7. Livestock Improvement

Cattle

Crossbred strain of cattle: The total population of Frieswal females in 37 different Military farms under the Frieswal Project of PDC Meerut was 18,537 (10,935 adult cows, 5,659 young stock and 1,943 calves). The number of elite cows producing 4,000-5,000 kg milk in a lactation was 920.

The overall mean of 300 days milk yield in Frieswal cattle based on 36,092 lactation records of the progeny of 135 bulls for the last 22 years (1991 to 2012) was 3,231.46 kg. Milk yield increased over the lactations and reached to 3,612 kg in fourth lactation. Peak yield averaged 14.68 kg. First lactation 300 days milk yield averaged 2,859.45 kg. The least squares means of age at first calving, service period, dry period and calving interval were 965, 155.54, 110.67 and 432.17 days, respectively. The breeding value of the top 10 Frieswal bulls ranged from 2,970 to 3,092 kg and their superiority over the herd average was from 146 to 268 kg.

Improvement of indigenous cattle breeds through selection: The programme covers Ongole, Gir, Kankrej and Sahiwal breeds and is being executed in collaboration with State Agricultural Universities, NGOs, State Animal Husbandry Departments and ICAR Institutes.

Ongole: The conception rate and age at first calving were 58.2% and 52.53 months, respectively; and 218 daughters were born at the SVVU, Tirupati. The average first lactation milk yield and peak yield were 711.24 and 4.02 kg. A total of 32 bulls in 4 sets have so far been evaluated and their breeding values ranged from 485.84 to 565.69 kg in first, 518.49 to 553.94 kg in second, 525.12 to 568.42 kg in third and 472.56 to 531.18 kg in fourth set. The superiority of top bulls ranged between 14.93 and 29.41 kg (2.15 to 6.19 %) over the herd average. Draught studies undertaken on the adult bulls using single harness plough with digital dynamometer revealed that the draught power varied from 0.60 to 0.72 HP.

Kankrej: The average first lactation milk yield and total milk yield of Kankrej cows at Sardar Krushinagar Agricultural University, Dantiwada, Gujarat were 2,431.99 and 2,517.97 kg respectively. The wet and herd averages were 8.82 and 5.49 kg. Age at first calving, dry period, service period and calving interval averaged 1,348.62, 119.75, 133.17 and 411.76 days. Semen of 8 bulls of the first set was used for 1,060 artificial inseminations with an overall conception rate of 50.94%.

Gir: The unit located at Junagadh (Gujarat) registered 3,575 breedable females at farmers' and 887 at associated herds. The Germplasm unit had 63 elite breedable females. Semen of 6 bulls of the first set was used for 2,580 artificial inseminations with an overall conception rate of 49.61%. The age at first calving averaged 1,412 days. The first lactation milk yield, first peak yield, total milk yield, and first lactation length were 1821.3, 7.4, 2,232.0 kg, and 315.0 days. The average dry period, service period and calving interval were 155, 213 and 504 days, respectively.

Sahiwal: The strength of breedable Sahiwal females in associated herds of the project was 985. Semen of eight bulls of the first set was used for 1,525 artificial inseminations with an overall conception rate of 35.86% and birth of 332 daughters.

Number of Sahiwal cattle is improving

Frieswal cattle

Kankrej cattle

Gir cattle

Genetic improvement of crossbred cattle under field conditions: The programme envisages to progeny test Frieswal and other Holstein – Friesian crossbred bulls under field conditions to improve crossbred field cattle.

GADVASU, Ludhiana: Daughters (2,100) from nine sets of bulls have completed first lactation. The average first lactation 305 days lactation milk yield of the daughters of first nine sets of bulls ranged from 2,698 to 3,364 kg. The milk yield showed increasing trend among the progenies of different sets. The average first lactation 305 days milk yield showed increasing trend over the years and it increased from 2,449 kg in 1993 to 3,256 kg in 2012. The average age at first calving also reduced from 1,192 days in first set to 732 days in ninth set.

