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Livestock Improvement

ANIMAL IMPROVEMENT

Cattle

Frieswal Project: Genetic merit of 80 bulls was evaluated based on first lactation (300 days milk yield) of their daughters. Top 10 bulls had their breeding values between 3,056 and 3,140 kg. Their superiority over the herd average (2,806 kg) ranged from 8.91 to 11.9%. Genetic and phenotypic trend of first lactation milk yield was 24.88±0.63 {0.88% of mean breeding value (2,827 kg)} and 30.76±3.26 {1.07% of mean phenotypic value (2878 kg)} kg/year, respectively.

At Semen Freezing Laboratory 127,208 semen doses were produced and 41,385 doses distributed to different Military Farms. The overall mean age at first calving in Frieswal cows was 977.06 days. The least squares mean of service period, dry period and calving interval were 173.58, 124.98 and 444.72 days respectively. The overall least squares mean of 300 days milk yield, total milk yield, peak yield and lactation length were 3246.72 kg, 3,355.36 kg, 15.33 kg and 341.91 days, respectively.

Indigenous breeds

Hariana unit: At Hariana unit, 55 bulls have so far been used under test mating in 7 sets. The overall conception rate was 56%. Average age at first calving, first lactation milk yield and peak yield, 300 days or less milk yield and lactation length were 1,496.6 days, 1,087.7 kg, 6.52 kg, 1085.8 kg and 234.9 days, respectively. First dry period, service period and calving interval averaged 208.4, 172.7 and 469.5 days, respectively. Six young bulls put to training for draught took an average of 40.50±1.18 days to be ready for the purposes. The mean fatigue score for empty cart ranged from 2.15 to 2.52 after 2 hr work and 2.45 to 2.70 after 3 hr work.

Ongole unit: At Ongole unit, 49 bulls have so far been used under test mating in 6 sets. The overall conception rate was 47%. The age at first calving averaged 53.19 months. The average lactation milk yield, 300 days or less milk yield, peak yield and lactation length were 405.9 kg, 403.6 kg, 2.98 kg and 183.7 days, respectively. The first service period, dry period and calving interval averaged 275.3, 357.1 and 588.1 days respectively. The draught power varied from 0.52 to 0.63 HP among the bulls.

Field progeny testing

At GADVASU, Ludhiana; KAU, Mannuthy; and BAIF, Urulikanchan units of the project 150, 180 and 126 bulls have so far been used in different sets. The overall conception rate was 45.3, 37.4 and 45.15% at these units, respectively. The average first lactation 305 days lactation milk yield of daughters in first five sets showed an increasing trend in milk yield. Similarly the average age at first calving among the progenies of first three sets at GADVASU, Ludhiana and BAIF, Urulikanchan, had shown positive decreasing trend.

Buffalo

Network Project on Buffalo Improvement

Murrah: Under Network Project on Buffalo Improvement sixth set of 16 bulls was progeny tested, and the top ranking bull showed sire index of 2,121 kg based on 21 daughters spread at 4 participating centres. The superiority of this bull was 13.3% over contemporary daughter's average of 1,818 kg. Bull ranked II and III with sire index of 1,972 and 1,953 showed 9.29 and 6.92 superiority to contemporary daughters. The XI set of 14 genetically superior Murrah breeding bulls was selected from the participating centers, and test mating was initiated from July 2008.

Jaffarabadi: A herd of 110 elite Jaffarabadi buffaloes was established at the JAU, Junagarh. The wet average was 7.52 kg/animal/day and average of 305 days or less lactation milk yield was 1,807 kg. AI programme was undertaken involving 7 bulls; and average conception rate of 58.5% was obtained in field animals.

Pandharpuri: A herd of 50 elite Pandharpuri buffaloes was established at the MPKV, Kolhapur. The annual wet average was 5.47 kg/animal a day, and 305 day or less lactation milk yield 1,833 kg. AI was undertaken covering 11 bulls of set I and 12 bulls of set II with 48.1% conception rate.

Surti: A herd of 80 elite Surti buffaloes was established at the MPUAT, Vallabhnagar. The annual wet average was 5.70 kg/animal a day and average 305 day or less lactation milk yield 1,649 kg. During the period 1,811 AI resulted in conception rate of 30.17%.

