वार्षिक प्रतिवेदन
ANNUAL REPORT
2017-18

भाकृअनुप-केन्द्रीय गोवंश अनुसंधान संस्थान
ग्रास फार्म रोड, पोस्ट बॉक्स सं.-17, मेरठ छावनी 250 001 (उ.प्र.), भारत
ICAR-CENTRAL INSTITUTE FOR RESEARCH ON CATTLE
Grass Farm Road, Post Box No. 17, Meerut Cantt.- 250 001 (U.P.), India

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Annual Report 2017-18
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Correct citation : Annual Report 2017 – 18
ICAR-Central Institute for Research on Cattle
Meerut Cantt. – 250 001

Designed & Printed at : M/s Royal Offset Printers, A-89/1 Naraina Industrial Area, Phase-I,
New Delhi 110 028, **Phone :** 9811622258

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Preface

In India, cattle is always recognized as important species of livestock due to its momentous contribution to the national milk pool and securing the economy of majority of rural farmers. Consistent efforts are being taken by the Government for genetic improvement of cattle through implementation of various cattle improvement programmes viz., National Programme for Bovine Breeding and Dairy Development, National Dairy Plan, Rashtriya Gokul Mission etc., as a result, significant advancement has been achieved in increasing the milk production. The national milk production during the year 2016-17 was recorded as 163.7 million tonnes of which 48 per cent was contributed by cattle while buffalo and goat contributed 49 and 3 per cent, respectively. The country has accomplished a per cent growth of 5.27 over the previous year 2015-16 production of 155.5 million tonnes.

In spite of all these achievements, it is still argued that the cattle of the country has not yet exploited fully as its average milk production is far below the world average. The cattle production system of the country is peculiar and is different from the commercial production system of most of the other countries. Most of the country's cattle is reared by small holders with limited resources which is an impediment for improving its efficiency of production. Continued and strenuous efforts are being done to improve the production efficiency of the larger non-descript cattle population by upgrading them with important indigenous dairy cattle breeds. Genetic improvement of defined indigenous cattle breeds for increasing their production efficiency and improving the economic viability of the crossbred cattle under small holding systems are some of the key issues to be addressed in near future. The inherent limitations like shortage of genetically proven breeding bulls, quality feed and fodder, land and water resources, established AI network are some other issues also to be resolved for improving the production efficiency. The development and application of semen sexing, MOET and genomic selection in cattle improvement programmes effectively are still underway. The changing climatic conditions due to global warming and the development of mitigation strategies for reducing the role of livestock in accelerating the global warming are other challenging issues gaining more importance at present.

Further, there is vast scope of utilizing existing information on animal nutrition for development of area-specific cost-effective feeding practice, area-specific micro and macronutrient, fortified feed supplements, utilization of non-conventional feed resources etc. The research also needs to be focused on increasing efficiency of low-grade roughage utilization through genetic and non-genetic tools, minimization of methane and greenhouse gases production and development of efficient by-pass diets for high producing animals. There is also a need for understanding comparative utilization of different nutrients amongst different grades of crossbred cattle vis-a-vis Indian breeds of cattle. Proper housing of animals, especially crossbreds is also essential to minimize the stress for improving productivity of cattle.

The ICAR- CIRC, Meerut being a nodal institute for cattle research, focuses in the fields of cattle genetics and breeding, feeding, management and reproduction to enhance productivity and profitability, to plan, coordinate and monitor the research projects on cattle and to serve as national data repository and provide consultancy for cattle production and reproduction. The institute also coordinates three important genetic improvement programmes under AICRP mode to increase the performance of different indigenous and HF x Sahiwal crossbred cattle maintained under both farm and field conditions. The institute also has a well established semen freezing laboratory to produce and supply superior male germplasm of different indigenous and crossbred cattle to the needy stakeholders like Military Dairy Farms, Animal Husbandry Departments, Livestock Development Boards, Gaushalas, NGOs and commercial dairy farmers. It also acts as a key player in the socio-economic upliftment of cattle owners by infusing superior germplasm in the farmer's herd for enhancing the milk and draught capacity.

I am happy to note that the significant achievements made by the Institute in the areas of research, extension and management during the year 2017-18 are presented in the form of Annual Report and hope that this compilation will be a useful ready reckoner for the teachers, scientists, government and non-government organizations, professionals, students, farmers involved in cattle research and production.

At this juncture, I would like to express my sincere gratitude and acknowledgement to the Director General, ICAR and Secretary, DARE, Deputy Director General (Animal Science) and their team at the ICAR HQ for their valuable support and guidance. The support received from Director, Frieswal Project and Principal Investigators of all the co-operating centres of AICRP is thankfully acknowledged. I would also record my sincere acknowledgment to the former Director Dr. B. Prakash, heads of divisions, scientists, administrative and technical staff of the Institute for their contribution towards the progress of this Institute and also appreciate the efforts made by editors & publication committee involved in the preparation of this document.

(Dr. Rajendra Prasad)
Director

ICAR-CIRC: An Introduction

The Central Institute for Research on Cattle (CIRC) formerly known as Project Directorate on Cattle (PDC) was established on 3rd November 1987 at Military Farms School and Research Centre, Meerut by upgrading the status of All-India Coordinated Research Project (AICRP) on Cattle. Since then the Directorate was actively collaborating with the Military Farms, Ministry of Defence to evolve a national milch breed of crossbred cattle "Frieswal" by crossing the Holstein Friesian (5/8) with Sahiwal (3/8) cattle. Considering importance of the Indigenous cattle breeds, for their adaptability, feed conversion efficiency and disease resistance etc., the Indigenous Breeds Project (IBP) was started in collaboration with State Agricultural Universities and State Government, Non-Government Organizations and sister ICAR Institutes for conservation and genetic improvement of some of the important indigenous cattle breeds of our country viz., Gir, Sahiwal and Kankrej. During the 8th Five Year Plan, Field Progeny Testing programme (FPT) was also started to undertake progeny testing of crossbred bulls under field conditions. Considering its sincere research and extension efforts and achievements made in cattle improvement, the PDC was upgraded as Central Institute for Research on Cattle (CIRC) during 2014. Thereafter, CIRC is acting as a nodal institution to monitor, coordinate and support all research and development projects for cattle improvement. The Institute is also providing good quality germplasm to stakeholders. The Institute obtained ISO 9001:2015 certification and has well equipped Semen Freezing and Molecular Genetics laboratories besides feed testing facilities in Animal Nutrition laboratory. Besides institutional research programmes on cattle genetics, nutrition, reproduction & management, sponsored research projects from SERB-DST, Govt. of India are also regularly taken by the institute scientists.

Vision

The vision of ICAR-CIRC is "Improvement of cattle for high productivity and profitability."

Mission

Germplasm improvement and technology development for realizing enhanced productivity and profitability.

Mandate

1. Basic and strategic research on productivity and production enhancement of cattle including indigenous cattle.
2. Dissemination of scientific information and technology for cattle production management.

Objectives

AICRP on Cattle

1. To develop a national milch breed of cattle 'Frieswal' using Holstein Friesian and Sahiwal base.
2. Conservation and genetic improvement of important indigenous cattle breeds.
3. Production of progeny tested crossbred bulls and genetic improvement of cattle under field conditions.

ICAR-CIRC Main Scheme

1. To undertake research in the field of cattle breeding, feeding, management and reproduction to enhance productivity and profitability.
2. To plan, coordinate and monitor the research projects on cattle.
3. To serve as national data repository and provide consultancy for cattle production and reproduction.

In future thrust areas

1. Genetic improvement of other important indigenous breeds of cattle viz. Tharparkar, Rathi, Red Sindhi, etc. using conventional and modern breeding techniques and studies on draught animal power of important indigenous draught breeds.
2. Large scale production of quality cattle germplasm.
3. Development of optimum feeding and management practices including designing of shelter to suit the local environment for enhancing cattle productivity.
4. Sexing of male germplasm for production of calves of desired sex.
5. Validation of therapeutic importance of cow produces like milk, Punchgavaya, urine, dung etc.
6. Genomic selection of bulls and use of embryo transfer technology for elite bull production.

7. Biotechnological strategies including biotic and abiotic stress for understanding and improving cattle production and reproduction.
8. Comparative economics of productivity of Indian cattle breeds vis-à-vis crossbred cattle.

Research programmes

AICRP on Cattle

1. Studies on genetic aspects of Holstein x Sahiwal crossbreds- "Frieswal Project".
2. Field recording of performance data for undertaking large scale progeny testing–"Field Progeny Testing of Frieswal Bulls".
3. Genetic studies on performance of important indigenous breeds (Gir, Kankrej and Sahiwal) of cattle and their improvement through selection – "Indigenous Breeds Project".

ICAR-CIRC Main Scheme

1. Increasing cattle productivity using latest breeding tools.
2. Enhancement of cattle productivity through reproductive techniques.
3. Use of nutritional and management interventions for optimization of cattle productivity.
4. HRD and technology dissemination.

Infrastructure

Germplasm Resources

The Institute has undertaken research programmes related to genetic improvement of indigenous and crossbred cattle by identifying germplasm (G.P.) and data recording (D.R.) units in various government and non-government organizations. While Frieswal cattle resource is presently available at 25 Military Farms, the bull rearing unit is located at Meerut under the administrative control of Directorate of Frieswal. Similarily indigenous cattle genetic resources are available at different G.P. and D.R. units of respective breeds. The germplasm unit of Sahiwal is located at ICAR-NDRI, Karnal (Haryana) while that of Gir, and Kankrej are located at Junagadh Agricultural University, Junagadh (Gujarat) and Sardarkrushinagar University, Dantiwada (Gujarat) respectively.

Research Laboratories

The Institute has well-equipped laboratories to undertake basic and applied research works in the fields of Animal Genetics and Breeding, Animal Nutrition, Animal Physiology, Animal Reproduction and Molecular Genetics. Semen Freezing Laboratory of the Institute has state of the art facilities for cryopreservation of bovine semen with a capacity to store 25 lakh doses of frozen semen.

Computer Centre/ ARIS cell

Internet connectivity was provided to all staff through Railtel under NKN, NIC, New Delhi for smooth functioning of research work, FMS/ MIS and other office work. The Institute website www.circ.org.in was updated from time to time. ARIS cell looked after repair and maintenance of computers, printers, scanners and UPS etc. ARIS cell also provided IT facilities to conduct the lectures/ practical for students / participants during the training programs.

Library

During the year, print versions of 04 foreign journals namely Andrology, Journal of Dairy Science, Animal-An International Journal of Animal Bioscience and Reproduction in Domestic Animals were subscribed. During this period library also procured 45 scientific books on different subjects making a total of 2204 on its roll. Three Hindi newspapers namely Dainik Jagran, Amar Ujala and Danik Hindustan and two English dailies namely Times of India and The Hindu along with 20 literary magazines viz. इण्डिया टुडे (हिन्दी), इण्डिया टुडे (अंग्रेजी), योजना (हिन्दी), योजना (अंग्रेजी), गृहशोभा, मेरी सहेली, कुरूक्षेत्र, सरिता, आरोग्य संजीवनी, निरोगधाम, सांइस रिपोर्टर (अंग्रेजी), विज्ञान प्रगति, रीडर डाइजैस्ट (अंग्रेजी), हेल्थ एण्ड न्यूट्रिशन (अंग्रेजी), सखी, प्रतियोगिता दर्पण, कॉम्पिटिशन सक्सेस रिव्यु (अंग्रेजी), फेमिना, वनिता (हिन्दी) आउटलुक (अंग्रेजी), इमप्लोयेमेंट न्यूज़ पेपर (हिंदी व अंग्रेजी) Library facilities were also made available to sister organizations and students from Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut and Meerut Institute of Engineering & Technology, Meerut and the participants of different trainings organized by ICAR-CIRC, Meerut. A book exhibition cum fair was also organized during the year.

Semen Distribution Centre

A semen distribution cum sale counter is working at main gate of the Institute. Semen of crossbred and indigenous breeds is made available to the needy stakeholders from this counter on all working days.

Executive Summary

कार्यकारी सारांश

I. AICRP ON CATTLE
गाय की अखिल भारतीय समन्वित अनुसंधान परियोजना

गोवंश की संकर नस्ल फ्रीजवाल का विकास

Development of a crossbred strain of cattle "Frieswal"

देश के विभिन्न कृषि जलवायु क्षेत्रों में स्थित 25 सैन्य फार्मों पर 31 मार्च, 2018 तक कुल 20673 गोवंश थे जिनमें से 11714 वयस्क गायें, 6991 युवा मादा एवं 1968 बछड़ियाँ थी। फ्रीजवाल गायों की सर्वाधिक संख्या सैन्य फार्म अम्बाला (2480), जालंधर (1811) एवं पिंपरी (1742) पर थी।

The total population of Frieswal females as on 31st March 2018 at 25 Military Farms located in various agro-climatic regions of the country was 20673 comprising of 11714 adult cows, 6991 young stock and 1968 calves. The number of Frieswal females was highest at MF Ambala (2480) followed by Jalandhar (1811) and Pimpri (1742).

साँड पालन ईकाई, मेरठ में कुल 235 फ्रीजवाल साँड उपलब्ध थे जिनमे 225 वयस्क एवं 10 युवा साँड थे। इसके अलावा 06 वयस्क एवं 02 युवा साहीवाल साँड भी पाले जा रहे हैं। देश के विभिन्न फार्मो पर कुल 992 अभिजात्य फ्रीजवाल गायें हैं जिनका उपयोग संभ्रांत साँडों से संभोग कराकर युवा साँडों का चयन किया जायेगा। परियोजना की स्थापना से अब तक संभ्रांत साँडों एवं अभिजात्य गायों से कुल 1546 युवा बछड़े 29 विभिन्न सैन्य फार्म पर पैदा कर साँड पालन ईकाई, मेरठ पर प्राप्त किए गये। अप्रैल, 2017 से मार्च, 2018 तक कुल 89 बछड़े साँड पालन ईकाई पर प्राप्त किये गये। इस वर्ष सर्वाधिक बछडे सैन्य फार्म, मेरठ (24) एवं बेंगडूबी (17) से प्राप्त किये गये। स्थापना के बाद से अब तक, सैन्य फार्म अम्बाला ने सबसे ज्यादा बछड़े (322), मेरठ (291) तथा पिंपरी (175) ने आपूर्ति की।

A total of 235 Frieswal bulls (including 225 adult and 10 young stock) and six Sahiwal adult bulls and two Sahiwal young stock were maintained at bull rearing unit, Meerut. A total of 992 elite Frieswal cows are maintained at Military farms for nominated mating and production of future bulls. Since inception of the project, a total of 1546 male calves born out of nominated mating and based on breed characteristics and physical conformity were received/ are available at BRU Meerut and military farms for selection of young male calves for future breeding. A total of 89 bull calves were received/due to receive at Bull Rearing Unit during April 2017 to March 2018. Meerut farm supplied the highest number of male calves (24) followed by Bengdubi (17) during this year. Since inception of the project Ambala farm had supplied highest number of male calves to BRU (322) followed by Meerut (291) and Pimpri (175).

देश के विभिन्न सैन्य फार्मों को कुल 67243 वीर्य मात्राएं वितरित की गईं तथा 36400 मात्राएं संतति परीक्षण परियोजना के विभिन्न केन्द्रों को वितरित की गई। प्रतिवेदन अवधि के दौरान 48616 फ्रीजवाल वीर्य मात्राएं विभिन्न पैरावेट, राज्य पशुपालन विभाग, आदि को विक्रय कर कुल रूपये 7,24,163/– के राजस्व की प्राप्ति की गई।

A total of 67243 doses have been distributed to Military Farms and 36400 doses to Field Progeny Testing Project. This year, 48616 doses have been sold to paravets, State Animal Husbandry Departments, Livestock Development Boards, State Agriculture Universities and a revenue of Rs. 7,24,163/- was generated.

फ्रीजवाल गायों में प्रथम ब्याँत आयु का औसत 967.24 दिवस था। प्रथम ब्याँत आयु पर फार्म एवं ब्याँत वर्ष का प्रभाव सार्थक था। फ्रीजवाल गायों में 300 दिन का दुग्ध उत्पादन, ब्याँत का सम्पूर्ण दुग्ध उत्पादन, उच्चतम उत्पादन एवं दुग्धकाल का न्यूनतम वर्ग माध्य क्रमशः 3340.26, 3358.86, 14.91 किग्रा एवं 322.09 दिन था। इन गुणों पर फार्म, दुग्धकाल संख्या, ब्याने का ऋतु एवं वर्ष एवं प्रथम ब्याँत आयु का प्रतिगमन का प्रभाव सार्थक था। फ्रीजवाल गायों ने 300 दिनों में सैन्य फार्म इलाहाबाद

(4116.91 किग्रा) पर सर्वाधिक दुग्ध उत्पादन किया। अन्य अधिक दुग्ध उत्पादन करने वाले सैन्य फार्म, कानपुर (3958.12) एवं लखनऊ (3824.91 किग्रा) थे। ब्याँत का सम्पूर्ण दुग्ध उत्पादन सैन्य फार्म इलाहाबाद (4245.44 किग्रा), कानपुर (4088.11 किग्रा) एवं लखनऊ (3852.33 किग्रा) में था। संशेचन काल, शुष्क अवधि एवं ब्याँत अंतराल का न्यूनतम वर्ग माध्य क्रमशः 162.52, 116.98 एवं 433.05 दिन था। इन पुनरुत्पादन गुणों पर फार्म, दुग्ध काल संख्या, ब्याने की ऋतु एवं वर्ष तथा प्रथम ब्याँत आयु का प्रभाव सार्थक था।

The overall mean age at first calving was 967.24 days (31.82 months). The effects of farm and year of birth were significant on AFC. The overall means of 300 days milk yield and total milk yield, peak yield (PY) and lactation length based on 31851 and 54062 lactation records were 3340.26, 3358.86, 14.91 kg and 322.09 days, respectively. The effects of farm, parity, season, year of calving and regression on AFC were significant on all the traits. Frieswal cows at MF Allahabad (4116.91 kg) produced the highest 300 days milk yield followed by Kanpur (3958.12 kg) and Lucknow (3824.91 kg). Similarly, Frieswal cows at Allahabad (4245.44 kg) had the highest total lactation milk yield followed by Kanpur (4088.11 kg) and Lucknow (3852.33 kg). The least square means of service period (SP), dry period (DP) and calving interval (CI) were 162.52, 116.98 and 433.05 days, respectively. These traits were also significantly influenced by farm, parity and season and year of calving and regression on AFC.

फ्रीजवाल गायों में प्रथम ब्याँत आयु, 300 दिन का दुग्ध उत्पादन, ब्याँत का सम्पूर्ण दुग्ध दुग्ध उत्पादन, उच्चतम दुग्ध उत्पादन की आनुवांशिकता क्रमशः 0.067±0.013, 0.148±0.001, 0.149±0.011 थी। जोकि निम्न थी। संशेचन काल, शुष्क अवधि एवं ब्याँत अंतराल की आनुवांशिकता क्रमशः 0.014±0.004, 0.015±0.005 एवं 0.011±0.004 थी।

The genetic parameters of production and reproduction traits were estimated by univariate and multivariate repeatability animal models using WOMBAT software. Estimates of heritability for AFC (0.067 ±0.013), MY300 (0.148 ± 0.001), TMY (0.141 ± 0.001), and PY (0.149 ± 0.011) were low. DP, CI and SP also had low heritability estimates of 0.014 ± 0.004, 0.015 ± 0.005 and 0.011 ± 0.004, respectively.

फ्रीजवाल गायों के 1766 ब्याँत आँकड़ों का प्रयोग प्रथम ब्याँत दुग्ध उत्पादन से वयस्क दुग्ध उत्पादन का अनुमान लगाने का अध्ययन किया गया। परिणामों के आधार पर यह पाया गया कि प्रथम ब्याँत उत्पादन वयस्क दुग्ध उत्पादन का अनुमान लगाने का उचित संकेतक नहीं है।

The lactation records of 1766 Frieswal animals born between 2001 and 2013 were considered for prediction of mature lactation milk yield from first lactation traits. First lactation traits considered under the study were age at first calving, 305-days milk yield, peak yield, service period, dry period and calving interval. The results revealed that first lactation traits are not indicative of mature lactation milk yield in Frieswal cows.

संकर गोवंश का क्षेत्र संतति परीक्षण द्वारा आनुवांशिक उन्नयन

Genetic improvement of crossbred cattle under field conditions- Field Progeny Testing of Frieswal bulls

गुरु अंगद देव पशु चिकित्सा व पशु विज्ञान विश्वविद्यालय, लुधियाना (पंजाब)

Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab (GADVASU)

इस इकाई पर अब तक 14 विभिन्न समूहों मे कुल 309 साँडों का प्रजनन हेतु प्रयोग किया गया है। अब तक कुल 142907 कृत्रिम गर्भाधान किये गये जिनसे 18974 बछड़ियाँ पैदा हुई हैं। इनमें से 5657 बछड़ियाँ प्रथम ब्याँत की उम्र पर आ चुकी हैं। वर्ष 2017 में, 3337 कृत्रिम गर्भाधान कराये गये जिससे औसत गर्भधारण की दर 46.2 प्रतिशत प्राप्त हुई।

A total of 309 bulls have so far been introduced in 14 different sets. The total number of inseminations done so far was 142907 yielding 18974 female progenies, of which, 5657 reached age at first calving. During the year, a total of 3737 inseminations were carried out with an overall conception rate of 46.2%.

बछड़ियों की प्रथम ब्याँत में 305 दिनों की उत्पादकता 3769.9±26.5 किग्रा. रिकॉर्ड की गयी तथा प्रथम ब्याँत पर औसत उम्र 1046.2±9.7 दिन थी। पिछले 12 समूहों में साँड़ों की लगभग 4013 बछड़ियाँ अपना प्रथम ब्याँत पूर्ण कर चुकी हैं। साँडों के प्रथम समूह (1995) में औसत दुग्ध उत्पादन 2697.8 किग्रा. से बढ़कर वर्तमान समूह (2017) में 3769.9 किग्रा. पर पहुँच गया है। इसमे कुल 1072.1 किग्रा. दूध (39.7) वृद्धि गत वर्षों में हुई है। वर्ष 1995 में प्रथम ब्याँत आयु 1192 दिन हुआ करती थी जोकि अब वर्तमान (2017) में, घटकर 1046 दिन पर आ गयी है।

अर्थात प्रथम ब्यांत आयु में 146 दिन (12.23%) की गिरावट दर्ज की गयी।

The average first lactation 305 days milk yield and age at first calving of daughters completed their first lactation was 3769.9 ± 26.5 kg and 1046.2 ±9.7 days, respectively. About 4013 daughters from first twelve batches of bulls have completed their 1st lactation 305 days milk yield. In 1st set of bulls (1995), the 305-days milk yield was 2697.8 kg and in current set, it was 3769.9 kg which indicates a sharp increase of 1072.1 kg milk (39.7%) in progenies of bulls under test. The age at first calving was 1192 days in progenies of first set of bulls (1995) which reduced to 1046 days in current set which indicate a sharp decrease of 146 days (12.23%).

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अभी तक यहाँ पर विभिन्न 15 समूहों मे कुल 292 साँड प्रयोग किये गये। इनसे कुल 1179215 कृत्रिम गर्भाधान किये गये जिनसे 9367 बछड़ियाँ पैदा हुईं। इनमे से 2269 अपनी प्रथम ब्याँत की उम्र प्राप्त कर चुकी हैं।

A total 292 bulls have so far been introduced in 15 different sets and a total of 117215 inseminations have been done in which 9367 female progenies born, of which, 2269 reached age at first calving.

वर्ष 2017 मे, कुल 46.00% गर्भाधान की दर के साथ 5163 गाय ग्याभिन कराई गयीं। 305 दिन के प्रथम ब्याँत में औसत दुग्ध उत्पादन 2961.22±43.73 किग्रा. प्राप्त हुआ है। प्रथम ब्याँत पर पहुँचने की औसत आयु 1024.22±14. 30 दिन प्राप्त हुई है। अभी तक पिछले 12 समूहों में 305 दिन की प्रथम ब्याँत 1807 बछड़ियों द्वारा पूर्ण किया जा चुका है। वर्ष 1992 मे प्रथम ब्याँत का औसत उत्पादन 1958.4 किग्रा. था। वह अब बढ़कर 2961.22 किग्रा. पर 1002.80 किग्रा. (51.2%) वृद्धि के साथ पहुँच गया है। वहीं औसत प्रथम ब्याँत उम्र वर्ष 1992 मे 1136.4 दिन थी जो घटकर 1024.22 दिन पर आ गयी है। जोकि 112.18 दिन (9.87%) कम है।

During 2017, 5163 inseminations were carried out with an overall conception rate of 46.0%. The averages for first lactation 305-days milk yield and age at first calving of daughters completed their first lactation were 2961.22 ± 43.73 kg and 1024.22 ± 14. 30 days, respectively. About 1807 daughters from first 12 batches of bulls have completed their first lactation 305 days milk yield. The frist lactation 305-days milk yield has showed an increasing trend over the sets as in first set (1992) it was 1958.4 kg which reached to 2961.22 kg showing a sharp increase of 1002.8 kg (51.2 %) in progenies of bulls under test. A trend of decrease in age at first calving was also observed in subsequent sets of bulls as it was 1136.4 days in progenies of first set of bulls (1992) which reduced to 1024.22 days in current set indicating a sharp decrease of 112.18 days (9.87%).

बैफ अनुसंधान विकास फाउंडेशन, उरलीकंचन, पुणे, महाराष्ट्र

BAIF Development Research Foundation, Central Research Station, Uruli-Kanchan, Pune

यहाँ पर अभी तक 13 समूहों के 286 सांडों से 114646 कृत्रिम गर्भाधान कराये गये। जिनसे 4954 बछड़ियाँ पैदा हुईं तथा उनमे से 4954 बछड़ियाँ प्रथम ब्याँत पर पहुंची हैं।

A total of 286 bulls have so far been introduced in 13 different sets and 114646 inseminations have been done in which 14522 female progenies born, out of which, 4954 has reached age at first calving.

वर्ष 2017 मे, कुल 4508 कृत्रिम गर्भाधान कराये गये, जिनकी औसत गर्भाधान दर 42.60% थी तथा इसी वर्ष का प्रथम ब्याँत औसत दुग्ध उत्पादन (305 दिन) 3257 किग्रा. था। वहीं प्रथम ब्याँत पर बछड़ी के पहुँचने की औसत आयु 968 दिन थी।

During 2017, a total of 4508 inseminations were carried out with an overall conception rate of 42.6%. Averages for first lactation 305-days milk yield and age at first calving of daughters completed their first lactation during the year were 3257 kg and 968 days, respectively.

अभी तक पिछले 12 समूहों से पैदा हुई 3563 बछड़ियों ने अपना प्रथम ब्याँत पूर्ण कर लिया है। वर्ष 1995 में इस इकाई पर प्रथम समूह की बछड़ियों का औसत दुग्ध उत्पादन 2930.30 किग्रा. था। जो अब वर्तमान समूह की बछड़ियों मे बढ़कर 3257 किग्रा. हो गया है। यहाँ सीधा 326.7 किग्रा. अर्थात 11.14% की वृद्धि हुई है। इसी के साथ प्रथम समूह (1995) में प्रथम ब्याँत की औसत उम्र 991.5 दिन थी जोकि वर्तमान में 23.50 अर्थात 2.3% की दर से घटकर 968 दिन पर आ गयी है।

About 3563 daughters from first 12 batches of bulls have completed their first lactation 305-days milk yield. In the first set of bulls (1995) the 305-

days yield was 2930.3 kg and in current set of bulls it was 3257 kg exhibiting a sharp increase of 326.7 kg milk (11.14%). A trend of decrease in age at first calving was also observed in subsequent sets of bulls. The age at first calving showed a decreasing trend as the average of 991.5 days in progenies of first set of bulls (1995) has reduced to 968 days in current set with a decrease of 23.5 days (2.3%).

गोविन्द वल्लभ पंत कृषि एवं प्रौद्योगिकी विश्वविद्यालय, पंतनगर

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पंतनगर इकाई पर पिछले 6 विभिन्न समूहों में 96 साँडों से 24001 कृत्रिम गर्भाधान कराये गये जिनसे 4177 बछड़ियाँ पैदा हुई तथा उनमें से 745 प्रथम ब्याँत पर पहुंच चुकी हैं। गतवर्ष 2017 में कुल 5651 कृत्रिम गर्भाधान कराये गये जिनमें गर्भधारण दर 61.2% थी।

A total of 96 bulls have so far been introduced in 6 different sets and 24001 inseminations have been done in which 4177 female progenies born, of which, 745 has reached age at first calving. During 2017, a total of 5651 inseminations were carried out and the overall conception rate was 61.2 %.

यहाँ पर बछड़ियों की प्रथम ब्याँत (305 दिन) की उत्पादकता 3024.2 किग्रा. थी तथा प्रथम ब्याँत उम्र 1083 दिन पाई गयी। इस इकाई पर पिछले 3 समूहों में कुल 490 बछड़ियाँ अपना प्रथम ब्याँत (305 दिन) पूर्ण कर चुकी है। पंतनगर इकाई पर प्रथम समूह (2010) की बछड़ियों का प्रथम ब्याँत का औसत दुग्ध उत्पादन 2281 किग्रा. था। जोकि वर्तमान समूह मे बढ़कर 3024.02 किग्रा. हो गया है। यहाँ सीधा 743.20 किग्रा. (32.58%) की वृद्धि दर्ज की गई। इसी के साथ बछड़ियों की औसत प्रथम ब्याने की उम्र प्रथम समूह (2010) में 1146 दिन थी। जोकि वर्तमान में 63 दिन (5.50%) घटकर 1083 दिन पर आ चुकी है।

The averages for first lactation 305-days milk yield and age at first calving of daughters completed their first lactation were 3024.2 kg and 1083 days, respectively. About 490 daughters from first three batches of bulls have completed their first lactation 305-days milk yield which showed an increasing trend as 2281 kg yeild in first set of bull (2010) has increased to 3024.2 kg in the current set with a sharp increase of 743.2 kg (32.58 %). Age at first calving showed a decreasing trend as as 1146 days reported for progenies of first set of bulls (2010) has reduced to 1083 days in current set with a decrease of 63 days (5.5 %).

स्वदेशी नस्ल सुधार परियोजना

Genetic Improvement of Indigenous Cattle Breeds through Progeny Testing - Indigenous Breeds Project

गिर नस्ल

Gir breed:

गिर की जर्म प्लाज्म इकाई पर 31 दिसंबर, 2017 तक गिर पशुओं की कुल संख्या 179 थी जिसमें 130 मादा एवं 49 नर थे। वर्ष 2017 में कुल 41 बच्चे सामान्य प्रसव से पैदा हुए जिसमें से 17 मादा एवं 24 नर थे। वर्ष 2017 के अन्त तक कुल 99 प्रजनन योग्य मादा उपलब्ध थीं। जिसमें 47 दुधारू गाय, 26 शुष्क गाय एवं 26 ढाई वर्ष से ऊपर की बछड़ियाँ थीं। इस इकाई पर 10 प्रजनन योग्य साँड एवं एक वर्ष से अधिक उम्र के 19 युवा साँड थे। वर्ष 2017 के प्रारम्भ से इस परियोजना के अंतर्गत हिमीकृत वीर्य की कुल 41020 मात्राएँ तैयार की गई जिनमें प्रथम, द्वितीय, तृतीय एवं चतुर्थ समूह में क्रमशः 6020, 7485, 27125 एवं 390 मात्राएँ तैयार की गयी। जिनमें से 11275 मात्राएँ इस वर्ष प्रयोग कर ली गई। इस परियोजना में अब तक वीर्य संग्रह हेतु चार समूहों में 26 साँडों (प्रथम समूह में 6, द्वितीय समूह में 9, तृतीय समूह में 9 एवं चतुर्थ समूह में 2 साँडों) का उपयोग वीर्य संग्रहण हेतु किया गया। उनमें से पहले तीन सेटों के 24 साँडों के हिमीकृत वीर्य को ही प्रजनन हेतु उपयोग किया गया। परियोजना के प्रारम्भ से अब तक हिमीकृत वीर्य की कुल 200583 मात्राएं तैयार की गयी जिसमें से 48990 वीर्य की मात्राएं परियोजना के अंतर्गत उपयोग की गयीं और 31 दिसम्बर 2017 तक 151593 वीर्य मात्राएं उपलब्ध थीं।

The total herd strength of GP unit as on 31st December 2017 was 179 comprising of 130 females and 49 males. There were 41 normal calving in the GP Unit during the year producing 17 female and 24 male calves. The closing herd strength of breedable females was 99 consisting of 47 milch cows, 26 dry cows and 26 heifers of more than 2 ½ years of age. The GP unit maintained 10 breeding bulls and 19 young bulls above one year of age. During the year, 6020, 7485, 27125 and 390 semen doses were frozen from first, second, third and fourth set of bulls, respectively amounting to a total of 41020 doses and 11275 doses were utilized during the year. So far 26 bulls in four sets (six in first, nine in second, nine in third and two in fourth) have been put under semen collection and the frozen semen doses of 24 bulls of first three sets were used for breeding. Since inception of the project, 200583 semen doses were produced of which, 48990

were utilized for breeding resulting to a balance of 151593 semen doses as on 31st December 2017.

वर्ष 2017 मे कुल 2793 गायों मे कृत्रिम गर्भाधान किया गया जिसमे से 1216 गाय गर्भित पायी गयी व गर्भधारण दर 43.54 प्रतिशत पायी गयी। प्रारम्भ से अबतक 24600 कृत्रिम गर्भाधान किये गये जिसमे 11830 गाय गर्भित पायी गयी तथा गर्भधारण दर 48.05% पायी गयी। अबतक प्रथम, द्वितीय एवं तृतीय समूह मे क्रमशः 12186, 8335, एवं 4098 गर्भधारण किये गये। वर्ष 2017 मे कुल 489 बछड़ियाँ पैदा हुई विभिन्न समूहों में कुल 5112 बछड़ियाँ पैदा हुई। इस इकाई पर 495 बछड़ियाँ प्रथम ब्याँत मे आ गयी और 255 बछड़ियों ने प्रथम ब्याँत के दुग्ध उत्पादन को पूरा कर लिया है तथा 222 बछड़ियों का प्रथम ब्याँत का दुग्ध उत्पादन 2563.793±112.6 किग्रा. पाया गया।

During the year, a total of 2793 inseminations were carried out and 1216 pregnancies were confirmed resulting to a conception rate of 43.54 per cent. Since inception of the project, 24619 inseminations have been done and 11830 pregnancies were confirmed resulting to an overall conception rate of 48.05 per cent. The total number of inseminations carried out since inception for first, second and third sets of bulls were 12186, 8335, and 4098, respectively. During the year, 489 female calves had born which resulted in to a total of 5112 daughters since inception of the project. Four hundred eighty daughters from the 1st set and 15 from 2nd set have reached the age of calving, out of which 255 (251+4) have completed their first lactation. The average first lactation milk yield of 222 Gir daughters of first set of bulls was 2563.793± 112.61kg.

कांकरेज नस्ल
Kankrej breed:

कांकरेज की जर्म प्लाज्म इकाई में 31 दिसंबर, 2017 में कुल संख्या 189 थी जिसमे 135 मादा एवं 54 नर थे और कुल 81 प्रजनन योग्य मादा 2.5 वर्ष से ऊपर उपलब्ध थी। जिसमें 38 गाय दूध में, 23 शुष्क एवं 20 बछड़ियाँ थीं। इस इकाई पर कुल 14 कांकरेज साँड प्रजनन के उद्देश्य के लिए उपलब्ध थे। कुल 4117 प्रजनन योग्य मादाओं की पहचान की गयी जिसमे पशु अनुसंधान केन्द्र इकाई पर 67 एवं क्षेत्रीय इकाईयों पर 4050 थीं।

The initial herd strength of GP unit as on 1st January 2017 was 189 which included 135 females and 54 males and the total number of breedable females above 2.5 years was 81 comprising of 38 milch, 23 dry and 20 heifer animals. The unit also maintained 14 Kankrej bulls for breeding purpose. A total of 4117 breedable females were identified under the project at LRS DR Unit of (67), organized farms and field units (4050).

इस परियोजना मे अब तक वीर्य संग्रह हेतु तीन समूहों में 26 साँड़ों (प्रथम समूह में 8, द्वितीय समूह में 9 एवं तृतीय समूह में 9) का उपयोग किया गया। 1 जनवरी, 2017 को इस इकाई पर कुल 121158 हिमीकृत वीर्य की मात्राएँ उपलब्ध थी तथा वर्ष 2017 के दौरान कुल 15329 वीर्य मात्राएं तीनों समूहों से तैयार की गयी। जिसमे से कुल 6352 हिमीकृत वीर्य की मात्राओं का उपयोग कृत्रिम गर्भाधान के लिए किया गया। वर्ष के अंत में कुल 83761 हिमीकृत वीर्य की मात्राएँ उपलब्ध थी। जिसमे प्रथम, द्वितीय एवं तृतीय समूह की क्रमशः 5822, 58844 एवं 19095 मात्राएं भविष्य में प्रजनन हेतु उपलब्ध थीं।

A total of 26 Kankrej bulls in three sets have been inducted so far. The first set consisted of eight bulls from Banas Dairy while the second and third sets consisted of nine bulls each. The opening balance of semen doses as on 1st January 2017 was 121158 and during the year 2017, a total of 15329 doses of semen were frozen from the third set of bulls. A total of 6,352 doses (445 from second set bulls and 5907 from third set bulls) were utilized for insemination during the year. At the end of the year, a balance of 83,761 doses of frozen semen covering 5822 doses of first set, 58844 doses of second set and 19095 doses of third set was available for future breeding.

वर्ष 2017 के दौरान कुल 2417 गायों का कृत्रिम गर्भाधान किया गया जिसमे से 1117 गायें गर्भित पायी गयी जिनसे कुल 420 बछड़ियाँ पैदा हुई तथा गर्भधारण दर 46.21 प्रतिशत पायी गयी। परियोजना के प्रारम्भ से अब तक कुल 1957 बछड़ियाँ पैदा हुई जिसमे प्रथम, द्वितीय एवं तृतीय समूह में क्रमशः 407, 1256 एवं 294 बछड़ियाँ पैदा हुई थीं। प्रथम दो समूहों में से कुल 235 अपने प्रथम ब्याँत में आयी थी। जिनमें से 187 (131+56) ने अपना प्रथम ब्याँत पूरा कर लिया है तथा प्रथम ब्याँत का औसत दुग्ध उत्पादन 2004.31±104.90 किग्रा. था जिसमे बच्चों को पिलाया गया दूध शामिल नहीं था।

During the year 2,417 animals were inseminated, 1117 animals were confirmed for pregnancy and 420 daughters born. The conception rate during the year was 46.21 per cent. The numbers of female calves born for the first, second and set of bulls were 407 and 1256 and 294, respectively resulting to 1957 Kankrej

daughters since the inception of the project. A total of 235 animals from first two sets have reached at the age of calving, out of which 187 (131+56) have completed their 1st lactation. The average first lactation milk yield of 127 Kankrej daughters of first set of bulls was 2004.31 ± 104.90 kg (excluding the milk suckled by the calf).

साहीवाल नस्ल
Sahiwal breed:

साहीवाल की जर्म प्लाज्म इकाई में वर्ष 2017 के प्रारम्भ में कुल जानवरों की संख्या 226 थी साथ ही प्रतिवेदन अवधि के दौरान दो वर्ष से अधिक उम्र के 31 युवा साँड भी थे। वर्ष 2017 के दौरान इस इकाई पर 44 मादा एवं 55 नर थे। साहीवाल की विभिन्न डाटा रिकॉर्डिंग इकाई पर दो वर्ष से ज्यादा उम्र की कुल 877 गाय (148 श्री गौशाला, भिवानी, 123 अँजोरा, दुर्ग, 364 जी.एल.एफ.–I, हिसार, 141 पंतनगर एवं 101 गुरु अंगद देव पशु चिकित्सा एवं पशु विज्ञान विश्वविद्यालय, लुधियाना) थी।

The GP unit at NDRI maintained 226 breedable females and 31 young bulls of above two years of age at the end of the reporting period. The female and male calves born during the year 2017 in the GP unit were 44 and 55, respectively. The number of breedable females above two years of age in different DR units was 877 consisting of 148 in Shri Gaushala, Bhiwani; 123 in Anjora, Durg; 364 in GLF-I, Hissar; 141 in Pantnagar; and 101 in GADVASU, Ludhiana.

इस परियोजना मे अब तक तीन समूहों मे कुल 25 साँडों का उपयोग किया गया है। जिसमे प्रथम समूह मे 8, द्वितीय समूह में 7 एवं तृतीय समूह में 10 साँडों का उपयोग किया गया। 1 जनवरी, 2017 को कुल 157548 हिमीकृत वीर्य की मात्राएं उपलब्ध थी तथा इस वर्ष के दौरान कुल 8944 हिमीकृत वीर्य की मात्राएँ तैयार की गयीं। वर्ष के दौरान कुल 7148 वीर्य मात्राओं का उपयोग किया गया तथा वर्ष के अन्त में प्रथम, द्वितीय एवं तृतीय समूह के क्रमशः 22908, 34557 एवं 28133 हिमीकृत वीर्य की मात्राएं प्रजनन हेतु उपलब्ध थीं। परियोजना के प्रारम्भ से अब तक कुल 166492 हिमीकृत वीर्य की मात्राएं तैयार की गई जिसमे से 80894 का उपयोग कर लिया गया तथा 85598 मात्राएं भविष्य मे उपयोग हेतु उपलब्ध थीं।

So far 25 Sahiwal bulls in three sets (8 in first, 7 in second and 10 in third set) were inducted for progeny testing under the project. The semen stock as on 01st January 2017 was 157548 and during the year 8944 doses were frozen. A total of 7148 doses were utilized during the year and at the end of the year, 22908, 34557 and 28133 doses of first, second and third set of bulls, respectively were available for breeding. Since inception of the project, 166492 semen doses were frozen and 80894 doses were utilized resulting to a balance of 85598 doses for future breeding use.

प्रतिवेदन अवधि के दौरान, कुल 1174 कृत्रिम गर्भाधान (269 करनाल, 284 भिवानी, 201 हिसार, 178 पंतनगर, 142 लुधियाना एवं 100 अँजोरा, दुर्ग) किया गया तथा परियोजना के प्रारम्भ से अब तक कुल 8985 कृत्रिम गर्भाधान किये गये। प्रतिवेदन अवधि के दौरान, गर्भाधान दर प्रथम एवं द्वितीय समूह में क्रमशः 50.00 एवं 44.30 प्रतिशत थी। वर्ष के दौरान, द्वितीय एवं तृतीय समूह से क्रमशः 88 एवं 152 बछड़ियाँ पैदा हुई तथा प्रारम्भ से अब तक कुल 1326 बछड़ियाँ (प्रथम, द्वितीय एवं तृतीय समूह से क्रमशः 592, 572 एवं 162) पैदा हुई। वर्ष के दौरान विभिन्न इकाइयों (हिसार, भिवानी, पंतनगर, लुधियाना, अँजोरा, दुर्ग एवं करनाल में क्रमशः 69, 37, 41, 14, 35 एवं 44) पर बछड़ियाँ पैदा हुई तथा परियोजना के प्रारम्भ से अब तक क्रमशः 418, 137, 229, 91, 57 एवं 394 बछड़ियाँ पैदा हुई थीं जिसमे से प्रथम एवं द्वितीय समूह मे से कुल 306 (294+12) बछड़ियां अपने प्रथम ब्याँत मे पहुँच गयी थीं जिसमे से 220 (2016+4) ने अपना प्रथम ब्याँत पूरा कर लिया था।

During the reporting period 1174 inseminations (269 in NDRI, Karnal, 284 in Bhiwani, 201 in GLF-I, Hissar, 178 in Pantnagar, 142 in GADVASU, Ludhiana, and 100 in Anjora, Durg) were carried out amounting to a total insemination of 8985 since the inception of the project. The conception rates for second and third sets of bulls during the year were 50.00 and 44.30 per cent, respectively. During the year, 88 and 152 daughters had born for second and third sets of bulls, respectively totaling to 1326 daughter since the inception of the project (592 for first, 572 for second and 162 for third set of bulls). The number of daughters born during the year in GLF-I Hissar, Bhiwani, Pantnagar, GADVASU Ludhiana, Durg and NDRI Karnal units were 69, 37, 41, 14, 35 and 44, respectively while the total number of daughters since inception was 418, 137, 229, 91, 57 and 394, respectively. A total of 306 (294+12) daughters from first and second sets have reached the age of first calving, out of which 220 (216+4) have completed their first lactation.

