table 26). Among 8AICs in the Dzongkhag, DVH Petakarpo had achieved the AI performance of both regional and national averages. Other 5AICs had at least achieved the AI or AISR, whereas AICs at Nysho and Bjena had grossly underperformed both AI and AISR and they need to be either closed or relocated in other feasible areas. Overall, proper awareness on benefit of AI needs to be provided in the Dzongkhag.

Table 26: AI centers and their performance in Wangdue Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Petakarpo	919	409	92	41	44.5	Adequate AI & AISR
Gaselo/ Gumina	1550	548	155	55	35.4	Inadequate AISR
LEC Sephu	107	49	11	5	45.8	Inadequate AI
LEC Phobji	548	262	55	26	47.8	Inadequate AI
Phangyul/Katikha	200	90	20	9	45.0	Inadequate AI
Nysho/ Samtegang	219	60	22	6	27.4	Inadequate AI & AISR
LEC Bjena	256	75	26	8	29.3	Inadequate AI & AISR
Rubesa	80	76	8	8	95.0	Inadequate AI
8	**3879**	**1569**	**388**	**157**	**40.4**	

Tsirang Dzongkhag

The Dzongkhag had performed on an average of 102 AI/center/year and achieved AISR of 44.2% (Table 27). The Dzongkhag is recorded as best performer among 20 Dzongkhags and all AICs had achieved the required AISR except for LEC Sergithang. However, the AICs at Mendrelgang, Tsirangtoe, barshong and Sergithang had under achieved the required no of AI to be done for which awareness needs to be provided to the communities.

Table 27: AI centers and their performance in Tsirang Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Damphu	2643	1269	264	127	48.0	Adequate AI & AISR
LEC Gosarling	817	390	82	39	47.7	
LEC Mendrelgang	599	241	60	24	40.2	Inadequate AI
LECTsirangtoe	237	105	24	11	44.3	
LEC Barsong	300	97	30	10	32.3	Inadequate AI and AISR
LEC Sergithang	276	50	28	5	18.1	
6	**4872**	**2152**	**487**	**215**	**44.2**	

Dagana Dzongkhag

The Dzongkhag had performed on an average of 52AI/center/year and achieved AISR of 26.6% (Table 28). All AICs in the Dzongkhag had not achieved either required AI to be done or AISR. Therefore, proper awareness on benefit of AI needs to be provided.

Table 28: AI centers and their performance in Dagana Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
Tshendagang/ Gozhi	1047	246	105	25	23.5	Inadequate AISR
LEC Drujeygang	636	184	64	18	28.9	Inadequate AI & AISR
Lhamoizingkha	257	90	26	9	35.0	Inadequate AI & AISR
LEC Tsangkha	20	2	2	0	10.0	Inadequate AI & AISR
4	**1960**	**522**	**196**	**52**	**26.6**	

Gasa Dzongkhag

The Dzongkhag had performed on an average of 34AI/center/year and achieved AISR of 40.2% (Table 29). Awareness on benefit of AI needs to be provided particularly to carry out required no of AI to be done.

Table 29: AI centers and their performance in Gasa Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Gasa	302	104	30	10	34.4	Inadequate AI & AISR
LEC Gendamji	337	153	34	15	45.4	Inadequate AI
2	**639**	**257**	**64**	**26**	**40.2**	

Bumthang Dzongkhag

The Dzongkhag had performed on an average of 90AI/center/year and achieved AISR of 36.2% (Table 30). Among the 6 operational AICs in the Dzongkhag, the LECs Chumey and Thangbi had underperformed for which awareness on benefit of AI needs to be provided as well as follow-up on progeny born needs to be strengthened.

Table 30: AI centers and their performance in Bumthang Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Bumthang	1231	461	123	46	37.4	Adequate AI & AISR
LEC Chumey	688	267	69	27	38.8	Inadequate AI
LEC Ura	155	98	16	10	63.2	Closed in 2016
LEC Tang	1795	608	180	61	33.9	Inadequate AISR
BS Farm +CHBPP	1413	527	141	56	39.6	Inadequate AISR
NHP Dungmithang	352	84	35	8	23.9	Closed in 2016
LEC Thangbi	572	170	57	17	29.7	Inadequate AI & AISR
Wobthang Farm	181	65	18	7	35.9	Inadequate AI
RNR- RC Jaker	81	34	8	3	42.0	Closed in 2015
6	**6468**	**2314**	**647**	**235**	**36.3**	

Trongsa Dzongkhag

The Dzongkhag had performed on an average of 54AI/center/year and achieved AISR of 41.9% (Table 31). Among the 6AICs in the Dzongkhag, except for Tangsibji all other 5 AICs had under achieved the required no of AI to be done and further Kuengarabten and Nimsong were crippled by under achievement of required AISR. Therefore, proper awareness on benefit of AI needs to be provided.

Table 31: AI centers and their performance in Trongsa Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Trongsa	291	168	29	17	57.7	Inadequate AI
LEC Tangsibji	1455	652	146	65	44.8	Adequatr AI & AISR
LEC Kuengarabten	524	146	52	15	27.9	Inadequate AI & AISR
LEC Langthel	199	73	20	7	36.7	Inadequate AI
LEC Nimsong	81	27	8	3	33.3	Inadequate AI & AISR
LEC Bemji	51	24	5	2	47.1	Inadequate AI
6	**2601**	**1090**	**260**	**109**	**41.9**	

Zemgang Dzongkhag

The Dzongkhag had performed on an average of 58AI/ enter/year and achieved AISR of 39.7% (Table 32). Among the 5 AICs in the Dzongkhag, except DVH Zhemgang all other AICs had under achieved the required no of AI to be done and further Kuengarabten and Nimsong failed to achieve the AISR as required. Therefore, proper awareness on benefit of AI needs to be provided for improvement of overall performance.

