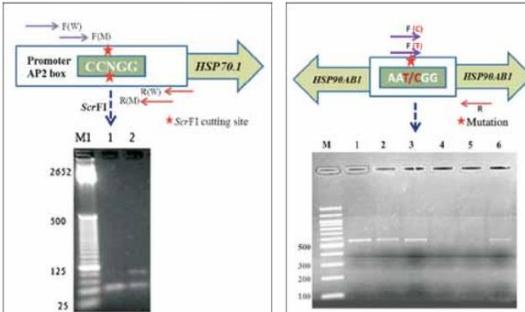


## Technology developed/products and facilities available at Central Institute for Research on Cattle, Meerut

S. No.	Name of Technology	Description of Technology	Utility / Benefit	Photograph
1	<b>Development of a new cattle breed “Frieswal”</b>	The Institute is developing a new breed of cattle “Frieswal” utilizing Holstein Friesian and Sahiwal breeds in collaboration with Ministry of Defence. Frieswal cows are being maintained at Various Military farms of the country. Currently the population of Frieswal is 17116. The average production and reproduction performance of Frieswal cow was 3284 kg milk yield in 300 days, 974 days age at first calving and 426 days calving interval. The current milk production of Frieswal cows has reached to 3600 kg in the 4 <sup>th</sup> lactation. A total of 105 Frieswal bulls have so far been evaluated based on first lactation performance of their daughters.	The crossbred Frieswal will be producing higher milk yield than the indigenous cattle breed in similar environment.	
2	<b>Availability of male germ plasm of Improved Indigenous breed of cattle</b>	Availability of superior bulls and frozen bulls and frozen semen of Kankrej, Gir for improvement of farmers animals breeds.	Farmers are getting superior germplasm for the improvement of their cattle.	

3	<b>Production of high quality male germplasm for farmers / cattle breeders use</b>	Superior quality frozen semen of Frieswal bulls is being produced in the ISO 9001:2000 certified laboratory of the Directorate and made available to various agencies. About 18 lakh doses of Frieswal semen have so far been produced and 10 lakh doses have been distributed to beneficiaries	Superior germ plasm of genetically meritorious progeny tested bulls will help in genetic improvement of crossbred population.	
4	<b>Improvement of field crossbred cattle through progeny testing programme :</b>	The crossbred field cattle in different agroclimatic zones of the country are being improved through progeny testing programme in collaboration with Guru Angad Dev Veterinary Sciences University, Ludhiana; Kerala Agricultural University, Mannuthy; BAIF, Urulikanchan, Pune; G.B. Pant University of Agriculture and Technology, Pantnagar and ICAR Research Complex for NEH Region, Sikkim Centre. Average milk production per cow under field progeny testing programme improved by 370 kg at BAIF, 515 kg at PAU and 400 kg at KAU during last 13 years.	Genetic improvement of crossbred population through progeny testing in farmers herds?	
5	<b>Development of ration for crossbred bulls</b>	Diet developed with 20% extra energy of NRC (1989) for growing Frieswal bull calves resulted in faster growth rate, better libido score, semen donation efficiency and semen quality.	This will economize the cost of rearing.	
6	<b>Development of an economical method to</b>	A cost effective and convenient method for induction of oestrus in anoestrus Frieswal heifers was developed by utilizing oral	This will help in overcoming the infertility, which is a severe problem	

	<p><b>overcome sub-fertility of crossbred cows</b></p>	<p>combination of Estrogen and Progesterone (Levonogestrel 1.2 mg and Ethinyloestradiol 0.24 mg) along with mineral mixture (Agrimin forte) @ 40 g/day for 10 days.</p>	<p>in bovines.</p>	
<p>7</p>	<p><b>Diagnostic methods developed for identifying genetic markers within HSP genes in Indian dairy cattle</b></p>	<p>Designed and developed molecular tools to identify genetic markers within the HSP genes in Indian dairy cattle — Sahiwal and Frieswal. The association studies involving physiological parameters like rectal temperature (RT), respiration rate (RR), heat tolerance coefficient (HTC) and milk production traits (total milk yield) were found significantly associated with the genetic markers. Double PCR-RFLP was used to identify deletion of cytosine within the AP2 box of HSP70.1 promoter. A set of primers were used to generate specific gene fragment. Mutated set of primers were then used to re-amplify gene, keeping single <i>ScrFI</i> restriction site intact. The RFLP generated DNA band pattern that helped diagnose animal genotypes.</p> <p>The other method was allele- specific PCR that identified genotype of intronic region within HSP 90AB1. A set of two forward primers with the mutation at 3' end and common reverse primers were used in two separate reactions to generate a partial gene fragment. Amplification clearly indicated animal genotypes with respect to SNP within HSP 90AB1. Double PCR-RFLP and allele-specific PCR could easily detect genotypes of HSP genes in cattle. These techniques can</p>	<p>Heat shock proteins (HSPs) play a major role in protection of cells from thermal stress. Diagnostic methods, double PCR- RFLP and allele-specific PCR (AS-PCR), have been developed to identify nucleotide polymorphisms (SNPs) within HSP 70.1 and HSP 90AB1 . The genetic markers are associated with relative thermo-tolerance and milk- production traits in Indian dairy cattle</p>	 <p>The figure consists of two panels. The left panel shows a schematic of the HSP70.1 promoter region with a CCNCGG AP2 box and a ScrFI restriction site. Below it is a gel image with lanes M1, 1, and 2. Lane M1 is a 25bp ladder, lane 1 shows a single band at 49 bp (wild type CC genotype), and lane 2 shows two bands at 47 bp and 96 bp (heterozygous mutant C genotype). The right panel shows a schematic of the HSP90AB1 gene with an AA7CGG mutation site. Below it is a gel image with lanes M, 1, 2, 3, 4, 5, and 6. Lane M is a 100 bp ladder, lane 1 shows a single band at 384 bp (CT genotype), lane 2 shows two bands at 384 bp and 586 bp (heterozygous mutant C genotype), and lane 3 shows a single band at 586 bp (TT genotype).</p>

		be employed to study heat-stress response in dairy cattle and their selection for better relative thermo-tolerance and milk-production traits.		
8	<b>Facility available for diagnosis of genetic diseases BLAD, Citrulinemia, DUMPS, Factor XI deficiency in cattle</b>	PCR-RFLP based techniques has been developed for identifying genetic diseases such as Bovine Leukocyte Adhesion Deficiency (BLAD), Deficiency of Uridine Monophosphate Synthase (DUMPS), Complex Vertebral Malformation (CVM), Bovine Citrullinaemia (BC) and Factor XI Deficiency (FXID).	This technology helps for identifying carrier bulls for these genetic diseases. Identified carriers animals are removed from the population and thereby spread of these diseases are controlled.	
9	<b>Genetic test developed and available for detection of A1, A2, Beta casein milk</b>	AS-PCR based technique has been developed to identify the genotype of individual animal for beta casein gene variants which has been associated with a number of human diseases like diabetes, heart diseases.	This technology helps for identifying animals with A2 alleles in the cattle populations. Consuming A2 milk is suggested to be beneficial for the health while A1 milk is supposed to increase certain diseases.	