KVASU, Thrissur: Daughters (1,326) from nine sets of bulls have completed their first lactation. The average first lactation 305 days lactation milk yield of the daughters of first nine sets of bulls ranged from 1,958 to 2,597 kg. The milk yield showed increasing trend among the progenies of different sets. The average first lactation 305 days milk yield showed increasing trend over the years and it increased from 1,480 kg in 1993 to 2,597 kg in the year 2012. The average age at first calving reduced from 1,136 days in first set to 1,007 days in ninth set.

BAIF Research Development Foundation, Uruli-Kanchan, Pune: Daughters (2,666) from nine sets of bulls have completed first lactation. The average first lactation 305 days lactation milk yield of the daughters of first eight sets of bulls ranged from 2,848 to 3,074 kg. The milk yield showed increasing trend among the progenies of different sets. The average first lactation 305 days milk yield increased by 11.69% from the year 1993 to 2012. The average age at first calving reduced from 995 days in first set to 669 days in eighth set.

GBPUAT, Pantnagar: So far 25 Frieswal bulls have been introduced in three sets. AI (4,416) resulted in 2,618 pregnancies with an overall conception rate of 63.74%; 733 daughters born from first two sets. Two daughters of first set of bulls calved and their first lactation milk yields are being recorded.

Reproduction: Semen doses (419,968) from Frieswal bulls were frozen of which 62,708 were distributed to Military farms, 13,860 used for field crossbred cattle improvement, and 165,245 were sold to various developmental agencies, para-vets and farmers for cattle improvement programmes. In addition, 2,450 semen doses were transferred to Gene bank of NBAGR, Karnal. In the semen bank 988,335 doses of Frieswal semen are presently available. Besides, semen doses from Ongole (16,930), Kankrej (32,775) and Gir bulls (9,403) were also frozen. The semen doses available in the semen bank of Ongole, Kankrej and Gir were 22,9185, 30,671 and 8,922 respectively.

In a controlled farm experiment it was observed that the average duration for exhibition of first postpartum oestrus in Frieswal heifers can significantly be reduced by individual feeding (67.45 vs. 80.7 days) in comparison to normal herd feeding.

Buffalopedia on CIRB Website

Buffalopedia (http://www.buffalopedia.cirb.res.in), an online database-cum-interactive information dissemination system, on buffalo production was made available at the official website of the Central Institute for Research on Buffaloes, Hisar (http://cirb.res.in). It presents buffalo husbandry data including facts, figures, demonstrations, examples, graphics, etc. The scientific concepts, practices and vocabulary used in buffalo husbandry configure the contents of database in user friendly formats.

Buffalo

Genetic resource improvement: During the year, milk yield data of first lactation was compiled from daughters born from the ninth set of bulls from all centres of Network Project, and sires were evaluated under the ongoing progeny testing plan. Murrah bull no. 1994 from GADVASU, Ludhiana top ranked with sire index value of 2,487 kg followed by bull no. 5258 from NDRI, Karnal having sire index of 2,466 kg with per cent superiority over contemporary daughters of 11.73% and 10.52 %, respectively.

Semen conservation and dissemination: At CIRB Hisar, 63,857 frozen semen doses of Murrah bulls were produced. Semen doses (13,188) were supplied to Network Project and sold (80,081 doses) to farmers for breed improvement. Champion bulls owned by progressive farmers in breeding tract of Murrah were identified, and 20,271 semen doses from such bulls were produced. Farmers from all over India are evincing keen interest in such elite germplasm for Murrah breed improvement in their respective locations. Semen doses (10,567) from these field bulls were also sold to farmers.

Performance parameters of CIRB herds (2012-13)

Traits	Mean ± SE (N)	
	Murrah	Nili-Ravi
305 DMY (kg)	2,335±45.71 (110)	2,017±46.7 (123)
Wet average (kg)	7.74 (109)	8.26 (90)
Herd average (kg)	4.76	5.34
Av. peak yield (kg)	11.23 (109)	11.14 (123)
Calving interval (days)	481±11.87 (73)	436±10.9 (75)
Service period (days)	174±8.19 (72)	126±10.8 (75)
Age at first calving (months)	44.48 (37)	39.6 (52)
Per cent (%) calf mortality (0–3 months)	5.92 (9/152)	3.75 (5/133)
Conception rate (%)	45.75 (151/330)	40.0 (166/415)

At CIRB Sub-campus Nabha, frozen semen doses produced during the year were 20,803, taking the frozen semen stock of Nili-Ravi bulls to 38,776 doses, after 13,245 frozen semen doses of Nili-Ravi bulls were sold to farmers during the year.