Table 32: AI centers and their performance in Zhemgang Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Zhemgang	1281	534	128	53	41.7	Adequate AI and AISR
LEC Buli/Nangkhar	228	111	23	11	48.7	Inadequate AI
LEC Pangbang	191	34	19	3	17.8	Inadequate AI & AISR
LEC Phangkhar	58	19	6	2	32.8	
LEC Tingtibi/Trong	52	21	5	2	40.4	Inadequate AI
5	**1810**	**719**	**181**	**72**	**39.7**	

Sarpang Dzongkhag

The Dzongkhag had performed on an average of 112AI/center/year and achieved AISR of 31.9% (Table 33). All AICs in the Dzongkhag had failed to achieve the national AISR and only LEC Gelephu and Umling had performed the required no of AI. Therefore, proper awareness on benefit of AI needs to be provided and follow-up on progeny born should be rigorous in the Dzongkhag.

Table 33: AI centers and their performance in Sarpang Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Sarpang	873	260	87	26	29.8	Inadequate AI & AISR
LEC Gelephu	2413	875	241	88	36.3	Adequate AI & AISR
LEC Dekiling	236	38	24	4	16.1	Inadequate AI & AISR
LEC Chuzagang	89	19	9	2	21.3	Inadequate AI & AISR
LEC Sersong	105	9	11	1	8.6	Inadequate AI & AISR
LEC Umling	84	10	8	1	11.9	Inadequate AISR
6	**3800**	**1211**	**380**	**121**	**31.9**	

S/jongkhar Dzongkhag

The Dzongkhag had performed on an average of 113AI/center/year and achieved AISR of 32.7% (Table 34). Among the 5 operational AICs, most of the AICs had not achieved the required performance except BLDC, Samrang. Therefore, proper awareness on benefit of AI needs to be provided and follow-up on progeny needs to be strengthened.

Table 34: AI centers and their performance in Samdrupjongkhar Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
LEC Deothang	1736	634	174	63	36.5	Inadequate AISR
Phuntshothang	276	128	28	13	46.4	Inadequate AI
LEC Orong	719	224	72	22	31.2	Inadequate AI & AISR
Gomdar	113	5	11	1	4.4	Inadequate AI & AISR
LEC Martshala	9	0	1	0	0.0	Closed in 2018
BLDCL Samrang	528	113	53	11	21.4	Adequate AI and AISR
5	**3381**	**1104**	**338**	**110**	**32.7**	

Pemagatshel Dzongkhag

The Dzongkhag had performed an average of 77AI/center/year and achieved AI success rate of 34% (Table 35). The 50% 0f the AICs in the Dzongkhag; DVH, P/gatshel, Zobel, Nangkhor, nanong and Norbugang had achieved the requirement of AI to be done, whereas only the DVH, Nangkhor and Yurung had achieved the AISR.

Table 35: AI centers and their performance in Pemagatshel Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH P/gatshel	1108	418	111	42	37.7	Adequate AI and AISR
LEC Zobel	511	158	51	16	30.9	Inadequate AI & AISR
LEC Nangkhor	947	345	95	35	36.4	Adequate AI & AISR
LEC Yurung	282	161	28	16	57.1	Inadequate AI
LEC Nanong	464	90	46	9	19.4	Inadequate AISR
LEC Khar	192	48	19	5	25.0	Inadequate AI & AISR
LEC Norbugang	510	147	51	15	28.8	Inadequate AISR
LEC Decheeling	13	2	1	0	15.4	Inadequate AI & AISR
8	**4027**	**1369**	**403**	**137**	**34.0**	

Trashigang Dzongkhag

The Dzongkhag had performed on an average of 63AI/center/year and achieved AISR of 40.7%. While 8 AICs had achieved the AISR of national average, only 2 AICs; DVH, T/gang and LEC kanglung had achieved the requirement of AI to be done (Table 36). Therefore, mass awareness on benefit of AI needs to be given in the Dzongkhag as well as follow-up on progeny born needs to be strengthened.

Table 36: AI centers and their performance in Trashigang Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Trashigang	1431	485	143	49	33.9	Inadequate AISR
LEC Kanglung	1464	548	146	55	37.4	Adequate AI & AISR
LEC Khaling	811	380	81	38	46.9	Inadequate AI
LEC Yangneer	701	324	70	32	46.2	Inadequate AI
LEC Radhi	401	130	40	13	32.4	Inadequate AI & AISR
LEC Bartsham	681	306	68	31	44.9	Inadequate AI
NNBF T/yangphu	91	145	9	15	159.3	Inadequate AI (closed)
LEC Bidung	263	61	26	6	23.2	Inadequate AI & AISR
LEC Changmi	364	159	36	16	43.7	Inadequate AI
Bikhar	169	70	17	7	41.4	Inadequate AI
Phongmay	119	35	12	4	29.4	Inadequate AI & AISR
Lumang	78	29	8	3	37.2	Inadequate AI
11	**6573**	**2672**	**657**	**267**	**40.7**	

Tashiyangtse Dzongkhag

The Dzongkhag had performed on an average of 32AI/center/year and achieved AISR of 31.7%. All 6AICs in the Dzongkhag had neither performed the minimum required AI nor achieved the national avg. AISR (Table 37). Therefore, mass awareness on benefit of AI needs to be imparted and follow-up on progeny born be strengthened.