ICAR-CIRC MAIN SCHEME (आईसीएआर-सी.आई.आर.सी मुख्य योजना)

गोवंश के अनुवांशिकीय पहलुओं पर अध्ययन

Studies on genetic aspects of cattle

- पीसीआर–एसएससीपी एवं डीएनए अनुक्रमण द्वारा कुल 250 गोवंश जिसमे 168 फ्रीजवाल व 82 साहीवाल मवेशियों में 2, 5 ओलिगोएडीनाइलेट 1 (ओएएस 1) जीन के एक्सोनिक क्षेत्रों में आनुवांशिक रूपान्तरण की पहचान की गयी जो दुग्ध उत्पादन गुण के साथ जुड़ा हुआ है। इस अध्ययन का संबंध कुल स्तनपान दूध उपज, 300 दिन दूध उपज और ी ि उपज जैसे गुणो के साथ किया गया था। ओएएस 1 जीन के एक्सोन 6 के खंड 1 के जीनोटाइप का दूध उत्पादन लक्षणों के साथ महत्वपूर्ण संबंध था, जबकि एक्सोन 2 और एक्सोन 5 में पहचाने गए जीनोटाइपों में फ्रीजवाल और साहीवाल मवेशियों में किसी भी गुण से संबंधित नहीं थे।
- Genetic variants in the exonic regions of 2, 5 Oligoadenylate 1 (OAS1) gene were identified using PCR-SSCP and sequencing for associating with milk production traits in a total of 250 cows comprising of 168 Frieswal and 82 Sahiwal cattle. Total lactation milk yield, 300 day milk yield and peak yield were taken for association study. The genotypes of exon 6 at OAS1 gene had significant association with milk production traits whereas genotypes identified in exon 2 and exon 5 did not reveal any association in both Frieswal and Sahiwal population.
- एकेएपी 4, पीआरएम 1 और सीएटी जीन की अभिव्यक्ति के साथ विभिन्न वीर्य गुणवत्ता मानकों के सहसंबंध पर अध्ययन ने फ्रीजवाल सांड वीर्य में एक्रोसम अखंडता और पोस्ट–था गतिशीलता पर सकारात्मक सहसंबंध दिखाया। एकेपी 4 के सहसंबंध भी वीर्य गुणवत्ता मानकों पर महत्वपूर्ण रूप से सहसंबंधित (पी<0.01) थे। पीआरएम 1 ने 1% स्तर पर पीटीएम के साथ उच्च सहसंबंध दिखाया। कुछ अन्य जीन जैसे सीएलयू, टीपीएन 1, टीपीएन 2 और एमएनएसओडी ने पीटीएम पर सकारात्मक सहसंबंध दिखाया, जिसमें एमएनएसओडी ने 1% स्तर पर सहसंबंध दिखाया। एसओडी, पीकेएम 2 की अभिव्यक्ति भी एक्रोसोम अखंडता से सहसंबंधित थी।
- Study on correlation of different semen quality parameters with expression profiles of genes like AKAP4, PRM1 and CAT showed positive correlation on both acrosome integrity and post thaw motility in Frieswal bull semen. The AKAP4 had significant correlation (p<0.01) with both semen quality parameters. PRM1 showed high correlation with PTM at 1% level. Other genes viz. CLU, TPN1, TPN2 and MnSOD showed positive correlation on PTM of which the MnSOD showed correlation at 1% level. Acrosome integrity was also correlated with the expression profiles of SOD, PKM2.
- पहली बार हीट ॉक प्रोटीन जीन (HSP90AA1) में कार्यात्मक आंतरिक राइबोसोमल प्रवेश स्थल (IRES, आईआरईएस) को पहचाना गया था, जो गोवंश में ऊ मा नियंत्रण की एक नयी प्रक्रिया खोल सकता है।
- Functional Internal Ribosomal Entry Site (IRES) was identified for the first time in bovine heat shock protein gene (Hsp90AA1), which may open a newer thermoregulatory mechanism in bovine.
- फ्रीजवाल मवेशियों के गोवंशीय पीबीएमसी (PBMC) में कुल 420 एमआईआरएनए (miRNA) की पहचान, आरएनए गहन अनुक्रम (RNA Deep Sequencing) के माध्यम से की गई थी और यह देखा गया था कि 65 एमआईआरएनए (miRNA) गर्मियों के दौरान अलग–अलग व्यक्त किए गए थे। रिपोर्टर विश्ले ाण से पता चला कि, बीटीए–एमआईआर–2898 तनावग्रस्त गोवंशीय पीबीएमसी (PBMC) मॉडल में गोवंशीय एचएसपीबी 8 जीन को लक्षित कर सकता है।
- A total 420 miRNAs in PBMCs of Frieswal cattle were identified through RNA deep sequencing and it was observed that 65 were differentially expressed during peak summer. Reporter assay revealed that bta-miR-2898 can target bovine HSPB8 gene in stressed bovine PBMC cell cultured model.
- तरल क्रोमैटोग्राफी–द्रव्यमान स्पेक्ट्रोमीटर (एलसी–एमएस / एमएस) तकनीक का उपयोग करके फ्रीजवाल सांड के ुक्राणुओ में कुल 1547 प्रोटीन की पहचान की गयी, जो दर्शाती है कि अधिक प्रजनन क्षमता एवं कम प्रजनन क्षमता गुणवत्ता वाले सांडो के ुक्राणुओ में क्रमशः 558 (36.1%) और 653 (42.2%) प्रोटीन अलग थे।

- A total of 1547 proteins were identified in Frieswal bull spermatozoa using liquid chromatography–mass spectrometer (LC-MS/MS) analysis which revealed that 558 (36.1%) and 653 (42.2%) proteins expressed differentially among fertile and inferior quality bull spermatozoa, respectively.
- फ्रीजवाल बछड़ों में अनुमानित प्रजनन क्षमता का अनुमान 5,10,14 दिन की कुल दूध उपज एवं पहले स्तनपान के 305 दिनों की दूध उपज (FL305DMY) को वोम्बट सॉफ्टवेयर के द्वारा आँका गया। संचयी दूध उपज के लिए ईबीवी फ्रीजवाल का अनुमान लगाते हुए बछड़ो की रैंकिंग 5,10 और 14 दिन FL305DMY के ईबीवी (अनुमानित प्रजनन मूल्य) के आधार पर रैंकिंग के समान नहीं थी। फ्रीजवाल बछड़ों का चयन उनके मादा के 5,10, व 14 दिन के दुग्ध उत्पादन के आधार पर चयन करना आनुवांशिक सुधार के लिए उपयोगी नहीं है।
- The expected breeding values (EBVs) of Frieswal sires were estimated for cumulative milk yield 5, 10, 14 days and first lactation 305-days milk yield (FL305DMY) using Wombat software. The rankings of sires using EBVs of Frieswal sires estimated for cumulative milk yield 5, 10 and 14 days were not similar to the ranking based on EBVs of FL305DMY. Thus, selection of Frieswal male calves on the basis of the first 5, 10 or 14-day yields of their dams is not effective for improving the first lactation milk yield as these test days did not significantly associate with the first lactation 305-days or less milk yield.
- फ्रीजवाल गायों मे पाँच गणितीय वक्रता मॉडल अध्ययन प्रथम ब्याँत के आधार पर किया गया। उसमे से विपरीत बहुपद और गामा फंक्शन का परिणाम संतोषजनक था। यह दोनों मॉडल का उपयोग वक्रता मॉडलिंग से फ्रीजवाल मे किया जा सकता है।
- The lactation curve modeling of first lactation milk yield in Frieswal cattle using five different mathematical functions revealed that the yield was explained accurately by the mixed log function (MLF). The inverse polynomial (IPF) and gamma function (GF) also had satisfactory results and hence these two functions can also be used for modeling the lactation curve in Frieswal cattle.

वीर्य उत्पादन

Semen Production

- 140 फ्रीजवाल सांडों से एकत्रित 4783 वीर्य नमूनों में कुल औसत आयतन (मिली.), ुक्राणु सांद्रता (मिलियन / मिली.), आरंभिक गतिशीलता (प्रतिशत) एवं पोस्ट–था गतिशीलता (प्रतिशत) क्रमशः 4.63±0.03, 946.74±9.48, 55.14±0.40 और 47.25±0.33 थी जबकि, 4 साहीवाल सांडों के 155 वीर्य नमूनों के उपरोक्त संबंधित आंकड़े क्रमशः 3.15±0.11, 897.39±34.27, 70.30±0.78 और 48.35±1.09 रहे।
- The overall average semen volume (ml), sperm concentration (million/ml), initial motility (%) and post thaw motility (%) were 4.63 ±0.03, 946.74 ±9.48, 55.14 ±0.40 and 47.25± 0.33, respectively in 4783 ejaculates collected from 140 Frieswal bulls. Whereas, the corresponding figures of 155 ejaculates collected from 4 Sahiwal bulls were 3.15±0.11, 897.39±34.27, 70.30±0.78 and 48.35±1.09, respectively.
- कुल प्राप्त वीर्य नमूनों में फ्रीजवाल सांडों के 44.49% एवं साहीवाल सांडों के 88.39% वीर्य नमूनों की आरंभिक गतिशीलता 70% या उससे अधिक रही। छियानवे (96) फ्रीजवाल सांडों के 1841 वीर्य नमूनों को हिमीकरण के लिए इस्तेमाल किया गया तथा 50% या अधिक पोस्ट–था गतिशीलता वाले नमूनों को भविष्य के लिए संग्रक्षित किया गया साहीवाल सांडों के 99 नमूनों का जिनकी पोस्ट–था गतिशीलता 50% या अधिक थी, प्रसंस्करण किया गया एवं कुल 11443 वीर्य की मात्राओं का उत्पादन किया गया।
- Out of total, 44.49% ejaculates from Frieswal and 88.39% ejaculates from Sahiwal bulls had initial motility of 70% or more. Frieswal semen samples (1841) from 96 bulls were processed for freezing and samples yielding more than 50% post-thaw motility were stored for future breeding. For Sahiwal bulls, 99 ejaculates had post-thaw motility of more than 50% and 11443 semen doses were produced.
- सांड पालन इकाई में उपस्थित 240 सांडों के सीरम नमूने आई.बी.आर. एवं ब्रुसेलोसिस बीमारियों की जांच के लिए सी.एम.वी.एल., मेरठ और केडरेड, आई.वी.आर.आई., इज्ज़तनगर भेजे गए, जिनमें से 100 सांड आई.बी.आर. के लिए सीरो–पॉजिटिव पाए गए जबकि

ब्रुसेलोसिस के लिए सभी नमूने नकारात्मक पाए गए। आई.बी.आर. सीरो–पॉजिटिव सांडों के 399 हिमीकृत वीर्य नमूनों की जांच केंद्रीय गोवंश अनुसंधान संस्थान, मेरठ के गोवंश अनुवांशिकी एवं प्रजनन विभाग में की गई जिसमें सभी नमूने नकारात्मक पाए गए।

- Frieswal bulls (240) were screened for IBR and brucellosis. Serum samples were sent for diagnosis to CMVL, Meerut and CADRAD, IVRI, Izatnagar. 100 bulls were found seropositive for IBR. All bulls were negative for brucellosis. Frozen semen samples (399) from IBR seropositive bulls were tested for IBR virus at Division of Cattle Genetics and Breeding of CIRC and all were found negative.
- बाड़े के अभिविन्यास के प्रकार से सांडों के बाड़े का परिवेशीय तापमान प्रभावित हुआ। जून माह में पश्चिम दिशा में खुले बाड़े का अधिकतम परिवेशीय तापमान 45 डी.से. तक ज्ञात हुआ, जबकि पूर्व दिशा में खुले बाड़े के लिए यह 43.5 डी.से. था। जाड़ों एवं आरामदायक ऋतुओं के दौरान औसत टी.एच. आई. आरामदायक सीमा में थी, जबकि ग्रीष्म–शुष्क एवं ग्रीष्म–नम ऋतुओं में सांड उष्मीय तनाव (टी.एच. आई.>72) में थे।
- The type of shed orientation affected the ambient temperature within the bull sheds. Highest ambient temperature reached up to 45°C in west open sheds; however, it was 43.5°C in east open sheds in the month of June 2017. Mean THI during winter and comfort seasons was within comfortable limits, however, the bulls were under thermal stress (THI > 72) during hot & dry and hot & humid seasons.
- दोनों ऋतुओं में सांडों ने अधिकतम समय खुलेमें कच्चे फर्श पर बिताया। ग्री म ऋतु में, दिन में उन्होंने ढके हुए क्षेत्र को पसंद किया जबकि रात में ज्यादातर समय खुले क्षेत्र में व्यतीत किया। ग्री म ऋतु में, पश्चिम दिशा में खुले बाड़े के सांडों ने विपरीत दिशा के सांडों की तुलना में ढंके हुए क्षेत्र के पक्के फर्श पर कम समय बिताया।
- The bulls preferred to spend maximum time on sitting on kachcha floor in the open area during both the seasons. They preferred covered area in the day time during summer season, however, spent maximum time in open area during night time. During summer season, bulls of west open sheds spent comparatively less time on sitting on pucca floor under covered area than the bulls of opposite side.

फ्रीजवाल वीर्य में ओक्सिकारक तनाव पर परीक्षण

Assessment of oxidative stress in Frieswal semen

- ई.वाई.टी.जी. वीर्य तनुकारक में 5 मि.मो. बी.एच.टी. का समावेश करने से फ्रीज़वाल सांडों के हिमीकृत वीर्य की पोस्ट–था गुणवत्ता जैसे एक्रोसोम इंटीग्रिटी, प्लाज्मा झिल्ली इंटीग्रिटी इत्यादि बेहतर प्राप्त हुई एवं वीर्य के आक्सीकारक तनाव में भी कमी दर्ज की गई।
- BHT at the concentration of 5 mM in EYTG extender helped to improve post-thaw sperm characteristics including acrosome intactness, plasma membrane integrity, and limiting oxidative stress in Frieswal bulls.
- फ्रीज़वाल सांडों के ुक्राणुओं की बाहरी झिल्ली पर एफ़.ए.ए. की उपस्थिति उन्हें आक्सीकारक तनाव के कुप्रभाव से बचाने में सहायक ज्ञात हुई साथ ही इसका जीवित ुक्राणुओं के एक्रोसोम तथा माइटोकांड्रिया पर भी सकारात्मक प्रभाव देखा गया।
- Presence of FAA on the sperm membrane might take part in protection processes involved against oxidative stress resulting in increased number of acrosome intact live sperm cells with functional mitochondria.
- फ्रीज़वाल सांडों के रक्त एवं वीर्य नमूनों में लेड एवं कैडमियम सार्थक स्तर पर ज्ञात हुए स लेड एवं कैडमियम का ुक्राणुओं की गतिशीलता, सांद्रण एवं वीर्य द्रव्य की एंटीऑक्सीडेंट क्षमता से नकारात्मक सम्बन्ध पाया गया सजबकि, एम.डी.ए. से इनका सार्थक सकारात्मक सम्बन्ध ज्ञात हुआ जो कि वीर्य के लिपिड का ओक्सिकारक विनाश दर्शाता है।
- Significant levels of lead and cadmium were detected in blood and semen of breeding Frieswal bulls. Lead and Cadmium were found negatively correlated with motility, sperm concentration and antioxidant markers of seminal plasma. Significant positive correlations were found between MDA and both heavy metals indicating their influence on oxidative damage to seminal lipids. The study suggests that even a slight enhancement of lead and cadmium in semen may affect fertility in breeding bulls.

फ्रीजवाल वीर्य की गुणवत्ता परीक्षण

Quality control of Frieswal semen

- फ्रीज़वाल सांडों के 144 हिमीकृत वीर्य नमूनों की जांच की गई, जिसमें 0, 30 एवं 60 मि. के ऊ मायन काल के बाद ुक्राणुओं की प्रारंभिक गतिशीलता क्रमशः 51.18±0.48, 44.72±0.42 एवं 37.64±0.53 ज्ञात हुई। प्लाज्मा झिल्ली तथा एक्रोसोम की अखंडता क्रमशः 50.52±0.64% और 72.40±0.43% थी।
- The quality of frozen semen was assessed by estimation of motility and integrity of plasma membrane. After freezing-thawing, the individual progressive motility (%) at 0, 30 and 60 minutes of incubation at 37°C (144 ejaculates) were 51.18±0.48, 44.72±0.42 and 37.64±0.53, respectively. The plasma membrane integrity as determined by hypo-osmotic swelling test (HOST) was 50.52±0.64% while acrosome integrity was 72.40±0.43%. The average concentration per 0.25 ml straw was 21.42±0.16 million.
- फ्रीज़वाल सांडों के वीर्य में औसत जीवाणु भार 610.83±57 सी.एफ.यू./मिली था। 144 में से 39 नमूने जीवाणु रहित पाए गए। किसी भी नमूने में जीवाणु संख्या 5000 सी.एफ.यू./मिली से अधिक नहीं थी।
- The mean bacterial load in the extended cryopreserved semen of Frieswal bulls was 610.83±57 CFU/per ml. Thirty-nine out of 144 (27.08%) samples were sterile or negative for bacterial growth. None of the samples out of 144 had bacterial counts of more than 5000 CFU/ml.
- भैंस से प्राप्त फाईब्रोब्लास्ट कोशिकाओं की कृत्रिम परिवेशीय परिपक्वता का मानकीकरण किया गया। भैंसों के अंडाणुओं की कृत्रिम परिवेशीय परिपक्वता का प्रयोग भी किया गया जिसमें उनकी परिपक्वता दर 71.42% ज्ञात हुई। जबकि, अच्छी गुणवत्ता वाले अंडाणु एवं शुक्राणुओं के ऊष्मायन के बाद भी विपाटन नहीं हुआ।
- To establish the *in-vitro* cell cultures of feeder cells for future experimentation, buffalo fibroblast cell monolayer cultures were established. In-vitro maturation of oocyte harvested from buffalo ovaries were also performed. Oocyte maturation rate was 71.42%. However, incubation of good quality matured oocytes with capacitated buffalo sperms failed to cleave.

ग्रामीण क्षेत्रों के गोवंश की प्रजनन क्षमता में सुधार

Cattle fertility improvement in field animals

- देशी नस्ल की गायों में अधि–डिम्बोत्सर्जन की तकनीक को मानकीकृत किया गया तथा यह पाया गया कि, फ़ॉलट्रोपीन की 200–250 मिग्रा. मात्रा से संकर गायों की अपेक्षा देशी नस्ल की गायों में अच्छे परिणाम प्राप्त हुए।
- In an attempt to standardise the optimum superovulatory response in indigenous cows, it was observed that indigenous cows respond well with almost half to 5/8 doses (200-250 mg) of Folltropin V compared to crossbred cows.
- मेरठ के आसपास के गावों में बाँझपन निवारण शिविर लगाने के पश्चात् यह पाया गया कि, यदि डेरी पशुओं को नियमित रूप से खनिज लवण और पेट के कीड़े मारने की दवा दी जाए तो उनमें बाँझपन तथा अन्य सम्बंधित बीमारियों की दर को कम किया जा सकता है।
- Under field conditions, regular supplementation of mineral mixture and anthelmintic to the dairy animals helps to minimize the occurrence of reproductive and other health related disorders.
- मद–हीन फ्रीज़वाल बछियों में मद–उत्तेजना हेतु प्रोजेस्टेरोन एवं एस्ट्रोजन हॉर्मोन युक्त तकनीक एक बेहतर विकल्प हो सकती है।
- Fertility improvement using progesterone and estrogen hormone based estrus induction protocols can be the best resort to overcome the problem of anestrus in Frieswal heifers.

फ्रीजवाल गोवंश में दंत उद्भेदन

Dentition in Frieswal cattle

- जन्म के समय फ्रीजवाल बछड़ों में अस्थाई मध्य क्रन्तक दांतों का एक युग्म उपस्थित था। जबकि, प्रथम एवं द्वितीय मध्यवर्ती एवं कोने वाले अस्थाई क्रन्तक 2 सप्ताह की उम्र पर निकले नर एवं मादा गोवंश में स्थाई मध्य क्रन्तक क्रमशः 24.6 और 24.4 माह की उम्र पर निकलना ुरू हुए एवं 26 माह की उम्र तक पूर्ण विकसित हुए सनर एवं मादा गोवंश में कोने वाले क्रन्तक क्रमशः 46.17 और 46.8 माह की उम्र पर निकलना आरम्भ हुए। मादा की अपेक्षा नर गोवंशों की दन्त संरचना में ज्यादा परिवर्तन देखा गया।

- Frieswal calves were born with a pair of erupting deciduous central incisors. However, first and second intermediate and corner deciduous incisors erupted by two weeks of age. Permanent central incisors teeth in male and female cattle started erupting at the age of 24.6 and 24.4 months, respectively and were fully developed by 26 months of age. The corner incisors started erupting at the age of 46.17 and 46.8 months in males and females, respectively. Variation in structure of teeth was more in male than in female cattle.

फार्मर फर्स्ट परियोजना के अंतर्गत पशु पालन विकास एवं कृषि एकीकरण

Improvement of animal husbandry practices and integrated farming through Farmer First initiative

- फार्मर फर्स्ट परियोजना के अंतर्गत 4 पशु बाँझपन सह–स्वास्थ्य शिविर लगाये गए जिसमें 148 पशुओं का उपचार किया गया। कुल 110 दुधारू गायों मेंसी. एम.टी. द्वारा थनैला रोग की जांच की गई जिसमे 41.81% पशु संक्रमित पाए गए। प्रत्येक गोद लिए गाँव में एक केंचुआ–खाद इकाई की स्थापना भी की गई सकुल 28 किसानों के खेतों में उच्च गुणवत्ता के गेहूं एवं गन्ने के बीजों के साथ–साथ सब्जी, दलहन, फूल इत्यादि का भी एकीकरण किया गया। साथ ही 25 किसानों को दुग्ध एवं उसके उत्पादों के मूल्य संवर्धन हेतु एन.डी.आर.आई. करनाल में प्रदर्शन एवं प्रशिक्षण दिलवाया गया।
- Under Farmer FIRST programme, four infertility cum animal health camps were organized and 148 animals examined, diagnosed and treated for various ailments. A total of 110 lactating cows were screened for sub-clinical mastitis using California mastitis test with 41.81% overall prevalence. One vermi-composting unit was established in each selected village. Integrated farming of vegetable, pulses, flower wheat and sugarcane was done on 28 farmer's field. In addition, 25 farmers from selected villages were given demonstration and training of value addition of milk and milk products at NDRI, Karnal.

ग्रामीण क्षेत्रों में गोवंश प्रबंधन का जल उपयोग पर प्रभाव

Assessment of cattle management practices on water productivity in fields

- पांचली गाँव के किसानों के देशी गोवंशों में पानी के बजट का आंकलन किया गया। दैनिक औसत जल खपत 13616 ली. ज्ञात हुई। देशी गायों में दूध की औसत जल उत्पादकता 89.20 ली. थी।
- In village Panchli, the indigenous animal herd maintained by a progressive farmer was assessed for water budgeting. Average daily water consumption was 13616 litre at this farm (28 milch cows and their followers). Average water productivity of milk in indigenous cows was 89.20 L.
- ग्रामीण क्षेत्र के पशुधन तंत्र में पानी के बजट का आंकलन करने पर यह पाया गया कि क्रमशः 53% और 23.5% परिवारों ने सबमर्सिबल एवं हैण्ड पंप का इस्तेमाल किया, जबकि शेष बचे हुए परिवारों ने हैण्ड पंप के साथ साथ ट्यूब वेल का भी उपयोग किया। पशुओं को नहलाने के लिए बाल्टी और सबमर्सिबल से जुड़े हुए हो। पाइप के उपयोग से औसत जल खपत क्रमशः 160 ली. एवं 460 ली. ज्ञात हुई। अपशिष्ट पानी की निकासी सामान्य नालों से थी एवं कोई भी परिवार अपशिष्ट पानी का पुनरुपयोग कृषि या अन्य कार्यों के लिए करता था। गाय एवं भैंसों के एक छोटे समूह के लिए जाड़ों एवं ग्रीष्म ऋतु में कुल जल खपत क्रमशः 94–134 तथा 125–438 ली./ए. एल.यू./दिन थी।
- Water budgeting in livestock system in rural area indicated that submersible and hand pumps were being used by 53 and 23.5 per cent families, respectively. However, remaining households used tubewell along with hand pumps. Average 160 and 460 litres water was utilized for washing of an animal / day using bucket and directly through hosepipe connected to submersible pump system, respectively. Waste water outlet was through general drainage and no family was found to reuse the waste water for agriculture or any other purpose. Total water consumption varied from 94 to 134 and 125 to 438 L / ALU / day, respectively during winter and summer season in a small herd of cattle and buffalo.

गोवंश के पोषण में खनिज तत्वों का विश्लेषण तथा फेरबदल का वृद्धि पर प्रभाव

Nutritional manipulations for enhanced growth

- पशु आहार में ताँबे (अकार्बनिक) के 12.5 (सामान्य) तथा 20 व 25 पी.पी.एम. स्तर पर 6 माह की अवधि पर अनुपूरण द्वारा करने से सांडों की सभी श्रेणियों में प्रतिदिन कुल शुष्क पदार्थ ग्राह्यता 1.43–1.61 किग्रा प्रति 100 किग्रा शारीरिक भार के बीच पायी गयी, जबकि क्रूड प्रोटीन की ग्राह्यता 172.94–185.25 ग्रा प्रति 100 किग्रा शारीरिक भार के बीच पायी गयी। विभिन्न पोशक तत्व जैसे– शुष्क पदार्थ, क्रूड प्रोटीन, ए.डी.एफ. तथा एन.डी.एफ. की प्रतिशत पाचकता क्रमशः 52.12–57.25, 63.24–66.85, 41.10–43.88 तथा 36.23–39.08 के बीच पायी गयी।
- On the supplementation of inorganic Cu at 12.5 (control), 20 and 25 ppm levels in the diets of good and poor categories of Freiswal bulls, the average daily intake of total DM and CP (per 100 kg BW) remained in the range of 1.43–1.61 kg and 172.94–185.25 g, respectively all treatment groups. Whereas, per cent digestibility of nutrients viz., DM, CP, ADF and NDF remained in the ranges of 52.12–57.25, 63.24–66.85, 41.10–43.88 and 36.23–39.08, respectively.
- फ्रीजवाल सांड पालन इकाई में पशुओं के सामान्य हरे चारे जैसे–ज्वार, बरसीम, गाजर के अगोले, मक्का व गन्ने के अगोले में (प्रति 100 ग्रा. शुष्कभार) क्रमशः 6.67, 20.86, 16.63, 14.16 व 9.86 मिग्रा बीटा–कैरोटीन 3.02, 10.29, 8.70, 7.55 व 4.70 मिग्रा विटामिन–ए. पाये गये। पशुआहार के विभिन्न नमूनों में सूक्ष्म खनिज पोशक तत्व जैसे– ताँबा, मैंगनीज तथा जिन्क का स्तर (पी.पी.एम.) क्रमशः 31.28, 52.22 तथा 221.51 दाने; 4.15, 40.69 तथा 42.59 ज्वार; 26.99, 36.45 तथा 35.23 बरसीम; 27.25, 41.23 तथा 36.11 गाजर के अगोले; 15.27, 35.73 तथा 29.28 मक्का व 11.24, 29,59 तथा 38.75 गन्ने के अगोले में पायी गयी।
- The average Beta-carotene and vitamin A contents (mg/100g DM) of jowar, berseem, carrot tops, maize and sugarcane tops green fodders were 6.67, 20.86, 16.63, 14.16 and 9.86 and 3.02, 10.29, 8.70, 7.55 and 4.70, respectively. The averages for Cu, Mn and Zn mincro minerals (ppm) were 31.28, 52.22 and 221.51 in concentrate, 4.14, 40.69 and 42.59 in jowar, 26.99, 36.45 and 35.23 in berseem, 27.25, 41.23 and 36.11 in carrot tops, 15.27, 35.73 and 29.28 in maize, and 11.24, 29.59 and 38.75 in sugarcane tops, respectively.
- पशुओं की पोषक स्थिति जानने के लिए मेरठ जनपद के कस्तला, अतरदा, अलीपुर तथा खानपुर गावों में 128 कृषक परिवारों से सम्पर्क किया गया। पशुओं के दाने में 89.84, 84.38, 50.78, 29.69, 10.94, 4.69, 3.13 तथा 3.13 प्रतिशत परिवार क्रमशः खली, चोकर, चुन्नी, गेंहूं, पैलेटस, बिनौला, जौ तथा चने का प्रयोग करते पाये गये।
- For assessment of nutritional status of cattle, information was collected from 128 families of four villages viz., Kastala (23), Atrada (29), Alipur (41) and Khanpur (35). Different feed ingredients like- oilseed cakes, brans, chunnis, wheat, feed pallets, cottonseed, barley and gram were used for making concentrate mixture by 89.84, 84.38, 50.78, 29.69, 10.94, 4.69, 3.13 and 3.13 per cent families, respectively.
- कस्तला, अतरदा, अलीपुर तथा खानपुर गाँव में हरा चारा क्रमशः 27.13, 4.23, 13.53 तथा 14.09 किग्रा प्रतिदिन प्रतिपशु प्रदान किया गया। जबकि उक्त गावों में क्रमशः 2.79, 9.30, 5.18 तथा 6.89 किग्रा सूखा चारा और 1.53, 2.92, 2.17 तथा 8.82 किग्रा दाना प्रतिदिन प्रतिपशु प्रदान किया गया। पशुआहार में नमक और खनिज लवणों का बेहद कम प्रयोग किया गया।
- In Kastala, Atrada, Alipur and Khanpur villages, the average quantities of green fodder, dry fodder and concentrate mixture fed to the animal per day were 27.13, 4.23, 13.53 and 14.09 kg, 2.79, 9.30, 5.18 and 6.89 kg and 1.53, 2.92, 2.17 and 8.82 kg, respectively. The overall average quantities of green fodder, dry fodder and concentrate mixture fed daily to the animals were 13.61, 6.23 and 2.66 kg, respectively. The supplementation of animal diets with mineral mixture and salt was rarely practiced and in few cases were practiced; the supplemented quantities were not adequate.
- पशुओं की विभिन्न प्रकार की स्वास्थ्य समस्यायों व रोगों में बाह्य और आन्तरिक परजीवियों से सम्बन्धित समस्यायें सबसे अधिक मिलीं। एफ.एम.डी., रिटेंड प्लसेंटा, एनइस्ट्रस, मेस्टाइटिस, मिल्क फीवर आदि जैसी अन्य समस्यायें भी पायी गयीं।

- The incidences of livestock diseases and health problems like- ecto-parasites, endo-parasites, repeat breeding, FMD, retained placenta, anestrous & dysentery, mastitis & milk fever, abortions, black quarter, HS and trypanosomiasis were reported as 59.38, 39.06, 36.72, 21.88, 9.38, 6.25, 3.91, 3.13, 2.34, 1.56 and 1.56 per cent farm families, respectively during last one year.

- मेरठ जनपद के सरधना क्षेत्र में प्रचलित पशु–फीडिंग सिस्टम के अध्ययन के लिए सात फार्म (कुल 1780 पशु– 55 गाय तथा 1725 भैंस) पर सर्वेक्षण किया गया। अधिकतर फार्म पर मैली, कुट्टा व चोकर के साथ केवल धान की पराली का चारा खिलाया जाता पाया गया। कुछ जगह गेहूँ का आटा भी प्रयोग में पाया गया। अधिकतर स्थानों पर प्रतिदिन प्रतिपशु 5–8 किग्रा मैली, 8 किग्रा कुट्टा, 2 किग्रा चोकर, व 5 किग्रा पराली को जलमग्न अवस्था में उपलब्ध कराते पाया गया।

- A total of seven farms were surveyed in the Sardhana area for studying the prevailing feeding system. These farms housed nearly 1780 animals comprising of 55 cows and 1725 buffaloes. Most of the farms provide paddy straw as a sole fodder with other items like- *mailly* (jaggery processing waste), *kutta* (brewery waste) and *choker*, and rarely wheat flour to their animals. The quantities of feed ingredients offered daily to each animal were 5-8, 8, 5 and 2 Kg of *mailly*, *kutta*, paddy straw and wheat bran, respectively.

- वर्ष के दौरान 22 मिलटरी फार्म के लिए कुल 948 पशु आहार के नमूनों का प्रोक्सीमेट विश्लेषण करके रिर्पोट प्रस्तुत की गयी।

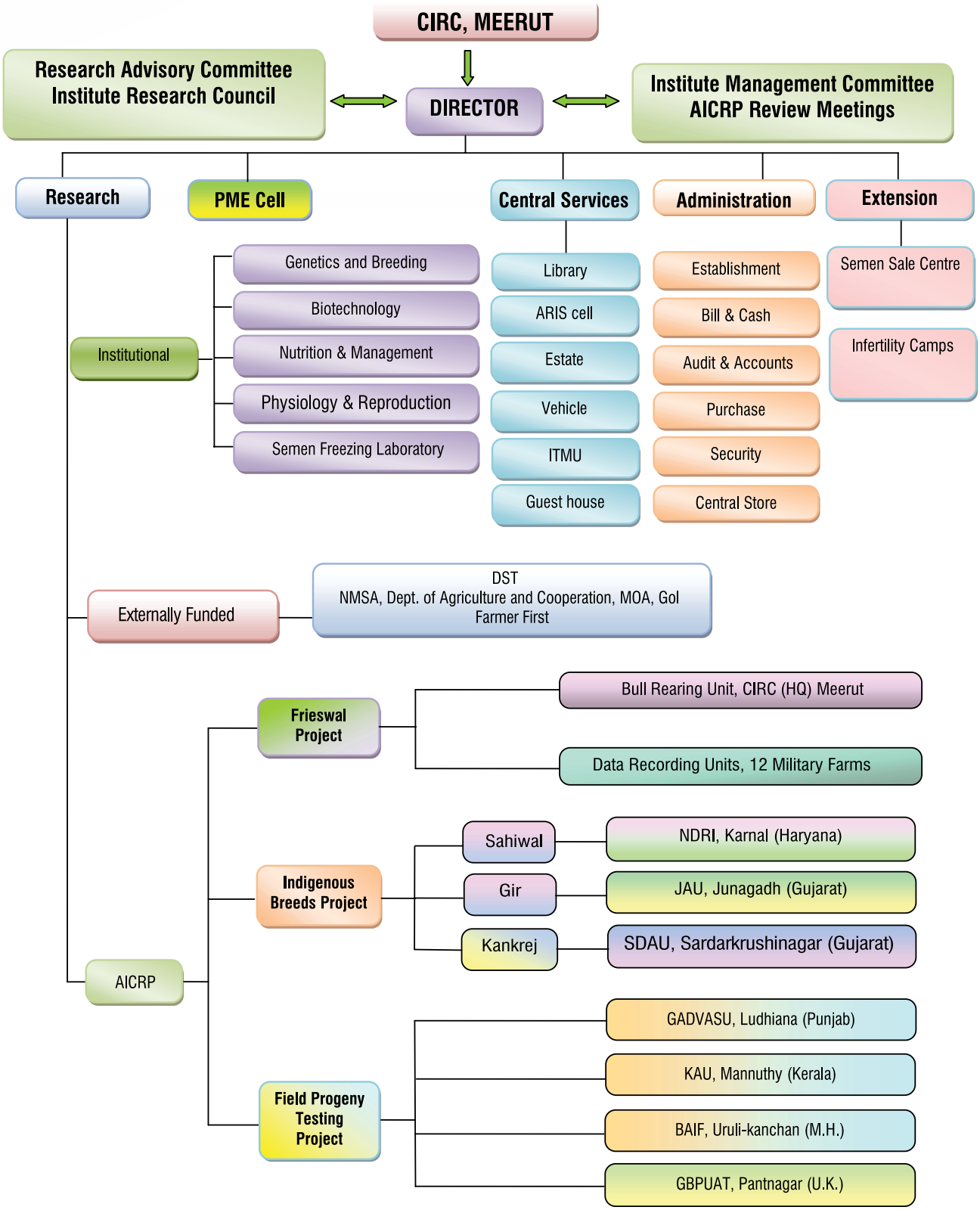
- Proximate analysis reports for 948 feed samples from 22 military farms were sent to the concerned farms during the year 2017-18.

गोवंश प्रसार गतिविधियां
Cattle extension activities

- भाकृअनुप–केंगोअनुसं ने प्रतिवेदन अवधि के दौरान राज्य और केंद्र सरकार के विभिन्न संस्थानों द्वारा आयोजित किये गये पाँच किसान मेलो में भाग लिया। इन मेलों में संस्थान के स्टॉल पर प्रमुख गतिविधियों व हस्तांतरित की जाने वाली तकनीकियों को प्रदर्शित किया गया और इसके बारे में बताया गया। अलग–अलग मेलों के दौरान संस्थान के स्टॉल का 4500 से अधिक किसानों व हितधारकों ने दौरा किया और जानकारी प्राप्त की। विभिन्न पशु संबंधी समस्याओं को हल करने के लिए संस्थान द्वारा विभिन्न पशु स्वास्थ्य सह बांझपन शिविर आयोजित किये गए। किसानों व इन्सेमिनेटर्स के लिये प्रशिक्षण कार्यक्रम का आयोजन किया गया और 200 से अधिक प्रतिभागियों को प्रशिक्षित किया। संस्थान ने 200 प्रगतिशील डेरी किसानों के लिये क्वालिटी लिमिटेड, नई दिल्ली के सहयोग से "उन्नत पशुपालन" पर कार्यशाला का आयोजन किया गया। मवेशी उत्पादकता बढ़ाने के लिए डेरी किसानों के साथ वैज्ञानिकों की एक इंटरैक्टिव बैठक भी आयोजित की गयी। एक किसान वैज्ञानिक इंटरफ़ेस बैठक और माननीय प्रधान मंत्री के भा ाण का वेब–प्रसारण संस्थान परिसर मे आयोजित किया गया जिसमे 300 से अधिक प्रतिभागियों ने भाग लिया। इसके अलावा संस्थान के वैज्ञानिक नियमित रूप से किसानों की समस्यायों को हल करने के लिए गोद लिए गाँवों और अन्य विभिन्न गाँवों में गये।

- During the report period, ICAR-CIRC, Meerut participated in 5 Kisan Melas organized by different State and Central Government institutions in which major activities and transferable technologies developed by the Insitute were exhibited. More than 4500 farmers and stakeholders visited the CIRC stall during different melas. Various animal health cum infertility camps were organized by the institute to solve different animal related problems faced by farmers. The institute organized training programmes for farmers and inseminators and trained more than 200 participants on scientific cattle rearing practices. The institute also organized a workshop on "Unnat Pashupalan" in collaboration with Kwality Ltd., New Delhi for 200 progressive dairy farmers. An interactive meet of scientists with dairy farmers to enhance cattle productivity was also organized. Successfully conducted the farmer-scientist interface meet with 325 participants and web casted the speech of Hon'ble Prime Minister on the occasion of Krishi Unnati Function held on 17-03-2018. In addition, scientists of the institute regularly visited the farmer's units of adopted villages and suitable advices were given to solve the problems faced by the farmers in cattle rearing.

Organogram


CIRC, MEERUT
Research Advisory Committee
Institute Research Council
DIRECTOR
Institute Management Committee
AICRP Review Meetings
Research
PME Cell
Central Services
Administration
Extension
Institutional
Genetics and Breeding
Biotechnology
Nutrition & Management
Physiology & Reproduction
Semen Freezing Laboratory
Library
ARIS cell
Estate
Vehicle
ITMU
Guest house
Establishment
Bill & Cash
Audit & Accounts
Purchase
Security
Central Store
Semen Sale Centre
Infertility Camps
Externally Funded
DST
NMSA, Dept. of Agriculture and Cooperation, MOA, GoI
Farmer First
AICRP
Frieswal Project
Bull Rearing Unit, CIRC (HQ) Meerut
Data Recording Units, 12 Military Farms
Indigenous Breeds Project
Sahiwal
NDRI, Karnal (Haryana)
Gir
JAU, Junagadh (Gujarat)
Kankrej
SDAU, Sardarkrushinagar (Gujarat)
Field Progeny Testing Project
GADVASU, Ludhiana (Punjab)
KAU, Mannuthy (Kerala)
BAIF, Uruli-kanchan (M.H.)
GBPUAT, Pantnagar (U.K.)

STAFF POSITION

Sl.No.	Category	Sanctioned	Filled	Vacant
1.	R.M.P.	01	01	00
2.	Scientific	38	24	14
3.	Technical	08	08	00
4.	Administrative	14	11	03
5.	Supporting	10	09	01
	Total	**71**	**53**	**18**

FINANCIAL STATEMENT
ICAR-CENTRAL INSTITUTE FOR RESEARCH ON CATTLE, MEERUT

A Statement of Budget Approved and Expenditure incurred in ICAR-CIRC Main Scheme and other Schemes funded by ICAR, Krishi Bhavan, New Delhi during Financial Year 2017-18

(Amount in Rupees)

Sl. No	Head of Accounts	CIRC Grants (Plan) Main Scheme		AICRP on Cattle		ITMU Project (IP&TM Unit), ICAR, New Delhi		ICAR - Winter School Training, Krishi Bhavan, New Delhi (Dr. Umesh Singh, Pri. Sci., ICAR-CIRC, Meerut)	
		RE 2017-18	Expenditure	RE 2017-18	Expenditure	RE 2017-18	Expendi-ture	RE 2017-18	Expenditure
1	2	3	4	5	6	7	8	9	10
	Grants for creation of Capital Assets (CAPITAL)								
1	Works								
	i) Minor Works								
2	Equipments	7225000.00	6565981.00	1047000.00	1047000.00				
3	Information technology (Instt.)	855000.00	541200.00	669000.00	669000.00				
4	Library Books/ Journals	730000.00	715889.00						
5	Vehicles & Vessels			75000.00	75000.00				
6	Live stock			100000.00	100000.00				
7	Furniture & fixtures (Institute)	140000.00	123541.00	291000.00	291000.00				
8	Others								
	Total CAPITAL (Grants for creation of Capital Assets)	8950000.00	7946611.00	2182000.00	2182000.00	0.00	0.00	0.00	0.00

Sl. No	Head of Accounts	CIRC Grants (Plan) Main Scheme		AICRP on Cattle		ITMU Project (IP&TM Unit), ICAR, New Delhi		ICAR - Winter School Training, Krishi Bhavan, New Delhi (Dr. Umesh Singh, Pri. Sci., ICAR-CIRC, Meerut)	
	Grant in Aid - Salaries (REVENUE)								
1	Establishment Expenses								
	(A) Salaries								
	i) Establishment charges	66900000.00	66821126.00	16900000	16900000				
	ii) Wages								
	iii) Overtime allowance								
	Total - Estt. Expenses (Grant in Aid-Salaries)	66900000.00	66821126.00	16900000.00	16900000.00	0.00	0.00	0.00	0.00
	Grant in Aid - General (REVENUE)								
1	Pension & other ret. benefits	1600000.00	439891.00	0	0				
2	Travelling Allowance								
	(A) Domesitc TA/ Transfer TA	550000.00	516347.00	851000.00	851000.00	36000.00	135.00	120000.00	61018.00
	(B) Foreign TA	0							
	Total : Travelling Allowance	550000.00	516347.00	851000.00	851000.00	36000.00	135.00	120000.00	61018.00
3	Research & Operational Exp.								
	(A) Research Expenses	3600000.00	3119122.00	22140000.00	22140000.00				
	(B) Operational expenses	6600000.00	6318574.00	23796000.00	23796000.00	600000.00	128761.00	385235.00	254145.00
	Total: Res. & Oprnl Expenses	10200000.00	9437696.00	45936000.00	45936000.00	600000.00	128761.00	385235.00	254145.00
4	Administrative Expenses								
	(A) Infrastructure:	4000000.00	3912527.00	542000.00	542000.00				
	(B) Communications	150000.00	135645.00						
	(C) Repairs & maintenance:								

Sl. No	Head of Accounts	CIRC Grants (Plan) Main Scheme		AICRP on Cattle		ITMU Project (IP&TM Unit), ICAR, New Delhi		ICAR - Winter School Training, Krishi Bhavan, New Delhi (Dr. Umesh Singh, Pri. Sci., ICAR-CIRC, Meerut)	
	i) Equipments, vehicles & others	500000.00	493471.00	150000.00	149999.00				
	ii) Office building	2550000.00	2484877.00						
	iii) Residential building	650000.00	611302.00						
	iv) Minor works								
	(D) Others (excluding TA)	1000000.00	818191.00	621000.00	621000.00				
	Total: Administrative Expenses	8850000.00	8456013.00	1312999.00	1312999.00	0.00	0.00	0.00	0.00
5	Miscellaneous expenses								
	(A) HRD	400000.00	350960.00						
	(B) Other (Fellow/ Scholarships)								
	(C) Publicity & exhibitions	50000.00	45945.00						
	(D) Guest house - maintenance								
	(E) Other miscellaneous	350000.00	327251.00					19965.00	19965.00
	Total: Miscellaneous expenses	800000.00	724156.00	0.00	0.00	0.00	0.00	19965.00	19965.00
	Total Grant-in-Aid : General	22000000.00	19574103.00	4809999.00	48099999.00	636000.00	128896.00	525200.00	335128.00
	Total: Rev. (Salaries + General)	88900000.00	86395229.00	64999999.00	65000000.00	636000.00	128896.00	525200.00	335128.00
	Grand Total (Capital + Revenue)	97850000.00	94341840.00	67181999.00	67181999.00	636000.00	128896.00	525200.00	335128.00

#	Resource Generation				1287377.00				

B Statement of Budget Approved and Expenditure incurrred in other ICAR institutes funded Scheme during Financial Year 2017-18

(Amount in Rupees)

Sl. No	Head of Accounts	ICAR Institutes Funding Schemes					
		Farmer FIRST Project, ICAR-ATARI, Zone-IV, Kanpur funded by (Agril. Extn.), ICAR, KAB-1, Pusa, New Delhi		Consortia Research Platform (CRP) on Water, IIWM, Bhuhneswar		ICAR- IIWM, Bhubaneshwar) Efficient Ground Water Management - Rasulpur Village	
		RE 2017-18	Expenditure	RE 2017-18	Expenditure	RE 2017-18	Expenditure
1	2	11	12	13	14	15	16
	Grants for creation of Capital Assets (CAPITAL)						
1	Works						
	i) Minor Works			300000.00			
2	Equipments	150000		360000.00		1102002.00	693000.00
3	Information technology (Instt.)	10000		50000.00	37799.00		
4	Library Books/Journals						
5	Vehicles & Vessels						
6	Live stock						
7	Furniture & fixtures (Institute)						
8	Others						
	Total CAPITAL (Grants for creation of Capital Assets)	160000.00	0.00	710000.00	37799.00	1102002.00	693000.00
	Grant in Aid - Salaries (REVENUE)						
1	Establishment Expenses						
	(A) Salaries						
	i) Establishment charges						
	ii) Wages						
	iii) Overtime allowance						
	Total - Estt. Expenses (Grant in Aid-Salaries)	0.00	0.00	0.00	0.00	0.00	0.00
	Grant in Aid - General (REVENUE)						
1	Pension & other ret. benefits						
2	Travelling Allowance						

Sl. No	Head of Accounts	ICAR Institutes Funding Schemes					
		Farmer FIRST Project, ICAR-ATARI, Zone-IV, Kanpur funded by (Agril. Extn.), ICAR, KAB-1, Pusa, New Delhi		Consortia Research Platform (CRP) on Water, IIWM, Bhuhneswar		ICAR- IIWM, Bhubaneshwar) Efficient Ground Water Management - Rasulpur Village	
		RE 2017-18	Expenditure	RE 2017-18	Expenditure	RE 2017-18	Expenditure
1	2	11	12	13	14	15	16
	(A) Domesitc TA/Transfer TA	100000.00	96619.00	80000.00	1005.00	25000.00	388.00
	(B) Foreign TA						
	Total : Travelling Allowance	100000.00	96619.00	80000.00	1005.00	25000.00	388.00
3	Research & Operational Exp.						
	(A) Research Expenses	2250000.00	924098.00	140000.00	140000.00	180000.00	
	(B) Operational expenses			580000.00	196158.00	180000.00	180000.00
	Total: Res.& Oprnl Expenses	2250000.00	924098.00	720000.00	336158.00	360000.00	180000.00
4	Administrative Expenses						
	(A) Infrastructure:						
	(B) Communications						
	(C) Repairs & maintenance:						
	i) Equipments, vehicles & others						
	ii) Office building						
	iii) Residential building						
	iv) Minor works						
	(D) Others (excluding TA)	100000.00	24997.00			22465.00	1890.00
	Total: Administrative Expenses	100000.00	24997.00	0.00	0.00	22465.00	1890.00
5	Miscellaneous expenses						
	(A) HRD	400000.00	285802.00			113793.00	
	(B) Other (Fellow/Scholarships)						
	(C) Publicity & exhibitions						
	(D) Guest house - maintenance						
	(E) Other miscellaneous			10000.00	1964.00		
	Total: Miscellaneous expenses	400000.00	285802.00	10000.00	1964.00	113793.00	0.00
	Total Grant-in-Aid : General	2850000.00	1331516.00	810000.00	339127.00	521258.00	182278.00
	Total: Rev. (Salaries + General)	2850000.00	1331516.00	810000.00	339127.00	521258.00	182278.00
	Grand Total (Capital + Revenue)	3010000.00	1331516.00	1520000.00	376926.00	1623260.00	875278.00

C Statement of Budget Approved and Expenditure for Externally Funded Programme from Govt. Departments Other than ICAR during 2017-18

(Amount in Rupees)

Sl. No.	Head of Accounts	SERB Project "Cataloging of miRNA ..... mRNA in Cattle (Dr. Rajib Deb, Scientist)		SERB Project "Dynamics of circulatory ..... to discover biomarkers (Dr. Rani Singh)		DST WOSA project "Molecular Characterization ..... Cell tropism in cattle" (Dr. Rani Singh)		MANAGE, Hyderabad Training (Dr. Srikant Tyagi, Pri. Sci)		ECR-SERB Project "Genetic and Management Intervention.....to reduce the cryoinjury on bull spermatozoa" (Dr. R R Alyethodi, Scientist)	
1	2	3	4	5	6	7	8	9	10	11	12
		RE 2017-18	Expenditure	RE 2017-18	Expenditure	RE 2017-18	Expenditure	RE 2017-18	Expenditure	RE 2017-18	Expenditure
1	Fellowship/ Manpower	209750.00	195513.00	772129.00	642022.00	165355.00	165355.00			360000.00	0.00
2	Operational Expenses							260700.00	184731.00		0.00
3	Consumables	245408.00	232720.00	207879.00	205999.00			66800.00	45463.00	631066.00	0.00
4	Contingencies	27488.00	14047.00	10000.00	9489.00			15000.00	12569.00		0.00
5	Other Costs / Other Misc.			300000.00							0.00
6	Travel Expenses	23456.00	2410.00	35000.00	15241.00			40000.00	14439.00		0.00
7	Overhead Expenses	100000.00	100000.00	100000.00	100000.00					79285.00	0.00
Total		606102.00	544690.00	1425008.00	972751.00	165355.00	165355.00	382500.00	257202.00	1070351.00	0.00

Research Achievements

I. All INDIA COORDINATED RESEARCH PROJECT ON CATTLE

A. Studies on Genetic Aspects of Holstein-Sahiwal Crossbreds-Frieswal Project

Frieswal is a crossbred cattle having 5/8 Holstein Friesian and 3/8 Sahiwal blood, developed by ICAR-Central Institute for Research on Cattle, Meerut in collaboration with Ministry of Defence. The Frieswal project envisages evolving a National Milch Breed "Frieswal", a Holstein- Sahiwal cross, yielding 4000 kg of milk with 4% butter fat in a mature lactation of 300 days. The evolution of Frieswal is being achieved by utilizing the existing crossbred herds available at Military Farms located in various agro-climatic regions of the country.

