

## 7. Livestock Improvement

### Cattle

**Development of crossbred strain of cattle (Frieswal):** Frieswal Project is operating in collaboration with the Ministry of Defence by utilizing the crossbred animals available at different Military Farms of the country. A total of 17,114 Frieswal females including 10,619 adult cows, 5,104 young stocks and 1,391 calves were available at 37 Military Farms located in various agro-climatic regions of the country. The elite cows were 969. A total of 97,975 frozen semen doses of high genetic merit pure HF bulls procured from various sources were distributed to Military Farms for breeding of the lower crosses since inception of the project.

Analysis of 25,860 lactation records of Frieswal cows at Military Farms for last 18 years (1991 to 2008) revealed that the overall mean of milk yield in 300 days was 3,308.65 kg. Peak yield averaged 15.04 kg. Milk yield improved over the parities and reached to 3,543 kg in fourth lactation. The average lactation length was 331.90 days. Frieswal animals delivered first calf at the age of 975.71 days. The average service period, dry period and calving interval were 167.60, 119.65 and 442.31 days, respectively. Bulls (90) were evaluated for their genetic merit based on first lactation 300 days milk yield of their daughters. Top 10 bulls had their breeding values between 2,970 and 3,092 kg. Their superiority over the herd average ranged from 146 to 268 kg.

### Conservation and genetic improvement of indigenous cattle breeds

**Ongole:** The female herd strength at the end of year 2009 was 1,282 including 776 breedable females (610 cows and 166 heifers above 2.5 years). Fifty-seven bulls in 7 sets have so far been inducted in the programme. The average age at first calving was 53.17 months. The overall average first lactation milk yield, peak yield and lactation length were 522 kg, 3.1 kg and 209 days, respectively.

**Kankrej:** The herd strength of Kankrej cattle was 298 including 93 breedable females and 25 breeding bulls. The average age at first calving was 1,305 days. The average lactation length of the first calvers of Kankrej cattle was 281.13 days. The average lactation yield, dry period, service period and calving interval were 2,230.43 kg, 127.40 days, 132.76 days and 397.55 days, respectively.

**Gir:** Herd strength of Gir cows was 238 including 109 heifers and of 7 breeding bulls. The age at first calving averaged 1,622.25 days. The lactation milk yield was 2,050.26 kg in a lactation period of 330.97 days. The average dry period, service period and calving

interval were 82.60, 197.85 and 475.58 days, respectively.

### Genetic improvement of crossbred cattle under field conditions

**Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana:** In nine sets 190 bulls have so far been used. The average first lactation 305-day lactation milk yield of the daughters of first 6 sets of bulls were 2,698, 2,827, 2,879, 2,896, 2,904 kg and 3,157 kg, respectively. The milk yield showed increasing trend (18.6% improvement) among the progenies of different sets. The age at first calving decreased from 1,192 days (first set) to 1,052 days in fifth set.

**Kerala Agricultural University, Mannuthy:** In 10 sets 174 bulls have so far been used. Overall conception rate was 37.6%. The average 305 days milk yield of first six sets was 1,958, 1,977, 2,098, 2,190, 2,209 and 2,250 kg, respectively, showing improvement over years. The average age at first calving of daughters born from first six sets of bulls was 1,136, 1,126, 1,205, 1,195, 1,160 and 1,120 days, respectively.

**BAIF, Uruli-Kanchan:** In eight sets 166 bulls have been used. Overall conception rate was 45.3%. The daughters of first five sets showed the average 305 days milk yield as 2,930, 2,848, 2,965, 2,973 and 2,884 kg, respectively. The average age at first calving was 991, 1,008, 1,000, 992 and 989 days for the progenies born from the bulls used in first five sets.

The use of superior bulls in the project has contributed to genetic improvement of field crossbred animals.

### Buffalo

#### Network Project on Buffalo Improvement

**Progeny testing:** Under the Network Project on Buffalo Improvement seventh set of bulls was progeny tested on the basis of daughter's 305-days or less first lactation milk yield using contemporary daughters' comparison method.

More than 65,000 frozen semen doses from progeny tested bulls of Murrah breed are available at various centres (34,700 at CIRB, 19,700 at GADVASU, and 11,000 at NDRI) for elite mating. Test mating from 12th set of Murrah breed was initiated in January 2010 and shall continue up to June 2011. Semen doses (81,560) from genetically superior Murrah bulls were disseminated to farmers. Elite herds of Nili-Ravi, Jaffarabadi, Surti, Bhadawari, Pandharpuri and Swamp buffaloes have been established at various participating centres in different parts of the country.



