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Research Achievements of AICRPs on Animal Sciences

Indian Council of Agricultural Research
Directorate of Information & Publications of Agriculture
Krishi Anusandhan Bhavan, New Delhi-110012

Contents

Network Project on Animal Genetic Resources

1. **Title of the Project** : **Network Project on Animal Genetic Resources**

2. **Name and Address of the Project Coordinator** : **Dr. B.K. Joshi, Director,**
National Bureau of Animal Genetic Resources,
GT Road bypass, PO Box 129, Karnal 132 001.

Phone: 0184-2267918
Fax: 0184-2267654
E-mail: directornbagr@yahoo.co.in

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

A. Phenotypic Characterization & development of Breed Descriptors of Animal Genetic Resources (24 breeds)

A set of twelve breeds of livestock and poultry were taken for the phenotypic characterization through survey during IXth Five year Plan. These units completed their technical programmes during first year of Xth Plan. The breed descriptors of all theses breeds were discussed in the 7th Scientists' meet at NBAGR, Karnal. These breeds are as follows as:

- **Bachaur cattle**
- **Dangi cattle**
- **Amritmahal cattle**
- **Nagpuri buffalo**
- **Changthangi sheep**
- **Deccani sheep**
- **Mecheri sheep**
- **Attapaddy goat**
- **Arunachali mithun**
- **Spiti horse**
- **Kutchi camel**
- **Ankleshwar poultry**

Another set of twelve breeds was taken up for the phenotypic characterization through survey during Xth plan. The Breed Descriptors and Monographs of these breed were published. These breeds are as follows as:

- **Khillar cattle**
- **Gangatiri cattle**
- **Gaolao cattle**

- **Tho Tho cattle**
- **Surti Buffalo**
- **Mandya sheep**
- **Chhotanagpuri sheep**
- **Coimbatore sheep**
- **Banpala sheep**
- **Rampur Bushair sheep**
- **Mehsana goat**
- **Ganjam goat**

B. Molecular Genetic Characterization of Animal Genetic Resources (24 breeds)

Molecular characterization of following livestock/Poultry breeds were completed by using 25 FAO recommended microsatellite markers:

Cattle: 12 breeds Gir, Kangayam, Umblacherry, Ongole, Amritmahal, Hallikar, Krishna Valley, Ponwar, Kherigarh, Kenkatha, Gangatiri and Siri cattle

Sheep: 5 breeds Patanwadi, Madras Red, Mecheri, Rampur Bushair and Banpala sheep

Goat: 5 breeds Zalawadi, Surti, Gohilwadi, Kanniadu and Ganjam goat

Horses: One breed Kathiawadi horse

Poultry: One breed Kadaknath Poultry.

Besides, Comparative diversity analysis of Gohilwadi, Zalawadi and Surti goat breeds and Kangayam, Umblacherry, Ongole, Amritmahal, Hallikar and Krishna Valley cattle breeds were also completed by using 25 microsatellite markers as suggested by FAO.

C. Conservation of Animal Genetic Resources

In-situ Conservation: Completed in-situ conservation programmes of Tharparkar cattle, Toda buffalo, Nilgiri and Magra sheep and Spiti Horse. The programme for four new breeds viz. Beetal and Surti goat and Chokla and Kilakarsel sheep initiated in the plan period.

Ex-situ Conservation: Nagori, Rathi and Kangayam cattle and Pandharpuri buffalo. The programme for four new breeds viz. Krishna Valley, Ponwar and Kherigarh cattle and Jaffarabadi buffalo were initiated during this plan period.

D. Publications:

Monographs on twelve breeds of livestock were published from all the twelve centres initiated in the tenth five year plan. These breeds are:

- Khillar cattle
- Gangatiri cattle
- Gaolao cattle
- Tho Tho cattle
- Surti Buffalo
- Mandya sheep
- Chhotanagpuri sheep
- Coimbatore sheep
- Banpala sheep
- Rampur Bushair sheep
- Mehsana goat
- Ganjam goat

All India Coordinated Research Project on Cattle

1. Title of the Project : **I. Frieswal Project : Studies on genetic aspects of Holstein-Sahiwal crossbreds.**
II. Indigenous Breeds Project : Genetic studies on performance of important indigenous breeds (Hariana and Ongole) and their improvement through selection.
III. Field Progeny Testing Project : Field recording of performance data for undertaking large scale progeny testing.