Herd Strength

The total population of Frieswal females as on 31st March 2018 at 27 Military Farms located in various agro-climatic regions of the country was 20673 comprising of 11714 adult cows, 6991 young stocks and 1968 calves (Fig. 1 & Table 1). The number of Frieswal females was highest at MF Ambala (2480) followed by Jalandhar (1811) and Pimpri (1742). A total of 243 Frieswal bulls (including 225 adult and 10 young stocks) and six Sahiwal adult and two young stocks are being maintained at Bull Rearing Unit, Meerut. A total of 992 elite cows maintained at Military Farms are being used for nominated mating with ranked Frieswal bulls for production of young male calves to be reared as young bulls for testing (Table-2).

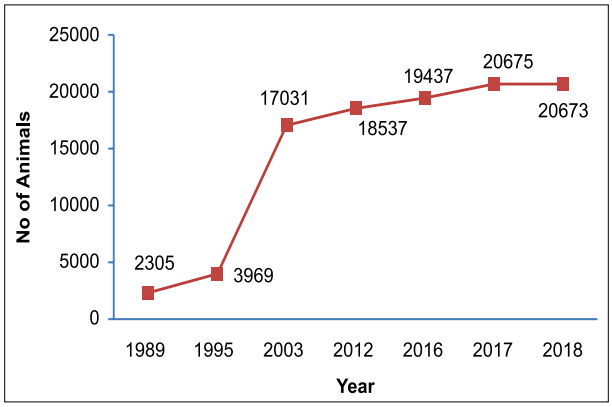


Fig 1 Growth of Frieswal population over the years

Since inception, a total of 1546 male calves, born from mating of elite cows with proven bulls and based on breed characteristics and physical conformity at 29 Military Farms in different years were received/available at BRU Meerut for selection of young male calves for future breeding. MF Meerut had supplied the highest number of such male calves (24) followed by Bengdubi (17) during this year. Since inception of the project MF Ambala had supplied highest number of male calves to BRU (322) followed by Meerut (291) and Pimpri (175).

Multiplication and Dissemination of Frieswal Germplasm

A total of 67243 frozen semen doses have been distributed to Military Farms and 36400 doses to Field Progeny Testing Project. This year 48616 doses have been sold to paravets, State Animal Husbandry Departments, Livestock Development Boards, State Agriculture Universities and a revenue of Rs. 7,24,163/- was generated by sale of Frieswal semen.

Performance evaluation of Frieswal animals

A total of 54062 lactation records of Frieswal cows sired by 180 bulls maintained in various agro-climatic regions over a period of 27 years from 1991 to 2017 were used for analysis. The data were classified according to farm, parity,

season and year of birth/calving. The seasons were classified as winter (December to March), summer (April to June), rainy (July to September) and post monsoon (October and November). The data for production and reproduction traits were analyzed using GLM procedure of SAS (SAS Institute, Cary, NC) considering farm, parity, season and year of calving as fixed effects and age at first calving as co-variable. For analysis of age at first calving, factors such as farm, year and season of birth were considered as fixed effects.

Milk Production performance

The overall means of 300-days milk yield and total milk yield based on 31851 and 54062 lactation records were 3340.26 and 3358.86 kg, respectively. This performance has been achieved despite almost no culling of poor producers as per policy of Military Farms. The peak yield of the Frieswal herd averaged 14.91 kg. The effects of farm, parity, season and year of calving and regression on AFC were significant on all the traits. Frieswal cows at MF Allahabad (4116.91 kg) produced the highest 300-days milk yield followed by Kanpur (3958.12 kg) and Lucknow (3824.91 kg). Frieswal cows at Allahabad (4245.44 kg) had the highest total lactation milk yield followed by Kanpur (4088.11 kg) and Lucknow (3852.33 kg). The peak yield was highest at MF Allahabad (19.17 kg) followed by Kanpur (16.75 kg) and Agra (16.60 kg). PY ranged from 11.48 kg at MF Panagarh to 19.17 kg at Allahabad. The variation in production performance among farms might be due to varying managemental and feeding practices and location of farm in various agro-climatic zones. Season of calving also affected the production performance. The cows calved in winter season yielded the highest 300 days milk (3407.56 kg) followed by post monsoon (3391.45 kg), summer (3296.65 kg) and rainy (3265.40 kg) calvers. Same trend was observed in the case of total lactation milk yield as well as peak yield as the total lactation milk yield and peak yield for winter calvers was highest (3416.03 and 15.64 kg) followed by those calved in post monsoon (3371.85 and 15.15 kg) and summer (3367.20 and 14.59 kg). The animals which calved during the rainy season had the lowest TLMY and PY of 3280.35 and 14.25 kg, respectively. There was lot of fluctuation in total lactation milk yield during various years and it ranged from 3024.93 to 3651.69 kg. Highest PY of 15.79 kg was observed in animals calved during the years 2001 and 2003.

The average lactation length of the Frieswal

cows was 322.09 days. Effects of farm, parity, season, year of calving and regression of AFC also played significant effect on lactation length as in the case of other traits. Lactation length was longest at MF Rajouri (345.50 days) followed by MF Jabalpur (336.84 days). All the Military Farms had lactation length higher than 300 days. The cows calved during summer season had the longest lactation length of 331.19 days.

Reproductive performance

The overall mean age at first calving was 967.24 days (31.82 months). The effects of farm and year of birth were significant on AFC. The animals at MF Dimapur (29.55 months/892.02 days) had shorter age at first calving followed by Namukum (29.93 months/909.01 days) and Lucknow (30.21 months/912.76 days). The longest AFC was recorded at MF Panagarh (36.41 months/1106.93 days) followed by Rajouri (33.53 months/ 1043.37 days). Large variation in AFC reflects the scope for its improvement by way of improving general management practices including feeding standards, timely heat detection and artificial insemination. Declining trend in AFC over the years was noticed which indicates a desirable improvement in this economically significant trait.

Service period (SP), dry period (DP) and calving interval (CI) were also evaluated. The average SP, DP and CI were 162.52, 116.98 and 433.05 days, respectively. These traits were also significantly influenced by farm, parity, season, year of calving and regression of AFC. The shortest service period was observed at MF Bengdubi (142.08 days) followed by Secunderabad (147.51 days) and Nowshera (148.04 days). Longest service period was observed in cows at MF Panitola (196.93 days). Similar trend was observed in the case of calving

interval also, as expected. The shortest calving interval was observed in cows maintained at MF Bengdubi (412.27 days) followed by Secunderabad (417.41 days) and Dehradun (418.17 days). The longest CI was also noticed at MF Misamari (471.56 days). MF Mhow had the shortest dry period of 97.87 days followed by MF Nowhshera (103.82 days) and Bengdubi (105.34 days). Longest DP was found in the cows at MF Missamari (142.74 days). In general, service period and calving interval had no definite trend over the lactations. Frieswal cows calved during post monsoon season had the shortest SP (144.86 days) followed by those calved in rainy (156.28 days), winter (168.64 days) and summer (180.30 days) seasons. Seasonal variation in other reproductive traits also showed similar pattern and post monsoon calvers were having shortest DP and CI (108.39 and 415.87 days) while summer calvers had the longest DP and CI (124.73 and 449.68 days, respectively). There was no definite trend in SP and CI over the years. Service period was longest during 1998 (189.13 days) and shortest during 2016 (91.77 days). Cows calved during 1999 had longest (135.28 days) dry period and thereafter a declining trend in dry period was observed. It reflected positive response for the attempts made for improving the reproductive traits at Military Farms over the years. Increase in service period was observed in recent years mainly due to reproductive problems of the cows.

Estimation of Genetic parameters

The genetic parameters of different production and reproduction traits were estimated by univariate and multivariate repeatability animal models using WOMBAT software. Estimates of heritability for AFC (0.067 ±0.013), MY300 (0.148 ± 0.001), TMY (0.141 ± 0.001), and PY (0.149 ± 0.011) were low. DP, CI and SP also had low heritability estimates of 0.014 ± 0.004, 0.015 ± 0.005 and 0.011 ± 0.004, respectively.

Table1: Female herd strength of Frieswal cattle at various Military Farms as on 31.03.2018

Farm	Adults	YS-II	YS-I	Calves	Total
Meerut	671	290	149	112	1222
Agra	432	149	89	77	747
Lucknow	481	216	81	102	880
Bareilly	264	80	59	75	478
Jabalpur	493	181	171	92	937
Namkum	348	148	105	63	664
Allahabad	292	113	50	67	522
Ambala	1370	622	228	260	2480
Jalandhar	921	486	201	203	1811
Ferozpur	276	122	57	29	484
Pathankot	413	25	83	55	576
Belgaum	349	154	68	52	623
Deolali	443	163	90	62	758
Secunderabad	522	199	105	75	901
Pimpri	1039	319	234	150	1742
Jhansi	381	103	52	55	591
Ahmednagar	379	118	57	39	593
Binnaguri	287	132	63	63	545
Missamari	413	173	102	52	740
Bengdubi	424	206	110	88	828
Guwahati	422	206	77	48	753
Panagarh	117	61	33	21	232
Udhampur	90	20	09	08	127
Jammu	551	151	123	74	899
Nowshera	336	96	62	46	540
Total	11714	4533	2458	1968	20673

YS-I is young stock below 15 months; YS II is young stock above 15 months

Table 2. Number of elite cows at various Military Farms as on 31.03.2018

S. No.	Command/Farm	Number
	Southern	
1	Pimpri	104
2	Belgaum	30
3	Deolali	11
4	Ahmednagar	6
5	Secundrabad	15
6	Jhansi	32
	Total	198
	Western	
1	Ambala	92
2	Jalandhar	9
3	Ferozpur	27
4	Pathankot	16
	Total	144
	Central	
1	Meerut	145

S. No.	Command/Farm	Number
2	Agra	24
3	Bareilly	26
4	Lucknow	148
5	Allahabad	50
6	Jabalpur	64
7	Namkum	37
	Total	494
	Northern	
1.	Jammu	49
2.	Udhampur	8
3.	Nowshera	7
	Total	64
	Eastern	
1.	Panagarh	13
2.	Guwahati	32
3.	Bengdubi	36
4.	Binnaguri	02
5.	Missamari	09
	Total	92
	Grand Total	992

First lactation traits are not indicative of mature lactation milk yield in Frieswal cows

The lactation records of 1766 Frieswal animals born between 2001 and 2013 were considered for prediction of mature lactation milk yield from first lactation traits. First lactation traits considered under the study were age at first calving, 305 day milk yield, peak yield, service period, dry period and calving interval. Out of the total animals used in the study, 78.14 per cent had attained mature milk yield within the age of fourth lactation itself. The correlation between mature lactation milk yield and first lactation 300 day milk yield and peak yield were 0.31 and 0.21, respectively. Stepwise regression model was used to find out the best prediction model and only the 305 day milk yield qualified for inclusion. The equation derived was Y=3113.16+0.41 (MY). The R^2 and root mean square error (RMSE) values of the model were 9.4% and 780.84, respectively. Other curvilinear models like logarithmic, quadratic, cubic and exponential models also developed. Quadratic and cubic models were the best models with an R2 value of 11%. But very low accuracies of all the models indicated that the first lactation traits cannot be used for predicting mature milk yield.

Dentition in Frieswal cattle

The data on dentition pattern (eruption and development of incisors) in 314 Frieswal cattle were compiled and analysed for estimation of age (ageing birth to six years). It was observed that the Frieswal calves (male and female) born with a pair of erupting deciduous central incisors. However, first and second intermediate and corner deciduous incisors erupted by two weeks of age (Fig. 2). In some cases corner deciduous incisors erupted by 25 days of age.

Fig. 2 Dentition pattern in Frieswal cattle (L to R) 1st row: Day old calf, Growing calf; 2nd row: Permanent central incisors, Permanent central & 1st intermediate incisors; 3rd row: Permanent central and 1st & 2nd Intermediate Incisors, Full mouth

During the study, one each of growing male and female calves had prognathism and brachygnathism, respectively.

Permanent central incisors teeth in male and female cattle started erupting at the age of 24.8 and 24.4 months, respectively and fully developed by 26 months of age (Table 3). First permanent intermediate incisors started erupting at the age of 31.72 and 32.5 months in males and females, respectively. However, second permanent intermediate incisors started erupting at the age of 38.6 and 39.1 months in males and females, respectively. The corner incisors started erupting at the age of 46.17 and 46.8 months in males and females, respectively (Fig. 2, 3rd row).

Table 3: Eruption table of incisor teeth in male and female Frieswal cattle

Type of incisor teeth		Age at eruption (months)	
		Male	Female
Permanent teeth	Central	24.8	24.4
	First intermediate	31.72	32.5
	Second intermediate	38.6	39.1
	Corner	46.17	46.8

B. Genetic Improvement of Crossbred Cattle Under Field Conditions- Field Progeny Testing Project

The Field Progeny Testing Programme envisages testing of 30 Frieswal bulls in each set having 50 to 75 per cent exotic inheritance and minimum dam's milk yield of 4500 kg. The period of bull usage of each batch will be 15 months. The bull should be free from all genetic diseases and gross physical defects. The target is to record a minimum of 40 daughters from each test bull spread over four different units namely Guru Angad Dev Veterinary and Animal Sciences, University (GADVASU), Ludhiana, Kerala Veterinary and Animal Sciences University (KVASU), Mannuthy, G.B. Pant University of Agricultural Science and Technology (GBPUA&T), Pantnagar and Bharthiya Agro Industries Federation (BAIF), Urlikanchan, Pune. This will involve inseminating at least 300 cows per bull at each unit. A population of about 9000 cows per unit thus will be needed for test mating with 30 bulls. Use of semen of 14th set of bulls has completed and insemination with semen doses of 15th set of bulls has been started and is progressing well. Evaluation of bulls through progeny testing and their extensive use has been a major source of genetic improvement in dairy animals. About 309 young HF crossbred bulls (Frieswal Bull) have been put under the test mating in different sets at four units. Daughters born in first ten sets have completed their first lactation and a total of 183 bulls have been evaluated on the basis of their first lactation milk yield of their daughters. Through the intervention of Field Progeny Testing programme of this Institute, the average first lactation 305-days milk yield of the Frieswal progenies in the adopted villages of FPT project has been increased by 51.2 % in KVASU, 39.7 % in GADVASU, 11.14 % in BAIF and 32.58 % in GBPUA&T unit. Subsequently average age at first calving (AFC) of the Frieswal progenies has been reduced by, 9.87 % in KVASU, 12.23 % in GADVASU, 2.35 % in BAIF and 5.5 % in GBPUA &T unit. The details on the comparative performance of crossbred cattle in four different FPT units during the year 2017 are summarized in Table 4.

Table 4. Comparative performance of 4 different units of FPT project during the reporting period (1.1.2017 to 31.12.2017)

Particulars	GADVASU Ludhiana	KVASU Thrissur	BAIF Pune	GBPUAT Pantnagar
Total Artificial inseminations	3737	5163	4508	5651
Pregnancies confirmed	1653	2183	1378	3195
Conception rate %	46.2	46.0	42.6	61.2
Total calving	2047	1270	1722	2351
Female calves born	981	623	900	1067
Female calves reached AFC	476	175	296	218
Female calves completed first lactation	472	150	201	125
Average 305 days milk yield (kg)	3769.9	2961.2	3257.0	3024.2
Average AFC (days)	1046.2	1024.2	968.0	1083.0
Total loss of data (%)	35.5	9.7	32.0	14.5

Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana

The Field Progeny Testing programme is covering adult cow population of about 12950 cows and 4831 breedable heifers. The insemination work of the Field Progeny Testing project is undertaken through 30 A.I. centres in Ludhiana district. Four of these centres are operated by Punjab State Department of Animal Husbandry and others by trained inseminators. During the period under report, frozen semen doses of 14th and 15th set of bulls were used for performing 3737 artificial inseminations in the adopted villages of Ludhiana district. The first lactation 305 days milk production performance of 647 daughters of 10th set, 576 daughters of 11th set, 378 daughters of 12th set and 8 daughters of 13th set of test bulls ranged from 4121.7±351.5 to 3373.7±183.4, 4260.4±171.2 to 3110.6±215.6, 4473.2±347.5 to 3356.9±214.0 and 3783.0±501.4 to 3319.1±635.7 kg, respectively. The average first lactation 305 days milk yields of the daughters of 10th, 11th, 12th and 13th set of bulls were 3714.7±22.9, 3751.8±22.9, 3802.4±31.4 and 3514.8±218.3 kg, respectively. The corresponding averages for age at first calving of the daughters were 1044.2±8.5, 1032.7±8.0, 912.6±7.5 and 756.1±31.7 days, respectively. The average fat percentages of milk of the daughters of 10th, 11th, 12th and 13th set of bulls were 3.7±0.003, 3.7±0.004, 3.7±0.013 and 3.7±0.009, respectively. A total 10,337 farmers have so far been registered and benefited through this project in Ludhiana district. A total of 309 bulls in fifteen different batches have so far been inducted in the program. A total 142907 Artificial Inseminations have so far been done and 18974 female calves had born, out of which, 5657 female progenies have reached age at first calving through the use of semen of bulls under test (Table 5).

Table 5. Information regarding different sets of bulls (GADVASU)

Set No.	Date of start	Total bulls used	Total inseminations	Total AI's followed	Pregnancies confirmed	Conception rate %	Followed for calving	Females calves	
								Born	Reached AFC
III	1.04.95	18	7595	7355	3065	41.7	3000	855	227
IVa	1.01.97	10	5150	4865	2132	43.8	2000	789	210
IVb	1.01.99	23	18006	17159	8258	48.1	8000	1844	562
V	16.12.01	30	12548	11504	5720	49.7	5720	1368	490
VI	1.04.03	22	10409	10154	4362	43.0	4362	1497	478
VII	1.2.05	25	8265	8105	3476	42.9	3476	1181	359
VIII	1.8.06	22	9710	9710	3999	41.1	3999	1120	448
IX	1.1.08	16	9611	9611	3898	40.6	3898	1186	461
X	1.7.09	24	14581	14581	5679	38.9	5679	1671	885
XI	1.3.11	20	12971	12971	5604	43.2	5604	2072	688
XII	1.8.12	28	15662	15662	7008	44.7	7008	2500	650
XIII	1.2.14	15	6662	6662	3039	45.6	3039	1321	195
XIV	1.8.15	30	8299	8299	3851	46.4	3851	1570	4
XV	1.6.17	26	3438	1389	633	45.6	--	--	-
Total		**309**	**142907**	**138027**	**60724**	**43.9**	**59636**	**18974**	**5657**

In first set of bulls (1995), the average 305-days yield was 2697.8 kg and in 12th set of bulls it was 3769.9 kg indicating a sharp increase of 1072.1 kg milk (39.7 %) in the daughters. The AFC was 1192 days in progenies of first set of bulls (1995) which reduced to 1046 days in current set showing a sharp decrease of 146 days (12.23 %) (Fig 3).

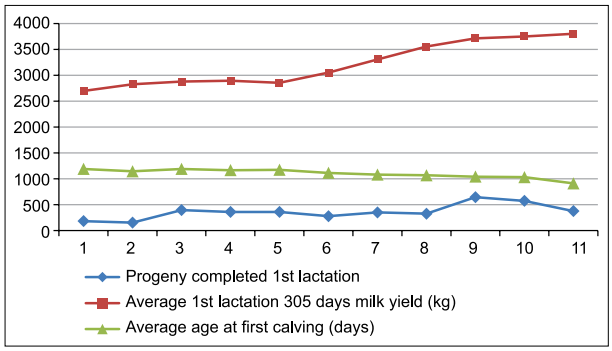


Fig 3. Set wise progeny performance at GADVASU unit since inception

A total of 184, 154, 397, 361, 361, 278, 351, 326, 647, 576, 378 and 08 progenies of 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th and 13th set of test bulls completed their first lactation 305-days milk production averaging 2697.8±40.1, 2827.09±48.7, 2878.7±25.5, 2896.1±26.0, 2855.9±25.9, 3051.8±24.5, 3305.4±28.9, 3556.6±31.2, 3714.7±22.9, 3751.8±22.9, 3802.4±31.02 and 3514.8±18.3 kg, respectively. Two calf rallies and five village level group meetings were organized to make the dairy farmers aware about the importance of the field progeny testing programme and farmers were enlightened on scientific breeding, feeding, management and health care practices for improving the production performance of their animals.

Field Progeny Testing Project has major contribution in changing the scenario of dairy farming in the adopted villages in Ludhiana district by providing technical knowhow, germplasm and motivation to farmers. The supply semen of high genetic potential test bulls and progeny tested bulls to the farmers in the villages adopted under the Field Progeny Testing Project has helped in improving their economic level. The average first lactation 305 days milk yields of the crossbred progenies in the adopted villages was 2449.7±57.0 kg in the year 1993, 2965.5±35.3 kg in 2006 and 3133.8±38.0 kg in the year 2011. This as a result of supply of high quality semen of test bulls which has increased to 3769.9±26.5 kg in the year 2017. Some progressive dairy farmers after getting training and superior germplasm from the project have established outstanding crossbred herds with first lactation milk yield of more than 6400 kg and peak yield of more than 40 kg a day.

Socio economic status of farmers under the Project

The production performance of the animals according to different categories of farmers (Table 6) showed that the farmers with fodder production had higher milk yield of their crossbred cows than the cows maintained by farmers without fodder. Crossbred cows maintained by farmers having adequate fodder supply produced 3777.5±26.7 kg milk during first lactation against 3330.0±146.1 kg of milk by the farmers having little or no green fodder supply. Commercial farmers had high milk yield (3770.9±26.5 kg) of their animals than the non-commercial farmers (3300.9 kg). With the availability of remunerative milk prices, the commercial farmers give more attention to feeding and management practices.

Table 6. Production performance of the animals according to different categories of farmers

Category	No.	Percentage	First lactation 305-days milk yield (kg)
Overall mean	472	100	3769.9±26.5
Feeding System			
1. With fodder	464	98.3	3777.5±26.7
2. Without fodder	8	1.7	3330±146.1
Type of farmer			
1. Commercial	471	99.8	3770.9±26.5
2. Non-commercial	1	0.2	3300.9
Education			
1. Illiterate	2	0.4	3562.6±25.3
2. Up to primary	56	11.9	3707.9±65.8
3 Up to matric	352	74.6	3766.6±32.6
4. Up to secondary	36	7.6	3689.7±64.1

Category	No.	Percentage	First lactation 305-days milk yield (kg)
5. College level	26	5.5	4075.2±67.9
Herd size			
1. ≤ 3	94	19.9	3547.3±48.1
2. 4 to 5	136	28.8	3688.7±40.9
3. 6 to 10	155	32.8	3693.6±40.9
4. > 10	87	18.4	4273.2±69.6
Land holding			
1. Landless	10	2.1	3308.8±141.5
2. Less than 1 acre	10	2.1	3544.8±134.5
3. 1 to 2 acres	13	2.8	3393.8±102.8
4. 2 to 5 acres	170	36.0	3704.3±35.8
5. 5 to 10 acres	206	43.6	3754.8±37.2
6. > 10 acres	63	13.3	4182.6±99.9
Occupation of owner **:**			
1. Agric. farmer	397	84.1	3707.6±26
2. Agric. labour	11	2.3	3323.4±146.7
3. Service	8	1.7	3571.2±153.2
4. Business	5	1.1	3165.8±171.4
5. Dairying	51	10.8	4441.7±80

Highest milk production of 4075.2±67.9 kg was recorded by owners having college level education. Educated owners have more awareness and practiced dairying on scientific lines for getting higher productivity (Fig 4).

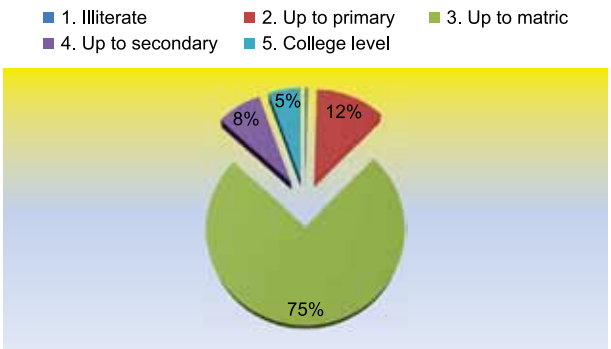


Fig 4. Education Level of Animal Owners participating in the project

The farmers having herd size of more than ten animals had the maximum lactation milk yield of 4273.2±69.6 kg. It was also observed that animals of the farmers having more than 10 acres of land produced maximum milk of 4182.6±99.0 kg (Fig 5). Only 10.8 % of the owners were having dairy as their whole time occupation and the average milk production of the cows reared by such farmers was 4441.7±80 kg which was significantly higher than the milk production of animals of owners having occupations of agricultural labour, service and business.

The milk production of the cows reared by

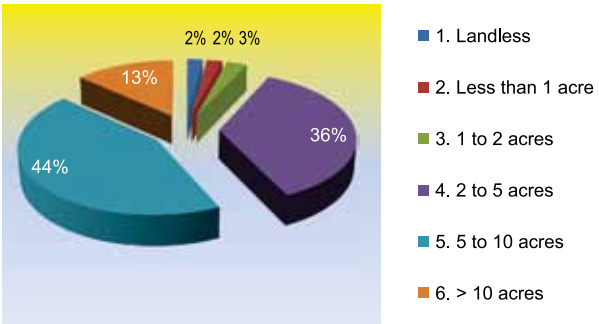


Fig 5. Land holding pattern of Animal Owners participating in the project

the agricultural farmers (3707.6±26 kg) was also higher than agricultural labour, service and business. This could be due to the fact that the agricultural farmers are giving more attention towards dairy farming along with agriculture farming and providing good quality feed, fodder, health care and management to the animals.

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Crossbreeding of cattle is the accepted breeding policy in Kerala for genetic improvement of dairy animals. More than 95% of cattle in the state are crossbreds. Continued genetic improvement of the crossbred cattle of the state is attempted through the project. It opens up the availability of Frieswal bull semen to the farmers of the state. The progenies born under the project are normally producing 450 to 500 kg milk yield

over and above their contemporaries and hence are in high demand. Apart from the genetic improvement of cattle, the farmers are provided with first aid services for their animals and other inputs like dewormers, mineral mixtures, feed and feed supplements etc. The increasing number of inseminations under the project is an indicator for increasing popularity of the scheme under the conditions of Kerala. The first set of bull at KVAU was executed in January 1992. A total of 292 bulls in 15 different sets have so far been inducted in the program. A total 117215 Artificial Inseminations have so far been done in which 9367 female progenies born, of which 2269 female progenies have reached age at first calving (Table 7).

Table 7. Information regarding different sets (KVASU)

Set No.	Date of Start	Total bulls used	Total AIs	Total AIs followed	Pregnancies confirmed	Conception rate (%)	Followed for calving	Female calves	
								Born	Reached AFC
1	01-01-1992	12	23351	6722	2420	36	1902	956	319
2	01-04-1994	11	12817	4800	1680	35	1300	603	240
3	01-09-1995	11	9331	3942	1324	33.6	1065	757	89
4	01-11-1998	15	11750	3753	1501	39.9	1489	676	178
5	09-11-2001	19	3437	3261	1136	34.8	847	401	139
6	24-06-2003	20	8173	7683	2582	33.6	1689	746	216
7	16-03-2005	24	5759	5211	2281	43.7	1298	597	180
8	30-08-2006	22	5703	5514	2472	44.8	1538	768	160
9	05-02-2008	16	3393	3131	1181	37.7	801	394	81
10	01-07-2009	24	5781	5612	2124	37.8	1324	664	162
11	01-04-2011	21	4820	4401	2006	45.6	1280	659	231
12	01-08-2012	28	6045	5531	2357	42.61	1302	642	226
13	01-03-2014	14	5211	4850	2063	41.97	1114	545	48
14	01-07-2015	29	9650	9211	4134	44.88	1959	959	0
15	02-08-2017	26	1994	525	235	44.76	0	0	0
	TOTAL	292	117215	74147	29496	42.0	18908	9367	2269

During the year 2017, a total of 5163 artificial inseminations were carried out with an overall conception rate of 46%. The average first lactation 305-days milk yield of daughters completed their first lactation in the reporting period (2017) was 2961.22 ± 43.73 kg. The average age at first calving of daughters was 1024.22 ± 14.30 days during this reporting period. The per cent loss of data in the project was 2.80 for 12th set, 1.47 for 13th set and 9.70 for 14th set of bulls till the end of report period. About 1807 daughters from first twelve sets of bulls have completed their first lactation 305-days milk yield. There is a consistent trend of increase in first lactation 305-days milk yield of daughters as it was 1958.4 kg in first set (1992) and in current set it was 2961.22 kg which indicates a sharp increase of 1002.82 kg milk (51.2 %) in progenies of bulls under test. A trend of decrease in age at first calving was also observed as 1136.4 days in progenies of first set of Bulls (1992) and has reduced to 1024.22 days in current set indicating a sharp decrease of 112.18 days (9.87 %) in AFC (Fig 6).

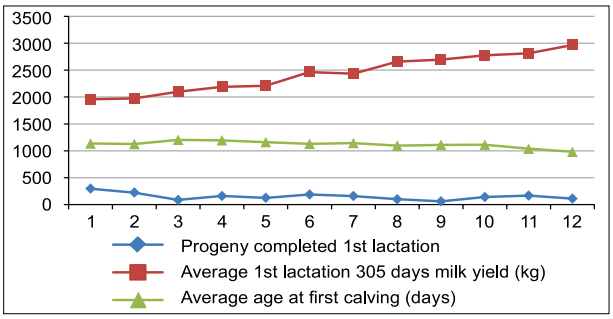


Fig 6: Set wise progeny performance (milk yield and age at first calving) at KVASU

Inseminations of 14th set of bulls were completed and 15th set is under progress. Recording of first lactation milk yield of daughters of 11th set of bulls were under process. The average conception rates of 14th and 15th set of bulls were 47.40 and 44.76%, respectively. Average fat per

cent of morning milk during the period was 3.5, 3.7, and 3.8 during 2nd, 5th and 8th month of lactation, respectively.

Socio economic status of farmers under the Project

Socio economic status of the farmers owning progenies of the project during the reporting period and the performance of progenies in different groups is presented in the Table 8. Socio- economic factors of the owners of the animals influencing the first lactation milk yield of progenies.

Table 8. Production performance of the animals according to different categories of farmers

Category	No. of Obser-vations	Percentage (%)	Average 1st lact. 305 days milk yield (kg)	
			Average	No.
Overall mean	518	100	2910.00 ±40.24	125
Education				
Illiterate	5	0.97	2268.75	2
Upto primary	129	24.90	2717.21	26
Upto metric	136	26.25	2833.19	29
Upto secondary	222	42.86	3033.53	63
College level	26	5.02	3058.00	5
Herd size				
≤3	293	56.56	2915.04	60
4 to 5	135	26.06	2839.69	40
6 to 10	76	14.67	3025.91	22
>10	14	2.71	2896.67	3
Land holding				
Landless	0	0	0	0
Below 10 cents	34	6.56	2861.67	9
10 -49 cents	170	32.82	2719.91	29
50-99 cents	90	17.38	2887.42	31
1 acre-2 acres	135	26.06	3029.61	38
2 -3 acres	69	13.32	3043.75	14
3 -4 acres	13	2.51	3235.00	2
>4 acres	7	1.35	2700.00	2
Occupation of Owner				
Agriculture farmer	447	86.29	2897.28	112
Agriculture labour	38	7.34	2944.00	5
Govt job	12	2.32	3587.50	2
Pvrivate job	9	1.73	2743.13	4
Business	12	2.32	3193.75	2

Owners of progenies which had completed their first lactation in the report period were classified to five different groups based on their occupation and it was found that 86.29 % of the progeny owners are agriculture farmers. Agricultural labours accounted for 7.34% of progenies and the other occupational groups of owners are negligible. The average lactation yield of cows owned by government servants was substantially higher than that of all other groups. The educational status of owners of the progenies was analysed. Owners with an educational qualification of higher secondary were 42.86%. Illiterate owners were less than 1% and 26.25% of the owners were having an educational qualification of matriculation and 5% of the owners were having college qualifications. The progeny performance was correlated with educational status of farmers (Fig 7).

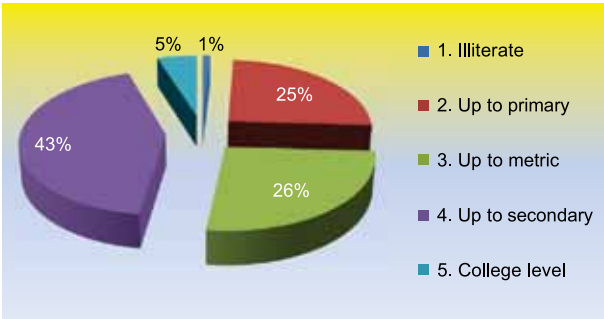


Fig 7. Education level of Animal owners participating in the project

The land holding pattern of farmers with progenies was studied and found that more than 56% of progeny owners had less than one acre land. The per cent of owners having more than two acres of land was 17.18. Performance of progenies was better in farmers with threeto four acres of land holding (Fig. 8)

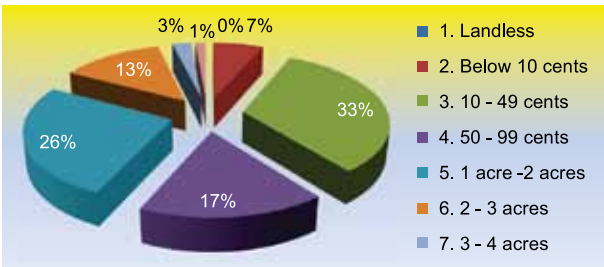


Fig 8. Land Holding pattern of Animal Owners participating in the project

Number of cattle present in houses was taken as herd size. 56.56% of the owners of progenies were having herd strength of 3 or less than 3. The herd size of more than 10 was observed only in 2.71% owners of the progenies and the first lactation yield was highest in this group. Twenty six per cent of the owners had a herd size of 4-5 animals and 14.67% had 6-10 animals.

BAIF Development Research Foundation, Uruli-Kanchan, Pune

Data generated over 20 years period from 1995 to 2014 on 4954 crossbred progenies born out of 230 sires and owned by 864 farmers spread over 140 village in 26 cattle developing centres from Ahmednagar, Pune and Satara district of Western Maharashtra. Out of these crossbred progeny born 3,206 (64.7%) completed their first lactation. A total of 286 bulls from thirteen different batches have so far been used for insemination and 114646 Artificial Inseminations have so far been done, out of which, 107604 AI followed and 48536 pregnancies confirmed with a conception rate of 45.11% (Table 9).

yield of daughters as in first set of bulls (1995) it was 2930.3 kg which has increased to 3257.0 kg in current set indicating an increase of 326.7 kgs milk (11.14 %). A trend of decrease in age at first calving was also observed as 991.5 days in progenies of first set of bulls (1995) has reduced to 968.03 days in current set with a decrease of 23.47 days (2.35 %) in AFC (Fig 9).

Till the reporting period, 14 sets of bulls completed test inseminations and in calving stage while 15th bull batch introduced in July 2017 is in progress for test inseminations and pregnancy diagnosis stage. The 11th bull batch completed milk recording of their progenies while 12th and 13th batches are under recording.

Table 9: Information regarding different set of bulls in BAIF unit

Set No	Bull Batch Starting date	Total bulls used	Total A.I. done	Total A.I. followed	Pregnancies Confirmed	Conception rate (%)	Followed for Calving	Female calves	
								Born	Reached AFC
III	Jul-95	20	16118	15063	7001	46.48	4868	2344	1563
IV	Jul-98	19	21321	17239	7673	44.51	3815	1756	514
V	Jul-01	20	7461	7380	3398	46.04	2626	1201	364
VI	Jul-03	20	5249	5162	2162	41.88	1493	731	289
VII	Feb-05	25	6806	6638	2989	45.03	1969	856	394
VIII	Sep-06	22	6533	6327	2899	45.82	1993	885	371
IX	Feb-08	16	4902	4902	2169	44.25	1561	733	313
X	Aug-09	24	6893	6867	2987	43.50	1997	878	391
XI	Apr-11	21	6364	6364	3109	48.85	2270	1010	409
XII*	Aug-12	28	9270	9030	4190	46.40	2509	1182	323
XIII**	Mar-14	15	7139	7139	3221	45.12	2536	1163	23
XIV	Aug-15	30	14223	14189	6196	43.67	4007	1783	0
XV	Jul-17	26	2367	1304	542	41.56	0	0	0
Total		**286**	**114646**	**107604**	**48536**	**45.11**	**31644**	**14522**	**4954**

A total of 3563 daughters from first ten sets of bulls have completed their first lactation. The first lactation 305 days milk yield showed an increasing trend among the progenies of different sets. During 2017, a total of 4508 AIs were carried out with an overall conception rate of 42.62%. Average first lactation 305 days milk yield of daughters completed their first lactation in the reporting period (2017) was 3257.0 kg. The average age at first calving of daughters was 968.03 days. The overall per cent loss of data was recorded as 32.09 till the end of this reporting period. There is an increasing trend in the first lactation 305 days milk

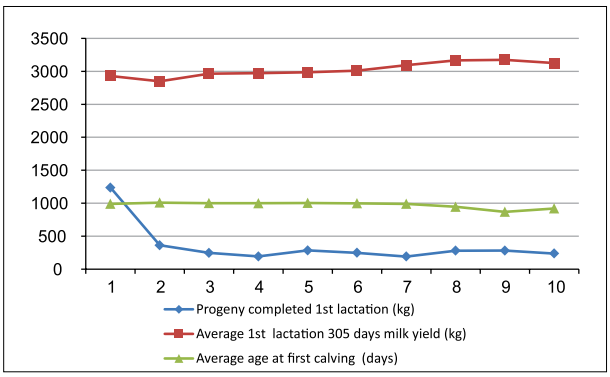


Fig 9: Set wise Progeny Performance (milk yield and age at first calving) at BAIF unit

Socio economic status of farmers under the Project

Socio economic status of the farmers owning progenies of the project during the reporting period and the performance of progenies in different groups is presented in the Table 10.

Table 10. Production performance of the animals according to different categories of farmers

A. Education Status of farmers participating in the project:

Education Level	Illiterate	Primary	Secondary	Higher secondary	Graduate &above	Total
No. of cow Owner	139 (9.39)	598 (40.41)	549 (37.09)	126 (8.51)	68 (4.59)	1480 (100)

B. Land holding wise frequency of farmers:

Frequency of farmers	Land holding (Acres)				Total
	0	Up to 5	5 To 10	Above 10	
According to total land holding	63 (4.26)	875 (59.12)	383 (25.88)	159 (10.74)	1480 (100)
According to land under fodder crop	451 (30.47)	955 (64.53)	61 (4.12)	13 (0.88)	1480 (100)

C. Main Occupation of farmers participating in the project:

Occupation Type	Agriculture	Dairy	Service	Other	Agriculture labour	Business	Total
No. of Cow Owners	1346 (90.95)	50 (3.38)	38 (2.57)	18 (1.22)	16 (1.08)	12 (0.81)	1480 (100)

D. Types of cattle housing in the project area:

Housing Type	Permanent	Semi-permanent	Temporary	Thatched	Total
No. of Herds	264 (17.84)	458 (30.95)	298 (20.13)	460 (31.08)	1480 (100)

Note: Figures in parenthesis indicate percentage

Regarding socio-economic status of farmers under the project, it was noticed that out of 1480 farmers, 40.41 per cent farmers had education upto primary level, 37.09 per cent upto secondary, 8.51 per cent higher secondary and 4.59 per cent graduate and above. The proportion of illiterate cow owner was 9.39 per cent (Fig 10).

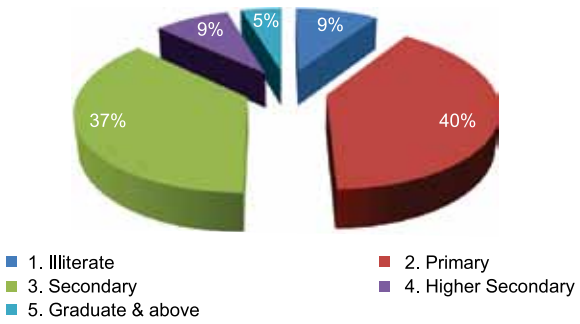


Fig 10. Education status of Animal Owners participating in the project

Among landholders, more than 2/3rd (69.53%) cattle owners were cultivating different fodder crops. The proportion of landless and those who didn't have land under fodder crop was 4.26 and 30.47, respectively. The fodder crops generally grown are sorghum, bajra, sugarcane, lucerne and maize. The dry and green fodders thus available to animals are sorghum straw, bajra straw, sugarcane tops, lucerne and maize. In concentrate, farmers are found to feed ready-made feed purchased from market. The thumb rule of concentrate feeding is half kg for every litre of milk produced. Due to non-availability of sufficient land, grazing is not practiced and the animals are managed intensively. About 90.95 per cent of cattle owners were agriculturists and almost all (95.74%) owned land. Nearly 60 per cent farmers had land up to 5 acres and the percentage of farmers having land more than 10 acres was 10.74 (Fig. 11).