Table 37: AI centers and their performance in Tashiyangtse Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH T/Yangtshe	732	247	73	25	33.7	Inadequate AI & AISR
LEC Rangthangwong	141	17	14	2	12.1	Inadequate AI & AISR
LEC Bomdeling	147	40	15	4	27.2	Inadequate AI & AISR
LEC Khamdang	490	132	49	13	26.9	Inadequate AI & AISR
LEC Tongsang	69	47	7	5	68.1	Inadequate AI
LEC Jamkhar	55	35	6	4	63.6	Inadequate AI
6	**1634**	**518**	**163**	**52**	**31.7**	

Mongar Dzongkhag

The Dzongkhag had performed on an average of 118AI/center/year and achieved AISR of 37.3%. Among the 10 operational AICs in the Dzongkhag, the AICs at DVH, Mongar, Chaskar had performed AI extremely well and LEC Ngatshang had achieved both AI and AISR and (Table 38). The LECs Dremtse, Drepong and Tsamang had though achieved the national AISR, the AI performed were extremely low. Further, 5AICs at Yadi, Chali, Lingmithang, Sherimong and Tsakaling had underperformed in both AI and AISR. Therefore, proper awareness on benefit of AI needs to be imparted among the underperforming AICs and follow-up on progeny born needs to be strengthened.

Table 38: AI centers and their performance in Mongar Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Mongar	2232	639	223	81	36.3	Adequate AI & AISR
LEC Chaskhar	3929	1314	393	151	38.4	
LEC Chali	500	146	50	15	29.2	Inadequate AI & AISR
LEC Dramtse	188	82	19	8	43.6	Inadequate AI & AISR
LEC Drepong	157	107	16	11	68.2	Inadequate AI
LEC Thangrong	99	28	10	3	28.3	Closed in 2016
LEC Lingmithang	103	21	10	2	20.4	Inadequate AI & AISR
LEC Ngatshang	2206	807	221	86	39.0	Adequate AI & AISR
LEC Sherimuhung	190	36	19	4	18.9	Inadequate AI & AISR
LEC Tsamang	103	42	10	4	40.8	Inadequate AI
Narang	2	2	0	0	100.0	Closed in 2016
LEC Tsakaling	76	4	8	0	5.3	Inadequate AI & AISR
10	**9785**	**3228**	**979**	**365**	**37.3**	

Lhuentse Dzongkhag

The Dzongkhag had performed on an average of 49AI/center/year and achieved AISR of 26.1%. All 4 operational AICs in the Dzongkhag had neither performed the required no of AI nor achieved the national/ regional average AISR (Table 39). Therefore, mass awareness on benefit of AI needs to be imparted and follow-up on progeny born should be strengthened.

Table 39: AI centers and their performance in Lhuentshe Dzongkhag

AI Centre	Records (2011-2021)		Annual avg.		AISR (%)	Remarks
	AI	Progeny	AI	Progeny		
DVH Lhuentse	562	146	56	15	26.0	Inadequate AI & AISR
LEC Thangmachu	423	131	42	13	31.0	
LEC Menji	330	68	33	7	20.6	
LEC Khoma	175	53	18	5	30.3	
Shertsham Farm	37	0	4	0	0.0	
4	**1527**	**398**	**153**	**40**	**26.1**	

Conclusion and Recommendations

The overall AI coverage as compared to breedable cattle population available in the country was low. Nevertheless, the contribution of AI progeny in total milk production was note worthy. Hence, AI coverage needs to be intensified with adequate logistic support like timely supply of LN_2 through establishment of LN_2 plants at strategic locations region-wise.

The AI performance for the review period in terms of no of AI done and AI success rate was below the baseline performance requirement (APA: 84AI/Centre/year and 37% AISR).The AI Centre performance validation in western region revealed that the AI centres that had rendered mobile AI services (8/36 AICs) and followed up on progeny born after AI (14/36 AICs) had recorded good performances achieving more than the baseline requirement. Therefore, mobile AI services and proper follow-up on progeny born after AI should be strengthened. Most of the CAITs in the region had stopped providing AI services and the discontinuity was attributed to non remuneration for the services according to the agreement signed between the service provider (CAIT) and the beneficiary (public). The supply of sexed semen in some of the AI centres, having good record of AI success rate, had recorded increase in no of AI done as well as AI success rate. Therefore, AI centres having fluent CAIT/ technicians (determined by the AISR) should be supplied with sexed semen for AI in virgin heifers and cows up to 3rd lactation with excellent breeding records.

In order to ensure resource efficient AI service delivery; enhancing AI coverage and efficiency (AI success rate), the Dzongkhags need to undertake following interventions;

- Provide awareness to public on benefit of AI
- Coordinate to sterilize uncertified/scrub bulls in the vicinity of AI centres
- Arrange to train at least one CAIT per AIC or more in potential pockets according to vastness of AI coverage area, targeting the ESP of RNR Centre/ Gewog Centre, in compliance with the guidelines for CAIT training and deployment: NDRDC (14),2019.