2. Name and Address of the Project Coordinator : **Prof. A.K. Misra**
Project Director
Project Directorate On Cattle
Post Box No.17,Grass Farm Road,
Meerut Cantt-250001(U.P.)India

Phone: 0121-2657136
Fax: 0121- 2657134
E-mail: pdoncattle@yahoo.com

3. Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years):

(A) Frieswal Project

ACHIEVEMENTS

- Generated a population of 18147 Frieswal females at 43 Military Farms by the end of year 2006.
- Evolved 739 elite cows at various Military Farms during the period.
- A total of 604 male calves, were born out of elite mating at 24 Military Farms and were sent to Bull Rearing Unit, Meerut for rearing and future bull production.
- A total of 13 lakhs doses of Frieswal semen produced and 7 lakhs doses distributed to different Military Farms.
- Achieved an overall mean of age (AFC) at first calving of 33 months.
- The overall mean 300 days milk yield is reached 3223.33 kg and a peak yield of 14.65 kg. The overall least squares mean of 300 days milk yield (MY300), total milk yield (TMY), peak yield (PY) and lactation length (LL) was 3223.33 kg, 3274.70 kg, 14.65 kg and 323.45 days, respectively.

(B) Genetic improvement of indigenous breeds of cattle

ACHIEVEMENTS

Hariana unit

- Created a female herd strength of 1214.
- A total of 51 bulls were inducted for test mating in 6 sets and one thousand nine hundred twenty daughters were produced.

Ongole unit

- Developed a female herd of 1306. The breeding population contained 846 females and 7 breeding bulls.
- Forty-nine bulls were inducted test mating in 6 sets.
- Two thousand three hundred and sixty six (2366) daughters were produced from these bulls. 1,56,965 semen doses were cryo preserved.

(C) Field progeny testing of crossbred cattle under field conditions

ACHIEVEMENTS

Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana

- A total of 150 bulls were evaluated in seven different sets. Achieved an overall conception rate of 42.1 % on total inseminations basis and 46.2 % on total AI's follow up basis.
- The milk yield showed increasing trend among the progenies of different sets. Achieved first lactation milk yield 2988 kg.
- The age at first calving was decreased from 1192 days in set 1 to 1059 days in set 4.
- First lactation yield averaged to 2965.5 kg.

Kerala Agricultural University, Mannuthy

- A total of 134 bulls were used in 8 different sets with an overall conception rate of 36.6 % on total AIs.
- The average 305 days milk yield was 1958 kg, 1977 kg, 2098 kg, 2194 kg and 2031 kg, in I to V sets, respectively, registering an increasing trend among the progenies.

BAIF, Uruli-Kanchan, Pune

- 126 bulls were used in six different sets with an overall conception rate of 41.8.
- The average 305 days milk yield varied from 2911.5 to 3037.8 kg. in the progenies of first three sets.

Network Project on Buffalo Improvement

1. **Title of the Project** : **Network Project on Buffalo Improvement**

2. **Name and Address of the Project Coordinator** : **Dr R K Sethi**
Director
Network Project on Buffalo Improvement
CIRB, Sirsa Road, Hisar 125 001
TeleFAX: 01662- 276170
Email : rksethi7@rediffmail.com

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

- 145 genetically superior bulls of Murrah breed put under progeny testing.
- First 5 sets of bulls have been progeny tested and 14 top ranking Progeny Tested bulls identified for nominated/ elite mating.
- 56000 frozen semen doses available from top ranking Progeny Tested bulls for sale.
- 3,50,000 doses of frozen semen available from bulls under progeny testing of Murrah and other breeds. More than 2,00,000 doses available for sale.
- Performance recording has been initiated at all the newly established centres of Network Project on Nili Ravi, Jaffarabadi, Surti, Bhadawari, Pandharpuri, Godavari and Swamp breeds of buffaloes.
- First set of 8 to 10 bulls in each set initiated for all thebreeds at the respective centres.
- Semen freezing initiated in all breeds. Frozen semen being used for test mating.
- 1000 to 2500 farmer's animals identified for test mating at each of the centre in the field animals from bulls selected under progeny testing.
- AI introduced in farmers animals for the first time in Bhadawari, Pandharpuri and Swamp buffaloes.