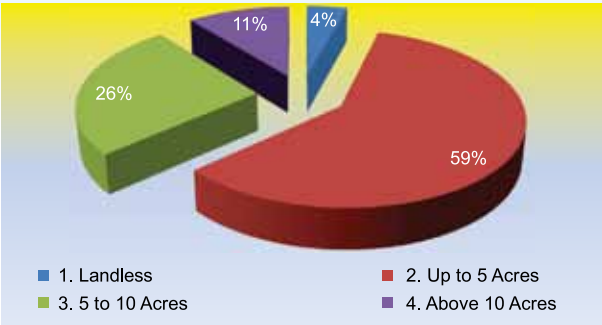


Fig 11. Land Holding pattern of Animal Owners participating in the project

The herd owners protect their animals from infectious diseases by preventive vaccinations against FMD, HS and BQ regularly. For external parasite control, insecticides are found used. The use of internal parasiticides is found restricted to calfhood stage. Regarding veterinary aids whenever required, help from nearby Government dispensaries is sought.

G. B. Pant University of Agri. & Tech. (GBPUA&T) Pantnagar

The project was sanctioned by ICAR on 18.06.2009 and it was implemented from 16.09.2009 at GBPUA&T, Pantnagar and presently running through seven AI centres of U.S. Nagar and Nainital districts of Uttarakhand. A total of 41,464 frozen semen doses from 96 bulls (3000 from 10 bulls of 10th set; 2906 from 6 bulls of 11th set, 4410 from 9 bulls of 12th set, 7350 from 15 bulls of 13th set; 7350 from 15 bulls of 14(a)th set), 7348 from 15 bulls of 14(b)th set and 9100 from 26 bulls 15th set) were received to carryout test insemiantions. A total 6524 farmers were registered and benefited through this project. A total 96 bulls has so far been introduced in 6 different sets and total 24001 insemination has been done in which 4177 female progenies born, of which, 745 has reached age at first calving (Table 11).

During 2017, a total of 5651 AI were carried out, 5222 AI were followed for pregnancy diagnosis and 3195 confirmed pregnancies leading to a conception rate of 61.2%. The average first lactation 305-days milk yield of daughters completed their first lactation during the reporting period (2017) was 3024.2 kg. The average age at first calving of daughters was 1083.0 days. The overall per cent loss of data was 14.5 till the end of this reporting period where as during 2017, it was 18.8. About 491 daughters of first four batches of bulls have completed their first lactation 305-days milk yield. The first lactation 305-days milk yield of daughters has showed an increasing trend from 2281.0 kg in first set of bulls to 3024.2 kg in current set of bulls showing a sharp increase of 743.2 kg (32.5 %) milk (Fig 12). The age at first calving has showed a decreasing trend from 1146 days in progenies of first set of bulls (2010) to 1083.0 days in current set indicating a decrease of 63 days (5.5 %).

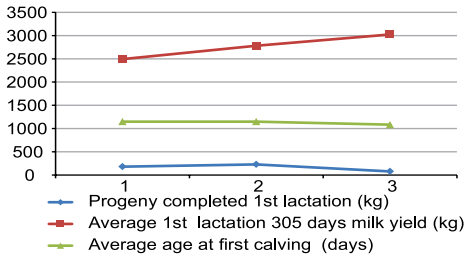


Fig 12. Set wise progeny performance (milk yield and age at first calving) at GBPUA &T, Pantnagar unit

Socio economic status of farmers under the Project

Socio economic status of the animal farmers classified according to different categories during the reporting period are presented in the Table 12. About 65.6 % of animal owners belong to farming community. 16.4 % belongs to labour class and 14.2 % belongs to service class. About 97% farmers keep their animals under stall feeding.

Table 11. Information regarding different set of bulls in GBPAU & T, Pantnagar unit

Set No.	Date of start	Bulls used	Total AI	A.I. followed	Pregnancy confirmed	Total calving	Female calves	
							Born	Reached AFC
X	20.01.2010	10	1,784	1,750	1,030	782	340	201
XI	16.03.2011	6	2,303	2,303	1,546	1,207	542	295
XII	25.07.2012	9	2,473	2,473	1,405	1,215	573	198
XIII	05.02.2014	15	5,205	5,205	2,934	2,433	1,058	51
XIV	22.07.2015	30	9787	9787	5411	3,625	1,664	-
XV	15.06.2017	26	2,449	1,179	594	-	-	-
SUM		**96**	**24,001**	**22,697**	**12,920**	**9,262**	**4,177**	**745**

The educational status of owners of the progenies was analysed. Owners of animals with an educational qualification of higher secondary were 17.5%. Illiterate owners were 11.4% and 42.4% of owners were having an educational qualification of matriculation and 14.1% of the owners were having college qualifications where as 2% animal owners having PG education (Fig 13).

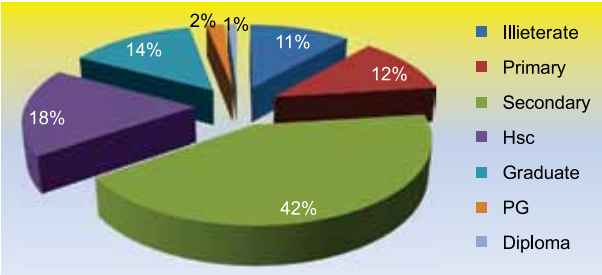


Fig 13. Education status of Animal Owners participating in the project

According to land holding patterns, about 24.6% farmers were having more than 10 acres of land, 11.4% farmers having less than one acres of land and about 18.6% farmers are landless while 20.2% farmers having 5-10 acre of land (Fig 14).

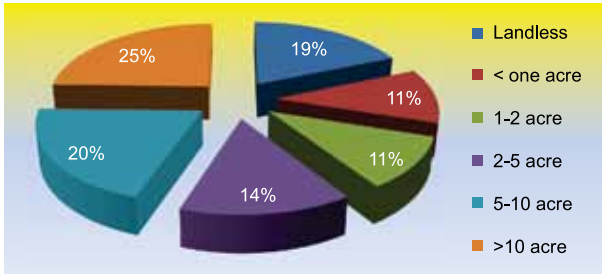


Fig 14. Land Holding pattern of Animal Owners participating in the project

Three field level training programs, one refresher program for inseminator cum data recorder, two animal welfare camps and one heifer show were conducted in field wherein 234 farmers took active part. Per cent loss of data interms of mortality and sales of daughters, etc. was 18.8 during the year. However, on cumulative basis, a total of 606 daughter data were lost i.e. 14.5% based on total daughters born.

C. Genetic Improvement Of Indigenous Cattle Breeds Through Progeny Testing – Indigenous Breeds Project

Conservation, propagation and genetic improvement of important indigenous cattle breeds of the country are the prime objectives of this project. Presently, project is being implemented in the home tracts of three important indigenous cattle breeds viz., Kankrej, Gir and Sahiwal in collaboration with State Veterinary / Agricultural Universities, ICAR institutes, State Government Farms, NGOs and Gaushalas. The project envisages establishment of germplasm (GP) and data recording (DR) units for each breed by registering the cattle maintained under farm and field conditions, respectively. The young bulls born out of nominated mating of elite cows at the germplasm centre will be progeny tested using animal and farm facilities existing at the data recording units/ associated herds. The genetic evaluation of young bulls will be done on the basis of their expected breeding values (EBVs) calculated from the first lactation 305-days milk yield of their daughters and frozen semen doses proven bulls ranked for EBVs will be used to breed the large cattle population to improve the milk production potential of the breed.

As per the technical programme, for each breed of cattle, about 75 elite breedable females will be made available at the GP unit and about 750 breedable females shall be identified at about five DR units (herds). The elite females in the GP unit will be mated with genetically superior proven bulls of the breed for production of superior young bulls. The young bulls born out of nominated mating in the germplasm unit will be utilized for breeding the females registered in the DR units and around 60 to 70 females will be mated by each bull so as to get the first lactation milk production records of at least 20 progenies per bull. The information on growth, reproduction, milk production and survivability will be recorded for performance evaluation, selection and genetic improvement of recommended indigenous cattle breeds.

Gir Breed

The GP unit of Gir cattle is located at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh. The DR units of the breed are located in 12 farmer herds and three associated herds. So far 24619 breedable females were identified and registered under the project.

Herd strength

The herd strength of GP unit as on 1st January, 2017 was 163 comprising of 124 females and 39 males. The initial strength of breedable females was 79 covering 37 milch cows, 24 dry and 18 heifers above two and half years of age. There were 41 normal calvings in the GP unit during the year producing 17 female calves and 24 male calves. The closing herd strength of breedable females was 99 consisting of 47 milch cows, 26 dry cows and 26 heifers of more than two and half years of age (Table 13). During the year 2017, the GP unit maintained 10 breeding bulls and 19 young bulls above one year of age. The total herd strength of GP unit as on 31st December 2017 was 179 comprising of 130 females and 49 males.

The initial herd strength of the DR unit at CBF, Junagadh as on 1st January 2017 was 339 consisting of 238 female and 101 male animals. A total of 49 normal calving resulting in 25 female and 24 male calves occurred during the year. At the end of the year, DR unit maintained 348 animals consisting of 242 female and 106 male animals. The unit maintained 109 breedable females aged above two and half years and 89 young bulls of above one year of age.

Bulls inducted and frozen semen doses produced

So far 26 bulls in four sets (six in first, nine in second, nine in third and two in fourth set) have been put under semen collection and the frozen semen doses of 24 bulls of first three sets were used for breeding. The semen stock as on 1st January 2017 was 159563 (31688, 88956 and 38919 doses for first, second and third sets, respectively). During the year, 6020, 7485, 27125 and 390 semen doses were frozen from first, second, third and fourth sets of bulls, respectively amounting to a total of 41020 doses and 11275 doses were utilized during the year. Since inception of the project, 200583 semen doses were produced of which 48990 were utilized for breeding resulting to a balance of 151593 semen doses as on 31st December 2017 (Table 14).

Insemination carried out, conception rate and daughters born

The details of insemination carried out, number of conception and daughters born are presented in table 15. During 2017, a total of 2793 inseminations were carried out and 1216 pregnancies were confirmed resulting to a conception rate of 43.54 per cent. Since inception of the project, 24619 inseminations have been done and 11830 pregnancies were confirmed resulting to an overall conception rate of 48.05 per cent. The total number of inseminations carried out since inception for first, second and third sets of bulls were 12186, 8335, and 4098, respectively resulting to a total of 24619. During the year, 489 daughters had born totaling to 5112 daughters since inception of the project. The numbers of normal male and female calving in GP and DR units of CBF, Junagadh were found to be 48 and 42, respectively with a male female ratio of 53.33 and 46.67.

Set wise performance

A total of 24 bulls in three sets (6+9+9 bulls) have so far been inducted in the program. Total number of semen doses frozen was 200583 (37709+96441+66044+390) out of which 48990 frozen semen doses were utilized. The number of cows covered for inseminations in different sets was 22036 (12186+8335+1515). A total of 5112 (3120+1647+345) daughters have so far been produced out of the three sets. Four hundred eighty daughters from the 1st set and 15 from 2nd set have reached the age of calving, out of which 255 (251+4) have completed their first lactation. The average first lactation milk yield of the 222 Gir daughters of first set of bulls was 2563.793± 112.61kg.

Productive and reproductive performance

The productive and reproductive performance of Gir cattle maintained at GP and DR unit of CBF, Junagadh are as follows:

Germplasm unit

The overall average first lactation milk yield was 2863.7 kg while average milk yield for all lactation was 3106.1 kg. The average first lactation

305-days milk yield was 2344.5 while all lactation 305-days milk yield was 2641.80 kg. The averages for first lactation length and first peak yield were 410.90 days and 13.30 kg, respectively. The overall age at first calving, first service period, first dry period and calving interval were 1409.0, 161.80, 52.40 and 415.0 days, respectively. The wet and dry averages of the GP unit were 8.3 and 4.3 kg, respectively.

Data recording unit

The average age at first calving of Gir cattle maintained under DR unit of CBF, Junagadh was found to be 1407.9 days while average estimates for first service period, first dry period and first calving interval were 131.40, 35.20 and 386.0 days, respectively. The averages for first and all lactation milk yields were 2057.0 and 1913.2 kg, respectively with an average first lactation length of 345.60 days. The average first lactation peak yield was 12.20 kg while the all lactation wet and dry averages were 6.3 and 3.1 kg, respectively. Based on the performance, it may be inferred that the GP unit excelled the performance of DR unit as desired.

Expected Breeding values (EBVs) of first set Gir bulls

The EBVs of six first set Gir bulls were estimated using the first lactation milk yield of their daughters by BLUP sire model using LSMLMW software. The overall average expected breeding value was 2563.79 kg (Table 16). Sire Pankaj had the highest breeding value of +150.71 kg with a superiority of 5.87 per cent. Rupak had the lowest breeding value of -71.13 kg which was 2.77 per cent inferior to the overall average. The difference between highest and lowest EBVs was 221.842 kg. Among the six sires, four had breeding values lower than overall average while only two had EBVs above the overall average. Based on this result, itwas recommended that the semen doses of Pankaj and Bhavik may be used extensively for breeding for improving the milk production potential of Gir cattle.

Kankrej Breed

The GP unit of Kankrej cattle is located at Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat. Under the project 2-3 DR units consisting of organized farms and farmers herds have been identified.

Herd Strength

The initial herd strength of GP unit as on 1st January 2017 was 189 which included 135 females and 54 males and the total number of breedable females above two and half years of age was 81 comprising of 38 milch, 23 dry and 20 heifer animals. At the end of the year, herd strength increased to 203 comprising of 146 females and 57 males. The total number of breedable females above two and half years was 93 covering 30 heifers, 48 milch and 15 dry animals (Table 13). The unit also maintained 14 Kankrej bulls for breeding purpose.

The DR unit of LRS, Dantiwada had the herd strength of 123 animals with 99 females and 25 males as on 1st January 2017. The unit maintained 67 adult breedable females of above two and half years of age of which 27 were in milking, 17 dry and 23 heifers. The herd strength of DR unit at the end of the year was 131 with 109 female and 22 males. A total of 4117 breedable females were identified under the project at LRS DR Unit (67), organized farms and field units (4050).

Bulls inducted and frozen semen doses produced

A total of 26 Kankrej bulls in three sets have been inducted so far. The first set consisted of eight bulls from Banas Dairy while the second and third sets consisted of nine bulls each. The opening balance of semen doses as on 01st January 2017 was 121158 and during 2017, a total of 15329 doses of semen were frozen from the third set of bulls. A total of 6352 doses (445 from second set bulls and 5907 from third set bulls) were utilized for insemination during the year. At the year end, a balance of 83761 doses of frozen semen covering 5822 doses of first set, 58844 doses of second set and 19095 doses of third set was available for future breeding(Table14).

Insemination carried out, conception rate and daughters born

During the year, 2417 animals were inseminated, 1117 animals confirmed for pregnancy and 420 daughters born. The conception rate during the year was 46.21 per cent against overall conception rate of 48.03 per cent (6423 conceptions out of 13374 inseminations). The numbers of daughters born for the first, second and set of bulls were 407 and 1256 and 294, respectively resulting in 1957 Kankrej daughters since the inception of the project (Table 15). The number of normal male and female calving in both GP and DR units of Kankrej breed during 2017 was 330 and 320, respectively with a male female ratio of 50.77:49.23 and the per cent abnormal calving was 0.46.

Set wise performance

A total of 26 bulls in three sets (8+9+9 bulls) have so far been inducted in the program. Total number of semen doses frozen was 136487 (8000+89438+39049), out of which 24821 frozen semen does were utilized/supplied. The number of cows covered for inseminations in different sets was 10000 (3000+3500+3500). A total of 1957 (407+1256+294) daughters have so far been produced from first three sets. A total of 235 from first two sets have reached at the age of calving, out of which, 187 (131+56) have completed their first lactation. The average first lactation milk yield of 127 Kankrej daughters of first set of bulls was 2004.31 ± 104.90 kg (excluding the milk suckled by the calf).

Expected Breeding values (EBVs) of first set Kankrej bulls

The EBVs of eight first set Kankrej bulls were estimated using the first lactation milk yield of their daughters by BLUP sire model in LSMLMW software (Table 17). The overall average EBV was 2004.314 kg. Sire K020 had the highest breeding value of 2194.047 kg (+189.733 Kg) with a superiority of 9.46%. K014 had the lowest breeding value (1852.993 kg) of -151.321 kg with 7.54% inferiority. The difference between highest and lowest value was 341.054 kg. Among the eight bulls, four had breeding values lower than overall average while four had values above the overall average. Based on this result, it was recommended that the semen doses of K020 and K017 may be used extensively for breeding for improving the milk production potential of Kankrej cattle.

Productive and reproductive performance

The productive and reproductive performance of Kankrej cattle maintained under GP and DR unit of LRS, Sardarkrushinagar during the year 2017 are presented below.

Germplasm unit

The overall averages for age at first calving, first service period and first dry period were 1195.21, 162.0 and 118.0 days, respectively. The average estimates for first lactation milk yield, and first lactation 305-days milk yield were 2375.07 and 2241.14 kg, respectively while the corresponding values for all lactation were 2648.42 and 2523.33 kg. The average first lactation peak yield was 10.60 kg with an average lactation length of 303.20 days. The all lactation wet and dry averages were 8.65 and 5.64 kg, respectively.

Data recording unit

The Kankrej cows maintained in the DR unit produced an overall average first lactation milk

yield and first lactation 305-days milk yield of 2145.82 and 2070.92 kg, respectively and the corresponding estimates for all lactations were 2171.33 and 2129.21 kg. The average lactation lengths for first and all lactations were 296.46 and 282.40 days, respectively. The average estimates of age at first calving, first service period, first dry period and first calving interval were 1201.64, 143.83, 111.17 and 424.94 days, respectively. The first lactation peak yield was 10.67 kg while the wet and dry averages were 8.38 and 5.37 kg, respectively.

Sahiwal Breed

The GP unit of Sahiwal breed is located at National Dairy Research Institute, Karnal and five DR units are located at i) Government Livestock Farm-I, Hissar, ii) GADVASU, Ludhiana, iii) Shri Gaushala Trust, Bhiwani, iv) G.B. Pant University of Agricultural and Technology, Pantnagar, Uttarkhand and v) Cattle Breeding Farm, Anjora, Durg, Chhattisgarh.

Herd strength

In the GP unit at NDRI, Karnal, the initial herd strength as on 1st January 2017 was 409 numbers which reduced to 369 at the end of the reporting period due to the sale of nearly 100 animals. At the end of the year, 301 female animals were in the herd with 226 breedable females above two years of age (Table 13). The GP unit also maintained 31 young bulls of above two years of age at the end of the reporting period. The female and male calves born during the year 2017 in the GP unit were 44 and 55, respectively with a female: male ratio of 44.44: 55.56. The number of breedable females above two years of age in different DR units was 877 consisting of 148 in Shri Gaushala, Bhiwani; 123 in Anjora, Durg; 364 in GLF-I, Hissar; 141 in Pantnagar; and 101 in GADVASU, Ludhiana.

Bulls inducted and frozen semen doses produced

So far 25 Sahiwal bulls in three sets (8 in first, 7 in second and 10 in third set) were inducted for progeny testing under the project. The semen stock as on 1st January 2017 was 157548. During the year, 8944 doses of semen were frozen and 7148 doses were utilized and at the end of the year, 22908, 34557 and 28133 doses of first, second and third set of bulls, respectively were available for breeding. Since inception of the project, 166492 semen doses were frozen and 80894 doses were utilized resulting to a balance of 85598 doses for future breeding use (Table 14).

Insemination carried out, conception rate and daughters born

During the reporting period, 1174 inseminations (269 in NDRI, Karnal, 284 in Bhiwani, 201 in GLF-I, Hissar, 178 in Pantnagar, 142 in GADVASU, Ludhiana, and 100 in Durg unit) were carried out amounting to a total insemination of 8985 since the inception of the project (Table 15). The conception rates for second and third sets of bulls during the year were 50.00 and 44.30 per cent, respectively. The conception rates for first, second and third sets of bulls since inception of the project were 36.55, 40.42 and 39.69 per cent, respectively with an overall conception rate of 38.70 per cent. During the year, 88 and 152 daughters born for second and third sets of bulls, respectively totaling to 1326 daughter since the inception of the project (592 for first, 572 for second and 162 for third set of bulls). The number of daughters born during the year in GLF-I Hissar, Bhiwani, Pantnagar, GADVASU Ludhiana, Durg and NDRI Karnal units were 69, 37, 41, 14, 35 and 44, respectively while the total number of daughters since inception was 418, 137, 229, 91, 57 and 394, respectively.

Productive and reproductive performance

The details of productive and reproductive performance of Sahiwal cattle maintained under GP and different DR units are discussed below:

Germplasm unit

In the Sahiwal GP unit at NDRI, Karnal, the overall average age at first calving, first service period, first dry period, first calving interval were 1314.32, 130.75, 136.50 and 407.19 days, respectively. The average estimates for first lactation milk yield, first lactation 305-days yield and first peak yield were 1480.72, 1462.67 and 9.74 kg, respectively. The average first lactation length of the herd was 268.97 days while the all lactation wet and dry averages were 6.46 and 4.27 kg, respectively.

Data recording unit

During the reporting period, lowest average age at first calving (AFC) of 1181.13 days was observed at Pantnagar unit while highest AFC of 1631.57 days was noticed in Anjora Durg unit. However, first service period was lowest (129.00 days) in GADVASU, Ludhiana and highest (248.17 days) at Shri Gaushala, Bhivani. The highest first lactation total milk yield of 2353.26 kg was recorded in Shri Gaushala, Bhiwani followed by GADVASU, Ludhiana (2070.86 kg) while the lowest yield of 1714.39 kg was recorded in Pantnagar and similar trend was noticed for first lactation 305-days milk yield also. The average first lactation length estimates of Sahiwal cows at GLF-1, Hissar, Pantnagar and GADVASU, Ludhiana were 318.00, 235.04 and 296.18 days, respectively. The wet averages of milk yield in different DR units ranged between 6.16 (Anjora, Durg) and 7.87 kg (Shri Gaushala, Bhiwani) while the range of dry average was 2.26 (Anjora, Durg) to 4.30 kg (GLF, Hissar).

Set wise performance since inception

A total of 25 bulls in three sets (8+7+10 bulls) have so far been inducted in the program. Total number of semen doses frozen was 166492 (54754+64365+47373), of which, 80894 frozen semen doses were utilized/supplied. The number of cows covered for inseminations in different sets was 5757 (2265+2296+1196). A total of 1326 daughters (592+572+162) have so far been produced out of the three sets. A total of 306 (294+12) daughters from first and second sets have reached the age of first calving, out of which, 220 (216+4) have completed their first lactation. A total of 85598 doses of frozen semen were available on 31st December 2017.

Table13. Number of breedable females registered and number of calves born in Germplasm units

Breed	No. of breedable females	Male calves	Female calves
Sahiwal	226	59	48
Gir	99	24	17
Kankrej	93	31	33

Table 14. Breed wise details of semen doses collected and utilized during the year 2017

Breed	Set No.	No. of bulls inducted	Semen doses produced		Total	Semen doses utilized			Balance as on 31-12-2016
			Up to 31st Dec -2016	Jan-Dec 2017		Up to 31st Dec 2016	Jan-Dec 2017	Total since inception	
Sahiwal	I	8	54754	0	54754	31621	225	31846	22908
	II	7	63725	640	64365	29263	545	29808	34557
	III	10	39069	8304	47373	12862	6378	19240	28133
	Total	25	157548	8944	166492	73746	7148	80894	85598
Gir	I	6	31688	6020	37708	18328	1225	19553	18155
	II	9	88956	7485	96441	16658	335	19993	76448
	III	9	38919	27125	66044	2729	6715	9444	56600
	New set	2	0	390	390	0	0	0	390
	Total	26	159563	41020	200583	37715	11275	48990	151593
Kankrej*	I	8	8000	0	8000	2178	0	2178	5822
	II	9	89438	0	89438	5830	445	6275	58844#
	III	9	23720	15329	39049	1460	5907	7367	19095#
	Total	26	121158	15329	136487	9468	6352	15820	83761

*Semen doses of first set Kankrej bulls were procured from Banas dairy farm; # Excludes discarded doses

Table 15. Breed wise details of insemination carried out, conception and daughter born (Sahiwal DR unit included)

Breed	Set No.	No. of bulls inducted	AI done			Conception			Daughters born		
			Up to December 2016	During 2017	Total	Up to December 2016	During 2017	Total	Up to December 2016	During 2017	Total
Sahiwal	I	8	3642	0	3642	1331	0	1331	592	0	592
	II	7	3347	104	3451	1343	52	1395	484	88	572
	III	10	822	1070	1892	277	474	751	10	152	162
	Overall	25	7811	1174	8985	2951	526	3477	1086	240	1326
Gir	I	6	12186	0	12186	6207	0	6207	3114	6	3120
	II	9	8266	69	8335	4054	54	4108	1428	219	1647
	III	9	1374	2724	4098	353	1162	1515	81	264	345
	Overall	24	21826	2793	24619	10614	1216	11830	4623	489	5112
Kankrej	I	8	2178	0	2178	1138	0	1138	407	0	407
	II	9	7609	72	7681	3813	42	3855	1130	126	1256
	III	9	1170	2345	3515	355	1075	1430	0	294	294
	Overall	26	10957	2417	13374	5306	1117	6423	1537	420	1957

Table 16. Expected Breeding Values (EBVs) of first set Gir bulls

Sl. No.	Bull	No. of daughters	FL305 DMY (Kg)	EBV (Kg)	Rank
Overall		222	2563.793		
1	Bhavik	59	2570.081	+ 6.288	2
2	Bhola	05	2539.085	-24.708	4
3	Murari	48	2541.141	-22.652	3
4	Pankaj	51	2714.503	+150.710	1
5	Raj	18	2525.286	-38.507	5
6	Rupak	41	2492.661	-71.132	6

Table 17. Expected Breeding values (EBVs) of first set of Kankrej bulls

Sl. No.	Sire No.	No. of obs.	FL305 DMY (Kg)	EBV (Kg)	Rank
Overall		127	2004.314		
1	K006	10	1892.478	-111.836	7
2	K007	30	1902.329	-101.985	6
3	K010	8	1923.515	-80.799	5
4	K012	10	2075.156	70.842	4
5	K014	20	1852.993	-151.321	8
6	K016	24	2093.572	89.258	3
7	K017	14	2100.422	96.108	2
8	K020	11	2194.047	189.733	1

II. INSTITUTIONAL PROGRAMMES

A. Expression and association of genes with production and reproduction traits

Differential expression and SNP identification of genes related to establishment of Pregnancy in Frieswal and Sahiwal cattle

Detection of OAS1 protein expression at bovine PBMC at day 18 post AI in pregnant and non-pregnant animals

i. Indirect Immuno-fluorescence Microscopy

The intracellular distribution of OAS1 protein was analyzed using fluorescence microscopy by incubating the cells in primary antibodies against OAS1 and secondary antibodies FITC conjugated anti-mouse IgGs followed by counterstaining cell nuclei with 4', 6'-diamidino-2-phenylindole (DAPI) and excitation at 488 nm (for Alexa-488) and 340 nm (for DAPI). Results from the immune-fluorescent assay confirmed the higher expression of OAS1 protein in nulliparous pregnant animals in comparison to open animals as the assay using FITC conjugated secondary antibody showed higher number of OAS1 specific immune-fluorescent cells in nulliparous pregnant animals (Fig 15 A and B). But the difference was not prominent in multiparous pregnant and open animals.

ii. Immuno-detection of protein using western blotting

The protein isolated from PBMCs at day 18 post AI in both pregnant and non-pregnant nulliparous and multiparous were used for western blotting. The band related to the target protein was confirmed by comparing with molecular weight marker. This assay revealed that expression of OAS1 was comparatively higher in nulliparous pregnant than non-pregnant animals. As in the case of mRNA transcript levels, the protein level of OAS1 was also not distinguishable in pregnant and open multiparous animals. Further, the levels of protein were quantified by measuring the intensities of each digitalized bands using Image Studio Lite Version 5.2 (LI-COR Biotechnology, Lincoln, United States) and it was found that the level of OAS1 protein gene in nulliparous pregnant animals was higher ($p<0.01$) than the non-pregnant animals.

Association of OAS1 genotypes with milk production traits

Genetic variants in the exonic regions of 2, 5 Oligoadenylate 1(OAS1) gene were identified and associated with milk production traits in a total of 250 cows comprising of 168 Frieswal and 82 Sahiwal cattle. The polymorphisms were identified by PCR-SSCP and sequencing. Total lactation milk yield, 300-days milk yield and peak yield were taken for association study. The genotypes of exon 6 of OAS1 gene had significant association with milk production traits; whereas genotypes identified in exon 2 and exon 5 did not reveal any association in Frieswal and Sahiwal population. Among the exon 6 genotypes, animals with pattern 3 (A-C-A-G-C/ A-C-A-G-C) genotypes had higher total milk yield (3718.97±153.09 kg), peak yield (15.22± 0.55 kg) and 300-days milk yield (3894.68±145.34 kg) in comparison to other genotypes (Table 18). Animals with pattern 5 (A-C-G-G-C/ G-T-A-A-A) genotype had lowest total milk yield (2870.31±244.06 kg), peak yield (11.59± 0.86 kg) and 300-days milk yield (3095.89±228.28 kg).

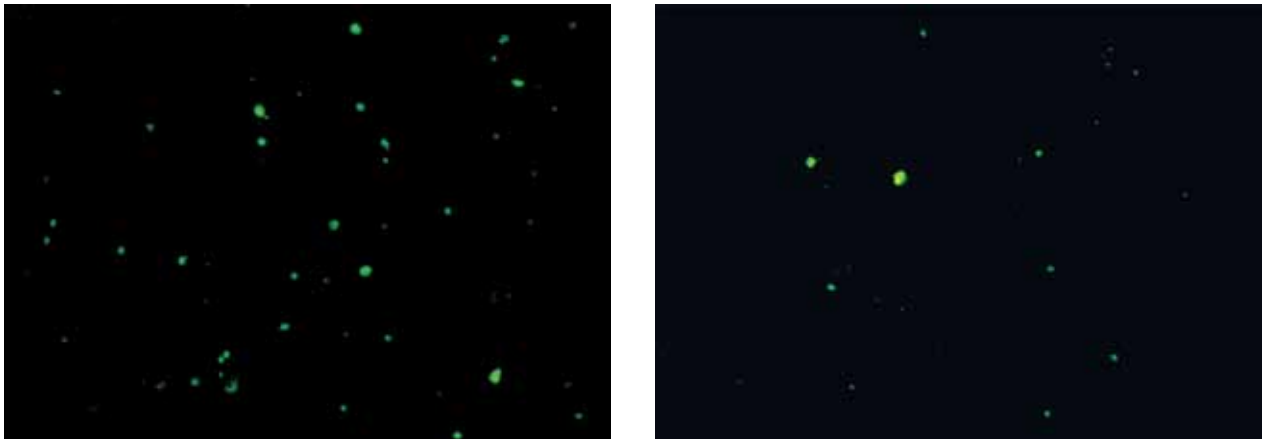


Fig 15: Immune fluorescent assay for detecting OAS1 expression in bovine PBMC at day 18 in pregnant and non-pregnant nulliparous animals A. Pregnant B. Non-pregnant

Table 18: Least squares means of milk production traits in Frieswal and Sahiwal population with respect to genotypes exonic regions of OAS1 gene

Effect	Genotype	300 day milk yield (kg)	Peak yield (kg)	Lactation milk yield (kg)
Genotype Exon 2				
Pattern 1	C-C-G-G-C/T-T-A-A-T	3996.11±207.56	17.25±0.77	4195.90±193.84
Pattern 2	C-C-G-G-C/T-T-G-G-T	4181.42±249.59	17.08±0.93	4212.97±224.87
Pattern 3	C-C-G-G-C/C-C-A-A-C	4236.54±266.05	17.91±0.98	4525.35±256.53
Genotype Exon 5				
Pattern 1	C-A-T-G-G-A/C-A-T-G-G-A	3356.85±120.08	14.25±0.43	3552.28±117.49
Pattern 2	C-A-T-G-G-A/C-A-T-G-G-C	3245.83±155.75	14.02±0.55	3398.93±162.34
Pattern 3	C-A-T-G-G-A/T-A-A-A-A-C	3330.99±163.22	14.25±0.58	3343.66±157.16
Genotype Exon 6		**	**	**
Pattern 1	A-C-G-G-C/G-C-A-G-C	3323.91±120.85[ab]	14.09±0.43[b]	3399.42±118.13[a]
Pattern 2	A-C-G-G-C/A-C-G-G-C	3180.08±146.31[a]	14.17±0.53[bc]	3503.37±145.39[a]
Pattern 3	A-C-A-G-C/A-C-A-G-C	3718.97±153.09[b]	15.22±0.55[c]	3894.68±145.34[b]
Pattern 4	A-C-G-G-C/G-T-G-A-A	3304.33±253.10[ab]	13.49±0.89[a]	3160.55±247.87[a]
Pattern 5	A-C-G-G-C/G-T-A-A-A	2870.31±244.06[a]	11.59±0.86[a]	3095.89±228.28[a]

**p<0.01

Expression of fertility associated genes in sperm transcriptome of different breeds of cattle

We generated preliminary data on comparative assessment of different breeds of cattle with respect to the expression profiles of certain genes and their association with semen quality parameters. The results revealed higher midpiece abnormality in the Frieswal crossbreds. Study on correlation of different semen quality parameters with expression profiles of genes revealed both positive and negative correlations (Table19). AKAP4, PRM1 and CAT showed positive correlations with acrosome integrity and PTM. PRM1 showed high correlation with PTM at 1% level. Other genes viz. CLU, TPN1, TPN2 and MnSOD showed positive correlation on PTM of which, the MnSOD showed correlation at 1% level. Acrosome integrity was also correlated with the expression profiles of SOD, PKM2.

Table 19: Correlation of expression levels of genes on different semen quality parameters

	Live%	HOST	Acrosome Integ	PTM	Head Abn	Middle Piece Abn	Total Abn
AKAP4	0.016	0.108	0.443**	0.394**	-0.129	0.161	0.071
PRM1	0.087	0.049	0.264*	0.324**	0.101	-0.023	0.037
CLU	0.218	0.241	0.239	0.325**	0.052	0.107	0.129
SOD	0.169	0.285	0.326*	0.263	-0.279	0.277	0.089
PRM3	0.186	0.253	0.025	0.115	-0.101	0.179	0.104
PKM2	0.104	0.144	0.302*	0.227	0.089	0.087	0.131
PLCz	0.111	0.100	0.063	0.159	-0.052	0.268	0.217
ARO1	-0.141	-0.165	0.248	0.237	0.250	-0.159	0.000
TNP1	0.222	0.054	0.242	0.312*	-0.080	-0.143	-0.178
TNP2	0.227	0.206	0.275	0.254*	0.003	0.082	0.077
GPX	-0.187	-0.168	0.074	0.189	0.063	-0.136	-0.092
MnSOD	0.021	-0.135	0.169	0.356**	-0.048	-0.239	-0.245
NQO1	0.024	-0.047	-0.057	0.073	0.118	0.193	0.266
CAT	-0.223	0.014	0.438*	0.432*	0.054	-0.031	0.003
HSPAL	-0.031	-0.151	0.063	0.169	0.280	-0.229	-0.049

**p<0.01, *p<0.05, Abn = abnormality

Seasonal effect on expression profiles of genes

The analysis on the seasonal variations in the gene expression profiles revealed that SOD and AKAP4 genes significantly highly expressed in summer compared to winter season (Table 20).

Table 20: Seasonal variations in gene expression profiles

Gene	Season	N	Mean	Std. Error Mean
AKAP4	Summer	21	5.36[a]	1.48
	Winter	24	1.59[b]	0.51
PRM1	Summer	21	3846.62	1049.08
	Winter	24	2892.21	974.01
CLU	Summer	26	3.60	0.87
	Winter	42	2.19	0.44
SOD	Summer	21	8.68[a]	2.92
	Winter	24	2.07[b]	0.47
PRM3	Summer	21	13.67	2.72
	Winter	24	11.48	2.61
PKM2	Summer	21	39.27	15.33
	Winter	24	13.02	4.76
PLCz	Summer	26	21.61	9.31
	Winter	42	25.69	5.08
ARO1	Summer	21	14.80	4.76
	Winter	24	5.40	3.08
TNP1	Summer	26	73.96	14.89
	Winter	42	78.46	17.78
TNP2	Summer	26	53.39	20.32
	Winter	42	37.99	7.44
GPX	Summer	25	13.55	2.85
	Winter	42	13.78	2.67
MnSOD	Summer	23	0.40	0.08
	Winter	42	0.30	0.05
CAT	Summer	22	12.38	2.87
	Winter	40	6.01	1.38
HSPAL	Summer	23	8.64	1.85
	Winter	38	8.08	1.61
NQO1	Summer	14	0.44	0.27
	Winter	21	1.00	0.32

Screening for genetic diseases in Frieswal and Indigenous breeds

Earlier, we reported the successful use of Tetra Primer-Amplification Refractory Mutation System based Polymerase Chain Reaction (T-ARMS –PCR) for genotyping of rs445709131- SNP responsible for the Bovine Leukocyte Adhesion Deficiency (BLAD) in cattle. The SNP is characterized by higher GC content of the surrounding region; hence, the previous protocol utilized dimethylsulfoxide as PCR enhancer. Here, the reaction cocktail was modified with the use of thermostable strand displacement polymerase (SD polymerase) instead of commonly used Taq DNA Polymerase. The amplification efficiency, reaction sensitivity, specificity, and need of PCR enhancer in reactions containing SD polymerase and Taq polymerase were compared. The described modification enabled generation of all amplicons by 25 cycles whereas the assay with Taq Polymerase needed a minimum of 35 cycles. The modified assay amplified all amplicons at a wider range of annealing temperature (50 to 60°C), without the addition of dimethyl sulfoxide (Fig 16). The replacement of Taq polymerase with SD polymerase found beneficial in the T-ARMS assay for development of user-friendly, faster assay which is less affected by the reaction and cyclic conditions.

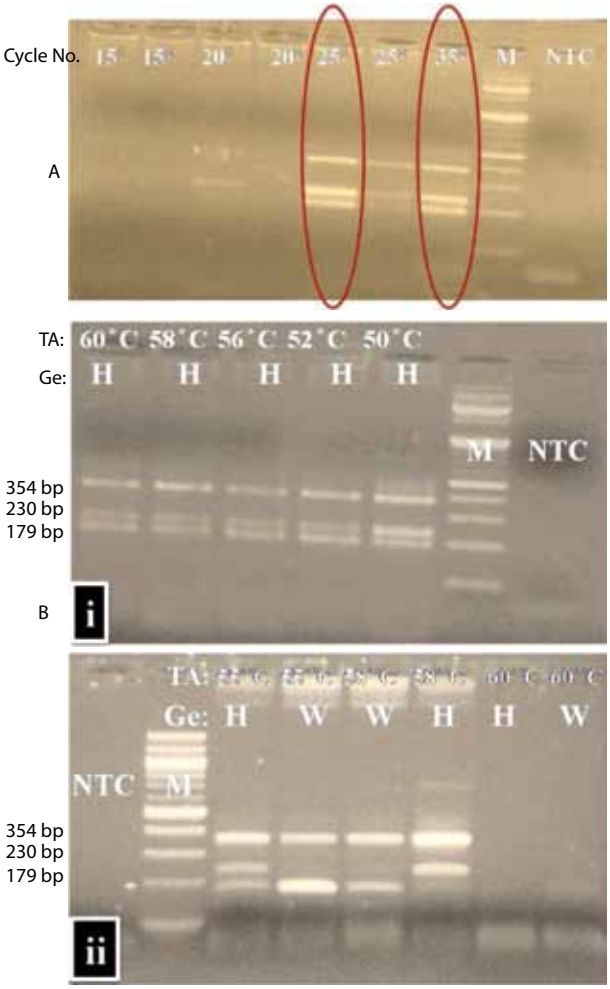


Fig 16. Comparison of SD polymerase and Taq DNA polymerase with respect to amplification efficiency (A) and influence of Annealing Temperature (B): A) Superscript 1: T-ARMS PCR with SD Polymerase. Superscript 2: T-ARMS PCR with Taq DNA Polymerase. M (Molecular ladder of 100 bp), NTC (No template control). B)(i) SD Polymerase at various TA on heterozygous (H) genotype(ii) Taq DNA Polymerase at various TA on heterozygous (H) and Wild (W) genotypes (Ge) in presence of DMSO (5%). M (100 bp Ladder); NTC (Non-template control)

Functional analysis of IRES elements at bovine heat shock protein genes: an approach to modulate thermo regulatory response in cattle

Characterized bovine HSP90AA1 IRES sequence was subjected for structural

prediction and generation of interactome model between the predicted bovine IRES with human 40S subunit ribosomal protein5 (RPS5) and ribosomal translational initiation factor (TIF). Putative Hsp90AA1 IRES fragment was excised with Bam HI and Bst XI to replace the IRES sequence in pIRES2AcGFP mammalian expression vector generating pHsp90IRES2AcGFP. Spectrophotometric readings revealed that the concentration of in vitro synthesized RNA from the pHsp90IRES2AcGFP plasmid DNA eventually increased from 14.4 ng/ µl (A260/280:1.65) to 2057.8 ng/ µl (A260/280:2.01). Transfected MDBK cells revealed the AcGFP expression under the control of bovine Hsp90AA1 illustrated in Fig 17-19. However, the GFP expression under the control of native IRES (53%) was slightly higher than the Hsp90AA1 IRES (47%). Further confirmation was made through immunefluroscent assay using GFP specific monoclonal antibodies, which also localized the GFP gene expression under the control of Hsp90AA1 IRES element.

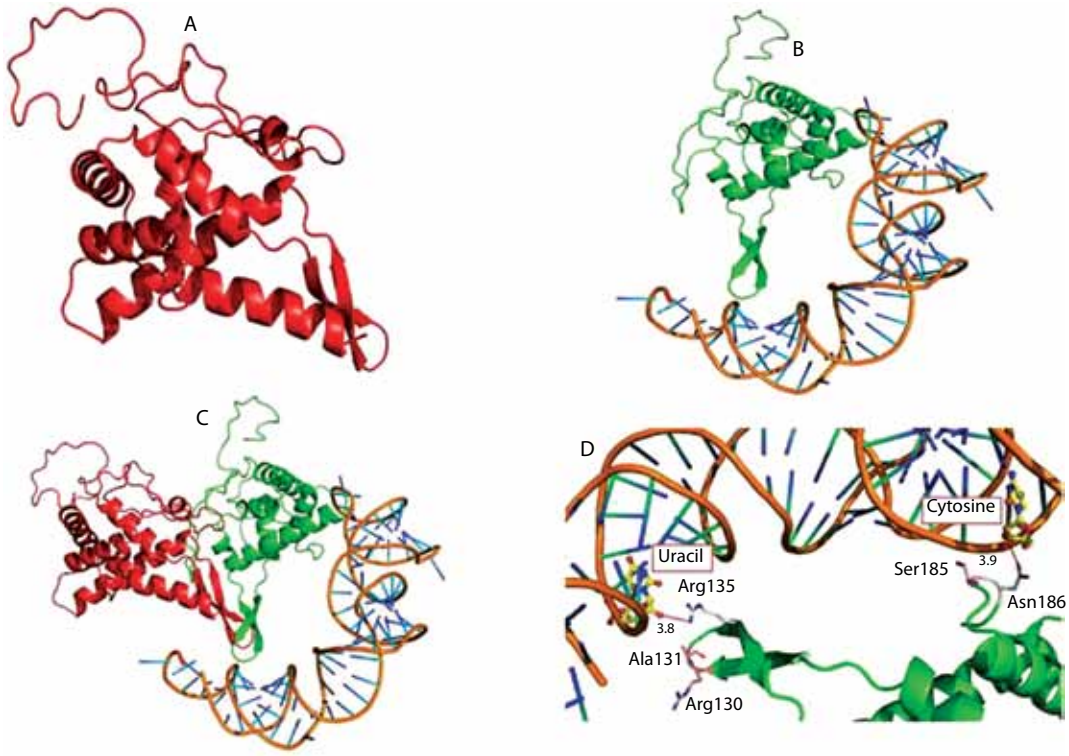


Fig 17: Structure of Human 40S subunit ribosomal protein5 (RPS5) (A), putative bovine Hsp90AA1 IRES (MF400854) bound model of human RPS5 (B), Structure alignment between the IRES unbound (red) and bound (green) conformation of human RPS5 (C), Molecular interaction between human RPS5 and IRES.

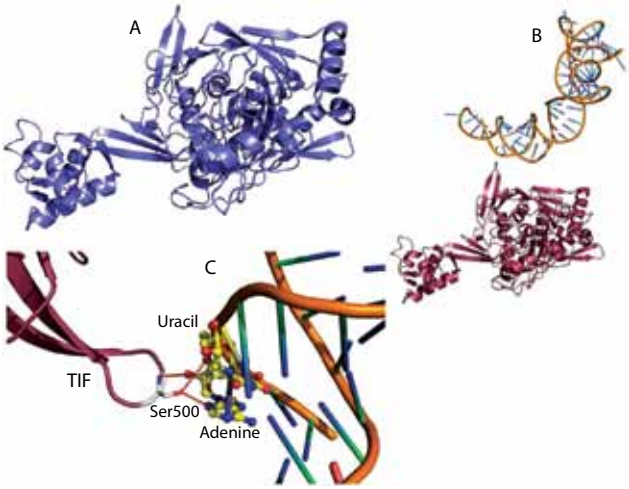


Fig 18: Structure of human ribosomal translational initiation factor (TIF) (A), Model structure of human TIF bound with putative bovine Hsp90AA1 IRES (MF400854) (B), Molecular interaction between human TIF and IRES (C).