Field progeny testing programme: A conception rate of 50.05% was achieved with 4,204 inseminations carried out in 2012-13. During this period 70 progenies, 49 of 10th and 21 of 11th set calved at an average age of 41.43 months at first calving. The monthly test day milk recordings of 116 progenies were obtained, out of which 50 daughters completed their lactation with an average milk yield of 7.88 kg/day. Physical identification using injectable microchips was performaed in all female progeny and at present 744 daughters of bulls of 11th to 13th sets are standing at various field unit centers for future milk recordings.

Sheep

Production and reproduction performance of prolific sheep developed under organized farm were evaluated. Three-breed cross Garole-Malpura - Malpura × Patanwadi (GMM × P) sheep attained 3.46, 12.77, 19.42 and 28.16 kg body weights at birth, 3, 6 and 12 months of age respectively. Tupping rate of 95.08% was achieved in 3-breed cross sheep. Prolificacy of 32.69% with litter size of 1.33 in GMM × P ewes was achieved. The molecular studies indicated that prolific gene (*FecB)* has significant effect on litter size at birth and varied from 1.13 (*FecB*$^{++}$) to 1.67 (*FecB*$^{B+}$) in GMM × P ewes.

	GM (Garole × Malpura)	GMM (Garole-Malpura × Malpura)	GMM × P (Garole-Malpura-Malpura × Patanwadi)
Litter size	1.72	1.57	1.33
Single (%)	47.4	45.69	67.31
Twin (%)	36.8	51.61	32.69
Triplet (%)	11.8	2.69	-
Quadruplet (%)	3.95	2.69	-

Mega Sheep Seed Project

Flocks of sheep—Chottanagpuri (608), Mandya (342), Mecheri (390) and Sonadi (450)—were built up for production of superior seed. Rams of Chottanagpuri (80), Mandya (26), Mecheri (50) and Sonadi (67) breeds were distributed to farmers for improvement of their flock.

Goat

Genetic improvement of goats

Jamunapari: The population growth in Jamunapari goats at farm level was 100.8% and kidding rate varied from 1.38 to 1.55. The average 12-month body weight was 24.37 kg and the milk yield was 140.98 kg in 140 days.

Barbari: Population growth was high (182%) in this elite Barbari flock. Implementation of genetic, nutritional and health strategies at Farm Unit of CIRG resulted in significant improvement in survival rate, body weight gain at different ages and reproductive performance. Positive genetic trend (0.999±0.213 kg) was observed for body weight growth over the years with reduction in mortality.

Sirohi: Superior Sirohi bucks (147) were introduced to improve the genetic potential of farmers' flock along with intervention of technologies for health care, nutrition and management. The overall mortality reduced from 5.40% to 1.43%. The kidding rate was improved from 1.12 to 1.29. The overall population growth was 84.58%.

Black Bengal: The population growth of these goats in adopted villages of the natural habitat increased to 63.26% and the annual mortality rate reduced to 7.59%.

Sangamneri: In Sangamneri field unit at Rahuri, 642 breedable does in four clusters were registered

Performance of different breeds of sheep under Network Project on Sheep Improvement

	Body weight at different months (kg)					Tupping, lambing rate (%) on ewe's available basis	
	Birth	3	6	9	12	Tupping	lambing rate
Chokla	2.88	13.71	21.84	-	26.23	99.49	103.22
Marwari	3.41	15.74	22.01	24.37	28.43 kg	96.66	90.57
Muzaffarnagari	3.72	16.92	21.63	26.52	31.71	74.3	86.7
Deccani Farm based Unit	3.43	15.67	22.14	23.61	25.60	93.94	83.02
Deccani Field based Unit	3.29	14.35	21.00	23.61	27.95	-	-
Nellore	3.08	10.42	14.21	20.32	25.57	-	-
Magra*	2.95		19.93	27.10	38.75	-	-
Madras Red	2.83	11.36	15.89	19.42	23.09	-	85.39
Ganjam	2.80	11.72	17.08	21.68	24.74	-	81.94

*Average greasy fleece yield at 6-month age and adult annual were 1,058 and 2,213 g, respectively.