- Arrange to provide AI refresher course to both field staff and CAIT at least once in a five year plan period.
- Incorporate AI services (Quantity – no. of AI done, Quality – AI success rate and Time – reporting deadline) in the Individual Work Plan (IWP) of extension staff responsible for delivery of AI services.
- Monitor the performance of AI centres at least on a quarterly basis by the DLO/ADLO/VO as per convenience of the Dzongkhag Livestock sector.
- Cluster nearby AICs with the provision of LN2 reserve tank and portable container at outreach Centre/ CAIT for delivery of mobile AI services.
- Regularly monitor infertility cases to achieve calving to calving interval of 14 – 15 months, for which VOs to attend the cases or refer complicated cases to RLDC/ NDRDC.
- Ensure timely placement of requisition for AI inputs (LN_2 and frozen semen) and lifting them from the RLDC to avoid its shortage in field AI centres in the Dzongkhag.
- Close/ relocate the AICs that are performing inadequately, after having provided all above arrangements for about a year, in consultation with Gewog Administration.

For continuity and sustainability of sexed semen usage in field, the actual cost of sexed semen may be charged as per policy directives preferably through CAIT who shall recover the cost by incorporating it in the service delivery package. The approach in turn is expected to strengthen the PPP in breed improvement programme.

Appendix 3. Detail of budget and expenditure statement

ADMINISTRATIVE UNIT:

FIELD OFFICE: 204.01 MINISTRY OF AGRICULTURE & FORESTS

03 DEPARTMENT OF LIVESTOCK 11, NATIONAL LIVESTOCK BREEDING PROGRAMME

PRG	SPRG	ACT	SACT	FIC	OBC		Budget	Expenditure
045	026	001	01	0001	01.01	Pay and allowance	11.781	11.778
					02.01	Other Personnel emolument	2.671	2.671
					11.03	Travel (LTC)	0.558	0.558
					24.03	Contribution – (PF)	1.578	1.578
					25.01	Retirement Benefit	0.086	0.085
			02	0001	12.01	Utilities –Tele/ Telex, Fax, E	0.110	0.110
					12.03	Utilities – Elec/Water/sewer	0.065	0.065
					14.01	S & M - Office Supplies, Prin	0.075	0.075
					14.06	S & M - Extension Kits, Lin	0.075	0.075
					15.01	MoP - Buildings	0.010	0.010
					15.02	Mop - Vehicles	0.590	0.590
					15.06	MoP - Plantations	0.079	0.079
					17.01	Op. Exp. - Advertising	0.025	0.025
					18.01	Hospitality & Entertainment	0.062	0.062
					54.02	Office equipment	0.040	0.040
			03	0001	11.01	Travel	0.952	0.952
		002	01	0001	12.03	Utilities – Elec/Water/sewer	0.584	0.584
					12.05	Utilities – Fuelwood	0.005	0.005
					15.05	MoP - Equipment	0.060	0.060
				5190	52.07	P & Equipt.- Hospital/Lab. E	3.50	3.50
			02	0001	14.02	S & M - Medicines & vacc	0.050	0.050
				5190	52.06	Plant & Equipt. - Livestock	2.750	2.750
					14.05	S & M - Animal Feeds	0.240	0.240
					15.05	MoP - Equipment	0.010	0.010
			06	0001	14.04	S & M - Seeds, Seedlings	0.021	0.021
					51.07	Expen on structure - Plant	0.704	0.703
		04	01	0001	14.02	S & M - Med & Lab Consum	0.024	0.024
					55.01	Professional services	0.228	0.228
					52.07	P&E–Hospital lab equipment	3.00	3.00
		05	01	0001	12.01	Utilities –Tele/ Telex, Fax, E	0.002	0.002
		06	07	5190	52.07	&E–Hospital lab equipment	5.000	5.000
						Total	**34.935**	**34.93**

Fund utilized IN 2020-21 is (34.93/34.935 *100) = 99.98% (Reference: EPEMS printout NDRDC, Yusipang)

Appendix 4. Detail of staffs of NDRDC Yusipang

Sl. #	Name	Designation	Sector
1	Dr. Nar Bahadur Tamang	Program Director	Management Direction services
2	Mr.Jigme Tenzin	Acct. Asst IV	Management Direction services
3	Mr. PemaDorji	Adm. Asst II	Management Direction services
4	Mr. DurgaChhetri	Driver I	Management Direction services
5	Mr. Domzang	Driver I	Management Direction services
6	Mr. Pema Tenzin	Driver II	Management Direction services
7	Mr. Tashi	Driver III	Management Direction services
8	UgyenWangchuk	Driver III	Management Direction services
9	MrSamten	Driver III (PT)	Management Direction services
10	Dr.D.BRai	Specialist III	Dairy Production Research Sector
11	Ms. DekiChoden	Dy. CLPO	Dairy Production Research Sector
12	Mr.Abi Narayan Koirala	Sr. LPS II	Dairy Production Research Sector
13	Dr. Dorji	Specialist III	Inputs Production Research Sector
14	MrThinleyDorji	Sr LPO	Inputs Production Research Sector
15	Mr.PhubDorji	Asst. Engineer II	Inputs Production Research Sector
16	Mrs. Yudon	Sr. LPS	Inputs Production Research Sector
17	Mr. Chungsila	LPS I	Inputs Production Research Sector
18	Mr. Kanti Ram Chhetri	LPS III	Inputs Production Research Sector
19	Mr. Nima	Lab Asst. I	Inputs Production Research Sector
20	Mr. Phuntsho T Norbu	PLO	Research Post Production Sector
21	Ms. Kinley Choki	Dy. CLPO	Research Post Production Sector
22	Ms. SonamZangmo	Dairy Officer	Research Post Production Sector
23	Mr.Lokey Thapa	Dy. CLPO	Dairy Research Communication Sector
24	Mr.YurajGiri	Sr.ES II	Dairy Research Communication Sector
25	MsTashiPemo	LPO	Dairy Research Communication Sector