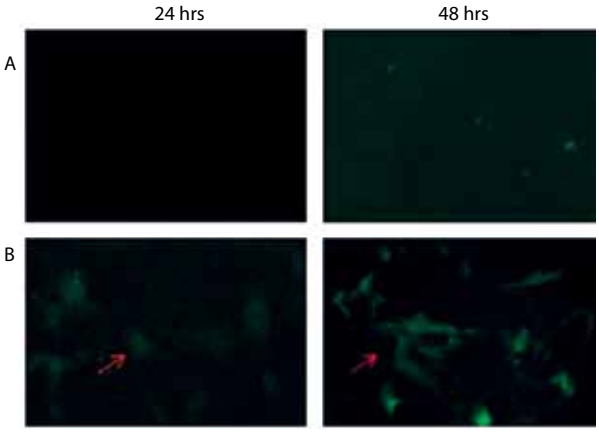


Fig 19: Monitoring of GFP expression in MDBK cells under the control of HSP90AA1 IRES element at 24, 48 hour of post transfection (20 X). A. Control/non transfected cells; B. Transfected cells

B. Sire selection using test day milk records

Estimation of breeding values for first lactation test days and 305-days milk yield and effectiveness of sire evaluation using test day yields.

The first 5, 10 and 14 days milk records of 947 Frieswal cows sired by 55 bulls were taken as individual traits for evaluation in addition to the first lactation 305-days milk yield. The expected breeding values (EBVs) of the Frieswal bulls for first test days 5, 10, 14 and FL305DMY were obtained by WOMBAT program. The overall average EBVs for test days 5, 10, 14 and FL305DMY were 23.928, 67.282, 109.182 and 2692.37 kg, respectively. The EBVs for FL305DMY ranged from 2414.326 to 2896.60 Kg while for cumulative 14 days the estimates were 103.368 and 113.48 kg, respectively (Table 21).

The Pearson's correlation coefficients of first 5, 10 and 14 test days with FL305DMY were 0.231, 0.459 and 0.536, respectively (Table 22). The first 5 test day yields did not have significant correlation with the FL305DMY while the other two estimates had statistically highly significant (P<0.01) association with FL305DMY. Similar results were obtained for rank correlation between the test days and FL305DMY as the estimates were 0.265, 0.458 and 0.523 for first 5, 10 and 14 days, respectively. The above results suggested that the first five test day yields were not significantly associated with the FL305DMY while the association of other two traits were highly significant (P<0.01). Since the coefficient estimates were significantly different from unity (to the maximum of 53.60%), ranking of Frieswal bulls by test day yields will differ significantly from ranking based on FL305DMY. Hence, it may be inferred that the ranking and selection of animals on the basis of different early test day yields may not be accurate which may lead to selection bias.

Further, to confirm similarity or dissimilarity in the ranking, the top 10 ranked bulls by four different traits are presented in Table 23. The results revealed that the top two ranking sires (29 and 18) by FL305DMY were not even ranked among the top 10 bulls evaluated by the other three traits. Moreover, only four sires (12, 27, 33 and 48) out of 10 were being ranked by the three different test day yields and among those four, three had more than 5 ranking. These results suggest that the ranking of sires using EBVs for cumulative milk yield 5, 10 and 14 days was not similar to the ranking based on EBVs of FL305DMY in Frieswal cattle. Hence, it may be concluded that the first 5, 10 and 14 test day yields could not be used for evaluating the Frieswal sires and selection on the basis of their EBVs may result bias in selection.

Table 21 : Average expected breeding values (EBVs) of Frieswal sires for cumulative first lactation 05, 10, 14 and 305-days milk yield by DFREML method

Sire evaluation	Average EBV (kg)	Number of sires above average EBV	Number of sires below average EBV	Maximum EBV (kg)	Minimum EBV (kg)
Different yields					
Cumulative 5 days	23.928	27 (49.09)	28 (50.91)	30.504 (27.48)	19.821 (17.17)
Cumulative 10 days	67.282	25 (45.45)	30 (54.55)	70.220 (04.37)	63.031 (06.32)
Cumulative 14 days	109.182	27 (49.09)	28 (50.91)	113.480 (03.94)	103.368 (05.33)
FL305DMY	2692.37	30 (54.55)	25 (45.45)	2896.600 (07.59)	2414.326 (10.33)

Figures in the parentheses indicate per cent above and below the average breeding value

Table 22: Correlations among expected breeding values (EBVs) of Frieswal sires for different first lactation traits

Traits	Cumulative 5 days	Cumulative 10 days	Cumulative 14 days	FL305DMY
Cumulative 5 days	1.0000	0.864**	0.800**	0.265
Cumulative 10 days	0.826**	1.0000	0.978**	0.458**
Cumulative 14 days	0.729**	0.978**	1.0000	0.523**
FL305DMY	0.231	0.459**	0.536**	1.0000

Figures above and below the diagonals are Spearman's rank and Pearson's correlation coefficients, respectively

Table 23: Ranks of top 10 Frieswal sires for cumulative first lactation 05, 10, 14 and 305-days milk yield by DFREML method

	First lactation traits			
Rank	**Cumulative 5 days**	**Cumulative 10 days**	**Cumulative 14 days**	**FL305DMY**
1	9	49	33	29
2	32	9	35	18
3	42	35	49	48
4	49	33	2	34
5	39	2	9	7
6	12	32	37	12
7	28	12	48	27
8	33	36	27	54
9	27	42	12	26
10	35	37	32	33

Based on the results, it was recommended that the Frieswal male calves could not be selected on the basis of the first 5,10 or 14-day yields of their dams as these test days did not significantly associated with the first lactation 305-days or less milk yield.

Modelling of lactation first lactation curve in Frieswal cattle

Five mathematical functions viz., Exponential decline function (EDF), Parabolic exponential function (PEF), Inverse polynomial function (IPF), Gamma function (GF) and Mixed log function (MLF) were used to fit 42368 first lactation weekly test day yields of 1072 Frieswal cows calved during 2005 to 2014 in Ambala and Meerut, Military dairy farms. The estimated lactation curve parameters and the statistical criteria used for judging their goodness of fit like adjusted R2 value, AIC, BIC, DW statistic and RMSE are given in Table 24. These statistical criteria help to compare and identify the best suited curve function which describe and characterize the first lactation milk yield in Frieswal cattle. They also help in prediction of the first lactation 305-days milk yield, understanding the persistency of lactation yield, and to take modify the managemental criteria for milking dairy animals and for deciding the selection criteria. The adjusted R2 per cent which indicates the accuracy of fitting the models revealed that the MLF (96.14) was more appropriate followed by IPF (95.57), GF (93.85), PEF (83.68) and EDF (69.09). The RMSE estimate of MLF was lowest (0.3483) as expected while the EDF had the highest RMSE value of 0.9858.The AIC criterion was lowest for IPF (5.7175) and highest for GF (8.0212). The BIC values of five functions ranged between -83.6262 for MLF and 3.1809 for EDF. All the DW estimates were positive and ranged between 0.3656 for EDF and 0.7106 for GF. The moderate DW estimates obtained in the present study indicated that the residual estimates had positive autocorrelation for all the functions and based on this result it may be inferred that the positive autocorrelation among the residuals increase the chances of positive error in the predictions.

The initial daily milk yield of 7.187 kg was recorded at sixth day (TD-1) of lactation which reached to the peak of 11.81 kg on the fifth week (TD-5) of lactation i.e. 34 day of post calving. The rate of increase during the initial ascending phase was 64.32 per cent. The results also revealed that peak yield was fairly retained up to 10th week of lactation i.e. 69th day with the yield of 11.54 kg with a little decline of 0.27 kg (Fig 20). The average test day yields showed gradual increase during the initial phase of lactation from calving to the peak period and decline thereafter till the end of lactation.

In the present study, the EDF was the least fitting lactation curve model as the peak yield of 12.009 kg was predicted during the TD-1 itself which declined gradually as the lactation advanced. On the contrary, all other functions predicted the peak yield in between 6th to 8th test days as PEF in TD-8, GF in TD-8, MLF in TD-7 and IPF in TD-6 against the actual peak yield of 11.81 kg observed during the TD-5. Gamma function gave better fit for the lactation curve while the MLF was the best to fit the first lactation yield in Frieswal cows followed by IPF.

Table 24: Lactation curve parameters and goodness of fit estimated by different functions for prediction of first lactation WTDMY

No.	Functions	Parameters of functions			Goodness of fit				
		a	b	c	Adjusted R^2	RMSE	AIC	BIC	DW
1.	EDF	12.1541 (0.3368)	-	0.0120 (0.0013)	69.09	0.9858	7.660	3.1809	0.3656
2.	PEF	10.6030 (0.3433)	0.0088 (0.0037)	0.0005 (0.0001)	83.68	0.7164	7.0218	-24.2715	0.5821
3.	IPF	0.0751 (0.0062)	0.0590 (0.0018)	0.0020 (0.0001)	95.57	0.3732	5.7175	-80.3576	0.3706
4.	GF	8.9365 (0.2740)	0.2347 (0.0197)	0.0285 (0.0015)	93.85	0.4399	8.0212	-63.536	0.7106
5	MLF	11.6953 (0.1838)	-3.6947 (0.1442)	5.0062 (0.2495)	96.14	0.3483	7.5540	-83.6262	0.6407

Actual – Actual observed test day yields; EDF – Exponential decline function; PEF -Parabolic exponential function; GF - Gamma function; MLF - Mixed log function; IPF - Inverse polynomial function; MSE – Mean square error; RMSE- Root mean square error; AIC -Akaike's information criteria; BIC - Bayesian Information Criteria

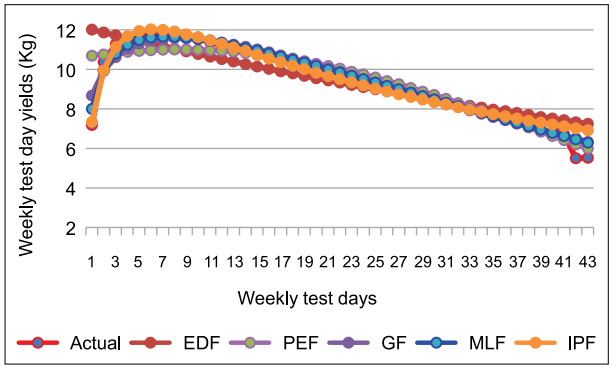


Fig 20: Actual and predicted weekly test day milk yields for different lactation curve functions

EDF – Exponential decline function; PEF -Parabolic exponential function; GF - Gamma function; MLF - Mixed log function; IPF - Inverse polynomial function

Based on the results obtained in the present study, it may be inferred that the first lactation yield was explained accurately by the mixed log function (MLF) in Frieswal cattle. As the inverse polynomial (IPF) and gamma function (GF) also had satisfactory results, these two functions can also be used for fitting the lactation curve models in Frieswal cattle. On the other hand, exponential decline function and parabolic exponential functions least explained the first lactation curve in Frieswal cattle.

C. Semen production and preservation

Germplasm production and performances

Frieswal bulls

The overall average semen volume (ml), sperm concentration (million/ml), initial motility (%) and post thaw motility (%) were 4.63 ± 0.03, 946.74 ± 9.48, 55.14 ± 0.40 and 47.25 ± 0.33, respectively in 4783 ejaculates collected from 140 Frieswal bulls during April 2017-March 2018. The bulls were divided into three age groups (14-36, 37-48, and more than 48 months) for analyzing the semen quality parameters. Considering the average local climatic variables round the year, the period was divided into four seasons viz. winter (Jan, Feb & Dec), comfort (Mar, Oct & Nov), hot & dry (Apr-Jun) and hot & humid (Jul-Sep).

The semen quality in Frieswal bulls of different age groups during different seasons is presented in Table 25. Maximum numbers of ejaculates were collected from the young bulls. Older bulls had higher volume of semen as well as initial sperm motility than the bulls of other age groups. During hot and dry season, age group 1 and 2 bulls had highest semen volume, however, no effect of season was found in older bulls on semen volume. Hot and humid season affected adversely initial sperm motility in all age group bulls.

Out of total, 44.49% ejaculates had 70% or more initial motility. Total 1841 semen samples were processed for freezing and semen samples from 96 bulls were frozen with more than 50% post-thaw motility.

Sahiwal bulls

Semen production from Sahiwal bulls was initiated in the laboratory. The overall average semen volume (ml), sperm concentration (million/ml), initial motility (%) and post thaw motility (%) were 3.15±0.11, 897.39±34.27, 70.30±0.78 and 48.35±1.09, respectively in 155 ejaculates collected from four Sahiwal bulls. Out of total, 88.39% ejaculates had 70% or more initial motility. Ninety nine ejaculates had PTM more than 50% and 11443 semen doses were frozen. The semen quality in Sahiwal bulls during different seasons is presented in Table 26.

Table 25: Effect of age and season on semen quality parameters of Frieswal bulls

Age group	Semen volume (ml)				Sperm concentration (million / ml)				Initial sperm motility (%)			
	Comfort	Hot & dry	Hot & humid	Winter	Comfort	Hot & dry	Hot & humid	Winter	Comfort	Hot & dry	Hot & humid	Winter
1	4.17 ± 0.09^{Aa}	4.39 ± 0.07^{Ab}	4.13 ± 0.06^{Ca}	4.10 ± 0.07^{Aa}	788.55± 28.13^{Aa}	1076.30 ± 21.79^{Ab}	1011.15± 19.53^{Ab}	819.21 ± 23.09^{Aa}	55.32 ± 1.19^{Aa}	52.43 ± 0.92^{Aa}	48.78± 0.82^{Bb}	54.15 ± 0.97^{Ca}
2	4.32 ± 0.09^{Aa}	4.81 ± 0.08^{Bb}	4.46 ± 0.07^{Ba}	4.27 ± 0.08^{ABa}	822.85 ± 28.63^{ABb}	978.65± 25.45^{Ba}	923.33 ± 22.63^{Ba}	984.35 ± 25.84^{Ba}	58.26 ± 1.21^{ABa}	58.18 ± 1.07^{Ba}	53.43 ± 0.95^{Ab}	58.60 ± 1.09^{Ba}
3	5.13 ± 0.15^{B}	5.35 ± 0.16^{C}	5.34 ± 0.15^{A}	5.21 ± 0.13^{C}	878.45 ± 45.65^{Bb}	1132.24 ± 50.72^{Aa}	1016.19 ± 45.81^{ABac}	929.64 ± 36.76^{Bbc}	61.62 ± 1.92^{Ab}	55.48 ± 2.14^{Bb}	42.20 ± 1.93^{Cc}	63.24 ± 1.55^{Aa}

Means bearing different superscripts in lower case letters in rows and upper case letters in columns differ significantly (P<0.05)

Table 26: Effect of season on semen quality parameters of Sahiwal bulls

Semen quality parameter	Season		
	Comfort	Hot & humid	Winter
Semen volume (ml)	2.97±0.17	3.26±0.23	3.24±0.14
Sperm concentration million/ml)	752.67±54.41^{b}	1040.04± 74.78^{a}	899.45± 44.87^{a}
Initial motility (%)	70.59±1.24^{ab}	67.78±1.71^{b}	72.53± 1.02^{a}
Post thaw motility (%)	48.95±1.76	48.57±2.37	47.54± 1.39

Means bearing different superscripts in rows differ significantly (P<0.05)

Breeding soundness evaluation & Culling of unproductive bulls

Breeding soundness evaluation of all bulls (127) under semen collection during 2017-18 was performed based on their seminal attributes. Twenty Five (25) bulls were found unsound for continuation in semen collection and were recommended for withdrawal from collection due to either poor semen quality or freezability. Nine (9) bulls were removed due to completion of their target frozen semen doses.

Bulls and semen doses were also screened for routine check for Brucellosis and IBR through Central Military Veterinary laboratory, Meerut and CADRAD, IVRI, Izatnagar. The details are shown in the Table 27.

Effect of different housing systems on physiological, behavioural and semen production performance of Frieswal bulls

The study was conducted to assess the effect of shed designs (North-South oriented modified sheds with open area in East and West directions) on physiological responses and semen quality parameters of breeding crossbred bulls. Bulls of both directional sheds were divided into two groups i.e. with and without flooring rubber mat. Table 28 shows average THI values inside the experimental sheds. Highest ambient temperature reached up to 45°C in west open sheds; however, it was 43.5°C in east open sheds in the month of June 2017. Mean THI during winter and comfort seasons was within comfortable limits, however, the bulls were under thermal stress (THI > 72) during hot & dry and hot & humid seasons. Average THI in afternoon period was higher than the THI recorded during morning period. THI observed in traditional shed was significantly higher (P<0.05) than in modified sheds during hot & humid season.

Table 29 depicts average physiological parameters observed in experimental bulls kept in two different designs of sheds during different seasons. The physiological responses were comparatively higher in all the bulls during afternoon period than in the morning. Significantly higher respiration rate was observed in bulls kept in east open sided sheds than the other ones in the morning during hot & humid season. However, higher pulse rate was observed in bulls of west open sided sheds in the afternoon period during the same season.

Table 27: Disease testing in Frieswal bulls

S. No.	Type of samples and Date	No of sample	Purpose	Result
1.	Serum, 01-08-17 to 19-09-17, Sent to CMVL	233	Brucellosis and IBR testing	Brucellosis- All negative IBR- 100 bulls seropositive and others negative
2.	Serum, 07-11-2017 Sent to CADRAD, IVRI	7	Brucellosis	All negative
3.	Frozen semen April 2017 to Nov. 2017, Sent to Div. of Cattle Genetics and Breeding, CIRC, Meerut.	399	IBR Testing	All negative

Table 28: Mean± SE values of THI inside the experimental sheds

Period	Temperature Humidity Index					
	Morning			Afternoon		
	Traditional shed	Modified (East Open)	Modified (West Open)	Traditional shed	Modified (East Open)	Modified (West Open)
Hot & dry	80.52 ± 0.49	80.70 ± 0.51	80.65 ± 0.50	85.40 ± 0.50	85.64 ± 0.59	84.87± 0.50
Hot & humid	81.53 ± 0.37	81.53 ± 0.37	81.34 ± 0.34	85.04 ± 0.26[a]	84.14 ± 0.25[b]	84.01± 0.29[b]
Comfort	70.85 ± 0.99	70.89 ± 0.99	70.73 ± 1.01	78.25 ± 1.14	78.51 ± 1.14	78.04 ± 1.12
Winter	60.53 ± 0.74	60.62 ± 0.76	60.54 ± 0.72	67.51 ± 1.18	67.47± 1.16	67.26 ± 1.17

Means with different superscripts between columns during afternoon period differ significantly (P<0.05)

Table 29: Physiological responses of experimental bulls during different seasons

Period of the day	Design of shed	Rectal temperature (°F)				Pulse rate (beat/min)				Respiration rate (breath/min)			
		Hot & Dry	Hot & Humid	Comfort	Winter	Hot & Dry	Hot & Humid	Com-fort	Winter	Hot & Dry	Hot & Humid	Com-fort	Win-ter
Morning	Modified (East Open)	100.82 ± 0.09	101.21 ± 0.08	101.02 ± 0.09	99.90 ±0.11	65.42 ±0.92	63.54 ± 0.73	61.67 ± 0.94	63.42 ±0.99	24.51 ±0.60	35.38 ± 1.36[A]	23.11 ±1.46	16.46 ±0.52
	Modified (West Open)	101.08 ±0.09	100.93 ±0.06	100.53 ± 0.12	99.99 ±0.10	65.50 ±0.81	63.65 ±0.95	65.03 ±1.16	62.90 ±1.03	24.91 ±0.75	27.87 ±0.81[B]	22.09 ±1.47	13.54 ±0.42
Afternoon	Modified (East Open)	101.49 ±0.06	101.81 ±0.06	101.67 ±0.09	101.29 ± 0.09	67.21 ± 1.01	65.50 ± 0.78[B]	65.27 ±1.02	67.02 ± 0.96	35.77 ± 1.17	46.42 ±1.18	27.44 ±1.43	18.46 ±0.67
	Modified (West Open)	101.66 ±0.08	101.72 ±0.06	101.74 ±0.08	101.53 ± 0.09	71.95 ±0.99	67.42 ±1.16[A]	71.09 ±1.14	66.70 ±1.12	36.47 ±1.00	46.98 ±1.40	32.58 ±1.61	19.45 ±0.72

Means with different superscripts between rows during period of a day differ significantly (P<0.05)

Figures 21 and 22 depict time spent on various behavioural activities by bulls in east and west open modified sheds during summer and winter seasons. The bulls preferred to spend maximum time on sitting on kachcha floor in the open area during both the seasons. Bulls preferred covered area in the day time during summer season, however, spent maximum time in open area during night time. During summer season, bulls of west open sheds spent comparatively less time on sitting on pucca floor under covered area than the bulls of opposite side. Feeding was the main activity of the bulls during day time, however, rumination during night time.

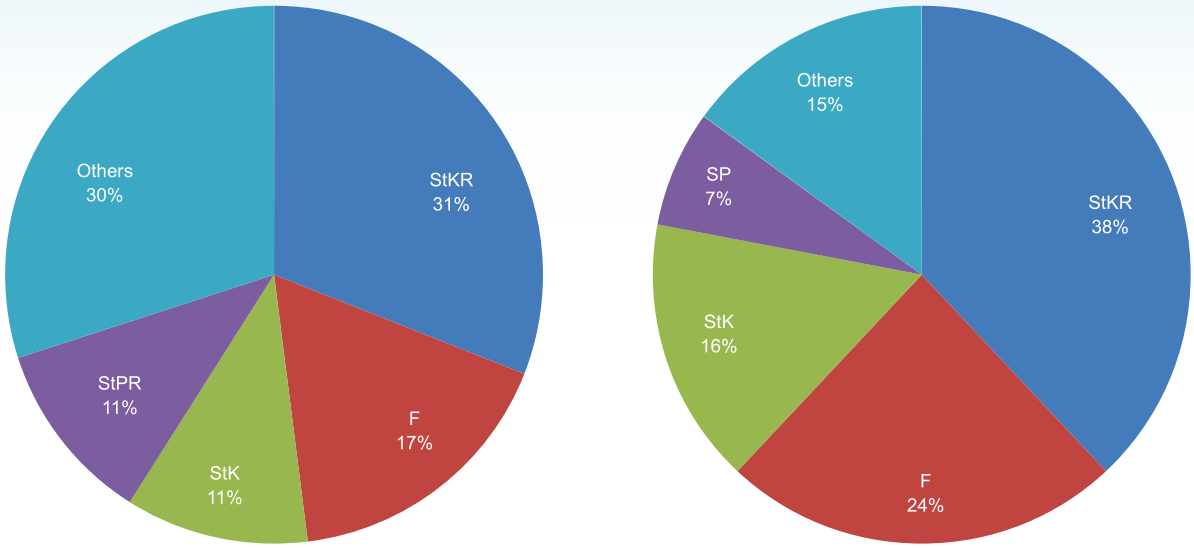


Fig 21: Time spent on various behavioural activities by bulls of modified sheds open in east direction during summer (left) and winter (right)
StKR: Sitting on kachcha floor with rumination; F: Feeding; StK: Sitting on kachcha Floor; StPR: Sitting on pucca floor with rumination; SP: Standing on pucca floor

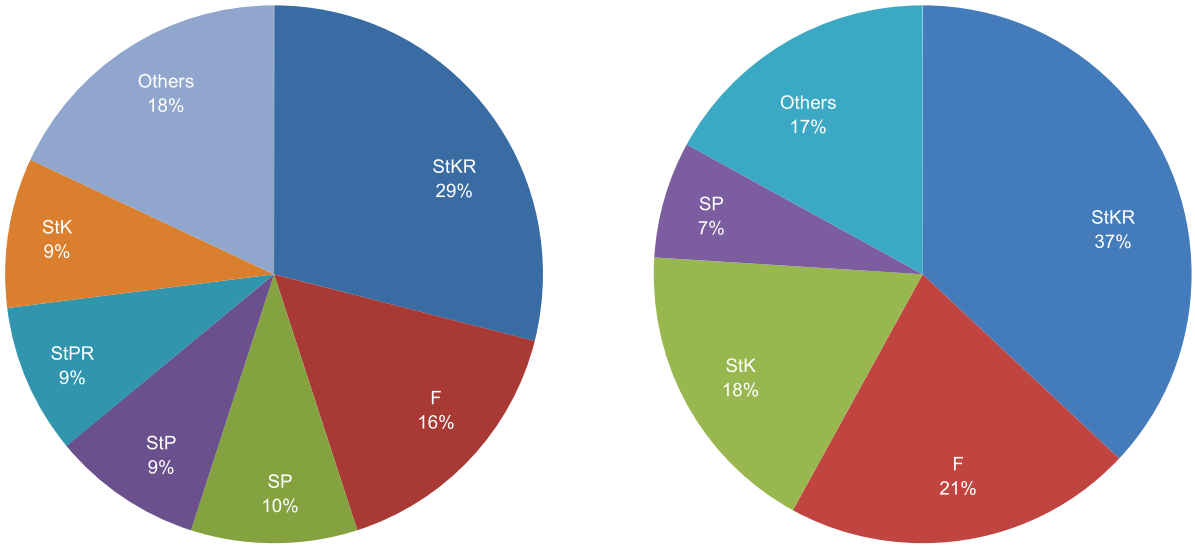


Fig 22: Time spent on various behavioural activities by bulls of modified sheds open in west direction during summer (left) and winter (right)
StKR: Sitting on kachcha floor with rumination; F: Feeding; StK: Sitting on kachcha Floor; StPR: Sitting on pucca floor with rumination; SP: Standing on pucca floor; StP: Sitting on pucca floor

Assessment of heavy metal status and its effect on biochemical parameters and trace mineral profile of Frieswal bulls

The study was conducted to assess the status of heavy metal in Frieswal bulls and their effect on biochemical, trace mineral profile and semen quality parameters of the bulls. Samples of blood, semen, hair, feed and water were collected and heavy metal and trace minerals in the digested samples were estimated by atomic absorption spectrophotometer. Biochemical and semen quality parameters were estimated using standard procedures. The data were analyzed between good and poor bulls. Correlation analysis was also performed between different parameters.

Table 30: Blood heavy metal, trace mineral and biochemical profile of Frieswal bulls (Mean ± SEM)

Parameter	Overall (n=82)	Good bulls (n=34)	Poor bulls (n=48)
Pb(µg/ml)	0.27±0.011	0.25± 0.021	0.29± 0.011*[a]
Cd(µg/ml)	0.15± 0.004	0.14± 0.007	0.16± 0.006*[a]
Zn(µg/ml)	2.01± 0.085	2.26±0.175	1.83± 0.066*[a]

Parameter	Overall (n=82)	Good bulls (n=34)	Poor bulls (n=48)
Cu(µg/ml)	1.39± 0.053	1.62± 0.090	1.23± 0.055**a
Co(µg/ml)	2.84± 0.097	3.04± 0.145	2.70± 0.128
Fe(µg/ml)	141.85± 4.54	145.16± 6.92	139.51± 6.05
AST(U/L)	56.68± 1.58	49.40± 2.82	61.63± 1.46*a
AKP(U/L)	60.37± 1.63	61.53± 2.29	59.55± 2.28
Total Protein(g/dl)	7.57± 0.151	7.96± 0.18	7.29± 0.22*a
Albumin(g/dl)	2.84± 0.05	3.05± 0.075	2.69± 0.058
Globulin(g/dl)	4.72± 0.154	4.91± 0.191	4.60± 0.226
BUN(mg/dl)	18.34± 0.78	19.41± 1.43	17.57± 0.864
Creatinine(mg/dl)	1.86± 0.069	1.95± 0.072	1.78± 0.11

a- significant difference between good and poor bulls, *p<0.05, **p<0.01

Significant levels of Pb and Cd were detected in blood samples of Frieswal bulls. On analysis of the data between good and poor bull categories, significantly higher Pb and Cd concentrations were present in poor bulls as compared to good bulls (Table 30). Significantly low Zn and Cu concentrations were observed in poor quality bulls as compared to good bulls. Co and Fe did not show significant variation between bull categories. Significantly higher AST and low total protein were recorded in poor quality bulls as compared to good bulls. No significant variation was seen in kidney function parameters between good and poor bulls. Significantly higher Cd was seen in hair samples of poor bulls as compared to good bulls. Pb, Zn, Cu, Co and Fe did not show significant variation in hair samples of good and poor bulls.

Significant levels of Pb and Cd were detected in semen samples of Frieswal bulls. Significantly higher concentration of Pb and Cd were present in semen samples of poor bulls as compared to good bulls (Table 31). Significantly low Zn and Cu were observed in poor bulls as compared to good bulls. Cobalt and Iron values did not show any significant variation between good and poor bulls. Significantly higher MDA and low SOD and Catalase were recorded in seminal plasma of poor bulls as compared to good bulls.

On correlation analysis, lead and cadmium showed significant negative correlation with Zn(r= -0.481, p<0.01; r= -0.578, p<0.01), Cu(r= -0.542, p< 0.01; r= -0.610, p<0.01), SOD(r=-0.395, p<0.01; r= -0.300, p<0.01), Catalase(r=-0.326, p< 0.01; r= -0.248, p<0.05), motility(r=-0.247, p<0.05; r= -0.218, p<0.05) and sperm concentration(r= -0.300, p<0.05; r= -0.313, p<0.01) while significant positive correlation was seen with MDA(r= 0.640, p< 0.01; r= 0.726, p<0.01). Zn and Cu had significant positive correlation with SOD(r= 0.347, p<0.01 and r= 0.359, p<0.01), Catalase(r= 0.266, p< 0.05 and r= 0.300, p<0.01), Motility(r= 0.279, p<0.05 and r= 0.273, p<0.05) and sperm concentration(r= .294, p<0.01 and r=0.282, p<0.05) while significant negative correlation with MDA(r=-.510, p<0.01 and r= 0.480, p<0.01). SOD and Catalase had significant positive correlation

Table 31: Semen heavy metal, antioxidant profile and quality parameters of Frieswal bulls (Mean ± SEM)

Parameter	Overall (n=82)	Good bulls (n=34)	Poor bulls (n=48)
Pb(µg/ml)	0.23± 0.006	0.21± 0.009	0.24± 0.008*a
Cd(µg/ml)	0.11± 0.005	0.091± 0.007	0.12± 0.006*a
Zn(µg/ml)	14.28± 0.74	16.08± 1.16	13.02± 0.93*a
Cu(µg/ml)	1.15± 0.09	1.41± 0.17	0.97± 0.09*a
Co(µg/ml)	7.03± 0.29	7.34± 0.47	6.80± 0.37
Fe(µg/ml)	12.04± 1.03	10.34± 1.42	13.25± 1.44
MDA(µM)	2.24± 0.08	1.88± 0.13	2.49±0.080**a
SOD(U/mg protein)	1.33± 0.057	1.89± 0.050	0.94± 0.021**a
Catalase(U/mg protein)	1.74± 0.050	2.19± 0.047	1.43± 0.038**a
Volume(ml)	4.36± 0.13	4.74± 0.180	4.10± 0.17*a
Motility (%)	50.68± 2.07	60.51± 2.38	43.71± 2.72**a
Sperm Conc. (million/ml)	992.16± 44.32	1113.6± 60.99	906.13± 59.62*a

a- significant difference between good and poor bulls, *p<0.05, **p<0.01

with sperm motility(r= 0.443, p< 0.01 and r=0.430, p<0.01) and concentration(r=0.279, p<0.05 and r=0.333, p<0.01). MDA had significant negative correlation with sperm motility(r= -0.307, p<0.01) and concentration(r=0.266, p<0.05).

Quality assessment of Frieswal bull semen

For evaluation of post thaw semen quality parameters, two straws per bull were randomly selected from the bunch of cryopreserved semen straws (0.25 ml, French mini), thawed (37°C for 30 s) and evaluated. In all assays, two replicates per sample were made for evaluation of quality parameters of spermatozoa. The per cent individual progressive motility following freezing-thawing at 0, 30 and 60 minutes of incubation at 37°C (144 ejaculates) were 51.18±0.48, 44.72±0.42 and 37.64±0.53, respectively. The plasma membrane integrity (%) as determined by hypo-osmotic swelling test (HOST) was 50.52±0.64 while acrosome integrity (%) as determined by Giemsa staining was 72.40±0.43. The average concentration per 0.25 ml straw was 21.42±0.16 million. The quality control estimates for various parameters are presented in Table 32 and depicted in Fig 23.

The mean bacterial load per ml recorded in the extended cryopreserved semen samples of the Frieswal bulls was 610.83±57 CFU. Thirty-nine out of the 144 (27.08%) samples were negative for bacterial growth. None of the samples out of 144 had bacterial counts of more than 5000 CFU/ml.

Table 32: The quality control estimates for various parameters of frozen-thawed Frieswal bull semen samples

Semen Attributes (N=144)	Mean ± SEM
PTM (%)	51.18±0.48
Motility after incubation for 30 min (%)	44.72±0.42
Motility after incubation for 60 min (%)	37.64±0.53
HOST (%)	50.52±0.64
Acr-Int (%)	72.40±0.43
Concentration (million/straw)	21.42±0.16
CFU/ml	610.83±57.81

N, number of samples; PTM, Post-thaw motility; HOST, hypo-osmotic swelling test; Acr-Int, acrosome integrity; CFU, Colony-forming unit.

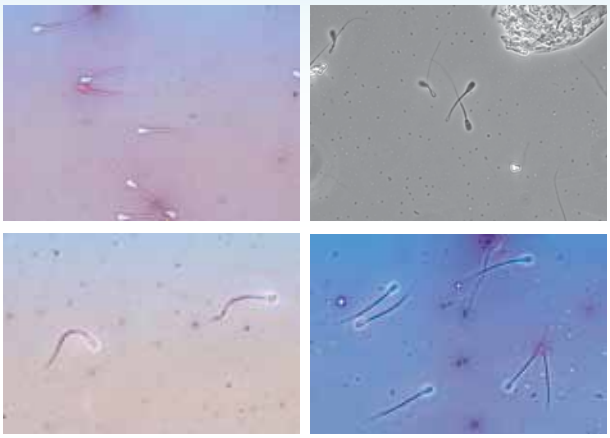


Fig 23: (L to R) 1st row: Sperm Viability test, HOS reactivity, 2nd row: Distal protoplasmic droplet, Abnormal Sperm head

Supplementation of butylated hydroxytoluene (BHT) reduces oxidative stress and improves quality of frozen–thawed Frieswal bull spermatozoa

The present study was conducted to compare the effects of different concentrations of antioxidant Butylated Hydroxytoluene (BHT) on semen quality parameters and oxidative stress (OS) in Frieswal bulls. The semen samples (22) were diluted in cryo-protective egg yolk Tris glycerol extender (EYTG) with different concentrations of BHT (2.5, 5.0 and 10 mM for group I, II and III, respectively). Motility, viability, abnormality, acrosome integrity and membrane stability tests were performed at post-dilution, post equilibration and post thaw stage. Subsequently, levels of lipid peroxidation along with superoxide dismutase (SOD) and catalase activities were evaluated following freezing-thawing. Group II with 5 mM BHT supplementation at post thaw stage, showed significantly (p<0.05) increased sperm motility, viability, acrosomal intactness, plasma membrane integrity and a significant reduction in abnormal sperm cells. Likewise, all the parameters related to OS were also found to be significantly superior (p<0.05) in this group (Table 33). Thus, the present study indicated that BHT at the concentration of 5 mM in EYTG extender is optimal for cryopreserving Frieswal bull spermatozoa by improving post-thaw sperm characteristics including acrosome intactness and plasma membrane integrity, and limiting oxidative stress.

Table 33: The effect of different concentrations of butylated hydroxytoluene (BHT) on malondialdehyde (MDA) concentration, superoxide dismutase (SOD) and catalase activity in Frieswal bull semen sample (mean ± SEM) at post-thaw stage

Semen Attributes	Control	Gr. I (2.5 mM)	Gr. II (5.0mM)	Gr. III (10 mM)
MDA (µmol/ml)	3.69±0.14[c]	2.64±0.09[b]	1.26±0.07[a]	2.74±0.21[b]
SOD (U/ml)	21.45±0.49[a]	38.82±0.94[b]	43.16±1.24[c]	39.61±1.14[b]
Catalase (U/mg)	0.002±0.0[a]	0.004±0.0[a]	0.02±0.0[b]	0.005±0.0[a]

[abc]Values bearing different superscripts in a row differ significantly ($p<0.05$).

D. Augmentation of reproductive efficiency

Superovulatory response and embryo production in cattle

Superovulatory response to exogenous gonadotropins was assessed in indigenous cattle breeds (Sahiwal, Kankrej, Haryana, Tharparkar and Gir) and compared with crossbred Frieswal cattle at MF Meerut and in herds around Meerut. Folltropin V at the rate of 400mg NIH in 8 divided tapering doses and PG with 5th injection was used to superovulate Frieswal cattle whereas the Folltropin dose was modified for indigenous cows to 50%, 55%, 60%, 65% and 70% of total dose (400mg NIH) considering the body weight and size in 8 divided tapering doses (Fig 24). A total of 12 indigenous and 06 crossbred cows were subjected to superovulatory treatment. Seventy five per cent indigenous (9/12) cows responded to 50-70% reduced doses with successful embryo recovery, whereas 66.66% (4/6) crossbreds resulted in optimum superovulatory response and embryo recovery with 400mg Folltropin V. The study indicated that indigenous cows may respond well in terms of optimum superovulatory response with almost half to 5/8 dose of Folltropin as compared to crossbred cows.

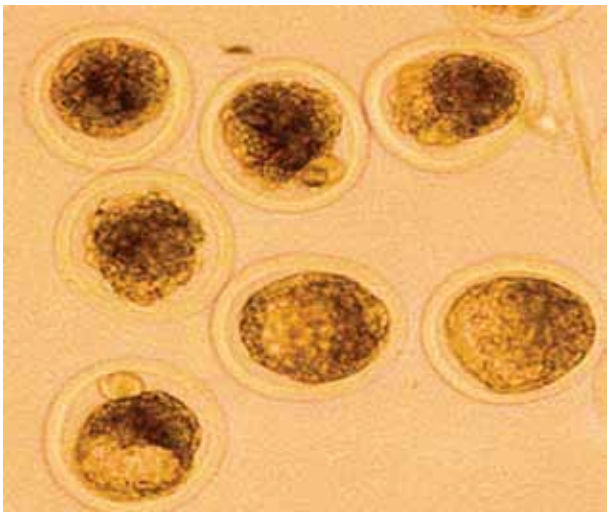


Fig 24: Embryo transfer in indigenous cattle and embryos collected

Fertility improvement of cattle in field and organized farms

The study was undertaken to assess the incidence of various reproductive problems in rural areas around Meerut and their mitigation using different nutritional and hormonal therapeutics. Mineral and biochemical profile of anestrus cattle were also assessed. The animals brought to (16) infertility cum health camp organized by CIRC in 12 different villages were examined for various reproductive problems (Fig 25). Out of total 705 animals examined, 27.94% were anestrus and 12.62% repeat breeders. Overall, 62.5% treatment response was recorded in sub-fertile animals, which received the mineral mixture or hormonal supplements after deworming. In anestrus cattle, the blood plasma levels of calcium, phosphorus, copper, zinc and manganese were below the normal reference ranges. Organization of infertility cum health camps under field conditions showed the importance of mineral mixture supplementation and regular deworming to the dairy animals to minimize the occurrence of reproductive and other health related issues for enhanced productivity. Fertility enhancement using progesterone and estrogen hormone based estrus induction protocols can be the economic way to overcome the problem of anestrus in dairy animals subject to the condition that nutrients especially the mineral and vitamin supplements are adequately incorporated in their ration.

Fig 25: Infertility cum health camps under field conditions

Isolation, in-vitro culture and characterization of different cell types

To ascertain the availability of feeder cells for future experimentations, monolayer cultures of fibroblasts cells derived from buffalo foetuses were standardised after harvesting the cells with enzymatic digestion (Fig 26). Primary monolayers were maintained up to 16 days on sub-cultures. Standardisation of the *in vitro* embryo production was also made utilising buffalo ovaries (Table 34). All visible surface follicles (>4 mm) were aspirated utilising 18 gauge hypodermic needle. Average oocyte recovery rate was 3.89 per ovary and 72.85% oocytes were considered as of good quality on the basis of presence of compact cumulus oocytes complexes (COCs). Oocytes having atleast 3-5 layers of cumulus cells and evenly granulated ooplasm were subsequently cultured in CO_2 incubator for 22-24 hr. Maturation rate was 71.42% on the basis of expansion of cumulus oophorous cell layers *in vitro* (Table 35). Good quality matured oocytes were incubated with capacitated buffalo sperms in fertilization drop for overnight and the excess sperms were gently washed out and kept for embryo development in media upto seven days, however, the oocytes failed to cleave (Fig 27).

Table 34: Isolation, attachment, confluence and survivability of cells

Attributes Recorded	Value(s)
Live cells percentage (Trypan Blue Test)	86.50
Attachment to surface of culture flask	Within 3-6 hrs
Time of confluence	2-3 days
in vitro survivability	Recorded up to 16 days

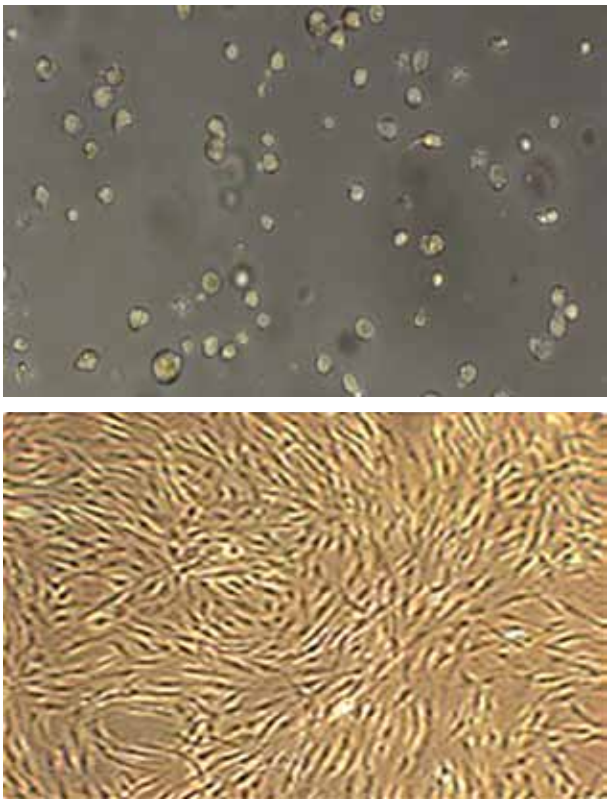


Figure 26: Isolated Fibroblast cells and confluence after 96 hrs of incubation

Table 35: *In vitro* fertilization & culture of oocytes

Attributes	Observations
No. of Trials	5
Total no. of ovaries	18
Total no. of oocytes aspirated	70
Av. Oocyte Recovery Rate	3.89
No. of good oocytes obtained	51 (72.85%)
Maturation Rate	71.42% (35/51)
No. of oocytes used in IVF	35
No. of embryos developed	Nil

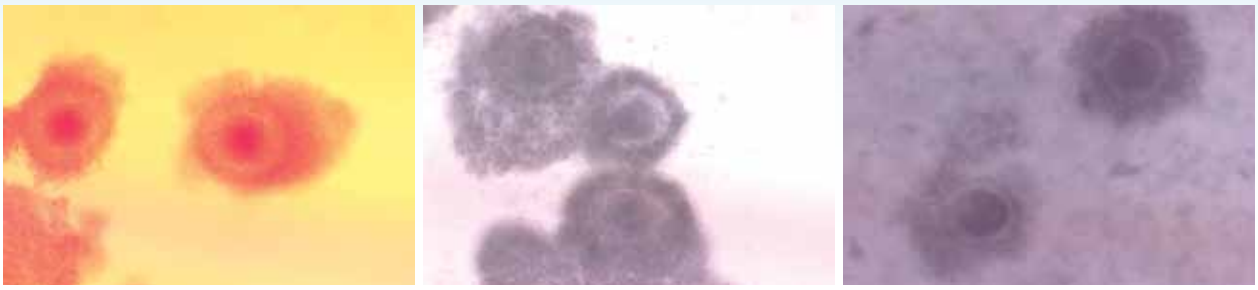


Fig 27: (L to R) Aspirated oocyte, IVM- expanded cumulus, IVF-Oocytes sperm incubation

Sperm membrane bound Fertility associated antigen indicates greater potential to withstand oxidative stress ensuing improved sperm function of cryopreserved bull spermatozoa

Fertility associated antigen (FAA) are more abundant in semen of bulls with high fertility. The objective was to investigate relationship of FAA, either membrane bound and/or in seminal plasma, with that of markers of oxidative stress, mitochondrial activity and acrosome integrity of live cells, in cryopreserved spermatozoa. Grouping of bulls was done by electrophoretic profiling of proteins from seminal plasma (SP), and sperm membrane (SM), based on presence/absence of the FAA in SP and/or SM or both. Group I had detectable FAA in both SP and SM; Group II, FAA detected only in SM; Group III, detectable FAA only in SP and Group IV, undetectable FAA in both SP and SM. At post-thaw stage, the lipid peroxide levels were significantly lower ($p<0.05$) and the activity of primary free radical scavengers (superoxide dismutase and catalase) was significantly higher ($p<0.05$) in Groups I and II (Table 36). Correspondingly, Group I and II showed significantly higher ($p < 0.05$) per cent of acrosome intact live spermatozoa and sperm cells with functionally active mitochondria (Table 37). Collectively, this study showed that the presence of FAA on the sperm membrane is related to greater protection against oxidative stress ensuing improved acrosome intact live-sperm cells with functional mitochondria.