Network Project on Sheep Improvement

1. Title of the Project : **Network Project on Sheep Improvement**

2. Name and Address of the Project Coordinator : **Dr S.A. Karim**
Director,
Network Project on Sheep Improvement
Central Sheep & Wool Research Institute
Avikanagar (Via-Jaipur) Rajasthan
Pin Code-304 501

Phone: 01437-240490/220162(O)
Fax : 01437-220163
E-mail: cswriavikanagar@yahoo.com

3. Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):

- Improvement of 15 and 18% in the market weight (i.e. 6 month weight and 12 month weight, respectively) of Chokla sheep compared to base year (1990s).
- Improvement of 14% in the adult annual greasy fleece yield of chokla sheep compared to base year (1990s).
- Improvement of 23 and 42% in the market weight (i.e. 6 month weight and 12 month weight, respectively) of Marwari sheep compared to base year (1990s).
- 11 and 12% improvement in the market weight (i.e. 6 month weight and 12 month weight respectively) of Muzaffarnagari sheep compared to base year (1990s).
- Improvement of 21 and 33% in the market weight (i.e. 6 month weight and 12 month weight respectively) of Deccani sheep compared to base year (1990s).
- Improvement of 9 and 5% in the market weight (i.e. 6 month weight and 12 month weight respectively) of Nellore sheep compared to base year (1990s).
- The overall flock survivability improved and ranged from 90.03% to 99.31% in farm based units.
- 262 superior males of Magra sheep, 143 males of Madras Red and 181 males of Ganjam sheep supplied to farmers flocks for genetic improvement.
- Overall survivability improved by 10% through health input (viz drenching, dipping and vaccination against prevailing diseases).

All India Coordinated Research Project on Goat Improvement

1. Title of the Project : **All India Coordinated Research Project on Goat Improvement**

2. Name and Address of the Project Coordinator : **Dr. N.P. Singh**
Director & P.C. (Goat)
CIRG, Makhdoom
P.O.- Farah – 281 122
Distt – Mathura (U.P.)
Phone: 0565- 2763380
Fax:- 0565- 2763246
E-mail – director@cirg.res.in

3. Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years):

- DNA fingerprinting and micro-satellite characterization and sequencing of mitochondrial DNA in HVRI region in different Indian goat breeds carried out.
- Black Bengal, Ganjam, Jamunapari, Marwari, Malabari, Sirohi, Sangamneri and Surti breeds improved in their natural habitat through production and distribution of elite breeding males under AICRP (2500 nos).
- Nutritional requirements of goats during different physiological stages determined.
- Fodder tree leaves and cultivated leguminous fodders based complete feeds for different categories of goats as mesh, pellets and blocks developed for economic goat production for meat and milk production.
- Developed economic milk replacers for pre-weaning kids.
- Supplementation of 15 g common salt and 15 g mineral mixture daily in the feed of the adult goats improved protein and energy availability by about 16%.
- Subabool (Leucaena leucocephala) leaf meal can be incorporated upto 30% in the complete feeds for goats without any deleterious effect.
- A modified freezing protocol with increased post-thaw motility developed for cryopreservation of buck semen.
- Technology perfected for collection and transfer of embryos for quick multiplication of superior goat germplasm.
- An eight cell invitro fertilized (IVF) embryo was transferred to a local goat and a healthy kid born from surrogate mother. This is recorded for the first time in the country.
- Housing requirements for different categories of goats determined and shelter management techniques standardized.
- Developed number of sets of feeders and waterers for different categories of goats for economic goat feeding.
- Goat rearing has been found profitable under semi intensive system of management with a net profit of Rs. 0.76 per rupee of input cost and net income of Rs. 1300 to 1800 per goat per annum.