## Sheep

### Network Project on Sheep Improvement

**Chokla Unit:** The improvement programme through selective breeding is in progress to improve Chokla sheep for carpet wool production. Average 6- and 12-month body weights 25.04 kg, and 31.61 kg, respectively, and first 6 monthly greasy fleece yield of 1.507 kg were the highest ever achieved in the project. Topping was 97.2%. Lambing on ewes available basis was 94.8%. Overall, survivability irrespective of age and sex was 96.99%. The selection differential for 6-month body weight and GFYI were 4.94 kg and 307 g, respectively, for rams.

**Marwari Unit:** The Marwari sheep is being improved through selection for carpet wool production. The average birth, 3-, 6-, 9- and 12- month weights were 2.91, 15.09, 21.14, 26.42 and 29.61 kg, respectively. The overall topping and lambing on ewes available basis were 99.47 and 87.92% respectively. Average annual greasy fleece yield during the year was 1,288 g. The overall survivability was 95.66%.

**Muzaffarnagri Unit:** The Muzaffarnagri sheep is being improved through selection for mutton production. The least square means for birth, 3-, 6-, 9- and 12-month body weights were 3.48, 14.59, 20.09, 23.78 and 26.62 kg, respectively. Topping was 98%. Lambing per cent based on ewes topped was 91.8.

**Deccani Farm Based Unit:** The development of elite flock of Deccani sheep is in progress at Rahuri. Average body weight at birth, weaning, 6-, 9-, and 12- months of age was 3.43, 15.46, 21.52, 22.65 and 23.89 kg, respectively. The topping was 92% while the lambing based on ewes available was 89%. Average age of ewes at first lambing was 638 days.

#### Sheep Seed Project

Participating Units in this project are KVAFSU, Bidar for Mandya sheep; RAJUVAS, Bikaner for Sonadi sheep; TANUVAS, Chennai for Mecheri sheep; BAU, Ranchi for Chottanagpuri Sheep. The main objective of the project is production of around 80 breeding rams of a breed every year and to cover about 8,000 breeding ewes using selected rams by the end of XI Plan. So far, 40 rams were distributed to participating farmers for genetic improvement of their flock.

**Nellore unit:** The Nellore sheep is being improved through selection for mutton production using selection index incorporating body weight at 3 and 6 months of age. The overall means for body weight at birth, 3-, 6-, 9- and 12- month of age were 3.15, 13.90, 16.47, 21.38 and 25.50 kg respectively. Lambing per cent based on ewes available basis was 83.5. Replacement rate in ewes was 29.2%.

**Patanwadi unit:** Performance evaluation of Patanwadi flock is in progress. The least square means for birth, 3-, 6-, 9- and 12- month body weights were 3.33, 15.58, 22.46, 25.64 and 30.1 kg, respectively. Lambing per cent based on ewes available basis was 82.4.

**Magra unit:** The Magra sheep is being improved through selection for carpet wool production. This is a field-based unit and centres were established at Norangdesar, Gadhwal, Kilchu and Kodemdesar. The Kodemdesar centre is a ram rearing centre and the technical inputs were given in the form of treatment of diseased animals and advisory services for management and breeding of animals. Average greasy fleece weight at 6 months of age and adult annual were 1,050 and 2,179 g, respectively.

**Madras Red unit:** Madras Red sheep is being improved through selection for mutton production. Sheep skins are preferred in tanning due to better grains in finished leather. In Chengalpettu District four centres, each having about 1,500 sheep, were identified for sheep improvement. Superior ram lambs were distributed in all centres. Average body weight at birth and 3 months were 2.85 and 11.37 kg, respectively.

**Ganjam unit:** Eight villages have been identified under three centres in Ganjam district for improving the Ganjam sheep. Overall mean of body weights for birth, weaning, 6 and 12 months were 2.68, 11.72, 16.75 and 24.49 kg.

**Deccani Field Based unit:** Elite Deccani rams were supplied to sheep owners for genetic improvement of sheep in their flocks. Baseline data of 835 sheep pertaining to growth, reproduction and physical parameters were collected.