Table 36: Effect of presence of FAA on malondialdehyde (MDA) concentration, antioxidant enzymatic activity and mitochondrial membrane potential (ΔΨm), in Frieswal bull semen sample (mean ± SEM)

Semen Attributes	I	II	III	IV
N	7	8	9	6
MDA (µmol/ml)	1.79±0.04 ^{a}	1.68±0.06 ^{a}	2.26±0.08 ^{b}	4.34±0.23 ^{c}
SOD (U/ml)	42.11±0.83 ^{c}	43.65±0.94 ^{c}	21.93±2.65 ^{b}	16.63±1.14 ^{a}
Catalase (U/mg)	0.012±0.0 ^{bc}	0.0152±0.0 ^{c}	0.0074±0.0 ^{ab}	0.0056±0.0 ^{a}
High ΔΨm(%)	44.29±1.46 ^{c}	49.75±0.59 ^{d}	32.78±1.01 ^{b}	19.83±1.40 ^{a}
Low ΔΨm(%)	55.71±1.46 ^{b}	50.25±0.59 ^{a}	67.22±1.01 ^{c}	80.17±1.40 ^{d}

N, number of samples; ΔΨm, mitochondrial membrane potential; SOD, superoxide dismutase, MDA, malondialdehyde; ^{abcd}Values bearing different superscripts in a row differ significantly ($p<0.05$).

Table 37: Effect of presence of FAA on per cent viability and acrosome status of spermatozoa in frozen thawed Frieswal bull semen at immediate post thaw (mean % ± SEM)

Viability and AcrInt (0 min)	I	II	III	IV
N	7	8	9	6
L-AI	39.00±2.36 ^{a}	38.25±1.70 ^{a}	24.78±0.98 ^{b}	18.00±0.86 ^{c}
L-AR	10.86±0.34 ^{b}	9.88±0.67 ^{b}	11.22±1.16 ^{c}	5.50±1.23 ^{a}
D-AI	20.29±5.16 ^{a}	13.25±1.83 ^{b}	13.44±4.78 ^{b}	10.83±1.07 ^{c}
D-AR	29.85±5.82 ^{a}	38.62±1.67 ^{a}	50.55±34.38 ^{b}	65.67±01.1 ^{c}

N, number of samples; L-AI, live acrosome-intact sperms; L-AR, live acrosome-reacted sperms, D-AI, dead acrosome-intact sperms, D-AR, dead acrosome-reacted sperms; ^{abc}Values bearing different superscripts in a row differ significantly ($p<0.05$).

E. Improvement of Cattle Through Nutritional Manipulation

Effect of different dietary levels of copper (as $CuSO_4$) on intake and digestibility of nutrients

Based on the previous semen production data, bulls at BRU were divided into two categories viz., good and poor. Bulls of each category were further divided into three groups of seven animals each. All the animals were fed as per the Military Farm standards i.e., individual animal offered wheat straw (ad lib), 20 kg seasonal green fodder and 3.6 kg of specific concentrate mixture. Different groups of animals under both categories were fed diets with normal 12.5 ppm (D1) and supplemented 20 ppm (D2) and 25 (D3) ppm of Cu on DM basis (Table 38).

Daily feed intake by individual animal during entire experimental period was recorded. For estimation of micro-minerals, samples of blood plasma from each bull were collected at the start of the experiment and at two months interval. The body weights of the experimental bulls were monitored at monthly intervals. The semen was collected as per the farm schedule. For the determination of digestibility of nutrients, a digestibility trial was conducted. During the six months of experimental feeding, the average daily DMI remained between 9.07 and 10.90 kg, and the DMI/100kg BW ranged between 1.54 and 1.77 in all the groups across both categories. Similarly the BW was in the range of 472.3 to 675.3 kg during entire feeding period across all groups in both in categories of bulls. The ADG (g/d) was 506, 577 and 616 in good category and 472, 675 and 655 in poor category of bulls on diets D1, D2, and D3, respectively. The plasma concentration of Cu has steadily increased over the different phases of supplementation in animals across different groups (Fig 28).

During the digestibility trial, the average daily DMI was 9.82. 9.38 and 9.28 kg in good bulls and 9.28, 9.09 and 9.87 kg in poor bulls on diets D1, D2 and D3, respectively (Table 39). The average daily intake of different nutrients and digestibility coefficients were remained similar in all categories and groups of experimental bulls.

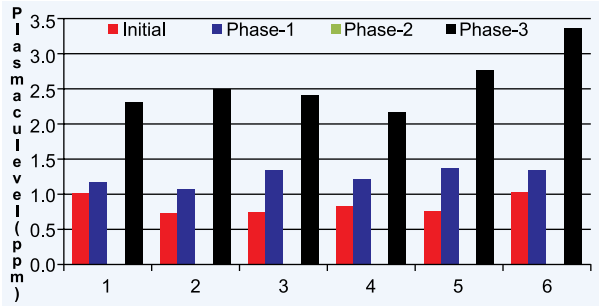


Fig 28: Trend of plasma Cu levels in different groups of bulls supplemented with $CuSO_4$

Table 38: Ingredient composition of concentrate mixtures (%) having 3 levels of Cu on supplementation with $CuSO_4$

Ingredients	Type of concentrate mixture		
	Conc. 1 (D1)	Conc. 2 (D2)	Conc. 3 (D3)
Maize	45	45	45
Wheat Bran	33	33	33
Groundnut Cake	9	9	9
Mustard Oil Cake	10	10	10
Mineral Mixture*	2	2	2
Common Salt	1	1	1
Dietary level of Cu (ppm, calculated)	12.5	20	25

* Additional 5.3146 and 8.4013g $CuSO_4.5H_2O$ per kg mineral mixture was used to achieve desired levels i,e., 20 & 25 ppm Cu in total diets, D2 and D3 respectively.

Table 39: Average daily nutrient intake and digestibility in different groups of bulls fed basal (12.5 ppm; G1, P1) and Cu supplemented (20; G2, P2 or 25 ppm; G3, P3) diets with $CuSO_4$ during digestion trial.

Parameters		Categories/ groups of animals					
		Good			Poor		
		G1	G2	G3	P1	P2	P3
DM intake	Conc. (kg)	3.18	3.18	3.18	3.18	3.18	3.18
	WS (kg)	4.99	4.58	4.46	4.57	4.33	5.08
	Berseem (kg)	1.65	1.61	1.63	1.66	1.58	1.61
	Total (kg)	9.82	9.38	9.28	9.42	9.09	9.87
	kg/100kg BW	1.61	1.48	1.52	1.49	1.43	1.56
	g/kg $W^{0.75}$	79.92	74.18	75.42	74.54	71.70	78.03
N intake	Conc. (g)	91.33	92.32	90.53	91.44	92.21	90.48
	WS (g)	32.89	30.21	29.42	30.10	28.54	33.46
	Berseem (g)	56.85	55.71	56.28	57.41	54.58	55.71
	Total (g)	181.07	178.24	176.23	178.95	175.32	179.65
	g/100kg BW	29.64	28.40	28.96	28.33	27.67	28.39
	g/kg $W^{0.75}$	1.47	1.42	1.44	1.42	1.39	1.42
% Digestibility	DM	56.63	52.12	54.68	57.25	54.14	55.26
	N	66.03	63.62	64.85	66.85	63.24	63.32
	CF	51.00	49.95	52.51	52.02	51.31	52.97
	EE	64.08	62.92	63.68	63.52	62.45	62.07
	TA	24.09	21.65	19.68	20.18	20.68	18.92
	NFE	56.65	54.85	55.85	57.24	55.29	55.92
	NDF	43.88	42.98	43.88	42.13	41.10	42.70
	ADF	39.08	36.23	39.07	38.50	37.48	38.80
	Ca	22.36	20.25	20.66	25.94	21.92	23.04
	P	17.18	20.11	17.36	17.61	17.80	19.32

Effect of different dietary levels of combined supplementation of Cu, Mn and Zn (as inorganic sulphates) on intake and semen quality

A feeding trial was initiated in 36 Frieswal bulls maintained in the BRU. Based on the previous semen production data, bull were divided into two categories viz., good and poor. Bulls of each category were further divided into 3 groups of 6 animals each. All the animals were fed as per the Military Farm standards i.e., individual animal offered wheat straw (ad lib), 20 kg seasonal green fodder and 3.0 kg of specific concentrate mixture. Different groups of animals in both categories were offered diets with basal 40 ppm Zn, 55 ppm Mn and 12.5 ppm Cu (D1), and supplemented 60 ppm Zn, 65 ppm, Mn and 20 ppm Cu (D2) and 80 ppm Zn, 80 ppm, Mn and 25 ppm Cu (D3) on DM basis. The observations for animal feed intake, body weights and semen quality are being recorded as per the farm schedule.

Assessment of micronutrient status in the samples of feeds/fodders from the BRU

Vitamin A and its precursor, carotenoids are rapidly destroyed by oxygen, heat, light etc. The presence of moisture and trace minerals reduces vitamin A activity in feeds. To assess the micronutrient status of animal feeds, samples were collected at regular intervals from BRU. The collected samples of concentrate and wheat straw were oven dried for the determination of proximate principals and micro-minerals. For the determination of beta-carotene (BC) and vitamin A (VA), samples of feeds and green fodder samples were stored under the temperature of -20°C until analysis was done. Total 65 samples were analysed for micronutrient determination (Tables 40 and 41).

Table 40: Average (%) chemical composition of feeds/fodders collected from BRU during the year 2017-18.

FEEDS		Nutrients (%, DM basis)									
		DM	CP	EE	CF	TA	NFE	NDF	ADF	Ca	P
CONC MIX	Mean	-	13.84	2.53	14.76	8.69	60.19	66.13	19.44	0.72	0.62
(n=33)	Min	-	11.88	2.09	14.08	8.04	56.14	63.69	17.40	0.44	0.40
	Max	-	16.56	2.89	15.28	9.54	62.46	69.54	21.61	1.00	0.83
JOWAR	Mean	29.64	7.91	1.92	33.26	9.82	47.09	61.06	38.66	0.45	0.18
(n=12)	Min	21.69	5.81	1.17	28.37	6.84	37.37	52.37	32.19	0.25	0.12
	Max	39.27	11.18	2.71	39.06	11.25	54.20	67.73	41.86	1.42	0.23
BERSEEM	Mean	15.82	18.05	2.57	26.22	12.83	40.33	45.90	30.20	1.34	0.26
(n=8)	Min	13.10	14.65	1.87	23.71	9.41	37.74	39.62	23.72	1.22	0.16
	Max	21.34	20.97	3.24	32.15	15.19	44.52	50.79	35.19	1.55	0.54
CARROT	Mean	15.02	12.50	1.74	21.93	11.17	52.68	43.43	29.77	1.84	0.42
tops (n=4)	Min	11.79	11.48	1.36	20.64	10.17	51.72	41.99	27.04	1.24	0.30
	Max	18.67	14.16	2.03	22.61	12.57	53.73	45.61	32.53	2.08	0.51
MAIZE	Mean	19.24	9.35	1.93	30.18	9.62	48.91	44.87	32.00	0.47	0.19
(n=3)	Min	15.83	8.90	1.83	27.88	8.83	46.11	42.15	29.07	0.36	0.17
	Max	22.91	10.07	2.02	32.43	10.61	51.77	46.38	35.47	0.61	0.20
SUGARCANE	Mean	28.83	5.03	1.65	32.59	8.84	51.89	66.18	39.37	0.48	0.04
tops (n=5)	Min	21.87	4.18	1.20	29.76	8.05	47.96	59.99	38.22	0.39	0.03
	Max	32.83	6.09	2.39	36.72	10.73	55.99	71.09	40.61	0.56	0.07
OATS	Mean	18.62	9.63	2.08	28.77	9.41	50.12	46.50	27.89	0.36	0.14
(n=4)	Min	14.33	8.09	1.79	25.96	8.54	47.77	42.65	26.56	0.29	0.11
	Max	22.24	10.65	2.36	31.05	11.07	52.49	48.59	29.58	0.46	0.17

Table 41: Average micronutrient composition of feeds/fodders collected from BRU during the year 2017-18.

FEED		Micro-minerals (ppm, DM basis)			Vitamins (mg/100g DM basis)	
		Cu	Mn	Zn	Beta-carotene	Vit.-A
CONC MIX	Mean	31.28	52.22	221.59		
(n=33)	Min	8.55	31.12	85.64		
	Max	93.80	79.04	372.73		
JOWAR	Mean	4.14	40.69	42.59	6.67	3.02
(n=12)	Min	0.85	21.96	24.96	3.67	1.95
	Max	11.00	82.00	74.02	11.01	6.62
BERSEEM	Mean	26.99	36.45	35.23	20.86	10.29
(n=8)	Min	11.60	23.63	18.11	15.75	6.62
	Max	51.82	55.71	88.97	29.98	13.95
CARROT TOPS	Mean	27.25	41.23	36.11	16.63	8.77
(n=4)	Min	19.35	32.08	20.52	13.99	6.49
	Max	38.11	49.95	64.27	19.66	11.96
MAIZE	Mean	15.27	35.73	29.28	14.16	7.55
(n=3)	Min	6.90	28.50	21.94	11.09	6.12
	Max	27.91	42.50	33.10	16.92	9.02
SUGARCANE	Mean	11.24	29.59	38.78	9.86	4.70
tops (n=5)	Min	5.78	21.16	22.70	6.89	3.96
	Max	24.04	35.18	48.81	13.78	6.09
OATS	Mean	8.95	23.32	31.71	14.75	7.60
(n=4)	Min	5.70	12.90	19.04	12.32	5.86
	Max	11.40	34.06	45.01	16.88	9.09

Assessment of nutritional status of cattle in Meerut district through biochemical parameters

A structured survey schedule was used to collect the information from respondents belonging to 128 farm families of four villages viz., Kastala (23), Atrada (29), Alipur (41) and Khanpur (35) from four different blocks of Meerut district. In addition, samples of animal feed and fodders were also collected. The chemical analysis of the samples is in progress and the result of survey is summarized below:

Demographic characteristics: The average age (years) of respondents or head of family was 47.43, 43.69, 48.78 and 51.66 in Kastala, Atrada, Alipur and Khanpur villages, respectively with overall average age of 48.17. The average size of family (members) was 6.61, 7.59, 6.32 and 6.94 from respective villages with overall average of 6.83. The literacy status in these villages varied considerably (Table 42). Most of the respondents in village Kastala and Atrada possessed high school qualification, while most of respondents in village Alipur and Khanpur were intermediate pass, with maximum in village Atrada and minimum in village Alipur.

Land and livestock holding: The averages for landless families in villages of Kastala, Atrada, Alipur and Khanpur were 21.74, 48.28, 26.83 and 28.57 per cent, respectively with overall percentage of 31.25. The average landholding of different respondents in respective villages was 10.97, 16.77, 16.45 and 20.10 bigha with an overall average of 16.42 bigha. The overall average number of animal owned by individual family was 4.87 and the averages for Kastala, Atrada, Alipur and Khanpur villages were 4.39, 5.21, 5.17 and 4.56, respectively.. Considering two young stocks equivalent to one adult, the net average number of llivestock owned by individual family was 3.59, 4.28, 4.26 and 3.67 from respective villages with an overall average of 3.98 animals.

Milk production and disposal pattern: The details of milk production and disposal are given in table 43. The average numbers of milking animals per family were 1.91 with maximum in village Khanpur and minimum in Kastala. The average daily milk production per family was 10.54 lt with maximum in Khanpur and minimum in Kastala. The average daily milk production (Lt/animal) was 5.95 with maximum in Khanpur and minimum in Kastala. The average daily milk consumption (Lt/family) was 4.56 with maximum in Khanpur and minimum in Atrada. The average quantity of daily milk sold (Lt/family) to different milk venders was 6.48 with maximum in Atrada and minimum in Kastala. Most of the farmers were not getting adequate sale price from the vendors for surplus milk.

Availability of feed and fodders: Farmers were offering green fodder, dry fodder and homemade concentrate feed to their animals regularly. Majority of farmers were using oil seed

Table 42: Literacy status of the farm families of different villages under survey

Name of Village	Literacy Status (%)						
	Illiterate	Read & Write	Fifth	Eighth	High School	Intermediate	Graduate
Kastala (n = 23)	8.70	13.04	4.35	8.70	34.78	26.09	4.35
Atrada (n = 29)	13.79	6.90	--	20.69	41.38	13.79	3.45
Alipur (n= 41)	17.07	4.88	--	14.63	17.07	31.71	14.63
Khanpur (n=35)	5.71	--	5.71	5.71	17.14	45.71	20.00
Overall (n=128)	11.72	5.47	2.34	12.50	25.78	30.47	11.72

Table 43: Description of milch animals, milk production and milk disposal pattern (average) in different villages from survey areas

Name of Village	No. of milch animals per family	Milk production (Lt)		Milk consumption per family (Lt)	Milk sale per family (Lt)
		per family	per milch animal		
Kastala	1.39	6.33	4.55	3.80	2.52
Atrada	1.79	11.41	6.42	3.29	8.19
Alipur	1.78	9.56	5.93	3.62	7.06
Khanpur	2.49	13.74	6.54	7.20	7.00
Overall	1.91	10.54	5.95	4.56	6.48

cakes and brans only for making concentrate mixture, and very few were adding wheat or other grains as energy source. Some farmers were using small quantity of commercial pelleted feed in addition to oil cakes and brans. For making concentrate mixture by farm families, the per cent use of different feed ingredients like oilseed cakes, brans, chunnis, wheat, feed pallets, cottonseed, barley and gram was 89.84, 84.38, 50.78, 29.69, 10.94, 4.69, 3.13 and 3.13, respectively. A few farmers were also using whole cottonseed for animal feeding.

As a routine, majority of farmers were providing green fodder and concentrate only once and dry fodder twice a day to their animals. Enough drinking water was offered twice or sometimes thrice a day to all animals. The daily average quantities offered (kg/animal) were 27.13, 4.23, 13.53 and 14.09 for green fodder; 2.79, 9.30, 5.18 and 6.89 for dry fodder; 1.53, 2.92, 2.17 and 8.82 for concentrate mixture in villages Kastala, Atrada, Alipur and Khanpur, respectively. The overall average daily offered quantity of different categories of feeds (kg/animal) was 13.61, 6.23 and 2.66 for green, dry fodder and concentrate, respectively. The use of dry fodder was highest in Atrada and lowest in Kastala and the use of green fodder was highest in Kastala and lowest in Atrada, whereas, use of concentrate was highest in Khanpur and lowest in Kastala.

Incidence of diseases: Different livestock diseases and health problems like ectoparasites, endoparasites, repeat breeding, FMD, retained placenta, anoesturous & diarrhoea, mastitis & milk fever, abortions, black quarter, HS and trypanosomiasis were reported by 59.38, 39.06, 36.72, 21.88, 9.38, 6.25, 3.91, 3.13, 2.34, 1.56 and 1.56 per cent farm families, respectively during last one year. Out of total 128 farm families, most of families reported sufferings of their animals with ectoparasites followed by endoparasites. In case of any disease most of the farmers (96.09%) contacted local "paravets" and 2.34% farmers approached quacks. Only 1.56% farmers accessed qualified veterinarian. The farmers were getting their animals regularly vaccinated and were well aware about the use of medicines for control of ecto and endo parasites. The detail of healthcare measure adopted by different farm families is given in table 44:

Few general questions were also asked from the farmers and it was revealed that 80.47% farmers had fair knowledge of fodder production but 25% farmers had shortage of land for fodder production and 7% farmers face shortage of quality seeds for fodder crops. Only 24% farmers provide salt to their animals regularly while 51% farmers offered salt sometimes and 25% farmers did not offer salt to their animals. Likewise, only 6% farmers fed mineral mixture to their animals regularly while

Table 44: Animal healthcare measures taken by different farm families

Name of Village	Health Care Measures (%) used by farm families		
	Vaccination	Ectoparasite Control	Endoparasites Control
Kastala (n = 23)	82.61	86.96	65.22
Atrada (n = 29)	93.10	100	93.10
Alipur (n= 41)	92.68	100	43.90
Khanpur (n=35)	97.14	97.14	71.43
Overall (n=128)	92.19	96.88	66.41

Table 45: Description of different dairy farms and the ingredients used for animal feeding, thereon.

S.No.	Owner/dairy	Village	No. of animals			Feed ingredients used
			Cow	Buffaloes	Total	
1.	Shri Satish, Chairman	Karnawal	20	30	50	Paddy Straw, Mally, Kutta
2.	Chauhan Dairy	Harra	-	300	300	Paddy Straw, Mally, Kutta chokar
3.	Akbar Chaudhary	Sardhana	20	380	400	-do-
4.	Munna Chaudhary	Sardhana	10	390	400	-do-
5.	Hazi Shameem	Sardhana	-	250	250	-do-
6.	Manoj Goswamy	Sardhana	5	25	30	-do-
7.	Hazi Naeem	Sardhana	-	250	250	Paddy Straw, Mally, Kutta Wheat flour

37% farmers offered mineral mixture sometimes and 57% farmers did not offer mineral mixture to their animals. More than 70% farmers opined that rearing of crossbred animals is costly affair and about 82% farmers informed that crossbred animals often fell ill. Almost 98% farmers desired to participate in training on livestock rearing to enhance their skills.

Evaluation of low cost feeding system prevailing in the vicinity of Meerut, its economics and interventions to increase farmer's profitability

A total of seven farms were surveyed in the Sardhana area for studying feeding system prevailing in the vicinity of Meerut (Table 45). These farms housed 1780 animals comprising of 55 cows and 1725 buffalos. Generally these animals are purchased at low cost. While procuring the animals, their breed, fertility or pregnancy status were generally not considered. Only good animals are used for breeding and more often animals are sold after milking is over. Calves are hardly used for milk letdown.

Most of the farms provide paddy straw as a sole fodder with other items like mally (jaggery processing waste), kutta (brewery waste) and choker, and rarely wheat flour to the animals. The quantity of feed ingredients offered daily was 5-8, 8, 5 and 2 kg for mailly, kutta, paddy straw and wheat bran, respectively for each animal at a respective cost of Rs. 400, 700, 300 and 1600 per quintal. The wheat flour was used for animal feeding occasionally at few farms. The feeds/fodders, often offered to animals in submerged condition. Green fodder, oilseed cakes, mineral mixture and common salt were not included in the animal ration at these farms. The feeding system appears suitable for buffalos as these found apparently in positive energy balance with BCS of 4.0-4.5, while crossbred cows found in negative energy balance with BCS of 3.5 or below. The farmers indicated average per litre milk production cost of Rs.28/- and average daily milk production (litre/day) by individual animal ranged 8-12 and 12-20 for buffalos and cows, respectively.

Consultancy Work (Military farms' feed sample analysis):

Feed analyses facilities are being extended to all the military farms on free of charge basis. Total of 948 samples of different feed ingredients from different military farms were analysed for different proximate principles during 2017-18 (Table 46). Highest number of samples were analysed for the MF Allahabad (138) followed by Secundrabad (134), Meerut (124), Ambala (123), Namkum (81), Bareilly (59), Agra (43), Jhansi (38), BRU Meerut (35), Jalandhar (34), and Mhow (27) etc. The average values of proximate parameters are given in the table 47. Few samples belonging to entrepreneurs/ traders were also analysed.

Table 46: Description of military farms' feed ingredient samples analysed during Apr 2017- Mar 2018.

S. No.	Name of Farm	Name of Feed Ingredient									
		Baled Hay	CS Cake	Dal Chunni	GN Cake	Guar Meal	Maize Whole	MO Cake	Soy DOC	Wheat Bran	TOTAL
1	BRU Meerut				10		6	7		12	35
2	MF Agra				3		18	5	1	16	43
3	MF Allahabad				6		16	22	3	91	138
4	MF Ambala		13		15		17	16	7	55	123
5	MF Bareilly				5		18	3	7	26	59
6	MF Binnaguri			2	1		3	3	3	3	15
7	MF Deolali		1				1	2		6	10
8	MF Dimapur				1		2	1	1	1	6
9	MF Gwalior				1		4	4		3	12
10	MF Jalandhar		1				2	1	1	29	34
11	MF Jhansi				1		12	10		15	38
12	MF Kanpur				1		5	3	1	6	16
13	MF Kargil				1						1
14	MF Lucknow				2			4		3	9
15	MF Meerut				3	3	20	33	3	62	124

S. No.	Name of Farm	Name of Feed Ingredient									
		Baled Hay	CS Cake	Dal Chunni	GN Cake	Guar Meal	Maize Whole	MO Cake	Soy DOC	Wheat Bran	TOTAL
16	MF Mhow				2		5	9	1	10	27
17	MF Namkum				8		23	11	7	32	81
18	MF Panagarh			2			2	3	1	2	10
19	MF Ranikhet				1		4	4	1	3	13
20	MF Sec'bad		16		3		39	23	1	52	134
21	MF Udhampur	4									4
22	MF Yol		2				3	4		7	16
	TOTAL	4	33	4	64	3	200	168	38	434	948

Table 47: Proximate composition Avg% on DM basis) of various military farms' feed ingredient samples analysed during the year 2017-18.

Parameters	Name of Feed Ingredient								
	Baled Hay	CS Cake	Dal Chunni	GN Cake	Guar Meal	Maize Whole	MO Cake	Soy DOC	Wheat Bran
	(n=4)	(n=33)	(n=4)	(n=63)	(n=3)	(n=200)	(n=168)	(n=38)	(n=435)
Moisture									
Mean	7.51	8.59	8.85	8.80	8.04	10.58	9.63	8.03	10.47
SE	0.15	0.12	0.10	0.09	0.25	0.04	0.05	0.15	0.03
Min	7.19	7.38	7.27	7.27	7.57	8.89	8.04	6.54	7.73
Max	7.89	10.48	10.25	10.56	8.44	11.87	10.98	10.89	11.94
CP									
Mean	5.03	23.80	46.72	46.60	44.95		37.13	47.87	15.27
SE	0.19	0.12	0.15	0.18	0.24		0.07	0.11	0.08
Min	4.55	21.53	44.08	38.24	44.63		35.53	46.55	14.00
Max	5.43	24.76	48.65	48.65	45.41		38.85	49.35	48.56
CF									
Mean	44.44	23.29	8.96	8.90	8.19		9.76	5.37	10.83
SE	2.02	0.19	0.11	0.09	0.10		0.05	0.08	0.03
Min	38.90	22.03	7.94	7.73	8.04		8.11	5.06	5.08
Max	47.63	25.72	10.87	10.87	8.39		11.16	6.71	12.48
EE									
Mean		5.97	5.82	5.77			9.09		
SE		0.08	0.09	0.09			0.03		
Min		5.03	5.08	5.08			8.13		
Max		6.73	7.23	8.26			10.92		
ASH									
Mean	10.35	6.01	8.12	8.02	7.45		8.55	6.37	4.86
SE	0.44	0.06	0.09	0.08	0.31		0.04	0.06	0.02
Min	9.06	5.16	7.03	6.62	6.84		7.16	5.39	4.07
Max	10.98	6.68	9.31	9.31	7.81		9.43	7.43	9.17
AIA									
Mean	8.12	1.35	1.65	1.61	1.39	1.75	1.73	1.37	0.49
SE	0.13	0.03	0.02	0.02	0.02	0.01	0.01	0.03	0.01
Min	7.74	1.06	1.38	1.26	1.37	1.28	1.28	1.07	0.27
Max	8.30	1.65	1.94	1.94	1.43	1.98	1.98	1.82	1.92

F. RESEARCH WORK AT FARMERS DOOR

The data were collected from 100 cattle owners of four districts namely Muzaffarnagar, Shamli, Ghaziabad and Meerut. The collected data were tabulated, statistically analyzed and the major findings are given below:

Constraints in adoption of improved cattle rearing practices as perceived by cattle owners

This study was carried out to identify the constraints perceived by cattle owners in adoption of improved cattle rearing, behaviour, attitude of cattle owners and disposal patterns of cattle by farmers.

The constraints in adoption of improved cattle rearing practices as perceived by cattle owners revealed that the major constraints of breeding practices in field conditions were ill equipped AI centre and negligible services at AI centre (MPS, 83.33), distant location of AI centre (MPS, 77.67), inadequate knowledge of AI services (MPS, 75.33), low genetic potential of local animals (MPS, 74.67), non-availability of improved sire in the village (MPS, 73.67), repeat breeding problems in dairy cattle (MPS, 72.33) and poor conception rate in cattle with AI practices (MPS, 70.67) in that order of ranking.

Regarding feeding practices the major constraints reported by the cattle owners were inadequate knowledge about proper feeding of dairy animals (MPS, 82.00), poor availability of high yielding variety seeds of fodder (MPS, 78.00), inadequate knowledge for cultivation of fodder crops round the year (MPS, 76.00), poor availability, high cost of concentrate feed and mineral mixture (MPS, 76.00), unwillingness in feeding balance ration (MPS, 76.00), poor irrigation facilities for growing green fodder (MPS, 74.00) and lack of credit facilities for purchase of cattle feed and mineral mixture (MPS, 72.67).

Regarding health care and management practices the major constraints reported by the cattle owners were lack of veterinary hospital and health care centre in/around village (MPS, 76.67), high cost of veterinary medicines (MPS, 75.67), lack of knowledge about cattle disease and their control (MPS, 75.33), poor knowledge about clean milk production & scientific method of milking (MPS, 75.33), lack of awareness & knowledge about importance of vaccination (MPS, 75.00), difficulty in maintaining records due to illiteracy (MPS, 72.00) and poor housing to dairy animals (MPS, 72.00).

The findings revealed that the major miscellaneous constraints perceived by cattle owners in adoption of improved cattle rearing practices were lack of dairy cooperative societies (MPS, 77.33), lack of loan facilities and high rate of interest (MPS, 75.67), high production cost of milk (MPS, 75.67), lack of trained rural youth in villages (MPS, 75.33), lack of knowledge regarding dairy innovations (MPS, 75.00), lack of knowledge in making value added dairy products (MPS, 73.67), lack of information about government programme and facilities provided for cattle keepers (MPS, 73.67), lack of educational programme on cattle rearing (MPS, 73.33).

Disposal patterns of cattle by farmers

The analysis of collected data regarding disposal patterns of cattle by livestock owners revealed that the disposal by culling are divided into two groups one is disposal of animals before the age at first calving and reasons were breeding problems (MPS, 73.67), health problems (MPS, 66.33) and poor growth (MPS, 54.33) and second is disposal of cows after the age at first calving and reasons were breeding problems (Silent heat, repeat breeding, ovarian cysts) (MPS, 84.67), low milk yields (MPS, 73.33), teat and udder disorders (MPS, 72.00).

The analysis of collected data on mortality pattern revealed that the major causes of mortality were parasitic and infectious diseases (MPS, 74.33), poor management practices (MPS, 68.33) and poor climate conditions (MPS, 59.67). The disposal of unused animals by cattle owners in field condition were done through sale of animals (MPS, 87.67), left the animals at gaushala (MPS, 75.00), left the animals outside as stray (MPS, 74.00), given to slaughter house (MPS, 60.33) and animals remains with farmers up to death (MPS, 60.00). Further, the dead animals were disposed by burying in soil (MPS, 95.67), burying in garbage (MPS, 43.67) and thrown away (MPS, 39.67).

Adoption of improved cattle rearing practices

The analysis of the data regarding adoption of improved breeding practices showed that the rank of the breeding statements were first for keeping important indigenous breeds of cow for higher milk (MPS, 85.67), second for practicing artificial insemination (A.I.) in animal at proper time of heat (MPS, 77.33) and practicing the cow served within 60-90 days after calving (MPS, 77.33) and third for

keeping watch on estrus cycle and heat symptoms of cows (MPS, 77.00).

The important priorities of farmers for adoption of improved feeding practices were feeding colostrum to newly born calves within 2-4 hrs of birth (MPS, 84.33), feeding concentrate mixture on the basis of milk production (MPS, 77.00), application of fertilizer in raising fodder crops (MPS, 77.00) and providing green fodder to animals around the year (MPS, 73.67).

The analysis of data regarding adoption of improved health care practices showed that the first priority is practicing vaccinations timely and regularly against the contagious diseases like HS, FMD, BQ (black quarter) (MPS, 79.67), second for segregating the diseased animals suffering from contagious diseases (MPS, 77.33), third for practicing ecto-parasitic drugs or other drugs for the prevention and control of ticks and mites (MPS, 76.33) and fourth for practicing treatment of sick, repeat breeding and anestrous animal cases by veterinarian (MPS, 76.00).

The analysis of data regarding adoption of improved management practices revealed that the rank of management statements were first for providing clean and fresh water for drinking to animals (MPS, 81.33), second for maintaining cleanliness of animal shed/houses (MPS, 78.67), third for practicing full hand method of milking the animals i.e. without the use of thumb for milking the animals (MPS, 77.33).

Attitude of cattle owners towards improved cattle rearing practices

The findings of attitude of cattle owners towards improved cattle rearing practices revealed that majority of cattle owners were agree with the statements like AI is a good breeding practices (Mean Per cent Score, 91.40), through scientific feeding milk yield of dairy animals can be increased (MPS, 86.80), I look forward to adopt scientific dairy practices (MPS, 85.40), milch animals in dry period can be neglected with respect to their feeding (MPS, 84.00) and it is good to keeping animals loose in an enclosure (MPS, 83.00). The above statements show the positive attitude of cattle owners towards improved cattle rearing practices. The cattle owners disagree with the negative statements like vaccination against FMD and HS in milch animal is not regularly needed (MPS, 39.00), vaccination of animals is ineffective exercise (MPS, 40.60) and deworming is not necessary for healthy calves (MPS, 42.80).

III. Inter-Institutional Programmes

Genetic variation of bovine kisspeptin and neuropeptide Y genes among indigenous cattle breeds and its impact on certain reproductive parameters

Kisspeptin (KISS1), a neuropeptide that acts upstream of gonadotropin-releasing hormone (GnRH) neurons, is critical for maturation and function of the reproductive axis. It is known that kisspeptin, acting centrally via kisspeptin receptor, stimulates secretion of gonadotrophin releasing hormone (GnRH). Loss of kisspeptin signaling causes hypogonadotropic hypogonadism in mammals. Kisspeptin interacts with other neuropeptides such as neurokinin B and dynorphin, to regulate GnRH pulse generation. In addition, research evidences suggest that kisspeptin signaling be regulated by nutritional status and stress. Kisspeptin may also represent a novel potential therapeutic target in the treatment of fertility disorders. Thus, Kisspeptin is considered as a regulator of puberty onset and also for the maintenance of normal reproductive function.The objective of this study is to elucidate the genetic variation of bovine kisspeptin and neuropeptide Y genes among Kankrej and Gir breeds and its impact on certain reproductive parameters. Exon 2 of kisspeptin gene comprising of 308 bp fragment was amplified in Kankrej and Gir cattle and further digested with Hae III restriction enzyme. Genotyping was carried out by PCR-RFLP in a total of 82 indigenous cattle comprising of 36 Gir and 46 Kankrej animals (Fig 29). Only two genotypes viz., TC and CC were observed with the frequencies of 87.80% and 12.20%, respectively (Table 48). The overall frequencies of alleles T and C alleles were 43.90 and 56.10, respectively.

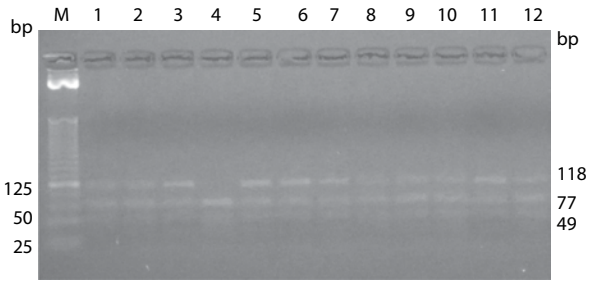


Fig 29: Genotyping of kisspeptin gene (Exon-2). Lane 1-3 and 5-12: TC; Lane 4: CC; M: DNA molecular weight marker

Table 48: Genotype and allele frequencies of T<C mutation at exon 2 region of kisspeptin gene among different breeds

	Genotype frequencies			Allele frequencies	
	TT	TC	CC	T	C
Kankrej	-	0.87(40)	0.13(6)	0.43	0.57
Gir	-	0.89(32)	0.11(4)	0.44	0.56
Total	-	0.88(72)	0.12(10)	0.44	0.56

IV. EXTERNALLY FUNDED PROGRAMMES

Cataloguing of miRNA transcripts during thermal stress and their crosstalk with heat shock protein 70 mRNA in cattle

Changes and differential expression of miRNA in Frieswal (Holstein Friesian x Sahiwal) crossbred dairy cattle which are distinctly adapted to environmental temperature stress were investigated. The results indicated that there was a significant variation in the physiological and biochemical indicators estimated under summer heat stress. Further stress response was characterized by identification of stress granules during heat stress. The differential expression of miRNA was observed under summer heat stress when compared to the normal winter season within each group of experimental animals (Fig 30-32). Out of total 420 miRNAs, 65 were differentially expressed during peak summer. Most of these miRNA were found to target heat shock responsive genes especially members of heat shock protein (HSP) family and network analysis revealed most of them having stress-mediated effects on signalling mechanisms. Being superior in their expression profile during peak summer, bta-miR-2898 was chosen for reporter assay to identify its effect on the target HSPB8 gene in stressed bovine PBMC cell cultured model.

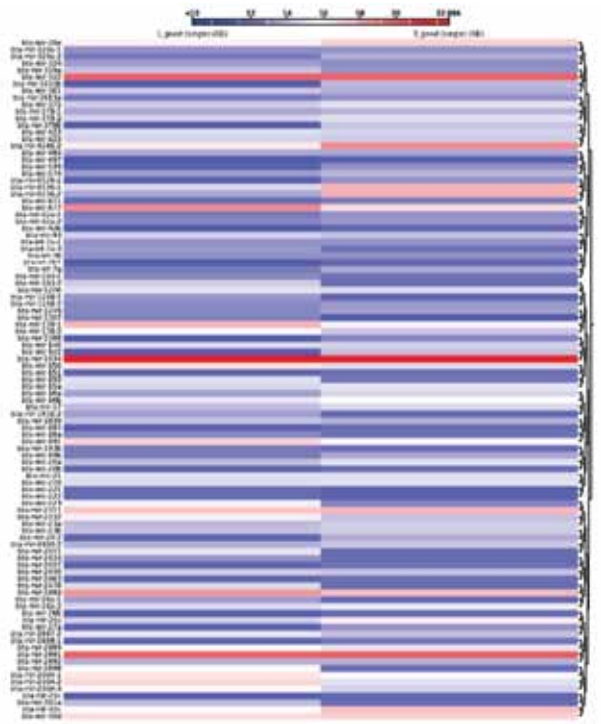


Fig 30: Heat map and the result of clustering to all MicroRNA detected. There are two specific groups. Column 1 represents normal groups and Column 3 represents heat stressed groups

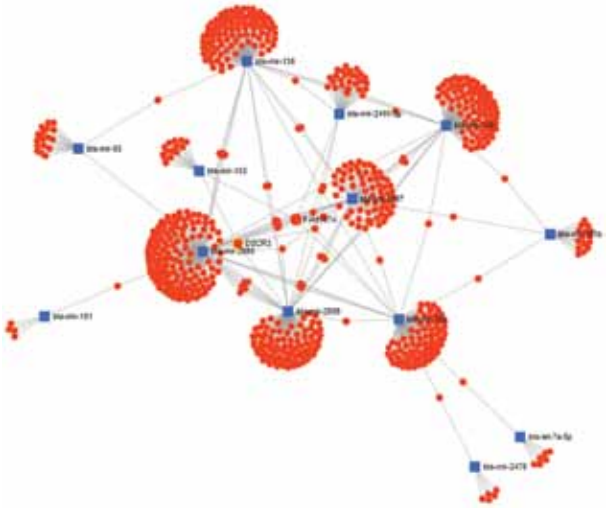
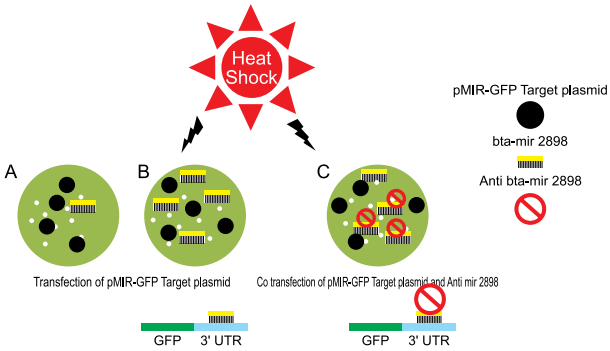


Fig 31: Interaction among different selected miRNAs with their predicted targets. Blue rectangular box: miRNAs and Orange circles: target genes



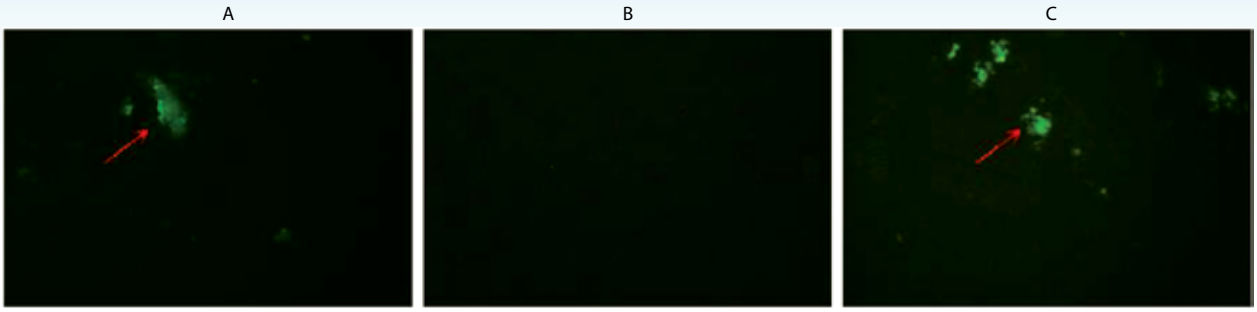


Fig 32: pMIR –GFP Reporter assay in bovine PBMC (heat shocked) for analysis the expression of GFP after cloning of bta-mir 2898 target region of bovine HSP gene at 3'UTR region. Upper panel depicted the experimental design and lower panel showed the level of GFP expression in different groups. A: Non heat shock group and transfected with pMIR –GFP Target construct; B: Heat shock group and transfected with pMIR –GFP Target construct; C: Heat shock group and co- transfected with pMIR –GFP Target construct and anti bta –mir 2898.

Dynamics of circulatory microRNA profile among motile and impaired bull spermatozoa: A novel approach to discover biomarkers

A study was designed to find out differentially expressed proteins in categorized crossbred (Holstein Friesian X Sahiwal) bull semen to serve as potential biomarkers for male infertility. Frozen crossbred bull semen with satisfactory phenotypic records were defined as "good" and "poor" based on their conception rates. A total of 1547 proteins were detected in bull spermatozoa using liquid chromatography–mass spectrometer (LC-MS/MS) analysis (Fig 33). Results revealed that 558 (36.1%) and 653 (42.2%) proteins were expressed in good and poor quality bull spermatozoa, respectively (Fig 34). Nearly 336 proteins (21.7%) were unique for both good and poor quality bull semen and among the common proteins, 224 (66.7%) and 112 (33.3%) were up and down regulated in good and poor quality categorized bull semen, respectively. GO analysis of global proteomes identified different signaling pathways and most of them were related to cellular motility, immune systems as well as cellular metabolisms (Fig 35). The distinctive presence of some of the proteins may provide insight into the molecular mechanistic role played by these proteins in crossbred bull infertility.