- A comb based dot ELISA kit and PCR based test developed for diagnosis of Brucella meltitensis infection (communicable to human) in goats and sheep. Development of DNA based vaccine against Brucella melitensis is underway.
- Efficacy of Monensin treatment in experiment coccidiosis in kids studied. Monensin in premixed concentrate mixture @ 40 mg per kid/day was found to be effective.
- The basic epidemiology of the common parasitic infestations and incidence of mortality under field conditions studied.
- National level baseline information recorded through micro survey of different states on epidemics of goat diseases has revealed that PPR, FMD, Ecoli infection. Contagious Ecthyma, Goat pox, Mastitis, Enterotoxaemia, Pasteurelloisis, Lymphadenitis, enteritis, Amphistomiasis and Mange were the major diseases of goats.
- A herbal drug against ectoparasites with the trade name 'ALQUIT' developed, validated and found to be very effective.
- Processing technique for preparation of goat milk Paneer – a value added product using citric acid, HCl, lactic acid and fermented paneer whey as coagulants developed and standardized.
- Carcass characteristics and meat quantity and quality of different goat breeds at different age intervals and under different feeding systems determined.
- Imparted training to 1626 farmers and entrepreneurs in scientific and commercial goat farming through 44 training programmes.
- Consultancy services on various aspects of goat production have been provided to commercial goat farmers, NGOs, Universities and National and International agencies.

All India Coordinated Research Project on Pigs

1. **Title of the Project** : **All India Coordinated Research Project on Pigs**

2. **Name and Address of the Project Coordinator** : **Dr. Anubrata Das,**
Director,
NRC on Pig (ICAR),
Rani – 781 131, Guwahati, Assam.
Telefax: 0361-2333359
E-mail : anubrata_das@rediffmail.com

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

- Exotic pig Landrace, Large White Yorkshire and Hampshire could be successfully raised and multiplied under organized farm condition.
- Litter size at birth and weaning registered progressive improvement in growth rate of indigenous pig of Jharkhand from 2002-06 (4.50±0.62 & 2.90±0.85 to 4.95±0.53 & 4.02±0.95). The body weight of indigenous pigs at 32 weeks increased from 25.99 kg to 30.67 kg under systematic managerial condition.
- Crossbred pigs with 75% exotic inheritance (Yorkshire or Hampshire) had higher value of litter trait than their 50% counter part.
- Locally available feed resources like root crop (Tapioca, sweet potato etc.), brewery waste, used tea leave and other vegetable waste like cabbage, collocassia etc. could be used to increase the nutrient for developing economic ration for pig.
- Various alternate source of energy and protein were identified:-
  - Energy sources: Rice polish, molasses, tamarind seed. Wheat bran, tea waste, pine apple waste, jackfruit waste and cashew apple.
  - Protein sources: Silk worm pupae, sunflower cake.
- Economic rations were evolved by partial or complete replacement of costly ingredient of the standard ration with the alternate feed sources.
  - Replacement of fish meal by silk worm pupae reduced the cost of pig production.
  - Replacement of maize with 20% molasses increased average daily gain and lower cost per kg gain in body weight.

- Replacement of wheat bran up to 50% level with de caffeinated waste lower the cost of production.
- Cabbage is an important vegetable crop of North East India. Generally 50 to 50% of the biological yield cabbage are used as human consumption and remaining portion is discarded as waste which is primarily the green leaves. This waste can be fed to grower and finisher pig replacement 10% of the concentrate mixer in the daily feed allowances.

- Dried cuttla fish bone meal could be used as calcium supplement in the ration for growing pigs replacing calcium carbonate.
- Incorporation of coconut oil at 2% level in the ration was found to improve the growth rate and feed conversion efficiency of grower pigs.

All India Coordinated Research Project on Poultry Breeding

1. **Title of the Project** : **All India Coordinated Research Project on Poultry Breeding**

2. **Name and Address of the Project Coordinator** : **Dr. R.P. Sharma, Project Director,**
Project Directorate on Poultry,
Rajendranagar, Hyderabad – 500030, AP
Phone: 040-24015650
Fax: 040-24017002
E-mail: pdpoult@ap.nic.in

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

Layer Crosses

1. ILI-80 developed at CARI, Izatnagar
2. ILM-90 developed at KAU, Mannuthy
3. ILR-90 developed at ANGRAU, Hyderabad.

Broiler Crosses

- B-77 developed at CARI, Izatnagar
- IBL-80 developed at PAU, Ludhiana
- IBB-83 developed at UAS, Bangalore
- IBI-91 developed at CARI, Izatnagar

All these varieties are continuously being improved over the years and supplied to the user agencies like State Governments, NGOs etc.