## Goat

### Performance of indigenous goats

**Jamunapari:** The Jamunapari flock witnessed population growth of 36.84% over previous year. Overall least squares means of body weights at birth, 3, 6, 9 and 12 months of age were 2.90±0.01, 10.41±0.49, 16.24±0.17, 19.61±0.86 and 24.15±0.68 kg, respectively. Sex of kid, year of kidding, type of birth and parity had significant influence on the body weight. Least squares means of part lactation milk yield in 90 days and 140 days were 67.93±5.78 and 89.89±5.53 kg, respectively. Year of kidding, season of kidding and parity of doe had significant influence on the milk yields. The average lactation length was 154.56±5.36 days. Does kidded in Oct–Nov season produced significantly higher milk during 90 and 140 day lactation period as compared to does kidded in Feb–Mar season. The heritability estimates for 90-day milk yield, 140-day milk yield, total lactation milk yield and lactation length were 0.409±0.135, 0.282±0.127, 0.239±0.143 and 0.246±0.144, respectively. The heritability estimates for body weights at birth, 6, 9 and 12 month age were 0.162±0.672, 0.587±0.144, 0.437±0.128 and 0.301±0.109, respectively.

**Barbari:** Overall mean milk yield for 90- and 140-day lactation period was 63.51±0.5 and 68.89±0.60 kg, respectively. The selection differential of bucks for 9 months body weight was 4.8 kg and that of the does milk yield was 10.9 kg.

**Jakhrana:** The least-squares means for body weights of Jakhrana kids at birth, 3, 6, 9 and 12 months of age were  $2.74 \pm 0.05$ ,  $8.83 \pm 0.17$ ,  $11.88 \pm 0.28$ ,  $15.73 \pm 0.50$  and  $21.61 \pm 0.60$  kg, respectively. The least-squares means for milk yield at 90- and 140- day were  $108.46 \pm 2.37$  and  $143.37 \pm 3.47$ . The kidding rate was 1.55 during the year.



Jakhrana does

**Sirohi:** The body weights at birth, 3-, 6-, 9- and 12- months of age were  $3.04 \pm 0.03$ ,  $11.59 \pm 0.17$ ,  $16.89 \pm 0.31$ ,  $20.63 \pm 0.27$  and  $25.79 \pm 0.30$  kg, respectively. The average milk yield was  $83.01 \pm 2.07$  kg for 90 day and  $101.99 \pm 2.62$  kg for 150 day.

**Black Bengal:** Black Bengal goat field unit registered 733 does reared by 391 registered goat farmers in four village clusters of four Gram Panchayats of two different blocks in two districts of West Bengal. The population growth of 61.43% was observed under field conditions.

**Malabari:** Malabari field unit registered 1,593 animals including 865 adult does. The overall population growth was 78.33%. The least squares means of body weights at below 1, 3, 6 and 9 months of age were  $3.24 \pm 0.07$ ,  $9.10 \pm 0.14$ ,  $15.51 \pm 0.35$  and  $18.95 \pm 0.57$  kg respectively. The average daily and 90-day milk yield were  $0.83 \pm 0.03$  and  $79.98 \pm 2.87$  kg respectively. The average age at first service and age at first kidding were  $263.45 \pm 11.33$  and  $393.22 \pm 9.48$  days respectively.

**Osmanabadi:** The registered goat population was 302 in Bibi and Wadgaon villages. The average litter size was 1.5.

## Pig

An extensive crossbreeding programme was initiated by taking Ghungroo and Niang Megha as indigenous and Hampshire and Duroc as exotic breed for development of suitable crossbred combination. The  $F_1$  crosses of Ghungroo and Hampshire ( $H_{50}G_{50}$ ) have evolved with promising results with high heterosis for all the production parameters.

## Poultry

**Poultry for eggs:** Under the AICRP on Poultry Breeding, six pure lines of White Leghorn chicken

### Poultry Seed Project

During the year, 6 centers of the project started rearing parent chicks of Vanaraja™ and Gramapriya™ using the existing facilities, while creation of full fledged infrastructure is in progress. Survivability of Vanaraja™ and Gramapriya™ parent chicks up to 8 weeks ranged between 91.8 - 93.93% and 88.76 - 93.2%, respectively. At 6 and 8 weeks of age, body weights of Vanaraja™ chicks ranged between 599-749g, and 1,204-1,389g, respectively, while the body weights of Gramapriya™ parents ranged between 344 - 553g and 751-926g, respectively. The body weight at 20 weeks of age in Vanaraja and Gramapriya birds was 2,500 and 1,400g, respectively.

(IWH, IWI, IWD, IWF, IWN and IWP) were improved through intra-population selection at different AICRP centres for egg production.

The egg production at 40 weeks of age was higher in IWH (106.6 eggs) and IWI (105.5 eggs) than IWK (95.9 eggs). In the IWK population, the correlated genetic and phenotypic response of egg mass to 40 weeks of age was 63.8 and 6.9g, respectively, while the correlated genetic and phenotypic response of egg production to 40 weeks of age in IWK population was 1.71 and 0.049 eggs, respectively, over the last five generations.