Sheep

Under the programme on sheep genetic improvement and conservation, the production traits of native breeds (Malpura, Chokla, Marwari, Magra and Garole) and synthetic sheep (Bharat Merino, Gaddi Synthetic and Avikalin) were improved. Under the programme for enhancing mutton production through introduction of prolificacy traits of Garole into Malpura sheep, the twining rate of 37.61% and triplets of 4.27% were achieved in Garole × Malpura sheep. Higher gain in body weights and growth rate of lambs were achieved by backcrossing GM rams with Malpura sheep.

Twining rate of 37.6% and triplets of 4.27% have been achieved in Garole × Malpura sheep

Goats

All India Co-ordinated Research Project on Goat Improvement

Jamunapari: Mean body weights of kids at birth, 3, 6, 9 and 12 months of age were 3.28±0.03, 11.99±0.14, 16.41±0.22, 21.54±0.38 and 27.06±0.38 kg, respectively. Average milk yield in 90 days, 140 days, total lactation yield and lactation length were 103.11±2.04, 143.68±2.94,152.78±4.17 kg and 169.98±3.09 days, respectively. The average age at first kidding, weight at first kidding and kidding interval were 754±21 days, 32.6±0.5 kg and 323±5 days, respectively. The multiple birth rate and kidding rate were 34.2 and 1.34%, respectively.

Barbari: The body weights of kids at birth, 3, 6, 9 and 12 months of age were 1.84±0.01, 6.11±0.10, 2.38±0.18, 17.19±0.10 and 23.58±0.28 kg, respectively. Year of birth had significant effect on the weights at different ages. Overall mean for 90 days milk yield, lactation yield, and lactation length were 58.81 kg, 62.21 kg and 109.80 days, respectively, which were higher in comparison to previous years.

Sirohi: The mean body weights at birth, 3, 6, 9 and 12 months of age were 3.09±0.44, 12.23±0.18, 15.48±0.31, 19.07±0.30 and 23.74±0.33 kg, respectively. The milk yield in the does averaged 74.43±1.58 kg for 90 days, 97.24±2.21 kg for 150 days and 107.93±3.36 kg for total lactation. Lactation length was 175.49±4.17days. The selection differentials of selected male kids from population for 9 months body weight and their dam's first lactation at 150 days milk yield was 4.75kg and 13.81 days respectively.

Ganjam: The average body weights of male kids at birth, 3, 6, 9 and 12 months of age were 2.35±0.02, 6.82±0.02, 9.36±0.03, 13.30±0.04 and 17.33±0.06 kg respectively. The average daily milk yield was 418.28±9.54 g with total milk production of 73.86±1.25 kg in 176.58 days of lactation.

Malabari: The mean weights at birth, 3, 6, 9 and 12 months of age were 2.28±0.07, 9.04±0.14, 16.17±0.56, 18.09±1.00 and 24.63±0.94 kg, respectively. The average lactation yield was 45.72±3.94 kg. The average gestation length, age at first kidding and inter kidding interval were 147.37±1.42, 394.47±25.73 and 274.0±21.3 days, respectively. The incidence of single, twins, triplet and quadruplet births was 43.37, 49.34, 5.96 and 1.33%, respectively. The kidding rate was 1.65%. The selection differential was 5.74 kg and genetic gain was 1.00 kg.

Surti: The overall mean for body weights at

Mega Seed Project

Mega Seed Project on Pig was launched with 4 cooperating centres (BAU, Ranchi; Veterinary and AH Department, Government of Mizoram; ICAR Research Complex for NEH region, Nagaland Centre; and Assam Agricultural University, Khanapara) for enhancing pig production through supply of superior pig germplasm to farming community.

birth 3, 6, 9 and 12 months age were 2.90±0.06, 9.23±0.26, 12.85±0.39, 15.40±0.54 and 20.38±1.01 kg, respectively. The milk yield for 90 and 120 days was 158.44±6.25 and 215.58±10.62 kg, respectively. The kidding rate was 1.63 under field conditions. Multiple birth was 56.15%. The improvement of 5.61% was observed at 3 months body weight because of use of elite bucks under field condition.

Black Bengal: The body weights of Black Bengal goats at birth, 3, 6 and 9 months of age averaged 1.17±0.01, 5.28±0.06, 7.82±0.09 and 10.91±0.15 kg, respectively. The average weekly milk yield for first, second and fifth week was 1.58±0.13, 1.66±0.14 and 0.97±0.18 kg respectively. Black Bengal is a highly prolific goat breed, and is having 83.72% multiple births. The kidding rate was 1.80, the highest among all the goat breeds of the country. The age and weight at first kidding were 378±2.12 days and 13.52±0.22 kg.