AICRP on Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production

1. Title of the Project: : **AICRP on Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production**

2. Name and Address of the Project Coordinator: :

Dr. K. T. Sampath
National Institute of Animal Nutrition & Physiology, Adugodi, Bangalore – 560 030
Phone: 080-25711303
Fax: 080-25711420
E-mail: ktsampath@sify.com

3. Research Achievements:

Major Achievements under the Project

- Feeding system followed at farm-gate level documented based on the primary data
- Commercialization of area-specific mineral mixture has been done by NIANP, Bangalore
- Mineral mapping of different agro-climatic zones in the country has been prepared based on micro nutrient status in water, feed, fodder and in animals
- Cataloguing of feeds and fodders based on their macro/micro nutrient content has been done for different ago-eco zones which would help in strategic supplementation of different nutrients at field level
- Documented availability and utilization of non-conventional feed resources and their commercialization.
- Unconventional feed resources like cashew apple waste, castor cake, tamarind seed kernel, jack fruit seed and rape seed cake have been evaluated for use an animal feed

All India Coordinated Research Project on Animal Disease Monitoring and Surveillance

1. **Title of the Project** : **All India Coordinated Research Project on Animal Disease Monitoring and Surveillance**

2. **Name and Address of the Project Coordinator** : **Dr. K. Prabhudas**
Project Director
Project Directorate on Animal Disease Monitoring and Surveillance,
Hebbal
Bangalore - 560 024

Phone:080-23419576
Fax: 080-23415329
E-mail: pd_admas@rediffmail.com

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years):**

Research Achievements during the period:

- Developed *India-ADMAS epitrak* software and NADRES-an inter-active website for updating animal health data base and forecasting and forewarning system for important animal diseases**.**

- National sero-Surveillance of Rinderpest disease through ELISA training and Data Monitoring System (ETDMC sero-surv) led to the **"declaration of freedom from Rinderpest Disease and Infection by OIE for India"**

- National Sero-surveillance for diseases like Brucellosis and Infectious Bovine Rhonotracheitis (IBR), Blue-tongue, PPR. etc.

- Creating national data base of village directory, demographic data of livestock population (upto district level), weather and agro-climatic data and dynamic disease data bases based of GIS and spatial, temporal occurrence of livestock diseases.

- Research on Leptosprirosis in animals- a zoonotic disease

- Development of National Serum bank for retrospective and prospective disease studies (continuing activity)

Diagnostic Kits developed, validated and used for population surveys:

- Avidin-biotin ELISA kits for antibody detection against bovine brucellosis.
- Avidin-biotin ELISA kits for antibody detection against Infectious bovine rhinotracheitis (IBR).
- ADMAS staining Kit for staining of Leptospira organisms**.**

Software Developed:

- *India admas-epitrak software* for animal health information system

nadres.org an interactive website for animal health information system, weather based forecasting and economic analysis of livestock diseases.

All India Coordinated Research Project on Foot and Mouth Disease

1. **Title of the Project** : **All India Coordinated Project on Foot and Mouth Disease**

2. **Name and Address of the Project Coordinator** : **Dr. B. Patnaik, Project Director**
Project Directorate on Foot and Mouth Disease
IVRI Campus
Mukteswar- 263138
Phone: 05942-286004
Fax: 05942-286595
E-mail: pattnaik@gmail.com,Pdfmd111@gmail.com