**Poultry for meat:** Under the AICRP on Poultry Breeding, five synthetic broiler strains (PB-1, PB-2, SDL, CSML and CSFL) were improved through intra-population selection for body weight at 5 weeks of age to 7 weeks of age. At 7 weeks of age the body weight was 1,435 g in PB-2, and 1,473 g in PB-1 lines. At PD on Poultry, in colour broiler male line PB-1, the body weight at 5-weeks was 922 g, which was improved by 15 and 41 g on phenotypic and genetic scales over the previous generation, respectively.

**Germplasm for rural poultry:** At PD on Poultry, PD-1, PD-2, PD-3, PD-4 and PD-5 lines were developed and used for production of rural varieties of chicken. The PD-1 line, which is used as male line for production of Vanaraja™ chicks showed improvement of egg production by 2.66 eggs as compared to previous generation. The body weights at 4 and 6 weeks of age were 299 and 607 g, respectively, and the shank length at 6 weeks was 68.1 mm. The PD-2 line showed improvement in 40 weeks egg production by 1.9 eggs and in egg weight by 0.5 g over the previous generation. PD-5 line had higher 40 wks egg production (49 eggs) as compared to PD-4 line (36 eggs). PD-5 line showed better shell quality than PD-4 line, while PD-4 line had better yolk index. Sperm concentration and live sperm counts were better in PD-4 line than those of PD-5 line at 42 weeks of age.

The C1 cross matured early and produced more eggs (161d; 91 eggs) compared to Gramapriya™ (165d; 81.5 eggs) up to 40 weeks of age. The 64 weeks egg production was almost similar in C1 cross (193.5 eggs) and Gramapriya™ (192.9 eggs). Egg production up to 72 weeks was higher in Gramapriya™ (233.5 eggs)



### Caribro-Dhanraja

At 33<sup>rd</sup> Random Sample Poultry Performance Test conducted by the Government of India at Gurgaon, the multi-coloured commercial broiler strain Caribro-Dhanraja indicated impressive performance and attained a body weight of about 1.5 and 1.9 kg with corresponding feed conversion ratios of 1.45 and 1.6 at 6 and 7 weeks of age, respectively.

The field production performance evaluation of multi-coloured Caribro-Dhanraja at an altitude of 2,286 m at Mukteshwar in Uttarakhand showed very encouraging results in terms of body weight gain of 1.53 kg and 1.4 kg with a feed conversion ratio (FCR) of 2.0 and 2.5 under cage and deep litter systems, respectively. The mortality was about 5%. This commercial broiler strain is in high demand not only in plains but also in the hilly regions.

and C1 cross (228.3 eggs) than C2 (213 eggs), C3 (207 eggs), C4 (183 eggs) and Vanaraja<sup>TM</sup> (183 eggs). Thus, C1 cross could be another promising dual purpose variety for rural poultry production, with body weight closer to Vanaraja<sup>TM</sup> and egg production similar to Gramapriya<sup>TM</sup>.

**Maintenance and evaluation of gene lines:** In Naked neck chicken, the age at sexual maturity was 157.3 days with a significant reduction (12 days) from the last generation. The egg production (63.8) at 40 weeks of age increased significantly from the previous generation. The *Na* gene had marginal effect on the egg quality traits. The age at sexual maturity in dwarf line was 144.8 days during the seventh generation, which decreased by 2 days, compared to the previous generation. The egg production in this line was 69.7, which increased significantly over the last generation. A 4 × 4 full diallele mating involving Naked neck, dwarf, PB-1 and PB-2 lines showed that PB-1 line combined well with all the lines with high degree of additive genetic variance, and the PB-1 and Naked neck cross excelled all the combinations with better nicking ability and hybrid vigour.

**Desi (indigenous) chicken variety:** Age at sexual maturity, body weight at 20 and 40 week of age and part time egg production till 40 weeks of age in Naked-neck were 153 days, 1.0kg, 1.4 kg and 100 eggs, respectively. The corresponding values in Frizzle-fowl were 162 days, 0.9 kg, 1.3 kg and 91 eggs, respectively.

**Quails for meat and egg production:** Per cent hatchability on total egg set in CARI Uttam, CARI Ujjawal, CARI Sweta, CARI Pearl and CARI Brown pure lines of quails were 78.7, 78.8, 72.9, 72.3 and 66.2, respectively. Further, an MoU between the CARI, Izatnagar and the M/s Grace Farm Innovations was signed in PPP mode for supply of elite quail germplasm and associated technology.