Appendix 5. Detail of GSP and ESP employed in the Centre

Sl. #	Name	CID	Position Title	Position Title
1	Dil Kumar Rai	10506000214	Wet Cleaner	GSP I
2	SangayDema	10709000375	Wet Cleaner	GSP I
3	Sancha Maya Blon	10308000412	Wet Cleaner	GSP
4	DawaZangpo	11607000761	Lab Utility Helper	ESP
5	KingaNamgyel	11903000629	Night Guard	ESP
6	Karma Wangzom	11604002278	Pasture Attendant	ESP
7	KanchiLepcha	11213005331	Pasture Attendant	ESP
8	DhilBdrLimbu	11212004232	Pasture Attendant	ESP
9	Bhim Raj Subba	11802001368	Pasture Attendant	ESP
10	Bee Maya Gurung	11213000765	Pasture Attendant	ESP
11	Bhim Raj Subba	11304000444	Pasture Attendant	ESP
12	BabitaRai	10201003652	Pasture Attendant	ESP
13	SonamGyeltshen	10208001239	Pasture Attendant	ESP
14	RoshanRai	10311002715	Pasture Attendant	ESP
15	San Maya Gurung	11213003312	Animal Attendant	ESP
16	SomBdrLimbu	11304001412	Animal Attendant	ESP
17	TsheringNidup	10903000547	Animal Attendant	ESP
18	Champa Maya Rai	11205000189	Animal Attendant	ESP

Annexure 6: Detail of Gewogs or AICs with Sexed semen technology promotion

Region	Name of Dzongkhag	Name of Gewogs/ AICs	AI	Progeny		
				M	F	Total
West	Thimphu	DVH - Ramtokto T/phu	0	0	0	0
		LEC Tshaluna	75	6	26	32
		NDRC, Yusipang	27	2	15	17
	Paro	DVH Wangchang	19	0	5	5
		LEC Katsho + Bji	61	7	34	41
	Chukha	LEC Darla	77	3	49	52
	Samtse	DVH Samtse	0	0	0	0
		LEC Ugyentse	18	0	9	9
		LEC Yoesheltse	8	1	6	7
	Total	***10***	***285***	***19***	***144***	***163***
West-C	Punakha	DVH Punakha (Guma)	48	3	14	17
		CNR Lobesa	16	0	4	4
	Wangdue	DVH Petakarpo	0	0	0	0
		LEC Gaselo/Gumina	8	0	2	2
	Tsirang	DVH Damphu, Kilkhorthang, Rangthangling, Cholingkhor	256	4	106	110
		LEC- Gosarling	15	1	18	19
	Dagana	LEC Tshendagang (Dagapela), Gozhi	47	4	18	22
	Total	***10***	***390***	***12***	***162***	***174***
	Bumthang	RCBC, Bumthang	24	1	7	8

East-C		Chokor	28	0	0	0
		LEC Tang/ Wobthang	0	0	0	0
	Trongsa	LEC Tangsibji	26	0	17	17
		DVH Sherabling, Trongsa	0	0	0	0
	Zhemgang	DVH Trong Z/gang	51	0	7	7
		LEC Panthang-(Phangkhar)	7	0	0	0
East	***Total***	***7***	***136***	***1***	***31***	***32***
	Lhuentse	LEC Menbi	52	0	6	6
		LEC Menji	25	2	13	15
	Mongar	DVH Mongar (Yakpugang)	98	0	31	31
		LEC Ngatshang	60	3	18	21
		LEC Chaskhar	74	9	27	36
	Tashiyangtse	DVH –Yangtse	52	3	14	17
		LEC Khamdang	23	0	0	0
	Trashigang	DVH T/gang	37	3	20	23
		LEC Kanglung	85	1	37	38
		LEC Bartsham	20	0	6	6
		LEC Yangnyer	85	4	45	49
		LEC Bikhar	4	0	0	
	Pemagatshel	DVH P/gatshel	23	1	20	21
		LEC Khar	28	4	16	20
		LEC Shumar (Nangkor)	61	1	24	25
		LEC Yurung	20	0	4	4
		LEC Zobel	39	0	13	13
		LEC-Nanong	94	4	29	33
		LEC Norbugang	57	5	28	33
		LEC Dechheling	20	1	3	4
	S/Jongkhar	LEC Deothang	13	4	19	23
		LEC Orong	42	2	26	28
		BLDCL Samrang	182	12	49	61
	Total	***23***	***1194***	***59***	***448***	***507***
	Grand Total	**54**	**2005**	**91**	**785**	**876**