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years):**

- 6021 clinical samples were subjected to sandwich ELISA and 3029 samples serotyped with a preponderance of serotype O (2390 samples) followed by type A (324) and Asia 1 (315).
- 213 virus samples revived in BHK-21 cell system were added to the ever growing national repository of Foot and Mouth Disease virus. The National Repository of FMD virus now contains 1310 field virus isolates.
- 660 field virus isolates characterized antigenically through two dimensional micro neutralization test, liquid phase blocking ELISA and sandwich ELISA using serum antibody and monoclonal antibody.
- 2324 serum samples tested in liquid phase blocking ELISA (LPBE) for FMD virus specific protective antibody titre.
- Extended technical and logistic support to FMD control programme initiated by Govt of India for the creation of disease free zones in selected 54 districts of the country. Diagnostic kits for analyzing about 22,000 serum samples were provided and 21,000 pre- and post vaccinate serum samples were tested by LPB ELISA. Sixty percent of the serum samples tested contained protective level of antibody indicating success of the first phase of the FMD control programme.
- Genetic characterization of field isolates (313, 107 and 132) belonging to type O, A and Asia 1, respectively were sequenced at the 1D region. The complete structural protein coding region of 31 type O, 18 A and 18 Asia 1 viruses was sequenced. Complete genome sequence

of two vaccine strains in type Asia 1 and 23 field isolates was determined. Besides, leader protease (L) and 3A genes involved in host range and virulence were also sequenced for many isolates belonging to types O, A and Asia 1. A huge sequence database on Indian FMD viruses could be created and expert analysis of these data led to many important phylogenetic inferences. In type Asia 1 two lineages were found circulating in the field with dominance of a divergent group in lineage 2. This was supported at the complete genome sequence based phylogeny and at the 5'-UTR length as well. The secondary RNA structures predicted for IRES regions revealed the probable presence of an extra domain in addition to the five domains in the isolates of the divergent group. In type A, four genotypes viz. I, IV, VI and VII, out of ten global genotypes, were found present in India. The presence of oldest PanAsia strain in India was traced back to 1982. Although, recombination in the capsid coding region in FMD viruses is a very rare event, an inter-genotype recombinant in type A was a significant finding during this period.

- A study undertaken to shortlist candidate vaccine strains in type O indicated that isolates IND 271/01 and IND 120/02 can be ideal substitutes to current vaccine strain, IND R2/75. Complete nucleotide sequence of all the short listed strains was generated.
- Determined the lineage of type Asia 1 field isolates using PCR protocols. A multiplex-PCR (mPCR) protocol for serotyping of FMD clinical samples was developed. The test was found to be sensitive and reliable for differentiating Indian FMDV serotypes. The detection level varied from 1.5 to 10,000 $TCID_{50}$ depending on serotypes. A non-isotopic RNA dot hybridization assay with colorimetric detection, targeting both the IRES and the 3D region, was also validated, and is capable of handling high throughput samples with ease. RT-PCR (oligoprobing) ELISA and dot hybridization assay showed 1000- and 10-fold greater sensitivity than the sandwich ELISA, respectively.
- Diagnostic Kits and reagents for FMDV detection (for testing 1,25,000 tissue samples) and for seromonitoring under FMD control program were produced, optimized, evaluated and supplied to different units/centers on a routine basis.
- A trained work force of 60 persons for undertaking FMD diagnosis and seromonitoring was created across the country.

Network Project on Bluetongue

1. **Title of the Project** : **Network Project on Bluetongue**

2. **Name and Address of the Project Coordinator** : **Dr. R.S. Chauhan,**
Joint Director (CADRAD),
Indian Veterinary Research Institute,
Izatnagar-243 122 (U.P.)
Phone: 0581-2302188
Fax: 0581-2301865
E-mail: rschauhan123@rediffmail.com