Marwari: The overall means for body weights at birth, 3, 6 and 12 months of age were 2.58±0.011, 9.68±0.29, 18.33±0.46 and 27.41±0.81 kg, respectively. The average milk yield was 38.30±0.27 kg in 30 days, 85.24±1.88 kg in 60 days, and 121.15±1.03 kg in 90 days of lactation.

Sangamneri: The least squares means for body weights at 1, 3, 6, 9 and 12 months of age were 4.87±0.04, 8.72±0.08, 13.16±0.41, 16.81±0.63 and 21.85±0.69 kg, respectively. The least squares means for milk yield in Sangamneri goats for morning, evening and daily milk yield were estimated for 90 days as 0.459±0.003, 0.423±0.003 and 0.881±0.006 kg, respectively.

Pig

All India Co-ordinated Research Project on Pigs

Two new centres of AICRP on Pig, one each at College of Veterinary Science, CAU, Mizoram and Nagaland University, Medziphema, were launched. Two genetic groups of pig, viz. 50%H50%I and 75%H25%I are being developed at AICRP on Pig, AAU, Khanapara, from crosses of Hampshire (H) and indigenous (I) pigs of Asom.

Rabbit

German Angora rabbits under temperate climates with scientific management produced 824g of wool annually with staple length, fibre diameter and guard hair of 6.14cm, 13.55µ and 4.67%, respectively. Further efforts are underway to achieve annual wool yield of 1,200 g through better feeding and management. Broiler rabbits under semi arid climate of Rajasthan gained body weights of 1.40 kg at 84 days of age under routine management.

Efforts are underway to improve wool yield of Angora rabbits

Poultry

Improvement of poultry for eggs: Under the AICRP on Poultry Breeding,WL pure lines, i.e. IWH, IWI, IWD, IWF, IWN and IWP strains were improved. The hen housed egg production up to 64 weeks increased in IWN (by 3.4 eggs) and IWP (by 3.5 eggs) over previous generation. The genetic response for egg production to 64 weeks in IWN (8.80 eggs) was higher than that in IWP (4.80 eggs) over the last 5 generations. The egg weight at 40 weeks also increased in both the strains.

At Anand center, S-7 generation of IWN and IWP showed positive genetic response of egg production to 64 weeks (1.28 eggs in IWN and 1.46 eggs in IWP) over last 6 generations. The egg production up to 72 weeks of age in IWN was 297 eggs. At the SVVU, Hyderabad, the IWD and IWF showed improvement in egg production to 64 weeks by 1 egg in both the strains in the present generation. The egg production up to 72 weeks in both the lines was around 290 eggs. In S-29 generation of IWH, IWI the egg weight at 28 weeks increased in both the populations on genetic scale. Improvement in pullets of S-6 generation of egg production in IWH (by 4.88 eggs) and IWI (by 9.47 eggs) and egg mass in IWK (by 1,043 g) was recorded up to 64 weeks of age over the previous generation. The humoral immune response increased in all the populations

Maintenance and evaluation of gene lines

Naked neck and dwarf lines were maintained as resource populations. Body weight at 20 weeks, ASM and egg weight at 28 and 32 weeks, respectively, were 2,378 g, 170.6 days, 52.7 g and 56.8 g in naked neck and 1,968 g, 148.6 days, 49.8 g and 51.2 g in dwarf line in S-6 generation. The lines matured early, while production traits were stable as compared to last generation.

over last generation. The control population was stable for most of the traits over last 6 generations.

Improvement of poultry for meat: Under the AICRP on Poultry Breeding, synthetic coloured broiler populations, viz. PB-1, PB-2, SDL, CSML and CSFL, were improved. In PB-2, the body weight at 5 weeks increased by 107g as compared to previous generation, while egg production up to 40 and 52 weeks improved by 3.12 and 11 eggs, respectively.