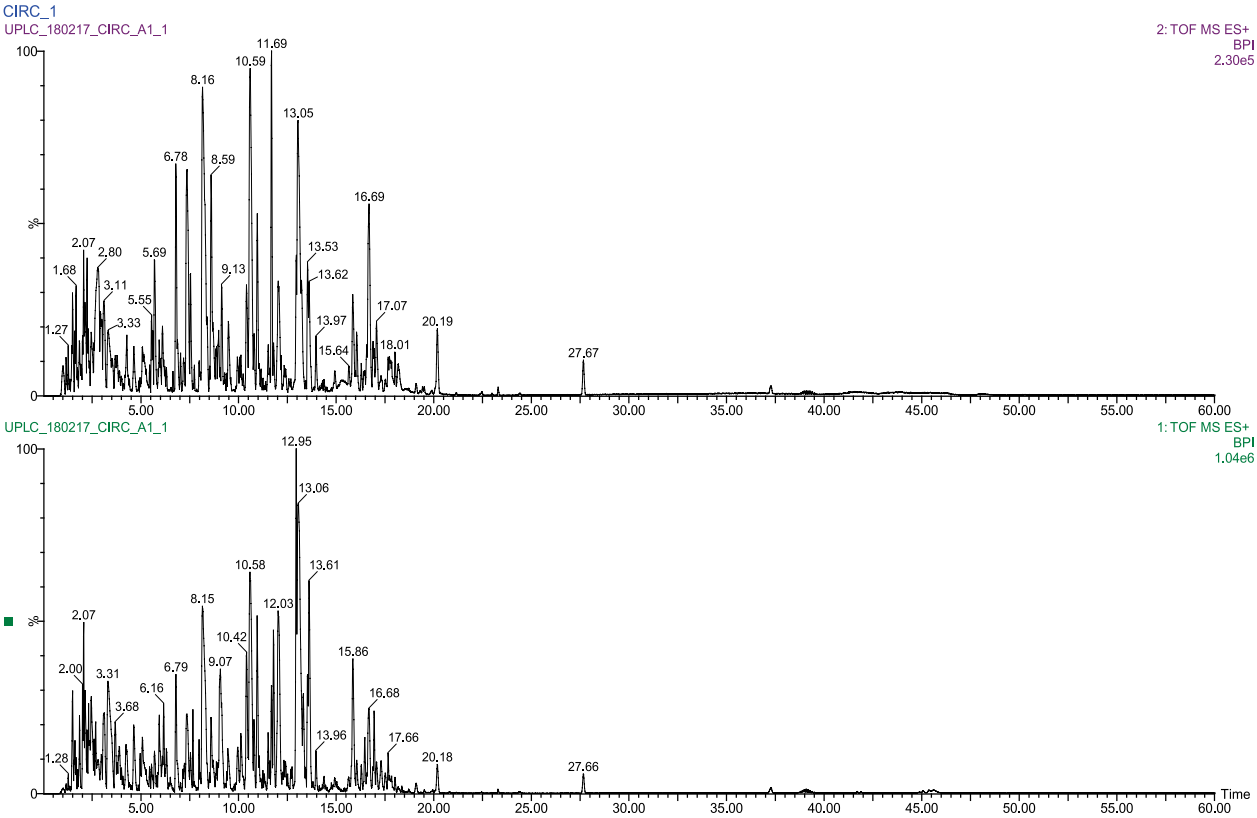


Fig 33: Representative LCMS-IT-TOF total ion chromatogram (TIC) of the identified proteins. X axis indicate relative intensity while Y axis indicates mass number/charge number

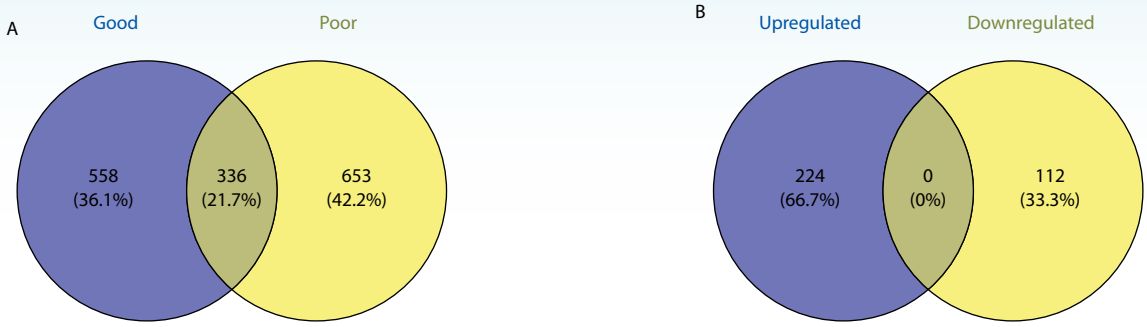


Fig 34: Distribution of proteins identified in good and low quality crossbred bull spermatozoa (A) and percentage of up or down regulated common proteins in good and poor quality samples

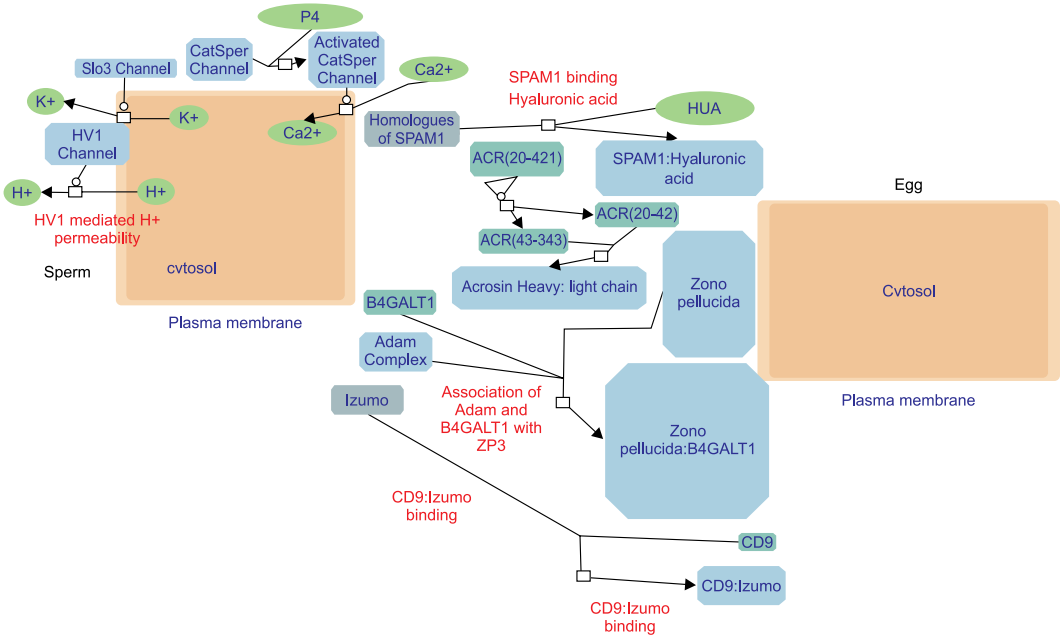


Fig 35: Different proteins and factors involved in sperm fertility and motility

Livelihood improvement through sustainable dairy farming using suitable interventions- (Farmer FIRST Programme of ICAR)

Reproductive management of dairy animals

Four infertility and animal health camps were organized in the adopted villages i.e. Chhabaria, Jhitkari and Chandana. A total of 148 animals belonging to 112 farmers were examined and diagnosed for various ailments. The animals were presented with various complaints like infertility, mastitis, indigestion, bloat, fever, tick infestation, skin infection, worm infestation, weakness, reduced milk yield, otitis, wound etc and were treated accordingly (Fig. 36). The farmers were given knowledge about the basic and advanced fundamentals of scientific animal rearing.

Therapeutic and Preventive Strategies for Mastitis control in Dairy Animals

Apparently healthy lactating animals (110) were screened for sub-clinical mastitis (SCM) with California mastitis test. The overall prevalence of SCM in lactating cows was 41.81%. The highest prevalence of SCM was 54.34% in cow's aged above 7 years. In terms of parity, the prevalence of SCM was higher in cows of above second parity (58.82%). The prevalence of SCM was highest (55.26%) in cows having more than 10 litres of milk production. Quarter-wise prevalence of SCM was 41.81 % in Left Front (LF), 43.63% in Left Hind (LH), 34.54% in Right Front (RF), and 52.72% in Right Hind quarters. Farmers (112) in adopted villages were trained to diagnose mastitis in subclinical stage

Fig. 36. Reproductive management of dairy animals in field camps

CMT paddle and SLS reagent

Stripping of milk in CMT paddle

Distribution of Mastitis Diagnostic kit to farmer

Mixing of SLS reagent and milk in CMT paddle

Gel formation in subclinical mastitis

Fig. 37. Training of dairy farmer for diagnosis of mastitis by CMT

with the help of California Mastitis Test (CMT) and Bromo-Thymol Blue (BTB) card test and awareness was created among farmers to use these cow side tests for prevention of mastitis. Farmers were also trained to use teat dips (Betadine + Glycerine) after every milking for prevention of mastitis in dairy animals. Farmers in each village having more than 10 animals were distributed teat dipping cups and mastitis diagnostic CMT kit (Fig. 37).

Integrated Farming System

Awareness programmes were conducted for the farmers of adopted villages for effective management of crop residues, farm waste and dung of livestock through vermi-composting. Around 28 farmers were demonstrated vermi-composting technology and one vermi-composting unit was established in each selected village. Integration of vegetable, pulses, flower production along with quality wheat and sugarcane seeds was done on 28 farmer's field. It included technical interventions related to vegetable (lady finger, ridged gourd, bottle guard, etc.) and pulses (mung etc.) crops. Twenty five farmers from selected villages were given demonstration and training of value addition of milk and milk products at NDRI, Karnal (Fig. 38).

Fig. 38. Farmers visit to NDRI, Karnal

Training of farmers

Two training programmes were organized for the farmers of adopted villages on "Scientific dairy farming" during 14-16th June 2017 and 28-30th November 2017 with the view to provide scientific knowledge to the farmers. During the training

programme, Animal health camps, Kisan Goshthi, demonstrations and Kisan-Vaigyanik samagam were organized (Fig. 39A). Folder/leaflets and training manual having scientific knowledge about dairy farming in hindi were distributed to the farmers. Farmer- scientist interface meeting was organized on 09-01-2018 and seed distribution of late sowing wheat variety was also done to 63 farmers (Fig. 39B). Prepared Facebook account with the name FFP-CIRC in which the activities carried out were uploaded. We also prepared a WhatsApp group directly linking farmers with the scientist.

Fig. 39A. A view of training cum Kisan Goshti at ICAR-CIRC

Fig. 39B. Seed distribution to farmers

Water budgeting and enhancing water productivity in livestock based farming system (CRP on water, ICAR, New Delhi)

Water productivity of milk in indigenous cows

The details of water budgeting at an indigenous cattle farm in village Panchli were recorded. Different breeds of Indigenous cattle viz., Sahiwal, Kankrej, Gir, Tharparkar, Hariana and Rathi are being maintained at this farm (Fig. 40). Average daily water consumption was 13616 litres at this farm (28 milch cows and their followers). Average water productivity of milk in indigenous cows was 89.20 litres.

Water budgeting in livestock systems in rural area

In order to assess the water budgeting in livestock system in rural area, the present study was conducted in Jhitkari, Rasoolpur and Rajhad villages of western Uttar Pradesh. Water meters (magnetic) were installed for recording of observations on water usage in three families at various locations in two different villages. Average number of cattle per family was 0.65, where 80% of families were mainly rearing crossbred cattle. Buffalo rearing is a common practice, where 85% families were keeping buffaloes. Submersible and handpumps were being used by 53 and 23.5% families, respectively however, remaining households used tubewell along with handpumps.

Fig 41 depicts water usage pattern in a household under rural area during different months. Drinking water was offered twice in a day, however, animals were washed daily twice in summer and once in winter season. A significant variation was observed in water utilization pattern for these activities depending on the source of water. On an average, 160 and 460 litres of water was utilized for washing of an animal / day using bucket and directly through hosepipe connected to submersible pump system, respectively. Waste water outlet was through general drainage and no family was found to reuse the waste water for agriculture or any other purpose. Total water consumption varied 94 to 134 and 125 to 438 L / ALU / day, respectively during winter and summer season in a small herd of cattle and buffalo.

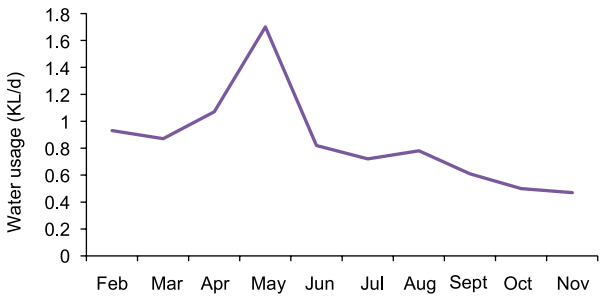


Fig. 41. Water usage pattern in a household (6 ALU) during different months

V. TECHNOLOGY/ METHODOLOGY/CONCEPTS

Patent filed

1. **Identification of functional internal ribosomal entry sites (IRES) at bovine heat shock protein 90.** A putative IRES was identified in bovine heat shock protein gene for the first time, which was showed to be functional. The identified bovine heat shock protein IRES was used to develop an artificial expression cassettes for simultaneous translation of two gene from a same reading frame. An Indian patent has been filed with application number 201711042562 dated 28/11/2017.

Inventors: Rajib Deb, Umesh Singh, Gyanendra Singh Sengar, Basavraj Sajjanar (NIASM, Baramati), Sushil Kumar, Saugata Hazra (IIT-Roorkee, UK), Rani Alex, T V Raja, Rafeeque Rahman Alyethodi, Ashish Kumar, A K Das, B Prakash

VI. EXTENSION ACTIVITIES

Institute celebrated World Environment Day on 5th June 2017 with the theme "Connecting People to Nature". The celebration began with a massive plantation drive in the campus. All the staff members including RA/SRF/YP participated in this event. Prof. S.V.S. Rana, Ex-Vice Chancellor, Bundelkhand University, Jhansi, Uttar Pradesh & Emeritus Professor, CSIR, Department of Zoology, CCS University, Meerut graced the occasion as chief guest. Dr. B. Prakash, Director, ICAR-CIRC welcomed the chief guest and explained the current year theme of world environment day. During his address, he narrated that India is a big heritage of plant and animal biodiversity and each citizen have the equal responsibility to save our ecosystem. The chief guest delivered a key note lecture on environmental issues with the highlights of journey of Earth Day to World Environment Day. He emphasized that the country with rich ecology will automatically become rich. The programme came to an end with the vote of thanks given by Dr. Rajendra Prasad, PS. Dr. Ravinder Kumar and Dr. Naresh Prasad coordinated the programme.

Plantation drive at institute campus during the World Environment Day -2017

Prof. S.V.S. Rana, Ex Vice Chancellor, Bundelkhand University, Jhansi addressing during World Environment Day celebration- 2017

Workshop organised

ICAR-CIRC, Meerut organized one day workshop on "Unnat Pashupalan" in collaboration with Kwality Ltd., New Delhi on 7th July, 2017. About 200 progressive farmers participated in the programme. During the workshop, various aspects of dairy cattle production like total mixed ration (TMR) and role of micro-nutrients in milk

Farmers workshop cum Gosthi on Unnat Pashupalan

production, reproduction management in high yielding cows, calf management practices for superior heifer, housing management for high yielding cows, clean milk production, animal welfare issues, animal health monitoring issues under field conditions were discussed. Beside this, the farmers were introduced with the salient features of Kisan Kalyan Pashudhan Yojana for utilizing its benefits. Further, the role of CIRC on improving the cattle productivity was also discussed.

Participation in Kisan Mela/Exhibition

ICAR-CIRC participated in Kisan Kalyan Mela-2017 organized jointly by Ministry of Agriculture and Farmers Welfare, Government of India and Department of Agriculture, Government of Bihar in Champaran district (Motihari), Bihar from 15th to 19th April 2017 and demonstrated cattle production related technologies. About 450 farmers visited our exhibition stall. Dr. Ravinder Kumar, Senior Scientist delivered a talk on commercialization of dairy farming for enhancement of farmer's income.

ICAR-CIRC participated in Kisan Kalyan Mela-2017

ICAR-CIRC participated in Agricultural Exhibition organized by ICAR from 22nd to 25th September 2017 at Pandit Deendayal Upadhayay Dham, Mathura to display the technologies related to cattle production. About 300 farmers and stakeholders visited our institute stall.

Participation in Agricultural Exhibition at Pt. Deendayal Upadhayay Dham, Mathura (UP)

A training programme entitled "सफल गर्भाधन हेतु हिमीकृत वीर्य का वैज्ञानिक रखरखाव एवं प्रयोग" तथा "डेरी पशुओं में बांझपन नियंत्रण" पर प्रशिक्षण कार्यक्रम" was organized on 27th October 2017. About 50 inseminators participated in the training programme. During the programme, three topics viz., handling of frozen cattle semen by Dr S. Tyagi, Principal Scientist, infertility in dairy animals by Dr Suresh Kumar, Principal Scientist, least cost ration for dairy animals by Dr. Rajendra Prasad, Principal Scientist were discussed in detail.

सफल गर्भाधन हेतु हिमीकृत वीर्य का वैज्ञानिक रखरखाव व प्रयोग एवं डेरी पशुओं में बांझपन नियंत्रण पर प्रशिक्षण कार्यक्रम 27 अक्टूबर, 2017

The ICAR-CIRC Meerut participated in All India Farmers Fair and Agri-Industrial Exhibition-2017 at Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut from 7th to 9th October, 2017. More than 500 farmers and stakeholders visited the Institute stall. The dairy farmers were enlightened on various aspects of cattle reproduction (Anestrous, repeat breeding, metritis and utero-vaginal prolapse), feeding, health care and management practices to overcome the problems faced by them.

CIRC exhibition stall in All India Farmers Fair and Agri-Industrial Exhibition-2017 at SVPUA&T, Modipuram, Meerut

ICAR-CIRC participated in India International Trade Fair-2017 at Pragati Maidan, New Delhi held from 14th to 27th November 2017. About 2500 farmers and stakeholders visited the exhibition stall and gained knowledge on scientific dairy farming.

Exhibition stall during India International Trade Fair-2017 at New Delhi

केन्द्रीय गोवंश अनुसंधान संस्थान, मेरठ के द्वारा एक दिवसीय कार्यक्रम "An Interactive meet of Scientists with Dairy Farmers to enhance cattle productivity" पर दिनांक 15 दिसंबर, 2017, संस्थान के परिसर मे आयोजित किया गया। जिसमे संस्थान से जुड़ें हुए लगभग 45 उन्नतिशील डेरी किसानों ने भाग लिया। इस दौरान किसानों को पशु नस्ल सुधार, संतुलित खान–पान, पशु स्वास्थ्य एवं बांझपन की समस्या, उच्च गुणवत्ता युक्त हिमीकृत वीर्य का उपयोग तथा डेरी व्यवसाय का व्यवसायीकरण विषयों पर चर्चा की गई। कार्यक्रम के दौरान संस्थान के निदेशक डॉ. ब्रह्म प्रकाश ने संस्थान के कार्यों व भविष्य की योजनाओं पर प्रकाश डाला। डॉ. राजेन्द्र प्रसाद, डॉ एस. त्यागी, डॉ. सुरेश कुमार, डॉ उमेश सिंह एवं डॉ. नरेश प्रसाद आदि का कार्यक्रम को सफल बनाने मे विशेष योगदान रहा। कार्यक्रम के अंत मे डॉ. रविन्द्र कुमार ने सभी को धन्यवाद ज्ञापित किया।

दिनांक 17 मार्च, 2018 को भारतीय कृषि अनुसंधान परिषद् के केंद्रीय गोवंश अनुसंधान संस्थान, मेरठ छावनी के

Interactive meet of Scientists with dairy Farmers to enhance cattle productivity at ICAR-CIRC Campus held on 15th December 2017

तत्वाधान में "किसान–वैज्ञानिक संवाद तथा माननीय प्रधानमंत्री जी के भाषण का सीधा वेब प्रसारण" कार्यक्रम का आयोजन किया गया। इसमें कृषि उन्नति मेला का उद्घाटन व पंडित दीनदयाल उपाध्याय कृषि विज्ञान केन्द्रों (KVK) पर सीधा प्रसारण के माध्यम से लगभग 7 लाख प्रगतिशील किसानों, कृषि वैज्ञानिकों, कुलपतियों व भारतीय कृषि अनुसंधान परिषद के सभी संस्थानों/निदेशालयों/ब्यूरों के निदेशकों को संबोधित किया। इसमें मेरठ जिला से लगभग 310 प्रगतिशील किसानों, वैज्ञानिकों व विद्यार्थियों ने बढ़–चढ़ कर भाग लिया। संस्थान के निदेशक डॉ राजेंद्र प्रसाद जी ने अध्यक्ष महोदय डॉ ब्रहम प्रकाश जी पूर्व निदेशक का स्वागत किया एवं संस्थान की विभिन्न गतिविधियों के बारे में बताया। मंच का संचालन डॉ रवीन्द्र कुमार जी ने किया। इस कार्यक्रम में माननीय श्री सत्यप्रकाश अग्रवाल जी विधायक मेरठ कैंट, श्री सत्यवीर त्यागी जी विधायक किठोर, श्री जितेंद्र सत्वई जी विधायक सिवालखास, 13 ग्राम प्रधान व अन्य गणमान्य व्यक्ति भी उपस्थित रहे। इस दौरान किसान–वैज्ञानिक संबाद कार्यक्रम का भी आयोजन किया गया। माननीय प्रधानमंत्री जी ने निम्नलिखित बिन्दुओं पर प्रकाश डाला व कृषि उन्नति मेला में 25 के॰वी॰के॰ (KVK) का शिलान्यास, कृषि व्यवसायिकरण, जैविक खेती, सौर ऊर्जा पर ज़ोर दिया। डॉ विनोद कुमार, डॉ सुरेश कुमार, डॉ महेश कुमार, डॉ ए॰ के॰ दास, डॉ ए॰ एस॰ सिरोही, डॉ नरेश प्रसाद, श्री राजीव वर्मा, श्री सुनील कुमार शर्मा व अन्य सदस्यों ने कार्यक्रम को सफल बनाने में भरपूर योगदान दिया।

केंद्रीय गोवंश अनुसंधान संस्थान, मेरठ छावनी के तत्वाधान में किसान–वैज्ञानिक संवाद तथा माननीय प्रधानमंत्री जी के भाषण का सीधा वेब प्रसारण कार्यक्रम

HUMAN RESOURCE DEVELOPMENT

Trainings attended

S. No.	Name	Name of training	Venue & Date	Imparting institute
1	Dr R R Alyathodi, Scientist	Microfluidics and Micro fabrication	Bangaluru May 25-Jun 24, 2017	C-CAMP Bangaluru
2	Dr A S Sirohi, Sr Scientist	Analysis of Experimental Data	Hyderabad Aug 3-9, 2017	NAARM Hyderabad
3	Dr A K Das, Pr. Scientist	Application of Bioinformatics in Agricultural Research and Education	Hyderabad Sep 14-23, 2017	NAARM Hyderabad
4	Dr Rani Alex, Scientist	Animal Breeding Data Analysis and Genomic Prediction	Hissar Oct 20-24, 2017	CIRB Hisar
5	Shri Suresh Chand, TO	ICAR-ERP for ICAR Technical Personnel	New Delhi Jul 17-22, 2017	IASRI New Delhi
6	Shri S K Sharma, TO	Computer Applications- design and Development of Website/portal	New Delhi Sep 22-27, 2017	IASRI New Delhi
7	Shri Omkar Singh, TO	Farm Management	Meerut Oct 24-28, 2017	IIFSR Meerut
8	Shri Rajnish Kumar, JAO	Implementation of NIC's e-procurement solution through CPP portal	Meerut Jun 15-16, 2017	IIFSR Meerut
9	Shri N S Saini, Asstt.	Implementation of NIC's e-procurement solution through CPP portal	Meerut Jun 15-16, 2017	IIFSR Meerut
10	Shri Vikas Kumar, UDC	Implementation of NIC's e-procurement solution through CPP portal	Meerut Jun 15-16, 2017	IIFSR Meerut
11	Shri A K Sharma, AAO	OSP on General Finance Rules 2017	New Delhi Jul 19-21, 2017	ISTM New Delhi
12	Shri A K Sharma, AAO	MDP on Public Procurement	Faridabad Sep 11-16, 2017	NIFM Faridabad
13	Shri Shankar Kashyap, Stenographer	Enhancing efficiency and behavioural skills	Hyderabad Oct 25-31, 2017	NAARM Hyderabad

Inauguration of training workshop on "Basic computer operation and soft skills" for the Skilled Support Staff by the Director CIRC, Meerut

Trainings organized

Sr. No.	Name of the training	Venue and Date	Course Director/ Organizing Secretary
1	ICAR-Winter School "Omic Technologies and Modern Breeding Approaches for Conservation and Productivity Enhancement of indigenous Cattle Resources"	ICAR-CIRC, Meerut, November 01-21, 2017	Dr. Umesh Singh
2	MANAGE sponsored Certified Livestock Advisor Programme on Scientific cattle management for profitable and sustainable dairying venture	ICAR- CIRC, Meerut February 14-28, 2018	Dr. S. Tyagi
3	वैज्ञानिक तकनीकों द्वारा किसानों की आय दोगुनी करने हेतु एक पहल Farmer-First Programme	Jhitkari, Chhabadia and Chandna Villages, June 14-16, 2017	Dr. Suresh Kumar
4	कृषक आजीविका में सुधार हेतु डेरी पशुओं का वैज्ञानिक प्रबंधन Farmer-First Programme	Jhitkari, Chhabadia and Chandna Villages, November 28-30, 2017	Dr. Suresh Kumar
5	"सफल गर्भाधन हेतु हिमीकृत वीर्य का वैज्ञानिक रखरखाव एवं प्रयोग" तथा "डेरी पशुओं में बांझपन नियंत्रण" पर प्रशिक्षण कार्यक्रम"	ICAR-CIRC, Meerut October 27, 2017	Dr. Ravinder Kumar

INSTITUTE TECHNOLOGY MANAGEMENT UNIT (ITMU)

During the year 2017-18, Institute Technology Management Unit (ITMU) arranged Institute Technology Management Committee meetings to discuss the issues related with patents to be filed and other routine work under the chairmanship of Dr. B. Prakash, Director, CIRC, Meerut. Lectures on IPR issues were also delivered in various short term and 21 days ICAR sponsored winter school training programmes. The nodal officer of institute participated in Zonal Technology management Unit meeting at NDRI, Karnal and presented status report of ITMU, CIRC

Students, farmers and other para-vet visiting the institute were given latest technology information developed by the institute and other ICAR institutes for livestock sector. ITMU facilitated the scientists in prior art search and patent registration and application filing at patent office. During the year one patent entitled "Identification of Internal Ribosomal entry site at bovine heat shock protein 90AA1" was filed. Two complete specifications and three early examination requests were also filed with patent office.

RIGHT TO INFORMATION ACT 2005

दिनांक 01.04.2017 से 31.03.2018 तक की अवधि की जनसूचना अधिकार अधिनियम-2005 के अंतर्गत ऑनलाइन/ऑफलाइन मॉगी गई सूचना का विवरण निम्नलिखित है:-

क. सं.	कुल प्राप्त ऑनलाइन/ ऑफलाइन मॉगी गई आर.टी.आई. सूचना	कुल प्राप्त ऑनलाइन मॉगी गई आर. टी.आई. सूचना	कुल प्राप्त भा.कृ. अ.प., नई दिल्ली के माध्यम से मॉगी गई ऑफलाइन आर.टी.आई. सूचना	कितनों के जवाब दिए गए	संस्थान में प्राप्त ऑफलाइन आर.टी. आई. की आई.पी.ओ. के रूप में जमा फीस	कुल प्राप्त भा.कृ.अ.प., नई दिल्ली को भेजी गई ऑनलाइन/ऑफलाइन मॉगी गई आर.टी.आई. सूचना की फीस
1	16	04	12	16	रू. 10.00 (आर.टी.आई. क.सं. 4 से 8 तक एवं 19)	रू. 150.00

Research Projects

The following research projects were in operation during the year 2017-18

Project type	Sl. No.	Project title	Project ID (PIMS)	Period	PI	Co-PIs
AICRP on Cattle	1	Studies on genetic aspects of Holstein Sahiwal crossbreds (Frieswal Project)	AGB/AICRP/IXX04334/ SK (1/1/1987 31/3/2020)	(1/1/1987 To 31/3/2020)	Dr SUSHIL KUMAR	1. Dr S. Tyagi 2. Dr Rajib Deb 3. Dr A.S. Sirohi 4. Dr Rani Alex 5. Dr N. Chand 6. Dr R. Prasad (Co-Opted)
	2	Genetic studies on the performance of important indigenous breeds and their improvement through selection (IBP)	AGB/AICRP/IXX04335/ US(4/1/2011-30/3/2020)	(4/1/2011 To 30/3/2020)	Dr UMESH SINGH	1. Dr T.V. Raja 2. Dr R. Alyethodi
	3	Field recording of performance data for undertaking large scale progeny testing(FPT)	AGB/AICRP/IXX04379/ AKD(1/7/1992-31/3/2020)	(1/7/1992 To 31/3/2020	Dr ACHINTYA KUMAR DAS	1. Dr R. Kumar 2. Dr S.K. Rathee
Institu-tional	4	Baseline survey on cattle to multiply superior germplasm in field conditions for enhanced milk prodcutivity	AGB/IP/IXX11097/ RK/(1/10/2014-31/03/2018)	(1/10/2014 To 31/3/2018)	Dr RAVINDER KUMAR	1. Dr Anil Kumar (IIFSR, Meerut) 2. Dr. Naresh Prasad
	5	Differential Expression and SNP identification of genes related to establishment of Pregnancy in Frieswal and Sahiwal cattle	AGB/IP/IXX11094/ RA/(1/10/2014-31/03/2018)	(1/10/2014 To 31/03/2018)	Dr RANI ALEX	1. Dr Umesh Singh 2. Dr Sushil Kumar
	6	Early selection of Frieswal sires using test day records	AGB/IP/IXX11096/ TR/(1/10/2014-30/09/2017)	(1/10/2014 To 30/09/2017)	Dr T.V RAJA	1. Dr R. Kumar 2. Dr S.K. Rathee
	7	Expression of fertility associated genes in sperm transcriptome of different breeds of cattle - A comparative approach	AGB/IP/IXX11093/ RRA/(1/10/2014-30/9/2017)	(1/10/2014 To 30/9/2017)	Dr RAFEEQUE ALYETHODI	1. Dr S. Tyagi 2. Dr A.K. Das 3. Dr Rani Alex
	8	Functional analysis of IRES elements at bovine heat shock protein genes: An approach to modulate thermo regulatory response in cattle	AGB/IP/IXX12036/ RD/(3/10/2015-30/9/2017)	(1/10/2015 To 30/9/2017)	Dr RAJIB DEB	1. Dr Umesh Singh 2. Dr B. Sajjanar (ICAR-NIASM, Baramati, Maharastra)

Project type	Sl. No.	Project title	Project ID (PIMS)	Period	PI	Co-PIs
	9	Effect of different levels of micro minerals on qualitative and quantitative attributes of semen in Frieswal bulls	AN/IP/IXX09737/ PS/(10/10/2012-31/3/2018)	(1/10/2012 To 31/3/2018)	Dr PRAMOD SINGH	1. Dr R. Prasad
	10	Micronutrient status in the feeds and effect of dietary supplementation on growth and semen quality of Frieswal bull calves	AN/IP/OXX02836/ PS/(9/10/2014-31/3/2018)	(1/10/2014 To 31/3/2018)	Dr PRAMOD SINGH	1. Dr R. Prasad
	11	Use of assisted reproductive technologies for genetic improvement and propagation of elite cattle	AP/IP/IXX12962/ SKDS/(7/10/2016 - 31/3/2019)	(7/10/2016 To 31/3/2019)	Dr SURESH KUMAR D.S.	1. Dr S. Saha 2. Dr Mahesh Kumar (Co-Opted) 3. Dr. Rajib Deb (Co-Opted)
	12	Augmenting the reproductive efficiency of cattle in organized farms and rural areas around Meerut through various reproductive and nutritional interventions	AP/IP/IXX11078/ YS/(1/10/2014-30/9/2017)	(1/10/2014 To 30/9/2017)	Dr YOGESH KUMAR SONI	1. Dr. Megha Pande 2. Dr S. Saha
	13	Effect of different housing systems on physiological, behavioural and semen production performance of Frieswal bulls	SFL/IP/IXX11077/ ASS/(1/10/2014 -31/3/2018)	(1/10/2014 To 31/03/2018)	Dr AJAYVIR SINGH SIROHI	1. Dr N. Chand
	14	Studies on Cryodamages of Bull Spermatozoa and its Mitigation using different Additives	SFL/IP/IXX12296/ SKDS/(9/10/2015-30/3/2018)	(9/10/2015 To 30/9/2018)	Dr SURESH KUMAR D.S.	1. Dr A.S. Sirohi
	15	Studies on heavy metal status, their effects on biochemical profile and semen quality in cattle	SFL/IP/IXX12033/ NM/(3/10/2015-30/9/2018)	(3/10/2015 To 30/9/2018)	Dr NAIMI CHAND	1. Dr S. Tyagi
	16	Functional analysis of sperm morphometric subpopulations in Frieswal bull	SFL/IP/IXX11092/ MK/(27/9/2014 -30/9/2017)	(01/10/2014 To 30/9/2019)	Dr MAHESH KUMAR	1. Dr S. Saha
	17	Determination of age through dentition pattern in Frieswal cattle	SFL/IPILOT/IXX13197/ ASS/(1/07/2016 -30/9/2017)	(1/07/2016 To 30/9/2017)	Dr. AJAYVIR SINGH SIROHI	NIL

Project type	Sl. No.	Project title	Project ID (PIMS)	Period	PI	Co-PIs
	18	Problems and prospects of improved cattle rearing in Western U.P	EXT/IP/IXX12986/ NP/(1/7/2016 -31/03/2018)	(1/7/2016 To 31/03/2018)	Dr NARESH PRASDAD	1. Dr R. Kumar
New Instit-utional	19	Genetic variability of X and Y bearing spermatozoa to cryopreservation stress and its implication on their motility		(1/10/2017 To 31/03/2020)	Dr. RR Alyethodi	1. Dr. S. Tyagi 2. Dr. Umesh Singh 3. Dr. Sushil Kumar 4. Dr. Rani Alex
	20	Genetic analysis of lactation persistency using random regression test day models in Frieswal cattle		(1/10/2017 To 31/03/2020)	Dr. T V RAJA	1. Dr. AK Das 2. Dr. SK Rathee
	21	Genetic evaluation of Frieswal cows using different lactations yield		(1/10/2017 To 31/03/2020)	Dr. SK RATHEE	1. Dr. AK Das 2. Dr. Ravinder Kumar (Co-opted)
	22	Assessment of Nutritonal status of cattle in Meerut district through bio-chemical parameters		(1/10/2017 To 31/03/2020)	Dr. SK VERMA	1. Dr. JK Singh 2. Dr. Rajendra Prasad (Co-Opted)
	23	Effect of herbal feed supplements on sexual perfrmance and semen quality in bulls		(1/10/2017 To 31/03/2020)	Dr. R. PRASAD	1. Dr. SK Verma 2. Dr. Pramod Singh (Co-Opted) 3. Dr. AS Sirohi (Co-Opt)
	24	Evaluation of low cost feeding system (Sardhana Model) prevailing in the vicnity of Meerut, its economics and interventions to increase farmer's profitability		(1/10/2017 To 31/03/2020)	Dr. Vinod Kumar	1. Dr. Pramod Singh 2. Dr. Rajendra Prasad (Co-Opted)
	25	Effects of unconjugated nanoparticles on bovine spermatozoa		(1/10/2017 To 31/03/2019)	Dr. Megha Pandey	1. Dr. J.K. Singh 2. Dr. Suresh Kumar (Co-Opted) 3. Dr. Mahesh Kumar (Co-Opted) 4. Dr. YK Soni (Co-Opted) 5. Dr. S. Tyagi (Co-Opted)

Project type	Sl. No.	Project title	Project ID (PIMS)	Period	PI	Co-PIs
	26	Studies on Heparin binding proteins in the semen of Frieswal and Indigenous bulls		(1/10/2017 To 31/03/2020)	Dr Y.K. SONI	1. Dr. Megha Pandey 2. Dr. Suresh Kumar (Co-Opted) 3. Dr. S. Saha (Co-Opted) 4. Dr. Mahesh Kumar (Co-Opted) 5. Dr. AS Sirohi (Co-Opted)
	27	Androgen and their relation with sexual behaviour and seminal attributes in bulls at CIRC-BRU.		(1/10/2017 To 31/03/2020)	Dr. JK SINGH	1. Dr. YK Soni 2. Dr. Suresh Kumar (Co-Opted) 3. Dr. S. Saha (Co-Opted) 4. Dr. Megha Pandey (Co-Opted) 5. Dr. Naimi Chand (Co-Opted)
Inter-Institutional	28	Bovine Kisspeptin gene and its association with reproductive traits in indigenous cattle breeds (kankrej&Gir)		(1/10/2017 To 31/03/2020)	Dr UMESH SINGH	1. Dr. Rajib Deb 2. Dr. KS Murthy (JAU, Gujrat) 3. Dr. BS Rathod (SDAU, Gujrat) 4. Dr. Rani Alex (Co-Opted)
	29	Purification and characterisation of bovine heat shock protein 70 chaperon among native and crossbred cattle		(1/10/2017 To 31/03/2020)	Dr RAJIB DEB	1. Dr. Yogesh Kumar Soni 2. Dr. Sougata Hazra (IIT Roorkee, Roorkee, Uttarakhand)
Institutional Pilot	30	Isolation, *invitro* culture and characterization of different types of cells in cattle	AP/IPILOT/--------/ SS/(1/10/2015-31/03/2018)	(1/10/2015 To 31/03/2018)	Dr. S. SAHA	1. Dr. JK Singh 2. Dr Suresh Kumar (Co-Opted)
Institional - Service	31	Screening for genetic diseases in Frieswal and Indigenous bulls	AGB/IP-SP/IXX12180/ RRA/(8/7/2014-30/9/2017)	(1/10/2014 To 30/9/2017) Research Project Closed on 30/09/17. Continued as service project.	Dr RAFEEQUE ALYETHODI	NA
	32	Quality assessment of Frieswal bull semen	SFL/IP-SP/IXX10465/ SKDS/(1/6/2013 - 1/5/2016)	(1/6/2013 To 31/3/2017) Research Project Closed on 30/09/17. Continued as service project	Dr SURESH KUMAR D.S.	1. Dr Megha Pandey 2. Dr M. Kumar
	33	Value addition in dung waste through Vermi culture	SFL/ISP/MK/06/07/15	06-07-2015 to be continued	1. Dr MAHESH KUMAR	1. Sh Rajeev Verma

Project type	Sl. No.	Project title	Project ID (PIMS)	Period	PI	Co-PIs
Externally Funded	34	Cataloging of miRNA transcripts during thermal stress and their crosstalk with heat shock protein 70 mRNA in cattle (SERB,DST)	AGB/Ext-DST/ OXX03250/RD/ (20/11/2015-19/11/2018)	(20/11/2015 To 19/11/2018)	Dr RAJIB DEB	NA
	35	Dynamics of circulatory microRNA profile among motile and impaired bull spermatozoa: A novel approach to discover biomarkers (SERB,DST)		12/072016 To 11/07/2019	Dr RANI SINGH	1. Dr. Rajib Deb
	36	Livelihood improvement through sustainable dairy farming using suitable interventions (Farmer FIRST Programme, ICAR)	APY/Ext- Funded/ OXX03793/SK/ (05/04/2017 To 31/03/2018)	05/04/2017 To 31/03/2018	Dr SURESH KUMAR D.S.	1. Dr. S. Saha 2. Dr. Naresh Prasad 3. Dr. Naimi Chand 4. Dr. Mahesh Kumar 5. Dr. Yogesh Kumar 6. Dr. Megha Pandey 7. Dr. JP Dabas
	37	Water budgeting and enhancing water productivity in livestock based farming system (ICAR)	SFL/EXTFUND/ OXX03230/ MK/(3/8/2015 To 31/3/2018)	3/8/2015 To 31/3/2019	Dr MAHESH KUMAR	1. Dr A.S. Sirohi 2. Dr R. Prasad 3. Dr. S. Saha
	38	Èfficient groundwater management for enhancing adaptive capacity to climate change in sugarcane based farming system in Muzzafarnagar district	QCL/Ext- Funded/ OXX03895/MK/ (1/4/2015 to 31/3/2018)	1/4/2015 to 31/3/2018	Dr. MAHESH KUMAR	1. Dr. SK Verma

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1. Alex R, Ramesha K P, Singh U, Kumar S, Alyethodi R R, Deb R, Sharma S, Sengar G S, Kumar A, Prakash B. 2017. Promoter variants of OAS1 gene are associated with reproductive performance and incidence of normal calving in cattle. *Theriogenology,* doi:10.1016/j.theriogenology.2017.12.002.
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7. Chand N, Tyagi S, Prasad R, Sirohi A S, Srivastava N, Kumar S and Yadav B P S. 2017. Heavy metal and trace mineral profile in blood and hair of cattle reared around industrial effluent contaminated area. *Journal of Animal Research,* 7(4): 685-689.
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12. Kumar S, Alex R, Singh U, Raja T V, Deb R, Alyethodi R R and Prakash B. 2017. Estimation of factors for standardizing lactation yield to Mature Equivalent basis and factors affecting 305 day mature equivalent Milk yield in Frieswal cattle. *The Indian Journal of Animal Sciences* 87(8):1038-1041.
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सिरोही अजय वीर सिंह, चंद नेमी, त्यागी श्रीकांत कुमार सुरेश 2017. जब होवे गोवंश प्रबंधन अच्छा तब होवे हर साल एक बच्चा. स्मारिका, बदलते जल वायु परिवेश में कृषि के नए आयाम, बीज दिवस एवं रबी कार्यशाला. भा.कृ.अनु.प.–भारतीय गेंहू एवं जौ अनुसंधान संस्थान, करनाल, पृष्ठ संख्याः 103–105.

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14. Sirohi A S, Kumar M, Prasad R, Saha S, Kumar D, Arya S and Maurya P. 2017. Water utilization pattern and bovine management practices in villages of western Uttar Pradesh. *International seminar on Global Climate Change: Implications for Agriculture and Water Sectors* held at WALMI, Aurangabad, Maharashtra from 14-16th December 2017, pp.645-646.

EXTENSION FOLDERS (HINDI)

सोनी योगेश कुमार, सुरेश कुमार, एस.साहा, मेघा पांडे, नरेश प्रसाद, नेमी चंद, महेश कुमार, ब्रह्म प्रकाश व राजेंद्र प्रसाद. 2018. डेरी पशुओं में बाँझपन एवं उचित प्रबंधन. भा.कृ.अनु.प.–केन्द्रीय गोवंश अनुसंधान संस्थान ग्रास फार्म रोड, मेरठ छावनी– 250001 (उ.प्र.) भारत, पृष्ठ 1–4.

पांडे मेघा, सुरेश कुमार, योगेश कुमार सोनी, एस.साहा, नेमी चंद, नरेश प्रसाद, महेश कुमार व शुभम आर्य. 2018. गोपशुओं में ग्रीष्मकाल का पुनरुत्पादन पर दुष्प्रभाव एवं बचाव. भा.कृ.अनु.प.–केन्द्रीय गोवंश अनुसंधान संस्थान ग्रास फार्म रोड, मेरठ छावनी– 250001 (उ.प्र.) भारत, पृष्ठ 1–4.

साहा सिद्धार्थ, सुरेश कुमार, नेमी चंद, योगेश कुमार सोनी, नरेश प्रसाद, मेघा पांडे, महेश कुमार, ब्रह्म प्रकाश व राजेंद्र प्रसाद. 2018. कृत्रिम–गर्भाधानः तकनीकी ज्ञान. भा.कृ.अनु.प.–केन्द्रीय गोवंश अनुसंधान संस्थान ग्रास फार्म रोड, मेरठ छावनी– 250001 (उ.प्र.) भारत, पृष्ठ 1–4.

प्रसाद नरेश, नेमी चंद, सिद्धार्थ साहा, सुरेश कुमार, योगेश कुमार सोनी, मेघा पांडे, महेश कुमार, ब्रह्म प्रकाश व राजेंद्र प्रसाद. 2018. गो–पशुओं में खुर–पका मुंहपका रोगः निदान, उपचार एवं बचाव. भा.कृ.अनु.प.–केन्द्रीय गोवंश अनुसंधान संस्थान ग्रास फार्म रोड, मेरठ छावनी– 250001 (उ.प्र.) भारत, पृष्ठ 1–4.

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Conferences/Seminar/Workshop Attended

Sr. No.	Name of the training / conf./seminar/ workshop	Venue / Period	Name of the Scientist
1.	3rd International Conference on Bio-resource and Stress Management	State Institute of Agriculture Management, Jaipur Nov 8-11, 2017	Dr. Naresh Prasad
2.	9th Asian Buffalo Congress 2018	ICAR- Central Institute for Research on Buffaloes, Hisar, Feb 1-4, 2018	Dr. Naresh Prasad
3.	One day workshop on **"Unnat Pashupalan"**	ICAR- Central Institute for Research on Cattle, Meerut Jul 7, 2017	Dr. Naresh Prasad
4.	XVII Biennial Conference of Animal Nutrition Society of India	Junagarh Agricultural University, Junagarh, Gujarat Feb 1-3, 2018	Dr. S K Verma
5.	XVII RAC meeting	ICAR-CIRC, Meerut on 28/05/2017	All Scientists
6.	National Steering Committee Meeting of National Mission on Bovine Productivity (NMBP) Scheme of of DADF, GOI	DADF, Krishi Bhawan New Delhi Aug 16, 2017	Dr. Umesh Singh
7.	Meeting of the Task Force (Joint Working Group of NITI Ayog and Uttar Pradesh) for the preparation of Action Plan for Uttar Pradesh	Directorate of Agriculture, Madan Mohan Malviya Marg Lucknow Aug 24, 2017	Dr. Umesh Singh
8.	SFC meeting of ICAR-Central Institute for Research on Cattle, Meerut	ICAR, Krishi Bhawan, New Delhi Sep 13, 2017	Dr. Shrikant Tyagi Dr. Umesh Singh
10.	National Workshop on developing a roadmap for Agricultural Knowledge Management in India	NASC Complex, New Delhi Sep 28, 2017	Dr. Umesh Singh
11.	Meeting on Research and Validation of Panchgavya	ICAR Krishi Bhawan, New Delhi Nov 27, 2017	Dr. Umesh Singh
12.	IRC Meeting	CIRC, Meerut from July 14-17, 2017.	All Scientists
13.	International Seminar on "Global climate change: Implications for agriculture and water sectors"	WALMI, Aurangabad, Dec 14-16, 2017	Dr Mahesh Kumar Dr A. S. Sirohi
14.	36th Annual Convention of Indian Society for Veterinary Medicine & National Symposium on "Animal Health Service Delivery - The Priorities of the Professionals for Enhancing Farmers' Income"	COVS & AH, OUAT, Bhubaneswar, Feb 1-3, 2018	Dr Naimi Chand

Professional Recognitions

Dr. Suresh Kumar

- Delivered radio talk on "Pashuon mein Banjhpan ki samasya, karan evam nivaran by All India Radio, Najibabad on 05.12.2017, broadcasted on 11.12.2017 at 06.45 PM by Akashwani Najibabad.

Dr. S.K. Verma

- Nominated as Vice President (South Zone, ANSI) of Animal Nutrition Society of India

Dr. A.S. Sirohi

- Fellow of Academy of Sciences for Animal Welfare awarded by Academy of Sciences for Animal Welfare, Bareilly on October 10, 2017.