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

- Sixteen bluetongue virus isolates of types 1, 2, 9, 15, 18 and 23 from different sources were utilized as virus repository.
- No outbreak of bluetongue was reported in north India except in Southern States like **Andhra Pradesh**, **Karnataka** and **Tamil Nadu**.
- Varying percentage of seroprevalence of BT has been recorded in different species of livestocks.
- One monoclonal antibody produced against BTV has potential for developing sandwich/competitive ELISA and BTV r-Ag based indirect ELISA for detection of BT antibodies has been developed and evaluated using more than thousand sera. In addition, typing facility developed to type the virus indigenously.
- BTV vaccine using BEI inactivated bluetongue virus serotype 1 adjuvanted with saponin or seppic oil yielded promising results in local and Bharat Merino breeds of sheep.
- Samples of midges from different parts of the country were identified as *C. oxystoma, C. clavipalpis, C. actoni, C. anophelis, C. orientalis*, *C. similis* and *C. imicola.*.
- Type specific primer designing for typing of new isolates of BTV, development of multiplex RT-PCR for differential diagnosis of BTV and PPRV, RNA-PAGE of the isolates, nucleotide sequence studies to determine the relationship of Indian isolates with other global isolates have been done. It has been found that BTV-2 isolate from Hyderabad is more closely related to European and Chinese isolate than to American isolate. Homology among Indian and Australian isolates ranged from 95.7% to 99.4 %. Indian BTV types are closely related to each other forming monophyletic group
- VP7 gene was amplified, cloned, expressed in PET 32a and identity was confirmed by SDS-PAGE and western blotting.
- Recombinant antigen reacted well with antibodies against 10 serotypes of BTV namely, BTV-1, 2, 3, 4, 5, 7, 14, 15, 22 and 23.

Network Project on Gastro-Intestinal Parasitism

1. **Title of the Project** : **Network Project on Gastro-Intestinal Parasitism**

2. **Name and Address of the Project Coordinator** : **Dr. JK Malik,**
Joint Director (Research),
Indian Veterinary Research Institute,
Izatnagar-243 122 (U.P.)
Phone: 0581-2300361
Fax: 0581-2300312
E-mail: jkmalik@ivri.up.nic.in

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

- A software based forecasting model 'FROGIN" developed for forecasting of haemonchosis for semi-arid zone of Rajasthan.

- Early detection of haemonchosis as early as ist week post infection in sheep through Dot ELISA with purified ES antigen.

- Significant immunoprotection achieved against haemonchosis in sheep utilizing H!! antigen (concealed gut derived antigen).

- Nemotophaghous fungi Duddingtonia flagrans evaluated for Biological control.

Network Project on Hemorrhagic Septicemia

1. Title of the Project : **Network Project on Hemorrhagic Septicemia**

2. Name and Address of the Project Coordinator : **Dr. R.S. Chauhan,**
Joint Director (CADRAD),
Indian Veterinary Research Institute,
Izatnagar-243 122 (U.P.)
Phone: 0581-2302188
Fax: 0581-2301865
E-mail: rschauhan123@rediffmail.com

3. Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):

- Low volume Saponified HS vaccine was developed and tested in field conditions and found working satisfactory.
- The main serotypes of *Pasteurella multocida* were found as B:2, A:1, A:1,3, A:3, A:4, F:3,4, A:3,4,12, D:1, D:3, F:1, F:3, F:4,12 in different parts of country.
- Molecular studies were conducted for identification and characterization of *Pasteurella multocida* isolates using PCR, Multiplex-PCR, RAPD analysis and ribotyping.
- Cloning and sequencing of 16s RNA gene from different isolates of *Pasteurella multocida* B:2.
- Two major outer membrane proteins of 32 kDa and 38 kDa were found to be immunogenic in rabbits.
- A patent for low volume Saponified Haemorrhagic septicaemia (HS) vaccine was submitted.

Network Project on R&D Support for Process Upgradation of Indigenous Milk Products for Industrial Application

1. **Title of the Project** : **Network Project on R&D Support for Process Upgradation of Indigenous Milk Products for Industrial application.**

2. **Name and Address of the Project Coordinator** : **Dr. G.R. Patil**
National Dairy Research Institute,
Karnal-132001
Phone: 0184-2259003
Fax: 0184-2250042
E-mail: grpndri@yahoo.co.in

3. **Research Achievements (New varieties/Technologies Developed/validated and being practiced in the last five years) (2002-2007):**

NDRI, Karnal Centre

- Developed a process for the manufacture of ready-to-reconstitute Rasmalai mix
- Developed a process for the manufacture of ready-to-reconstitute Basundi mix
- An industrial scale technology developed for the manufacture of instant Kheer mix
- Process for manufacture of Arjuna herbal ghee developed
- Technology for the manufacture of reduced fat oven-baked ready-to-reconstitute Gulabjamun developed
- A process for long life milkcake developed
- A survey for ascertaining the levels of pesticides, antibiotics and heavy metals residues in milk marketed in Northern region conducted