Jamunapari goat


Sirohi goat

and 33 elite bucks were rotated in the selected clusters. Population of Sangamneri goats increased by 25.15%. The improvement in body weight from base population at 6 months of age was 6.98% and improvement in milk yield was 21.42%.

Camel

Milk production potential: The average daily milk production from two teats was 3.3 L in Bikaneri, 3.8 L in Jaisalmeri, 3.2 L in Kachchhi and 2.8 L in Mewari, respectively. The peak yield was observed in fifth month of lactation. The mathematical equation $Y=106.727+ 238.597(Y_{5m})$ utilizing fifth month's average daily yield gave the best predictions (R^2, 0.90). The persistency of lactation was 76.20, 67.07, 55.67 and 35.87 % for the lactation length of 10, 12, 14 and 16 months, respectively.

Mithun

Performance of mithun carcass traits: Studies on growth and carcass traits of mithun showed better meat quality with less fat thickness, more marbling and juiciness. Its important traits are — slaughter weight, 349.33 kg; carcass weight, 198.33 kg; dressing percentage, 56.42%; carcass length, 49.66 inches; carcass oblique length, 52.16 inches; fat thickness, 0.74 inches; rib eye area, 84.29 cm^2; shrinkage, 5.00%; degree of marbling, moderately abundant; texture of marbling, fine; colour of lean, dark red; firmness of lean, slightly soft; texture of lean, fine; body condition score, 2.5/5.0.

Pig

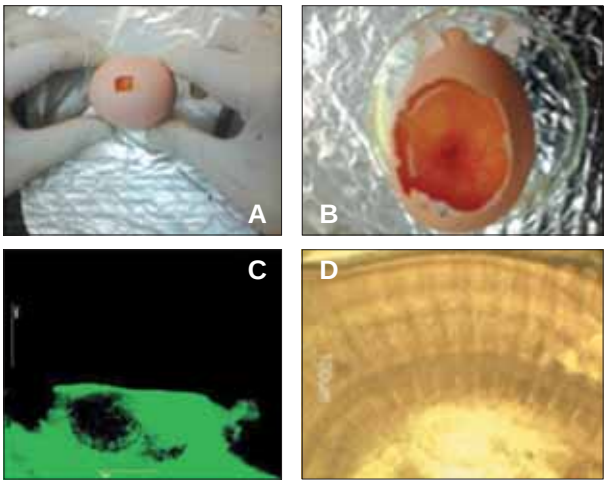
Pig varieties for breeding and fattening: Three pig varieties, viz. $H_{50}G_{50}$, $H_{50}M_{50}$ and $H_{25}G_{25}D_{50}$ were developed at National Research Center on Pig for breeding and fattening purpose. The variety 1 ($H_{50}G_{50}$) was developed by using pure parental lines of Hampshire (exotic) and Ghungroo (indigenous) breed of pigs. Its average litter size at birth and weaning were 9.86 and 8.81, respectively; average pre- and post- weaning growth rate, 142.59 and 331.17g/day, respectively; and the average slaughter weight at 8 month of age was 71.55 kg. Variety 2 ($H_{50}M_{50}$) was developed by crossing pure parental lines of Hampshire (exotic) and Niang Megha (indigenous) pigs. These two varieties of pigs were superior in terms of productive, reproductive and carcass traits as compared to the indigenous animals with higher adaptability in local climatic condition.

The variety 3 was developed by crossing selected population of Variety-1 pigs with pure Duroc (exotic) males. Duroc was used as terminal sire in this breeding programme due to its high potential of lean meat production with superior growth rate. As a fattener pig, this three breed cross was found suitable for farmers because of its growth, adaptive and carcass characteristics. As a fattening germplasm, this variety showed promisingly higher pre- and post-weaning growth rate of 173.19 and 379.23g/day. Marketable weight at 8 months of age was 76.26 kg.