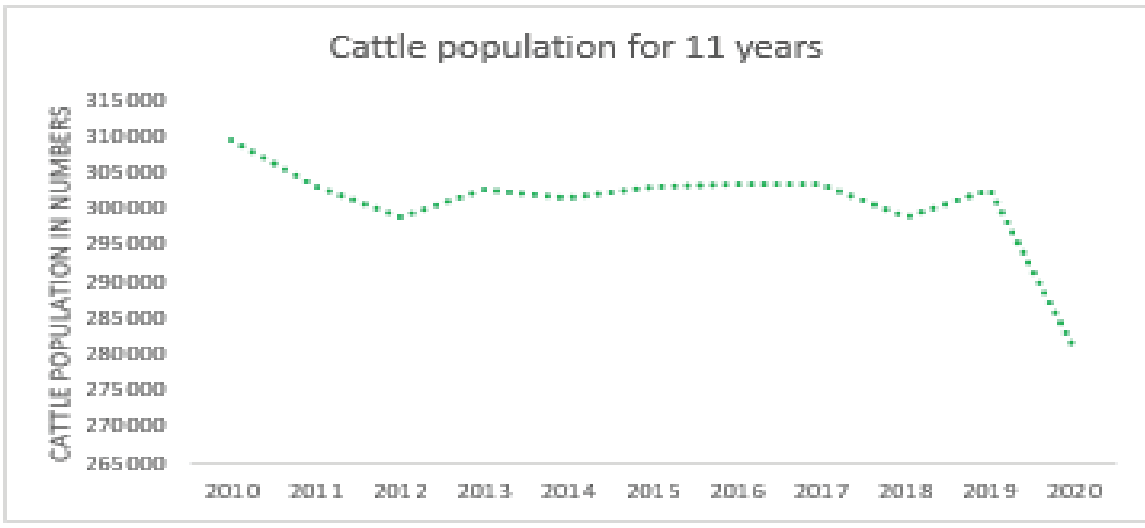
Appendix 7: AI performance and progeny born (July 2021 to June 2022

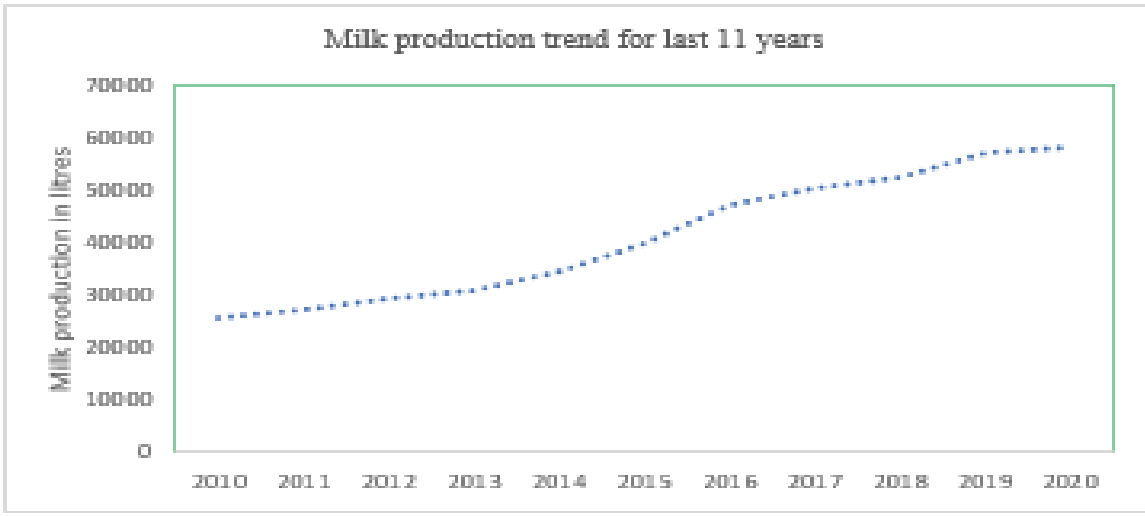
Dzongkhag	AI centre	Total AI	Male	Female	Total progeny	AI success rate(%)	Avg. AI/month	Remarks
Thimphu	DVH - Ramtokto T/phu	121	6	7	13	10.74	10.08	
	LEC Khasadrapchu	64	1	26	27	42.19	5.33	
	LEC Kawang	18	1	2	3	16.67	1.50	
	LEC Genekha	51	0	2	2	3.92	4.25	
	LEC Tshaluna	119	17	38	55	46.22	9.92	
	NDRC, Yusipang	55	9	21	30	54.55	4.58	
Total	**6**	428	34	96	130	30.37	5.94	
Paro	DVH Wangchang Paro	151	25	46	71	47.02	12.58	
	LEC Tshentog	50	10	7	17	34.00	4.17	
	LEC Lamgong	73	24	28	52	71.23	6.08	
	LEC Shari	50	9	6	15	30.00	4.17	
	LEC Dogar (Dawakha)	53	16	9	25	47.17	4.42	
	LEC Shaba	45	2	3	5	11.11	3.75	
	LEC Luni	45	8	13	21	46.67	3.75	
	LEC Doteng	60	18	28	46	76.67	5.00	
	LEC Naja	63	18	11	29	46.03	5.25	