NDRI-SRS, Bangalore Centre

- Technology for production of Palada Payasam developed
- Technology for production of Gas gasse payasam developed
- Up-gradated process for large scale manufacture of Palada payasam ready to use mix
- Technology for ready to use mixes for Palada Payasam and Avalakki payasam developed
- Donducted a survey on the status of pesticides and heavy metals in milk and milk products sold in southern states

AAU, Anand Centre

- A market survey was conducted for characterization of Basundi
- Process for the manufacture of basundi standardized
- A mechanized system designed and developed for the manufacture of Basundi
- Conducted a survey work was carried out on status of pollutants and contaminants in milk and feed sources marketed in Gujarat state

WBUAFS, Mohanpur Centre

- carried out survey work on milk, traditional milk products and other dairy products of eastern region
- Developed/standardized a method for Rasogolla making
- Developed/standardized a method for Sandesh making

Patents Filed under Network Project:

- A process for instant rasmalai mix by: G.R.Patil, R.R.B.Singh, A.A.Patel, S.K.Nayak and Sangeeta Mishra.
- A process for the manufacturing of ready to reconstitute paneer curry mix by: Surinder Kumar and G.R.Patil
- Development of analytical process for detection of antibiotic residues in milk using bacterial spores as biosensors by: N.K.Goyal, Sharmila Sawant, G.R.Patil and R.K.Malik
- A process for the preparation of ready-to-reconstitute kheer mix and prepared by such a process by: A.A.Patel, G.R.Patil, R.R.B.Singh, Neeraja Tyagi, Vishal Tripathi and Alok Jha
- A formulation and process for ready to reconstitute Basundi mix by: Prateek Sharma R.R.B.Singh, G.R.Patil and A.A.Patel
- A process for low fat, oven baked instant gulabjamun by: G.R.Patil, R.R.B.Singh, A.K.Singh, A.A.Patel, Anuradha Singh and Rekha Dahiya
- A process for long-life milk cake by: Anil Kumar, G.R.Patil, R.R.B.Singh and A.A.Patel.
- Process for milk gelatinized Ada production by: S.Kulkarni, B.D.Tiwari, B.C.Ghosh, B.V.Balasubramanyam, K.Jayaraj Rao, Rekha R.Menon and K.Vani Rai.
- Process formlation of Palada Payasam Ready mix by: S.Kulkarni, B.D.Tiwari, B.C.Ghosh, B.V.Balasubramanyam, K.Jayaraj Rao, Rekha R. Menon and K.Vani Rai
- A process for accelerated development of colour and flavour in Palada Payasam B. by: Surendra Nath, V. Unnikrishnan, M.K.Bhavadasan, Mrs. M.K.Vedavati, Satish Kulkarni.

- Utilization of caramelized sucrose as an ingredient in the process optimization of Kunda and other related products by: Satish Kulkarni, K.Jayaraj Rao, B.C.Ghosh, B.V.Balasubramanyam, Vani Rai K., Menon Rekha Ravindra, T.Mahalingaiah, B.V.Venkateshaiah, F.Magdaline, E.E.

Technologies commercialized:

- Technology for the manufacture of Arjuna herbal Ghee has already been commercialized for domestic market as well as for export by a Mumbai based entrepreneur M/s Punjab and Sind Dairy Products Pvt. Ltd., AG-2, Cama Estate Walbhat Road, Goregaon(East) Mumbai-400063 under the brand name PUNJAB SIND HERBAL GHEE. The manufacturer has been given non-exclusive rights to use the technology.
- The complete technology packages for the ready-to-reconstitute Rasmalai mix, Ready-to-reconstitute Basundi mix, Ready-to-reconstitute Kheer mix, Long life milk cake and Arjuna Herbal Ghee have been assigned to National Research Development Corporation (A Government of India Enterprise), 20-22, Zamroodpur Community Centre, Kailash Colony Extenion, New Delhi 110048 for commercialization under a Memorandum of Understanding signed between National Dairy Research Institute, Karnal and the NRDC, New Delhi