Pig varieties were developed at NRC on Pig

Poultry

Silencing myostatin gene for growth in broilers: In *in-vivo* trial, the highest weekly body weight up to six weeks and the highest knock down of myostatin gene in heart and breast muscle were observed in chicks injected with GFP lentivector clones @ 6,000 pfu/chick (I/V). Only treated chicks showed GFP expression in cryosections of breast muscles.



Window (A) for injecting shRNA lentivector on germinal disc (B); embryos formation (6^{th} day of incubation) and GFP expression: (C) fluorescent light, (D) normal light

Under *in-ovo* trials 2,000 and 4,000 pfu/100 ml of DMEM of lentivectors containing myostatin RNA were injected on 16^{th} day of incubation through broad end of the egg. The results revealed that the body weights were highest in 2,000 pfu/100 µl dose group compared to un-injected control. Knocking down of myostatin gene in breast muscles of chicks of different groups at the age of 6 weeks ranged between 55.1 and 65.4%.

In-ovo lentivector injection (2,000 cells/100µl media) trial by making single window (approximately 2 mm × 2 mm) in fertile eggs just above the germinal disc, fertility of 37.5% and transfection efficiency of 33.33% were obtained. In repeat trial fertility improved to 55% (11/20) and transfection efficiency to 63.3%.

Germplasm for rural poultry

Four new crosses of rural poultry, viz. PD-1 × PB-2 (B), PD-1 × PD-3 (R), PD-1 × PD-4 (A) and PD-1 × IWI (W) were developed. The age at sexual maturity (ASM) and 72 weeks egg production of A, B, R and W crosses were 158, 160, 157 and 149 days and 161.9, 113.4, 219.1 and 212.5 eggs, respectively. The overall performance of R and W was better in terms of ASM and 72 weeks egg production.

All India Coordinated Research Project on Poultry Breeding

The BNR cross developed from BN cross (PB-2 × Native) × RIR at Udaipur centre was released as a dual purpose variety, Pratapdhan for rural poultry. The 72 weeks egg production is 161 eggs with adult body weight of 2,250 g at 40 weeks.

Poultry for egg: Six pure lines of White Leghorn chicken (IWD, IWF, IWN, IWP, IWH and IWI) are being improved through intra population selection under the AICRP on Poultry Breeding Programme. At KVASU, Mannuthy centre, the hen housed egg production up to 72 weeks of age in IWN and IWP were 308.2 and 297.5 eggs, respectively. At AAU, Anand centre, egg production up to 64 weeks of age increased by 5.3 eggs in IWN and by 13.9 eggs in IWP line over previous generation. The egg production of IWN × IWP and IWD × IWK crosses up to 72 weeks of age was 300.8 and 264.3 eggs, respectively.

Poultry for meat: Five synthetic colour broiler populations are being improved through mass selection for 5-week body weight in sire lines (PB-1 and CSML) and 5-week body weight along with egg production in dam lines (PB-2, CSFL and SDL). The 5 weeks body weight of PB-2 was 1,022 g at KVAFSU, Bengaluru centre and 1,189g at GADVASU, Ludhiana centre. At Ludhiana centre, over the last 6 generations, the 5-week body weight in PB-2 improved by 25.7 and 25.8 g/generation on phenotypic and genetic scales, respectively. The 5-week body weight of PB-1 at KVAFSU, Bengaluru was 1,041g while that at Ludhiana centre 1,310g. At PD on Poultry, three colour broiler lines namely, PB-1, PB-2 and control broiler are being conserved and evaluated. Two gene lines, naked neck and dwarf were also maintained as resource populations.

Synthetic colour broiler

Srinidhi

A dual purpose rural variety, Srinidhi was developed at the Directorate of Poultry Research with body weights of 37.4, 131.8, 329.8 and 668.4 g at day- old, 2, 4 and 6 weeks of age in battery brooders. The shank length at 6 weeks of age was 75.63 cm. This bird was at par with body weight gain of Vanaraja and egg production of Gramapriya. Long shanks and multiple colour plumage make it well suited for rural area.