The body weight of S-32 generation at 5 weeks was 1,036, 1,024 and 973 g in PB-2, PB-1 and control population, respectively, and showed improvement (38 g) over previous generation. The egg production up to 40 and 52 weeks increased by 4.5 and 8 eggs, respectively, in PB-2.The phenotypic response per generation for 5-week body weight was 21.2 and 24.67 g and genetic response was 22.9 and 26.4 g, respectively, in coloured synthetic male line (CSML) and coloured synthetic female line (CSFL) over last 7 generations. The S-12 generation of the SDL improved marginally in the current generation as genetic and phenotypic responses of 5-week-body weight were 12.7 g and 20.6 g respectively.

The body weight, breast angle and shank length, respectively, at 5-week were 934g, 88.1° and 72.4mm in S-18 generation of PB-1. On genetic scale, 5-week body weight improved by 46 g over the last generation. In the PB-2 line, ASM, body weight at 20 and 40 weeks, egg weight at 32 and 40 weeks and egg production to 40 weeks, respectively, were 166.2 days, 2,461 g, 3,533 g, 54.2 g, 59.0 g and 57.8 eggs.

Rural poultry

Pure lines, viz. PD-1, PD-2 and PD-3, were improved and utilized in production of crosses for rural poultry production. Besides, PD-4 and PD-5, which originated from Aseel and Kadaknath, were maintained as source of native germplasm in production of crosses. Shank length, the primary trait of selection, improved by 4.63 mm in SL-2 generation of PD-1 line as compared to previous generation. The ASM reduced by 3.1 days and the egg production improved by 0.51 eggs per generation over the last 7 generations in PD-2 line during S-7 generation. The PD-3 line matured 11.5 days early compared to previous generation, and egg production and egg mass improved by 1.67 eggs and 111.3 g respectively. PD-5 matured early compared to PD-4 and laid more eggs compared to PD-4, but egg weights were better in PD-4 line. The lines were regenerated (G-2), and the body weight at 6 weeks in PD-4 and PD-5 was 305 and 192 g, respectively.

The cross PB-2 × PD-3 was used as male line and crossed with PD-2 line (TC) and evaluated along with a reciprocal cross (TCR) and Vanaraja (VR) under intensive system. TC cross matured early and produced more number of eggs (168.7 eggs) compared to TCR (158.4 eggs) and VR (152.6 eggs) at 72 weeks of age.

CARI Nirbhic and CARI Shyama birds were evaluated at Agartala centre of AICRP on Poultry Breeding, at both farm and field levels. Two medium types of multicoloured populations were produced by crossing CSML with coloured normal and dwarf birds, and evaluated up to 6 weeks of age at the centre.

Improvement of backyard poultry in Kashmir Valley: The performance of Vanaraja chicks was evaluated under rural backyards at the SKUAST, Srinagar experimental farm. The body weight of male birds at 8, 16, 24 and 30 weeks was 840, 1,719, 1,908 and 3,248 g, respectively. The corresponding values in females were 613, 1,337, 1,502 and 2,642 g, respectively. The mortality between 5 and 26 weeks under backyard was 14.6% and for the next 26 weeks it was 4.7%. The body weight was higher and mortality was lower under intensive management system. Vanaraja is now in considerable demand in Kashmir.

BIOTECHNOLOGY

Human lactoferrin expressed in yeast systems

Lactoferrin, a unique multifunctional protein expressed in the milk of mammalian species including human, is a high value protein of considerable value due to its direct impact on human health. Its major role is in iron absorption and has strong iron-binding properties. Lactoferrin is also used in the treatment of bacterial, viral and fungal infections, sepsis, cancer, tumors and immuno-suppressory illnesses both in human and veterinary medicine. Human lactoferrin (hLf) with several bioactive functions in particular, can find potential market in health/functional foods for elderly or immuno-compromised hosts. Lactoferrin-fortified dairy foods will also have extended shelf life, hence finds application in dairy, food and meat industry. Alternatively, the iron-loaded lactoferrin can be added to baby formula, cereal, and ice cream to enhance their nutritional value. However, it is impractical to purify native lactoferrin particularly from human milk to make it a commercially viable product. Hence, human lactoferrin (hLf) cDNA was cloned and sequenced both from mammary gland tissue and neutrophils and finally expressed in *Saccharomyces cerevisiae* and in *Pichia pastoris*.