Dr. Rajib Deb

- Associate Member and Fellow of Academy of Sciences for Animal Welfare, Recognized by the Animal Board of India under the Ministry of Environment, Forest and Climate Change, Govt. of India

Dr. Megha Pande

- Acted as CPCSEA (Ministry of Environment, Forest & Climate Change, GOI) Nominee at Chaudhary Charan Singh National Institute of Animal Health, Baghpat (UP) and Bharat Institute of Technology, Meerut
- Associate editor in International Journal of Veterinary Sciences and Animal Husbandry.

Awards

Dr. Umesh Singh received 5th Academic Achievement Award for Excellence in Research by EET ERS, Education expo, Research and Branding Company, NOIDA on September 10, 2017 at Mumbai.

Dr. Suresh Kumar received Field Functionary Award, 2018 awarded by Indian Society for Buffalo Development (ISBD), ICAR-CIRB, Hisar during 9th Asian Buffalo Congress held at ICAR-CIRB from February 01-04, 2018.

Dr. Ajayvir Singh Sirohi won Bronze Medal in 5 Km bicycle race in ICAR Zonal Sports (North Zone) held at ICAR-IISR, Lucknow during October 30th to November 2nd, 2017.

Oral / Poster presentation

Dr. Ajayvir Singh Sirohi won first prize in technical paper presentation during Hindi Saptah, 2017 at ICAR-CIRC, Meerut Cantt.

Deb R, Sengar G S, Singh U, Alyethodi R R, Alex R, Kumar S, Raja T V, Das A K and Prakash B. 2017. Best poster presentation award for Rapid colour based assay for detecting of cow Milk/Meat adulterated in goat milk/ meat samples. World Congress Biotechnology and Biological Studies, November 09-11, New Delhi.

Best Thesis Award

Dr. Alex R, Scientist (AG&B) received best Ph.D. thesis Award from NDRI, Karnal for her PhD dissertation entitled “SNP identification and expression during early pregnancy of OASI gene in Sahiwal and Frieswal cattle”.

Important Committees and Meetings

RESEARCH ADVISORY COMMITTEE (RAC)

1.	Dr S.N. Maurya, Ex-Vice Chancellor, Vety. University, Mathura 15A, Foot Hill Colony Behind Gurukul Intl. School, Kamaluaganja Haldwani – 263139 (UK)	Chairman
2.	Dr K.T. Sampath, Ex- Director, NIANP FF2-Passion Paradise, Ist Main Ist Block, Thyagraj Nagar Bangalore – 560028	Member
3.	Dr S.N.S. Parmar I/c Vice Chancellor and Dean Faculty (संकायअधिष्ठाता) Nanaji Deshmukh Veterinary Science University, Civil Line, Jabalpur – 482001	Member
4.	Dr. S.K. Srivastava, Ex – PS (Microbiology) IVRI, Izatnagar, 95, Mandal Vihar, Opposite IVRI Gate No. 1, Bareilly, Izatnagar - 243122	Member
5.	Dr K.P. Aggarwal, Ex-National Coordinator, NAIP G-29, Brahma Apartments, Sector-7, Plot No. 7, Dwarka, New Delhi	Member
6.	Shri Vinod Bharti, Village Arnawali, Block Rohta, Meerut (U.P.)	Member
7.	ADG(AP&B), Indian Council of Agricultural Research Krishi Bhawan, New Delhi	Member
8.	Dr. Vijay Kumar Pandit, Green Care Society, 57, Vikas Enclave, Rohta Road, Meerut (U.P.)	Member
9.	Director, ICAR-Central Institute for Research on Cattle, Meerut, U.P.	Member
10.	Dr Rajendra Prasad, Principal Scientist, ICAR-Central Institute for Research on Cattle, Meerut, U.P	Member Secretary

Institute Management Committee

Sl. No.	Nominated Officers/Persons	Designation
1.	Director, Central Institute for Research on Cattle, Meerut (UP)	Chairman
2.	The Assistant Director General (AP&B), Indian Council of Agricultural Research, Krishi Bhavan, New Delhi-110001	Member
3.	The Deputy Director (Animal Husbandry) Deptt. of Animal Husbandry, U.P. Govt., Abulane, Meerut Cantt.-250001 (UP)	Member
4.	The Director, Animal Husbandry, Uttrakhand Livestock Development Board, Govt. of Uttrakhand, Dehradoon, Uttrakhand	Member
5.	The Director of Research, College of Vety. Sciences, SVBP Univ. of Agri. & Technology, Modipuram, Meerut-250110 (UP)	Member
6.	Miss. Sushma Singh, 2/524, Vineet Khand, Gomti Nagar, Lucknow-226010 (UP)	Member
7.	Finance & Accounts Officer, ICAR-Indian Institute of Farming System Research, Modipuram, Meerut-250110 (UP)	Member
8.	Dr. P. K. Singh, Principal Scientist (AG&B), ICAR-National Bureau of Animal Genetics Resources, Karnal-132001 (Haryana)	Member
9.	Dr. S. S. Dahiya, Principal Scientist (Animal Nutrition), ICAR-Central Institute for Research on Buffaloes, Hisar-125004 (Haryana)	Member
10.	Dr. Arun Kumar Tomar, Head (AG&B), ICAR-CSWRI, Avikanagar, P.O. & Tehsil-Malpura, Distt. Tonk-304501, (Rajasthan)	Member
11.	Dr. P. K. Rout, Principal Scientist (AG&B), ICAR – Central Institute for Research on Goats, Makhdoom, P.O.-Farah, Mathura-281122 (UP)	Member
12.	Dr. T.K.Dutta, Principal Scientist (Animal Nutrition), ICAR-National Dairy Research Institute, Karnal-132001 (Haryana)	Member
13.	Administrative Officer, ICAR-Central Institute for Research on Cattle, Grass Farm Road, Meerut Cantt.-250001 (UP)	Member Secretary

INSTITUTE JOINT STAFF COUNCIL (IJSC):

OFFICE SIDE

1. Director : Chairman
2. Dr. Shrikant Tyagi, Principal Scientist : Member
3. Dr. Megha Pandey, Scientist : Member
4. Administrative officer : Member
5. Shri D. S. Verma, AF&AO : Member
6. Shri A.K. Sharma, Asst. Admn. Officer : Member Secretary (Office)

STAFF SIDE

1. Shri O. P. Agarwal, Assistant : Member
2. Shri Vikas Kumar, UDC : Member Secretary (Staff)
3. Shri S. K. Sharma, Technical Officer : Member
4. Shri Omkar Singh, Technical Officer : Member (CJSC)
5. Shri Veer Mahender, Skilled Supporting Staff : Member
6. Shri Mohan Chandra, Skilled Supporting Staff : Member

Important Meetings

XVII Research Advisory Committee (RAC)

The XVII RAC meeting of ICAR-CIRC, Meerut held on 15 May 2017. The meeting was conducted under the chairmanship of Prof. S. N. Maurya, Ex Vice-Chancellor PDDUVAS Mathura. RAC members namely Dr. K. T. Sampath Ex-Director NIANP, Bangalore, Dr. K. P. Agarwal, Ex-Coordinator, NAIP, New Delhi, Dr. S. K. Srivastava, Ex-Head and PS, Microbiology, IVRI Bareilly, Dr. Birham Prakash, Director CIRC, Meerut, Shri Vinod Bharati, Farmers representative attended the meeting. Dr. Rajendra Prasad, Principal Scientist (Animal Nutrition) CIRC as member secretary of RAC presented the action taken report on the recommendations of the last RAC held on 28 May 2016.

In the opening remarks, Chairman Dr. S. N. Maurya emphasized that cattle is an important species and has significant role to play in the society and its milk production is increasing at the rate of 6.25%. Bringing improvement in cattle productivity is a difficult task as no selection is applied due to no culling of inferior producers due to socioeconomic and religious taboos in the country. Due to indiscriminate breeding some time genetic merit of indigenous breeds are lost. Sharp changes in climate with shrinking feed and fodder resources have also adversely affected the productivity. The Institute should frame their programmes in such a way that such types of problems are addressed. The committee recommended that Institute should develop a targeted programme indicating quantifiable output for faster multiplication of quality indigenous cattle germplasm in a well-defined time frame through application of assisted reproductive techniques. Secondly, the progeny testing project on indigenous breeds Gir and Kankrej is working satisfactorily and giving encouraging results under field conditions and hence, ICAR should consider extra funding under the programme for including one or two additional indigenous breeds like Tharparkar and Rathi.

Institute Research Committee (IRC)

The IRC meeting for the year 2016-17 was conducted on 14-17th July, 2017 under the chairmanship of Director, ICAR-CIRC. At the outset, Dr B. Prakash, Chairman, IRC informed the members that from the year 2018 onwards, RAC and IRC meetings will be conducted by 15th February and 15th April, respectively. Director informed the members regarding the financial crunch of the Institute on research contingencies during the current year. Chairman instructed the members to submit the copies of the published articles to PME and ITMU for records and to upload the required information in KRISHI portal. In view of lack of institute's own animals for experimentation RAC recommended to take up the projects in field conditions, the chairman therefore suggested to take up the projects in the line suggested by the RAC and should also focus for submitting projects to externally funding agencies. In-charge, PME briefed the members about the projects status and intimated that project information for 21 on-going and 10 completed projects is incomplete at PIMS portal. So, he requested all the members to upload the necessary data of their projects (RPF 1, 2 & 3) at the earliest.

A total of 30 projects (3 AICRP, 18 Institutional, 4 externally funded, 1 inter institutional, 2 Pilot and 2 Service project) were presented before the IRC as per the details in Annexure-I (project title, project ID, workers, date of start and termination etc.). The reports were presented by the PIs of respective project. In addition to this, eleven new project proposals were discussed.

XVI Annual Review Meeting of AICRP

The 16th Annual Review meet of AICRP on Cattle was organized at NASC Complex, New Delhi on 22-06-2017. The meeting was chaired by Secretary DARE & DG (ICAR) Dr. Trilochan Mohapatra. Dr. B. Prakash, Director, CIRC Meerut delivered welcome address and presented the action taken report on the recommendations of 15th review meeting held at BAIF, Pune. The future status of Frieswal project due to the proposed closure of Military Farm was discussed in detail.

Hon'ble DG, ICAR had interaction with all PIs and Co-PIs of the cooperating centres and informed them to provide their feedback on the points discussed for further improvement of the

project. Deputy Director General, Dr. J.K. Jena stressed that concerted efforts are needed for ex-situ and in-situ conservation and improvement of important indigenous breeds in their respective breeding tracts for sustainable milk production in the country. He requested the house to deliberate in detail on the ways and means for attaining the benefits from this programme in a time frame and redefine the technical programme, if required. Col. Sudhir Kashyap, DDG (MFs) highlighted the contributions of MFs for execution of the Frieswal project and appreciated the efforts made by ICAR-CIRC for development of the Frieswal cattle.

XVI Review Meet of AICRP on Cattle

The progress of Frieswal, Indigenous breeds project and Field progeny testing project was presented by Dr. Sushil Kumar, Dr. Umesh Singh and Dr. A.K. Das, respectively. The unit report for Sahiwal, Gir and Kankrej in Indigenous breeds project and Pantnagar, GADVASU, KVASU and BAIF were also presented by the unit PIs. The meeting was ended with vote of thanks by Dr. Umesh Singh, Incharge AICRP on Cattle.

Institute Animal Ethics Committee

IAEC received twelve new research project proposals from different scientists for consideration during the year. In the meeting held on August 04, 2017, all proposals were discussed and finally cleared by the committee.

Monthly Seminars Organized

S. No	Title	Date	Name of Speaker
1	Antimicrobial resistance in animal production system	29.04.2017	Dr. A S Sirohi
2	Livestock production and environmental issues	27.05.2017	Dr. Ravinder Kumar
3	Genetic evaluation of breeding bulls: International and Indian context	29.06.2017	Dr. T V Raja
4	Genome editing: Challenges and opportunities in livestock species	22.07.2017	Dr. Rajib Deb
5	Baseline survey on cattle to multiply superior germplasm in field conditions for enhanced milk productivity	26.08.2017	Dr. Ravinder Kumar
6	Blood transfusion: A vital part of critical care medicine	27.09.2017	Dr. Naimi Chand
7	ICAR- ERP: Application aspects	29-09-2017	Shri Suresh Chand, Technical Officer
8	Leptin: A metabolic gate for the onset of puberty in farm animals	31.01.2018	Dr. S Saha

Institute activities/ Days celebrated/ Sports etc.

SPORTS ACTIVITY

The sports contingent of the Institute comprising of 20 participants Including one Chief-de-Mission and one Manager participated in ICAR Zone IVth annual Inter-Institutional Staff Sports Meet (North Zone) held at IISR, Lucknow from 30-10-2017 to 02-11-2017. Dr. Ajayveer Singh Sirohi, Senior Scientist won the bronze medal in Cycle Race during the above sports meet.

INDEPENDENCE DAY CELEBRATION

15th August, 2017 was celebrated as Independence Day of the country. On this occasion, Dr. Birham Prakash, Director hoisted the National Flag, remembered all those who sacrificed their lives for this dream come true and paid tribute to them. He wished the staff and their families for a brighter future.

REPUBLIC DAY CELEBRATION

The Institute celebrated Republic Day on 26th January, 2018. At this occasion Dr. Rajendra Prasad, Director (Acting), CIRC, Meerut hoisted the National Flag and highlighted the progress made by the Institute during preceding years. He appreciated the efforts made by the staff in bringing the Institute to the present position and requestedthem to work hard for achieving the objectives set forth by the Institute.

स्थापना दिवस समारोह

संस्थान का 31 वॉं स्थापना दिवस दिनांक 03.11.2017 को धूमधाम एवं ह ोल्लास के साथ मनाया गया। इस अवसर पर संस्थान परिसर में साज–सज्जा की गई एवं सभी अधिकारियों/कर्मचारियों के लिए विभिन्न सांस्कृतिक, खेलकूद कार्यक्रम एवं प्रतियोगिताओं का आयोजन किया गया जिसमें सभी ने बढ़–चढ़ कर भाग लिया एवं पुरस्कार जीते। कार्यक्रम में सभी के लिए सूक्ष्म जलपान एवं लंच की व्यवस्था भी की गई।

स्वच्छ भारत अभियान

भारतीय कृ ि ा अनुसंधान परि ाद्, नई दिल्ली के पत्रांक जी.ए.सी./21–46/2014/सी.डी.एन. दिनांक 11.05.2017 के अनुपालन में दिनांक 16.05.2017 से दिनांक 31.05.2017 तक संस्थान में स्वच्छता पखवाड़ा मनाया गया जिसके अन्तर्गत संस्थान में सभी अधिकारियों/कर्मचारियों द्वारा वृक्षारोपण किया गया तथा समिति कक्ष में गो ठी का आयोजन भी किया गया जिसमें डॉ. ब्रहम प्रकाश, निदेशक द्वारा सभी अधिकारियों/कर्मचारियों को स्वच्छता पखवाड़े के वि ाय में जानकारी दी गई।

उप–सचिव (जी.ए.सी.), भारतीय कृ ि ा अनुसंधान परि ाद्, नई दिल्ली के पत्रांक जी.ए.सी./21–46/2014/सी.डी.एन.(वोल.–1) दिनांक 22.08.2017 एवं दिनांक 12/13.09.2017 के अनुपालन में संस्थान में दिनांक 17.09.2017 से दिनांक 02.10.2017 तक "स्वच्छ भारत अभियान" के अंतर्गत निम्नलिखित कार्य किए गएः–

1. सभी अधिकारियों/कर्मचारियों द्वारा संस्थान परिसर में श्रमदान किया गया।
2. दिनांक 17.09.2017 को सेवा दिवस के रूप में मनाया गया तथा इस दिन सभी अधिकारियों/कर्मचारियों ने प्रातः 10:00 बजे से 12:00 बजे तक संस्थान के सम्पूर्ण परिसर की साफ–सफाई करने में अपना योगदान दिया।
3. दिनांक 18.09.2017 को डॉ. ब्रहम प्रकाश, निदेशक द्वारा सभी अधिकारियों/कर्मचारियों को शपथ ग्रहण कराई गई।
4. दिनांक 25.09.2017 को सर्वत्रा स्वच्छता दिवस के अंतर्गत नजदीकी सार्वजनिक स्थल/मोहल्ला कासमपुर बस्ती में साफ–सफाई की गई।
5. दिनांक 26.09.2017 को सभी अधिकारियों/कर्मचारियों द्वारा वृक्षारोपण किया गया।
6. दिनांक 28.09.2017 को नजदीकी पर्यटन स्थल गंगोल तीर्थ की साफ–सफाई संस्थान के सभी स्टॉफ द्वारा की गई।
7. दिनांक 29.09.2017 को स्वच्छता प्रश्नोत्तरी का कार्यक्रम हुआ एवं पुरस्कार वितरण किया गया। सभी स्टॉफ द्वारा संस्थान परिसर में कंटीली अनुपयोगी घास–फूस/झाड़ियों की सफाई की गई।
8. कार्यालय में लगे ए.सी. व कूलर आदि की मच्छरों से बचाव हेतु सफाई की गई।
9. कार्यालय कक्षों, शौचालयों, गलियारों व अतिथि गृह में मच्छरों से बचाव एवं उनके सफाए हेतु कीटनाशकों का छिड़काव कराया गया।

10. संस्थान में सभी अधिकारियों/कर्मचारियों द्वारा साफ–सफाई एवं स्वच्छता के कार्य किए गए।

विश्व पर्यावरण दिवस

संस्थान में विश्व पर्यावरण दिवस दिनांक 05.06.2017 को "Connecting People to Nature" के वि ाय (Theme) के साथ मनाया गया। दिवस की ुरूआत संस्थान में वृक्षारोपण कार्यक्रम के साथ हुई। इस कार्यक्रम में संस्थान के सभी वैज्ञानिकों/अधिकारियों/कर्मचारियों एवं आर.ए./एस.आर.एफ./वाई.पी. ने भाग लिया। इस कार्यक्रम में प्रोफेसर एस.वी.एस. राणा, भूतपूर्व कुलपति, बुंदेलखण्ड विश्वविद्यालय, झॉसी, उत्तर प्रदेश एवं प्रोफेसर (अवकाश प्राप्त), सी.एस.आई.आर., डिपार्टमेंट ऑफ जूलॉजी, चौधरी चरणसिंह विश्वविद्यालय, मेरठ को मुख्य अतिथि के रूप में आमंत्रित किया गया। संस्थान के निदेशक डॉ. ब्रहम प्रकाश ने मुख्य अतिथि का स्वागत किया एवं विश्व पर्यावरण दिवस के महत्व पर प्रकाश डाला। प्रोफेसर एस.वी.एस. राणा ने वर्तमान परिप्रेक्ष्य में पर्यावरण परिस्थितिकी संतुलन पर चर्चा की एवं भवि य के खतरों एवं इनसे बचने के उपाय बताए। कार्यक्रम का संचालन डॉ. रविन्द्र कुमार, वरि ठ वैज्ञानिक एवं डॉ. नरेश प्रसाद, वैज्ञानिक ने किया। कार्यक्रम के अंत में डॉ. राजेंद्र प्रसाद, प्रधान वैज्ञानिक ने धन्यवाद ज्ञापन दिया।

अंतर्राष्ट्रीय योग दिवस/कार्यशाला

उप–सचिव (सी.डी.एन.), भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली के पत्रांक जी.ए.सी./13–1/2017/सी.डी.एन. दिनांक 31.05.2017 के अनुपालन में संस्थान में दिनांक 21.06.2017 को अंतर्राष्ट्रीय योग दिवस मनाया गया। इस अवसर पर दिनांक 21.06.2017 को स्थानीय योग प्रशिक्षक श्री संजीव शर्मा द्वारा अपरान्ह 03:00 बजे सभी अधिकारियों एवं कर्मचारियों को योग प्रशिक्षण दिया।

सतर्कता जागरूकता सप्ताह

अवर सचिव (सतर्कता), भारतीय कृ ि ा अनुसंधान परि ाद्, नई दिल्ली के पत्रांक 5–9/2017–सतर्कता दिनांक 13.10.2017 के अनुपालन में संस्थान में दिनांक 30.10.2017 से 04.11.2017 तक सतर्कता जागरूकता सप्ताह मनाया एवं इस दौरान निम्नलिखित कार्य किए गए:–

दिनांक 30.10.2017 को प्रातः 11:00 बजे निदेशक डॉ. ब्रहम प्रकाश द्वारा सभी अधिकारियों/कर्मचारियों को ापथ ग्रहण कराई गई।

दिनांक 01.10.2017 को प्रातः 11:30 से 12:00 बजे तक सभी अधिकारियों/कर्मचारियों के लिए निबंध लेखन का आयोजन किया जिसका विषय – भ्रष्टाचार का बढ़ता मर्ज और उसका निवारण– रखा गया।

दिनांक 01.11.2017 को अपरान्ह 03:00 बजे से 04:40 बजे तक सभी अधिकारियों/कर्मचारियों के लिए कार्यशाला का आयोजन किया गया जिसका विषय भ्रष्टाचार मुक्त भारत–जिम्मेदारी किसकी– रखा गया।

दिनांक 01.11.2017 को अपरान्ह 03:30 बजे से 04:30 बजे तक सतर्कता अधिकारी डॉ. राजेंद्र प्रसाद, प्रधान वैज्ञानिक ने–सरकारी सेवाओं में भ्रष्टाचार उन्मूलन– विषय पर गोष्ठी में विचार रखे गए जिसमें सभी अधिकारी एवं कर्मचारीगण उपस्थित थे।

भारत छोड़ो आन्दोलन के संबंध में Sidhi to Sankalp की शपथ ग्रहण

उप–सचिव (जी.ए.सी.), भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली के पत्रांक पी.एस./डी.एस./जी.ए.सी./2017/सी.डी.एन. दिनांक 09.08.2017 के साथ संलग्न करके भेजे गए कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार, नई दिल्ली के ओ.एस.डी. द्वारा जारी परिपत्र दिनांक 08.08.2017 के अनुपालन में भारत देश की आजादी के संबंध में अंग्रेजों द्वारा भारत छोड़ो आन्दोलन (09.08.1942) के 75 वर्ष पूरे हो जाने के उपलक्ष में संस्थान में दिनांक 09.08.2017 को प्रातः 11:30 बजे निदेशक डॉ. ब्रहम प्रकाश द्वारा सभी अधिकारियों/कर्मचारियों को भारत छोड़ो आन्दोलन के संबंध में Sidhi to Sankalp की ापथ दिलाई गई।

हिन्दी पखवाड़ा/हिन्दी सप्ताह/हिन्दी दिवसः-

संस्थान में दिनांक 14.09.2017 से 20.09.2017 तक हिन्दी सप्ताह मनाया गया जिसके दौरान विभिन्न प्रतियोगिताओं/कार्यक्रमों का आयोजन किया गया। हिन्दी सप्ताह का समापन दिनांक 20.7.2017 को किया गया तथा विभिन्न प्रतियोगिताओं के विजेताओं को निम्न विवरण के अनुसार पुरूस्कार वितरित किए गए।

क.सं.	अधिकारी/कर्मचारी का नाम व वर्ग/श्रेणी	पुरस्कार
	हिन्दी टंकण प्रतियोगिता	
1	श्री निरंजन सिंह सैनी	प्रथम
2	श्री विकास कुमार	द्वितीय

क.सं.	अधिकारी/कर्मचारी का नाम व वर्ग/श्रेणी	पुरस्कार
3	श्री मनोज नेहरा	तृतीय
	हिन्दी निबंध लेखन (वैज्ञानक एवं तकनीकी वर्ग)	
1	डॉ. रविन्द्र कुमार	प्रथम
2	डॉ. राजिब देब	प्रथम (अहिन्दी भा ी वर्ग)
3	श्री राजीव वर्मा	सान्त्वना पुरस्कार
	हिन्दी निबंध लेखन (प्रशा. एवं सहा. कर्मचारी वर्ग)	
1	श्रीमति पु पा	प्रथम
2	श्रीमति अनीता जैन	सान्त्वना पुरस्कार
	हिन्दी तकनीकी लेख प्रस्तुतिकरण (वैज्ञानिक वर्ग)	
1	डॉ. अजयवीर सिंह सिरोही	प्रथम
	हिन्दी सुलेख प्रतियोगिता (सभी श्रेणी)	
1	श्री विकास कुमार	प्रथम
2	डॉ. मेघा पाण्डे	द्वितीय
3	श्रीमति नीरजा जोशी	तृतीय
	हिन्दी श्रुत लेखन प्रतियोगिता (सभी श्रेणी)	
1	श्री निरंजन सिंह सैनी	प्रथम
2	डॉ. सुशील कुमार	द्वितीय
3	श्री डी. एस. वर्मा	तृतीय
	हिन्दी पत्र लेखन प्रतियोगिता (सभी श्रेणी)	
1	डॉ. मेघा पाण्डे	प्रथम
2	श्री डी. एस. वर्मा	द्वितीय
3	श्रीमति नीरजा जोशी	तृतीय
	सरकारी कामकाज मूल रूप से हिन्दी में करने के लिए प्रोत्साहन योजना पुरस्कार (2016–17)	
1	श्री निरंजन सिंह सैनी	प्रथम
2	श्री डी. एस. वर्मा	द्वितीय
3	श्री मनोज नेहरा	तृतीय
4	श्रीमति नीरजा जोशी	तृतीय
	पूरे वर्ष स्थापना अनुभाग में हिन्दी में अधिकाधिक कार्य करने हेतु विशेष प्रोत्साहन पुरस्कार (2016–17)	
1	श्री ंकर कश्यप	———
	प्रतिदिन हिन्दी में आज का शब्द लेखन हेतु प्रोत्साहन पुरस्कार (2016–17)	
1	श्री वीरपाल सिंह	———

हिन्दी प्रकाशन

संस्थान द्वारा वर्ष 2017–18 के दौरान राजभाषा हिन्दी गृह पत्रिका सुरभि–2 का प्रकाशन किया गया।

हिन्दी कार्यशाला

संस्थान में राजभाषा हिन्दी के उचित प्रयोग एवं हिन्दी में कार्य करने एवं बोलने की झिझक को दूर करके बढ़ावा देने हेतु सभी अधिकारियों एवं कर्मचारियों के लाभ के लिए दिनांक 17.06.2017 को हिन्दी कार्यशाला का आयोजन किया गया। उक्त कार्यशालाओं में भा.कृ.अ.प., नई दिल्ली के 02 स्थानीय कार्यालयों एवं निदेशक, सैन्य फार्म एवं फ्रीजवाल परियोजना, मेरठ कैण्ट के राजभाषा अनुभाग के कर्मचारियों सहित संस्थान के सभी अधिकारियों एवं कर्मचारियों ने भाग लिया।

संस्थान की राजभाषा कार्यान्वयन समिति की बैठक

1. माह अप्रैल, 2017 को समाप्त तिमाही की 63 वीं तिमाही बैठक दिनांक 11.07.2017 को हुई।
2. माह सितम्बर, 2017 को समाप्त तिमाही की 64 वीं तिमाही बैठक दिनांक 17.10.2017 को हुई।
3. माह दिसम्बर, 2017 को समाप्त तिमाही की 65 वीं तिमाही बैठक दिनांक 17.01.2018 को हुईं
4. माह मार्च, 2018 को समाप्त तिमाही की 66 वीं तिमाही बैठक दिनांक 28.04.2018 को हुई।

नगर राजभाषा कार्यान्वयन समिति, मेरठ की बैठकों का आयोजन एवं समीक्षाः-

नगर राजभाषा कार्यान्वयन समिति, मेरठ की छमाही समीक्षा बैठक में समीक्षा हेतु दिनांक 01.10.2016 से 31.03.2017 तक समाप्त छमाही की हिन्दी के प्रगामी प्रयोग/कार्यान्वयन संबंधी समेकित छमाही प्रगति रिपोर्ट कार्यालय पत्राँक 2–6/04/2013–स्था./खण्ड–1/72 दिनांक 25.04.2017 के द्वारा अध्यक्ष, नगर राजभाषा कार्यान्वयन समिति, मेरठ के अवलोकनार्थ स्थानीय कार्यालय राजभाषा अधिकारी एवं सदस्य सचिव, (नगर राजभाषा कार्यान्वयन समिति, मेरठ) कार्यालय मुख्य महाप्रबंधक (राजभाषा अनुभाग), उ.प्र. (प.) दूरसंचार परिमंडल, भारत संचार निगम लिमिटेड, मेरठ को भेजी गई तथा उक्त कार्यालय द्वारा दिनांक 26.05.2017 को आयोजित छमाही समीक्षा बैठक में कार्यालय की ओर से श्री ए. के. शर्मा, सहायक प्रशासनिक अधिकारी एवं श्री शंकर कश्यप, आशुलिपिक ने भाग लिया।

नगर राज भाषा कार्यान्वयन समिति, मेरठ की छमाही समीक्षा बैठक में समीक्षा हेतु दिनांक 01.04.2017 से 30.09.2017 तक समाप्त छमाही की हिन्दी के प्रगामी प्रयोग/कार्यान्वयन संबंधी समेकित छमाही प्रगति रिपोर्ट कार्यालय पत्राँक 2–6/04/2013–स्था./खण्ड–1/1072 दिनांक 20.10.2017 के द्वारा अध्यक्ष, नगर राजभाषा कार्यान्वयन समिति, मेरठ के अवलोकनार्थ स्थानीय कार्यालय राज भाषा अधिकारी एवं सदस्य सचिव, (नगर राज भाषा कार्यान्वयन समिति, मेरठ) कार्यालय मुख्य महाप्रबंधक (राजभाषा अनुभाग), उ.प्र. (प.) दूरसंचार परिमंडल, भारत संचार निगम लिमिटेड, मेरठ को भेजी गई तथा उक्त कार्यालय द्वारा इस अवधि के लिए कोई समीक्षा बैठक आयोजित नहीं की गई।

Staff Details

LIST OF EMPLOYEES OF CIRC AS ON 31-03-2018:

S. No.	Name	Designation
		SCIENTIFIC
1	Dr. Birham Prakash	Director up to 2-1-2018
2	Dr. Rajendra Prasad	Acting Director, w.e.f. 2-1-2018
3	Dr. Shrikant Tyagi	Principal Scientist (Animal Physiology)
4	Dr. Vinod Kumar	Principal Scientist (Animal Nutrition)
5	Dr. Umesh Singh	Principal Scientist (Animal Genetics & Breeding)
6	Dr. S. K. Dhoop Singh	Principal Scientist (Animal Reproduction)
7	Dr. Sushil Kumar	Principal Scientist (Animal Genetics & Breeding)
8	Dr. Mahesh Kumar	Principal Scientist (Animal Physiology)
9	Dr. A.K. Das	Principal Scientist (Animal Genetics & Breeding)
10	Dr. Pramod Singh	Principal Scientist (Animal Nutrition)
11	Dr. Jitender Kumar Singh	Senior Scientist (Animal Physiology)
12	Dr. S.K.Verma	Senior Scientist (Animal Nutrition)
13	Dr. Ajayveer Singh Sirohi	Sr. Scientist (Livestock Production & Management)
14	Dr. Ravinder Kumar	Sr. Scientist (Animal Genetics & Breeding)
15	Dr. T.V. Raja	Sr. Scientist (Animal Genetics & Breeding)
16	Dr. Neeraj Srivastava	Sr. Scientist (Animal Reproduction & Gynaecology) up to 31-05-2017
17	Dr. Siddhartha Saha	Sr. Scientist (Animal Physiology)
18	Dr. Naimi Chand	Sr. Scientist (Veterinary Medicine)
19	Dr. S.K. Rathee	Scientist (Animal Genetics & Breeding)
20	Dr. Rajib Deb	Scientist (SS) (Animal Biotechnology)
21	Dr. Naresh Prasad	Senior Scientist (SS) (Vety. Extn.)
22	Dr. R.R. Alyethody	Scientist (SS) (Animal Genetics & Breeding)
23	Dr. (Mrs.) Rani Alex	Scientist (SS) (Animal Genetics & Breeding)
24	Dr. (Mrs.) Megha Pandey	Scientist (Animal Reprod. & Gynaecology)
25	Dr. Yogesh Kumar Soni	Scientist (Animal Reprod. & Gynaecology)
		TECHNICAL
26	Shri C.P. Singh	Chief Technical Officer
27	Shri Rajiv Verma	Asstt. Chief Tech. Officer
28	Shri Jitender Kumar	Asstt. Chief Tech. Officer
29	Shri Y.P. Malhotra	Technical Officer
30	Shri S.K. Sharma	Technical Officer
31	Shri Suresh Chand	Technical Officer
32	Shri Omkar Singh	Technical Officer

S. No.	Name	Designation
33	Shri Chhote Singh	Technical Officer
	ADMINISTRATIVE	
34	Shri Rishi Ram	AO up to 10-4-2017
35	Shri Harish Ram	AO w.e.f. 29-12-2017
36	Shri D.S. Verma	AF & AO
37	Shri Rajnish Kumar	Junior Account Officer
38	Shri A.K. Sharma	AAO
39	Mrs. Anita Jain	Private Secretary
40	Shri N.S. Saini	Assistant
41	Shri O.P. Agarwal	Assistant
42	Mrs. Pushpa	Personal Assistant
43	Shri Shanker Kashyap	Stenographer (Hindi)
44	Shri Manoj Nehra	Assistant
45	Shri Vikas Kumar	UDC
	SUPPORTING	
46	Shri Veer Mahendra	Skilled Supporting Staff
47	Shri Kailash	Skilled Supporting Staff
48	Shri Dungar Singh	Skilled Supporting Staff
49	Shri Jitendra Giri	Skilled Supporting Staff
50	Shri Mohan Chandra	Skilled Supporting Staff
51	Shri Umesh Kaushik	Skilled Supporting Staff
52	Shri Veer Pal Singh	Skilled Supporting Staff
53	Shri Sunil Kumar	Skilled Supporting Staff
54	Mrs. Neerja Joshi	Skilled Supporting Staff

Personal Milestones

ACTING CHARGE OF THE DIRECTOR, ICAR-CIRC, MEERUT

1. Dr. Rajendra Prasad, Principal Scientist (Animal Nutrition) has taken over the acting charge of the Director, ICAR-CIRC, Meerut on 02-01-2018 (A/N) from Dr. Birham Prakash, Ex-Director, ICAR-CIRC, Meerut on the completion of his tenure as Director,ICAR-CIRC, Meerut on re-employment.

NEW JOININGS

1. Dr. Vinod Kumar, Principal Scientist (Animal Nutrition) has joined on transfer on the forenoon of 01-04-2017 after having been relieved on 31-03-2017 (A/N) from ICAR-Indian Institute of Farmining System Research, Modipuram, Meerut.
2. Dr. Sanjeev Kumar Verma, Senior Scientist (Animal Nutrition) has joined on transfer on the forenoon of 01-04-2017 after having been relieved on 31-03-2017 (A/N) from ICAR-Directorate of Poultry Research, Hyderabad.
3. Shri Harish Ram has joined the post of Administrative Officer on the forenoon of 29-12-2017 after having been relieved on 28-12-2017 (A/N) from ICAR-Directorate of Coldwater Fishries Research, Bhimtal (Nainital).

TRANSFERS

1. Shri Rishi Ram, Administrative Officer transferred to ICAR-Central Institute for Research on Buffaloes, Hisar and relieved in the afternoon of 10-04-2017.
2. Dr. Neeraj Srivastava, Senior Scientist (Animal Reproduction & Gynaecology) transferred to ICAR-Indian Veterinary Research Institute, Izatnagar and relieved in the afternoon of 31-05-2017.

PROMOTIONS

1. Dr. Rafeeque Rahman Alyethodi, Scientist (AG&B) placed to the next higher grade pay of Rs. 7000-00 in the same pay band of Rs. 15600-39100 (PB-3) w.e.f. 01-01-2017 under CAS vide CIRC, Meerut O/O No. 3-1/50/2008-Rectt./Estt./48-58 dated 13-04-2018 .
2. Dr. (Mrs.) Rani Alex, Scientist (AG&B) placed to the next higher grade pay of Rs. 7000-00 in the same pay band of Rs. 15600-39100 (PB-3) w.e.f. 17-03-2017 under CAS vide CIRC, Meerut O/O No. 3-1/50/2008-Rectt./Estt./48-58 dated 13-04-2018 .
3. Shri Rajiv Verma, Sr. Technical Officer promoted to the post of Asstt. Chief Technical Officer (T-7-8) in the higher pay level-11 of Rs. 67700-196700 w.e.f. 20-03-2017vide CIRC, Meerut O/O No. 3-1/45/04-Rectt./Estt./203-211 dated 02-06-2018.
4. Shri Jitender Kumar, Sr. Technical Officer promoted to the post of Asstt.Chief Technical Officer (T-7-8) in the higher pay level-11 of Rs. 67700-196700 w.e.f. 01-07-2017vide CIRC, Meerut O/O No. 3-1/45/04-Rectt./Estt./203-211 dated 02-06-2018.

RETIREMENTS

1. Dr. Birham Prakash, Director, ICAR-CIRC, Meerut retired from Council's service on re-employment and relieved from ICAR-CIRC, Meerut on 02-01-2018 (A/N).

Standing Institutional Committees

Works Committee:

1.	Dr. Sushil Kumar, Principal Scientist	Chairman
2.	Dr. Mahesh Kumar, PS/Incharge, Estate	Member
3.	Shri Krishan Kumar, STO IIFSR, Modipuram, Meerut	Member
4.	Shri D.S. Verma, AF&AO	Member
5.	Shri Rajiv Verma, ACTO	Member
6.	Shri A.K. Sharma, AAO	Member Secretary

Printing and Publication Committee:

1.	Dr. Shrikant Tyagi, Incharge, PME	Chairman
2.	Dr. A.S. Sirohi, Sr. Scientist	Member
3.	Dr. T.V. Raja, Sr. Scientist	Member
4.	Dr. (Mrs.) Rani Alex, Scientist	Member
5.	Dr. Rafeeque Rehman Alyethodi, Scientist	Member Secy.

Store Supply Inspection Committee:

1.	Dr. Rajendra Prasad, Principal Scientist	Chairman
2.	Dr. Mahesh Kumar, Principal Scientist	Member
3.	Dr. Y.K. Soni, Scientist	Member
4.	Indenting Officer	Member
5.	Incharge Store	Member Secretary

PME Cell:

1.	Dr. Shrikant Tyagi, Principal Scientist	Offi. I/C./Nodal Officer
2.	Dr. T.V. Raja, Sr. Scientist	Member
3.	Dr. N. Srivastava, Sr. Scientist	Member (upto 31-05-17)
4.	Dr. (Mrs.) Rani Alex, Scientist	Member

Purchase Advisory Committee:

1.	Dr. Rajendra Prasad, Principal Scientist	Chairman
2.	Dr. S.K. Dhoop Singh, Principal Scientist	Member
3.	Dr. A.K. Das, Principal Scientist	Member
4.	Dr. Naimi Chand, Sr. Scientist	Member
5.	Shri D.S. Verma, AF&AO	Member
6.	Shri Harish Ram, AO	Member Secretary (From 29-12-2017)

Tender Opening & Financial Evaluation Committee:

1.	Dr. Mahesh Kumar, Principal Scientist	Chairman
2.	Dr. A.K. Das, Principal Scientist	Member
3.	Dr. A.S. Sirohi, Sr. Scientist	Member
4.	Shri Harish Ram, AO	Member (From 29-12-2017)
5.	Shri D.S. Verma, AF&AO	Member
6.	Shri A.K. Sharma, AAO	Member Secretary

Local Purchase Committee:

1.	Dr. A.K. Das, Principal Scientist	Chairman
2.	Dr. Pramod Singh, Principal Scientist	Member
3.	Shri D.S. Verma, AF&AO	Member
4.	Indenting Officer	Member
5.	Shri Harish Ram, AO	Member Secretary (From 29-12-2017)

Technical Tender Evaluation Committee:

1.	Dr. Umesh Singh, Principal Scientist	Chairman
2.	Dr. N. Srivastava, Sr. Scientist	Member (upto 31-05-17)
3.	Dr. Naimi Chand, Sr. Scientist	Member
4.	Dr. Rajib Deb, Scientist	Member
5.	Indenting Officer	Member
6.	Incharge Purchase	Member Secretary

Repair, Maintenance & AMC Committee:

1.	Dr. Pramod Singh, Principal Scientist	Chairman
2.	Dr. S.K. Rathee, Scientist	Member
3.	Shri D.S. Verma, AF&AO	Member
4.	Shri Rajiv Verma, ACTO	Member
5.	Indenting Officer	Member
6.	Shri A.K. Sharma, AAO	Member
7.	Incharge Purchase	Member Secretary

Women Complaint Committee:

1.	Dr. (Mrs.) Rani Alex, Scientist	Chairperson
2.	Dr. (Mrs.) Megha Pande, Scientist	Member
3.	Mrs. Anita Jain, Private Secretary	Member
4.	Shri Vijay Pandit, Chief Functionary, Green Care Society (NGO)	Member
5.	Shri Harish Ram, Admn. Officer	Member Secretary (From 29-12-2017)

Library Advisory Committee:

1.	Dr. Rajendra Prasad, Principal Scientist	Chairman
2.	Dr. Shrikant Tyagi, Principal Scientist	Member

3.	Dr. S.K. Dhoop Singh, Principal Scientist	Member
4.	Dr. Sushil Kumar, Principal Scientist	Member
5.	Dr. S. Saha, Sr. Sci. & I/C. Library	Member Secretary
6.	Dr. Naimi Chand, Sr. Scientist	Member
7.	Dr. (Mrs.) Megha Pande, Scientist	Member
8.	Shri D.S. Verma, AF&AO	Member
9.	Shri Harish Ram, Admn. Officer	Member (From 29-12-2017)

Rajyabhasha Committee:

1.	Director	Chairman
2.	Dr. J.K. Singh, Sr. Scientist	Member
3.	Dr. Ravinder Kumar, Sr. Scientist	Member
4.	Dr. Naimi Chand, Sr. Scientist	Member
5.	Dr. Rajib Deb, Scientist (SS)	Member
6.	Shri Harish Ram, AO	Member Secretary & Rajbhasha Officer (From 29-12-2017)

Institutional Animals Ethics Committee (IAEC)

1.	Dr. Rajendra Prasad, Principal Scientist	Chairman
2.	Dr. Sushil Kumar, Principal Scientist	Member
3.	Dr. Mahesh Kumar, Principal Scientist	Member Secretary
4.	Dr. Naimi Chand, Sr. Scientist	Member
5.	Dr. (Mrs.) Megha Pande, Scientist	Member

Staff Welfare Committee:

1.	Director	Chairman
2.	Dr. Y.K. Soni, Scientist	Member
3.	Shri Harish Ram, AO	Member (From 29-12-2017)
4.	Mrs. Pushpa, Personal Assistant	Member
5.	Secretary (Staff Side), IJSC	Member Secretary
6.	Shri Dungar Singh, Skilled Supp. Staff	Member

Institute Deputation Committee:

1.	Director	Chairman
2.	Dr. S.K. Dhoop Singh, Principal Scientist	Member
3.	Dr. Umesh Singh, Principal Scientist	Member
4.	Dr. Pramod Singh, Principal Scientist	Member

Institute Technology Management Committee (ITMC):

1.	Director	Chairman
2.	Dr. Shrikant Tyagi, PS/Incharge, PME Cell	Member
3.	Dr. Sushil Kumar, Principal Scientist	Member Secretary

Institute Technology Management Unit (ITMU):

1.	Director	Chairman
2.	Dr. Rajendra Prasad, Principal Scientist	Member
3.	Dr. Shrikant Tyagi, Principal Scientist	Member
4.	Dr. Sushil Kumar, Principal Scientist	Member Secy. / Nodal Officer

Data Cell:

1.	PI, Frieswal Project	Officer Incharge
2.	PI, Indigenous Breeds Project	Member
3.	PI, Field Progeny Testing Project	Member
4.	Incharge, S.F. Lab.	Member
5.	I/C. ITMU	Member Secy.

Institute Committee for Extension work:

1.	Dr. S.K. Dhoop Singh, Principal Scientist	Chairman
2.	Dr. J. K. Singh, Sr. Scientist	Member
3.	Dr. Ravinder Kumar, Sr. Scientist	Member
4.	Dr. Naresh Prasad, Scientist	Member
5.	Dr. Y.K. Soni, Scientist	Member
5.	Shri Jitender Kumar, ACTO	Member Secy.

Nodal Officers

- Dr. Shrikant Tyagi, Principal Scientist as Nodal Officer of Tribal Sub-Plan (TSP, HYPM and PIMS).
- Dr. Umesh Singh, Principal Scientist as Nodal Officer for implementation of e-publishing of tender details on the Central Public Procurement Portal.
- Dr. Umesh Singh, Principal Scientist as Nodal Officer for Right to Information Act-2005.
- Dr. Umesh Singh, Principal Scientist as Nodal Officer for monitoring and providing the research and technical informations of different activities related to Agriculture and Animal Husbandry conducted and organized by the ICAR, New Delhi.
- Dr. J. K. Singh, Sr. Scientist as Nodal Officer for CPGRAMS.
- Dr. Siddhartha Saha, Sr. Scientist as Nodal Officer for IMS/FMS, INFLIBNET and CeRA.
- Dr. Ravinder Kumar, Sr. Scientist as Nodal Officer for sending advisory to the farmers.
- Shri Harish Ram, Admn. Officer as Nodal Officer for PERMISNET-IRS-FMS, PMIS Database, Aadhar Based Biometric System & CPIO for Right to Information Act-2005.
- Dr. Sushil Kumar, Principal Scientist as Nodal Officer for KRISHI Portal ICAR.

NOTE

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