Srinidhi in rural backyard at Jharkhand

Poultry Seed Project (PSP)

Improved poultry germplasm for rural poultry were supplied through six centres located across the country. Patna centre supplied day-old 66,739 chicks of Vanaraja and Gramapriya during the period. Kolkata centre supplied 129,236 chicks of Vanaraja and Gramapriya to Sundarbans, Nadia, West Midnapur and South Dinajpur in West Bengal. At Jharnapani centre, under the tribal sub plan component of PSP, four training-cum-demonstration programmes were conducted for farmers for creating awareness and hands-on training in poultry rearing. At the Jharnapani centre, 45,150 birds were distributed to farmers of Nagaland, Asom, Meghalaya and Arunachal Pradesh. At Gangtok centre, 16,802 birds were distributed to Lower Chawang and Upper Chawang, Mangan, Pakyong, Ongchu Jongu, Tingvong areas of Sikkim state. At Imphal centre, 51,124 chicks were supplied to the farmers.

Fisheries

Spawning of cobia in recirculation aquaculture system: Spawning of cobia *(Rachycentron canadam)* was successfully achieved in recirculation aquaculture system (RAS) for the first time at Mandapam, CMFRI Centre. In this system, the brooders could be conditioned and maintained in healthy condition. One female and two male brooders were kept in the system. The ova size was assessed by cannulation and based on the same, the brooders were induced with HCG. The total number of eggs spawned was 2.40 million and the fertilization percentage was 86.1.The temperature range was 27.5 – 29°C. A total of 1.80 million larvae hatched out with a hatching percentage of 86.7%. The larvae

'*Purnima*' cloned from *Karan-Kirti*

A cloned calf named '*Purnima*', weighing 44 kg was born through hand-guided cloning technique by normal parturition on 6 September 2013. The calf is different from the earlier cloned calves as the donor cell was taken from the ear of an adult outstanding buffalo *Karan-Kirti,* which has highest recorded milk yield of 25.1 kg/day at NDRI, Karnal.

Spawning of cobia in aquaculture system

were stocked at different densities in the larviculture tanks.

Silver pompano fingerling production: The technology of seed production of silver pompano, *Trachinotus blochii*, a topmost fish due to fast growth rate and high market demand was scaled up for bulk seed production for distribution. The larval survival was directly proportional to larval stocking density and rotifer density. A larval density of 5 numbers/litre and a rotifer density of 25/ml ideal for getting best survival rates. The maximum survival rate obtained was 23.4%. By attaining better survival rate in seed production, more than 1.0 lakh seeds were produced at the Mandapam Centre. The first bulk transportation of seed was done in a truck by using 1.0 tonne capacity tanks fitted with oxygen cylinders. Each tank was stocked with 5,000 numbers of pompano seeds. The length of fingerlings ranged from 2.5 to 4.9 cm (mode 4.2 cm) and weight ranged from 0.25–1.14 g (mode 0.85 g). Ice bags were placed in each tank to reduce the temperature. No mortality occurred for 29 h. Thus scaling up technology of *Pompano* seed production and subsequent transportation have opened new vistas for this highly valued fish.

Improved fish production from marine resources

During 2012-13, an estimated catch of 3.94 million tonnes, an all time record landings for Indian marine fisheries was reported with a growth of 3.37% compared to 2011-12. Pelagic fishery (54%) contributed more to the landings followed by demersal (28%), crustacean (13%) and molluscan (5%) fishery. Major contribution was from Indian oil sardine with 7.2 lakh tonnes (18.2% of total catch) along South-west (Kerala) coast and major decline was observed in Hilsa fishery along North-east, West – Bengal coast. Region wise resources were as follows.

Year	NE	SE	SW	NW
2011-12	687,713	912,174	1,191,740	1,028,579
2012-13	403,056 10.2%	1,005,759 25.5%	1,386,360 35.1%	1,153,764 29.2%

Off-season breeding of climbing perch: Climbing perch, an air breathing fish, Koi (*Anabas testudineus)* having tremendous potential for farming in derelict and shallow waters can attain 98% and 90% fertilization and hatching, respectively, with the help of proper diet and water quality management. The off-season breeding of this species has paved the way for round-the-year production of its quality seeds. This fish contains high levels of available iron and easily digestible polyunsaturated fatty acids. It is considered a valuable item of diet during sickness and convalescence and fetches high price (` 300–500/kg) in West Bengal, Tripura, Asom, Manipur, Nagaland, Jharkhand, Bihar and Kerala.

❑