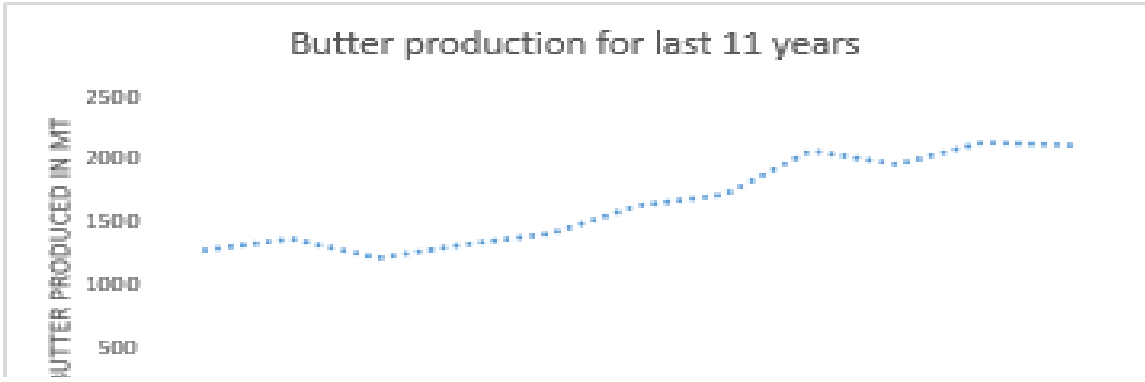
Total	**9**	590	130	151	281	47.63	5.46	
Haa	DVH Tshelungkha Haa	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Bji (Yangthang)	15	1	0	1	6.67	1.25	
	LEC Katsho	119	14	42	56	47.06	9.92	
Total	**2**	134	15	42	57	42.54	5.58	
Chukha	DVH Tsimasham	7	0	5	5	71.43	0.58	
	LEC Darla	195	32	95	127	65.13	16.25	
	LEC Sampheling	85	9	13	22	25.88	7.08	
	LEC Phuntsholing	73	20	29	49	67.12	6.08	
	LEC Chapcha	12	3	8	11	91.67	1.00	
	CRC - Wangkha	0	0	0	0	#DIV/0!	0.00	In-active
Total	**5**	372	64	150	214	57.53	6.20	
Samtse	DVHSamtse	15	2	4	6	40.00	1.25	
	LEC Changmari/Norbugang	34	0	1	1	2.94	2.83	
	LEC Chargarey/Sangachholing	10	0	0	0	0.00	0.83	
	LEC Ugyentse	23	0	13	13	56.52	1.92	
	LEC Yoesheltse	39	17	20	37	94.87	3.25	
	LEC Sipsu/ Tashicholing	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Dorokha/Dophuchen	35	7	13	20	57.14	2.92	
	LEC Tendu	15	6	4	10	66.67	1.25	
	LEC- Gomtu/ Phuntshopelri	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Buduney - Samtse	18	0	0	0	0.00	1.50	
	LEC- Tading	3	0	0	0	0.00	0.25	
	LEC Norgaygang/ Bara	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Namgaycholing/Lareney	35	2	7	9	25.71	2.92	
	NJBC- Samtse	25	15	12	27	108.00	2.08	
Total	**11**	252	49	74	123	48.81	1.91	
Gasa	DVH Gasa	18	7	5	12	66.67	1.50	
	LEC Damji	37	12	10	22	59.46	3.08	
Total	**2**	55	19	15	34	61.82	2.29	
Punakha	DVH Punakha	235	36	80	116	49.36	19.58	
	LEC Dzomesa (Samdingkha)	172	17	37	54	31.40	14.33	
	LEC Talo	43	9	8	17	39.53	3.58	
	LEC Thinlaygang/Toepaisa	33	1	3	4	12.12	2.75	
	LEC Kabjisa	131	19	21	40	30.53	10.92	
	LEC Barp/CNR Lobesa	59	5	9	14	23.73	4.92	
	LEC -Shengana	26	3	6	9	34.62	2.17	
	LEC -Lingmukha (Tshochasa)	6	7	0	7	116.67	0.50	
	LEC Chubu	29	8	5	13	44.83	2.42	
Total	**9**	734	105	169	274	37.33	6.80	
Wangdue	DVH Petakarpo Wangdue	37	13	10	23	62.16	3.08	
	LEC Gaselo/Gumina	72	7	19	26	36.11	6.00	
	LEC Phobji (Phobjikha)	8	4	6	10	125.00	0.67	
	LEC Sephu	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Rubesa	10	3	7	10	100.00	0.83	
	LEC Phangyul (Katikha)	6	4	6	10	166.67	0.50	
	LEC Bjena	28	1	3	4	14.29	2.33	
	LEC Nyisho(Samtegang)	0	0	0	0	#DIV/0!	0.00	In-active
Total	**6**	161	32	51	83	51.55	2.24	
Tsirang	DVH Damphu Tsirang	491	42	164	206	41.96	40.92	
	LEC- Gosarling	93	16	73	89	95.70	7.75	
	LEC- Mendrelgang	64	8	6	14	21.88	5.33	
	LEC- Barsong	52	3	15	18	34.62	4.33	
	LEC- Sergithang	50	23	27	50	100.00	4.17	
	LEC Tsirangtoe	28	9	9	18	64.29	2.33	
	LEC Semjong	23	3	4	7	30.43	1.92	
Total	**7**	801	104	298	402	50.19	9.54	
Dagana	LEC Tshendagang (Dagapela)	169	17	42	59	34.91	14.08	