### Fish

**Genetic improvement of giant freshwater prawn:** A project was initiated at CIFA, Bhubaneswar, in collaboration with World Fish Center, Malaysia. Design

## SUCCESS STORY

### Housewife to fish seed grower

Smt Odisha Mekap (45) a housewife residing in village Kaijanga in Baliana Block of district Khurda, who owned 2 ha of paddy land and two ponds (0.4 ha) started fish seed rearing activity on a trial basis in the year 2003, which enabled her to earn a net income of ₹ 0.3 lakh within 4 months with the technological help from KVK, CIFA. The sustained rise in income from fish seed production made her to convert the adjacent paddy fields into fish ponds of different sizes. She started working hard and succeeded in establishing herself as a fish seed grower by constructing a cement hatchery. At present, she has 18 nursery ponds, 2 brood fish ponds, 1 portable FRP hatchery besides the cemented one. She now earns ₹ 2.7 lakh per year.

of a selective breeding programme was prepared for *Mycobacterium rosenbergii* for which a synthetic base population for genetic selection of *M. rosenbergii* was established using a complete 3 × 3 diallel crossing. Protocol for fullsib and halfsib family production of *M. rosenbergii* was developed and standardized. The magnitude of heterosis effect based on crossing of stocks was estimated. Phenotypic and genetic variation in body weight was also estimated.



Juvenile raising of *Mycobacterium rosenbergii* till tagging

**Chitosan nanoparticles based hormone delivery system:** Chitosan nanoparticles were developed for the delivery of biomolecules in the fishes. In the first study, Chitosan (CN) and gold based Salmon LHRHa (S LHRHa) hormonal nanoparticles were formulated for effective delivery of the hormone for spawning of a cyprinid fish (common carp), which can serve as an alternative for the commercially available inducing agents. The commercial LHRHa showed peak hormonal levels only up to 7 h, while chitosan-sLHRHa nanoparticles and chitosan-gold-sLHRHa nanoparticles showed a sustained higher level after 7 and 24 h, which is due to the control release of nanoparticles throughout the spawning period of common carp. Chitosan and gold based Salmon LHRHa (S LHRHa) hormonal nanoparticles help to maintain the hormone

## SUCCESS STORY

### Breakthrough in breeding and seed production of cobia

Cobia (*Rachycentron canadum*) a marine fish was successfully bred in captivity for the first time at the Mandapam Regional Centre of CMFRI. Envisaging the prospects of cobia farming in India, broodstock development was initiated at the Mandapam Regional Centre of CMFRI, in sea cages of 6 m diameter and 3.5 m depth during 2008. A total of 40 fishes were stocked in 4 cages having size range of 80–127 cm, and 4–20 kg, respectively.

The fish is being considered an excellent species for aquaculture due to its fast growth rate, adaptability for captive breeding, good meat quality and high market demand especially for *sashimi* industry. Under culture conditions, cobia can reach 3–4 kg weight in one year and 8–10 kg in two years.

level in blood through controlled delivery system which in turn helps for spawning of the fishes.

**Management of mid-altitude exotic fishes:** To improve the yield from aquaculture along the hilly regions of country, two imported (Hungarian strain) varieties of Common carp (Ropsa scaly carp and Felsosomogy mirror carp) were evaluated for growth performance against the existing Bangkok strain. Highest growth was recorded in a year in Hungarian

### Mass scale spat production of green mussel

Large scale spat production of Green mussel (*Perna viridis*) has been achieved for the first time in India in the Marine Hatchery of the Visakhapatnam Regional Centre of CMFRI. Over 2 lakh spat are being reared in the hatchery.

mirror carp (352 g) under poly culture system when 2.5 fish per cubic meter of water were stocked followed by Hungarian scale carp (304 g). The growth of the existing strain was low (187 g) in polyculture. Early maturity was also observed in mirror carp than the scale carp. Hence these two strains of common carp are identified for mid altitude farming along with other exotics.

**Farming of Asian sea bass in sea:** A demonstration project on open sea cage culture of the Asian seabass (*Lates calcarifer*) showed that a crop of 3.5 tonnes of sea bass was harvested at the end of 6 months of rearing in the open sea (7 m diameter and 4 m depth (outer cage) and 6 m diameter and 3 m depth (inner cage). Periodical sampling was done to monitor growth and survival of the fish. At the time of harvest, the fishes had attained size range of 25–49 cm in total length (0.8–1.8 kg) in total weight with an average weight of 1.3 kg. The harvested fish were sold at prices ranging from ₹ 180 to ₹ 200/kg.

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