FISHERIES

Genetic improvement of tiger shrimp

(*Penaeus monodon*): Harvest weights of tagged shrimp *Penaeus monodon* were recorded. Significant genetic variations in body weight at harvest and pond survival were observed. These estimates indicated the possibility of genetic improvement of these traits through selection. The heritability estimate for resistance to white spot syndrome virus (WSSV) was extremely low. There was a slight positive association between harvest weight and pond survival whereas a negative association was observed between body weight at harvest in ponds and resistance to WSSV recorded in the challenge test.

Natural bioactive substances of therapeutical importance: Root extracts of *Rhizophora mucronata*, *Rhizophora apiculata* and *Acanthus ilicifolius* from backwaters of Kochi were orally tested after checking LD_{50} values for analgesic, anti-pyretic and wound healing effects in rats. Maximum activity was observed for methanolic root extracts of *A. ilicifolius*, followed by *R. apiculata* and *R. mucronata*.

Biocontrol of *Listeria monocytogenes*: *Lactobacillus* spp. inhibited four strains of *Listeria monocytogenes* and showed desirable characteristics for use as a biocontrol (competitive exclusion) culture. *Yersinia enterocolitica* was isolated from crustaceans, bivalves and cephalopods collected from Kochi. Other species identified were *Y. bercovieri* (20%), *Y. frederiksenii* (20%) and *Y. intermedia* (60%). Biotype and genotype characterization of the *Y. enterocolitica* strains isolated from shellfish samples revealed that they belonged to biovar 1A and virulence markers *ail* and *yst* were not present in them, but *inv* genes were noted.

Aquatic insect control: The potential of silver barb, *Puntius sarana* as a candidate species for control of aquatic insects was assessed. Notonectids were accepted well by fry of *P. sarana*. The fry showed significantly higher final body weight, net weight gain and specific growth rate with provision of live notonectids thereby showing the feasibility of inclusion of the species for biological control of insects.

Detection of viral pathogens affecting shrimps and carps

A demo microarray (biochip) was developed for the detection of economically important viral pathogens white spot syndrome virus (WSSV), monodon baculovirus (MVV) affecting shrimp and Koi herpes virus. The results demonstrated the possibility of development of a single DNA microarray (biochip) for the detection of all the reported viral pathogens of finfish and shellfish.

Fish seed: Breakthrough in early carp breeding

Rohu and catla were bred during off-season, and spawn was successfully produced at carp hatchery, CIFA, Bhubaneshwar, under controlled conditions to advance gonadal maturation. Rohu was bred on 24 January, 9 February and 12 March 2008 and catla on 26 February 2008 accounting for first record of early carp breeding in India. The breeding season of carps in India is from May to August depending on the onset of monsoon and suitable size of fish fingerlings (80-100 mm) for grow out culture is normally available to the farmers earliest by September. The present breakthrough would enable the farmers to have fingerlings by May for stocking and utilize at least five more months as the growing period. Besides, this opens up the possibility of breeding and seed production of carps round the year.

Phytoremediation potential of water hyacinth: Water hyacinth (*Eichhornia crassipes*) plant removed approximately more than 90% of copper and cadmium. The accumulation of Cu and Cd in roots and stems increased with the initial concentration. The biocencentration factor (BCF) of Cu was higher than that of Cd at the same duration, suggesting that the accumulation potential of *Eichhornia crassipes* for Cu was higher than that for Cd and could be used to treat wastewater contaminated with low Cu and Cd accumulations.

Successful spawning of pengba (*Osteobrama belangeri*): *Osteobrama belangeri* known as pengba is an endemic species of Loktak lake, Manipur. It is a rare species and fetches high price locally. It was successfully bred under controlled conditions. One female fish weighing 372 g released 1.4 lakh eggs out of which 0.60 lakh spawn was recovered with 54% hatching success.

Breeding of *Ompok pabda* and rearing of hatchling/spawn: Pabda (*Ompok pabda*), weighing 25-27 g, attained maturity and were bred through hypophysation technique. The early fry of pabda (average length of 280 mm) were reared in cement cistern and indoor glass aquaria, fed with live feed and silkworm pupae, and the fry attained a size of 390-470 mm (average length 441 mm, weight 0.5 g) in 35 days. They are being further reared for fingerlings and table fish. Another significant achievement is the multiple breeding (twice) of pabda.

Mariculture seed production: Shrimp, *Penaeus semisulcatus*, and crab, *Portunus pelagicus*, seeds were produced in hatchery and sea ranched. Spawning, hatching and larval rearing of crucifix crab, *Charybdis feriatus* was achieved for the first time.