	LEC Drujegang	74	19	21	40	54.05	6.17	
	LEC Lhamoizingkha	30	2	6	8	26.67	2.50	
	LEC Tsangkha	7	0	1	1	14.29	0.58	
Total	**4**	280	38	70	108	38.57	5.83	
Bumthang	DVH Bumthang	172	44	54	98	56.98	14.33	
	LEC Chokhor (Thangbi)	17	1	4	5	29.41	1.42	
	LEC Chumey	27	10	10	20	74.07	2.25	
	LEC Tang/ Wobthang	55	6	10	16	29.09	4.58	
	LEC Ura	0	0	0	0	#DIV/0!	0.00	In-active
	BS Farm - Bumthang	148	20	31	51	34.46	12.33	
Total	**5**	419	81	109	190	45.35	6.98	
Trongsa	DVH Sherabling Trongsa	34	2	5	7	20.59	2.83	
	LEC Kuengarabten/Takse	53	18	11	29	54.72	4.42	
	LEC Langthel/Bayling	23	5	1	6	26.09	1.92	
	LEC Tangsibji	99	6	32	38	38.38	8.25	
	LEC Bemji	9	1	7	8	88.89	0.75	
	CAIT Korphu (Nimzhong)	3	0	6	6	200.00	0.25	
Total	**6**	221	32	62	94	42.53	3.07	
Zhemgang	DVH Trong Z/gang	122	32	45	77	63.11	10.17	
	LEC Panbhang - Ngangla	9	1	1	2	22.22	0.75	
	LEC Buli - Nangkhar	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Pantang - Phangkhar	9	1	0	1	11.11	0.75	
	LEC Tingtibi - Trong	9	1	4	5	55.56	0.75	
Total	**4**	149	35	50	85	57.05	3.10	
Sarpang	DVH Sarpang	21	5	6	11	52.38	1.75	
	LEC - Gelephu	105	2	7	9	8.57	8.75	
	LEC - Dekiling	6	1	1	2	33.33	0.50	
	LEC- Chuzargang	3	0	0	0	0.00	0.25	
	LEC- Sersong	5	3	6	9	180.00	0.42	
	LEC Umling	4	6	6	12	300.00	0.33	
Total	**6**	144	17	26	43	29.86	2.00	
Lhuntshe	DVH Gangzur Lhuntshe	4	0	1	1	25.00	0.33	
	LEC Khoma	16	2	3	5	31.25	1.33	
	LEC Menbi	83	6	8	14	16.87	6.92	
	LEC Minjey	36	4	19	23	63.89	3.00	
	NPHPC Sertsham - Jarey	0	0	0	0	#DIV/0!	0.00	In-active
Total	**4**	139	12	31	43	30.94	2.90	
Mongger	DVH Monger	274	22	48	70	25.55	22.83	
	LEC Chali	37	7	3	10	27.03	3.08	
	LEC Ngatshang	118	13	29	42	35.59	9.83	
	LEC Sherimung	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Chaskhar	254	40	68	108	42.52	21.17	
	LEC Drametse	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Tshakaling	2	2	0	2	100.00	0.17	
	LEC Lingmithang/Thridandbi	37	5	9	14	37.84	3.08	
	LEC Depong	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Tsamang	11	0	5	5	45.45	0.92	
	LEC Narang	0	0	0	0	#DIV/0!	0.00	In-active
Total	**7**	733	89	162	251	34.24	8.73	
Tashiyangtse	DVH -Yangtse	84	10	17	27	32.14	7.00	
	LEC Khamdang	33	2	3	5	15.15	2.75	
	LEC Bumdeyling	1	0	0	0	0.00	0.08	
	LEC Ramjar (Tongshang/ tongmajangsa)	47	1	14	15	31.91	3.92	
	LEC Jamkhar	2	1	0	1	50.00	0.17	
	LEC Toedtsho	0	0	0	0	#DIV/0!	0.00	In-active
Total	**5**	167	14	34	48	28.74	2.78	
Trashigang	DVH T/gang	94	19	31	50	53.19	7.83	
	LEC Radhi	59	8	15	23	38.98	4.92	

	LEC Bartsham	81	17	29	46	56.79	6.75	
	LEC Yangnyer	229	51	153	204	89.08	19.08	
	LEC Kanglung	104	8	35	43	41.35	8.67	
	LEC Khaling	45	2	16	18	40.00	3.75	
	LEC Bikhar -Samkhar	13	6	3	9	69.23	1.08	
	LEC Phongmaed	2	0	0	0	0.00	0.17	
	LEC Bidung	11	2	4	6	54.55	0.92	
	RNR-Changmay - Shongphu	3	0	0	0	0.00	0.25	
	LEC Lumang	6	0	0	0	0.00	0.50	
	NNBF -T/yangphu	0	0	0	0	#DIV/0!	0.00	In-active
Total	**11**	647	113	286	399	61.67	4.90	
Pemagatshel	DVH P/gatshel	68	9	38	47	69.12	5.67	
	LEC Khar (Tshebar + petingma)	40	4	34	38	95.00	3.33	
	LEC Nangkhor (Shumar)	98	3	30	33	33.67	8.17	
	LEC Yurung	36	4	18	22	61.11	3.00	
	LEC Zobel (Tshelingore + Nangmalang)	60	2	13	15	25.00	5.00	
	LEC-Nanong (Wangchelo)	259	27	66	93	35.91	21.58	
	LEC Norbugang (Nganglham+ Menchu)	168	13	46	59	35.12	14.00	
	LEC Decheeling (Dechheling/Martshala)	54	4	3	7	12.96	4.50	
Total	**8**	783	66	248	314	40.10	8.16	
S/Jongkhar	LEC Deothang(Rikhey+Domphu+Martang)	104	14	33	47	45.19	8.67	
	LEC Orong	71	3	33	36	50.70	5.92	
	LEC Phuntshothang/Martshala	0	0	0	0	#DIV/0!	0.00	In-active
	LEC Gomdhar (Rechanglu+ Amsing+Chidungkhar+Bazor)	0	0	0	0	#DIV/0!	0.00	In-active
	BLDCL Samrang	228	17	50	67	29.39	19.00	
Total	**3**	403	34	116	150	37.22	11.19	
Grand Total	**120**	7612	1083	2240	3323	43.65	5.29	


Cattle population for 11 years
CATTLE POPULATION IN NUMBERS
315000
310000
305000
300000
295000
290000
285000
280000
275000
270000
265000
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020


Milk production trend for last 11 years
Milk production in litres
700000
600000
500000
400000
300000
200000
100000
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020


Butter production for last 11 years
UTTER PRODUCED IN MT
2500
2000
1500
1000
500