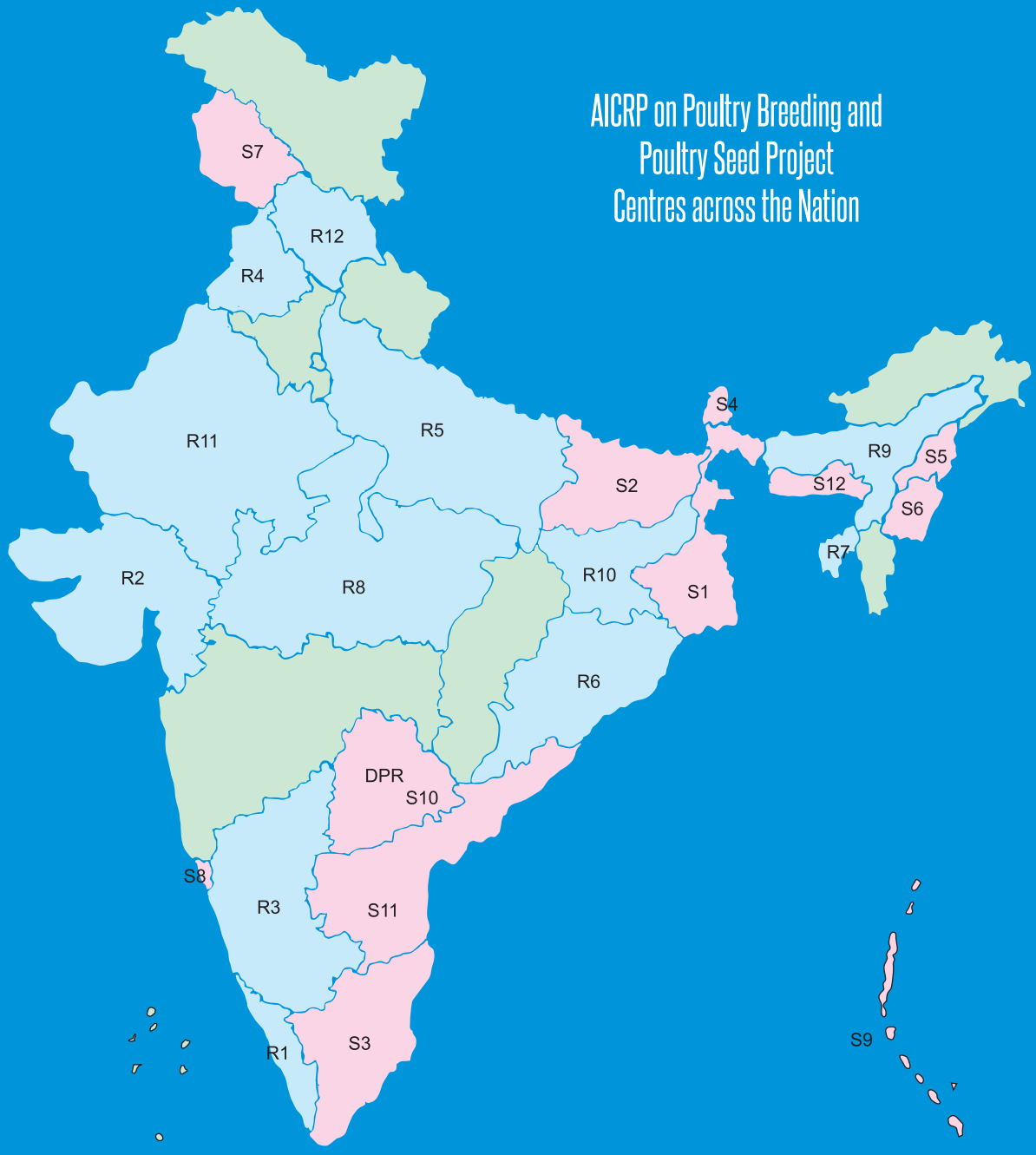
# ICAR - DPR ANNUAL REPORT 2019

**ICAR - Directorate of Poultry Research**
Rajendranagar, Hyderabad - 500 030, Telangana, India
www.pdonpoultry.org
ISO 9001:2015

# AICRP on Poultry Breeding and Poultry Seed Project Centres across the Nation




## ICAR - DPR

| AICRP Centres | |
|---|---|
| R1 | KVASU, Mannuthy |
| R2 | AAU, Anand |
| R3 | KVAFSU,Bengaluru |
| R4 | GADVASU, Ludhiana |
| R5 | ICAR-CARI, Izatnagar |
| R6 | OUAT, Bhubaneswar |
| R7 | ICAR-RC, Agartala |
| R8 | NDVSU, Jabalpur |
| R9 | AAU, Guwahati |
| R10 | BAU, Ranchi |
| R11 | MPUAT, Udaipur |
| R12 | CSKHPKVV, Palampur |

| PSP Centres | |
|---|---|
| S1 | WBUAFS, Kolkata |
| S2 | BASU, Patna |
| S3 | TANUVAS, Hosur |
| S4 | ICAR-NOFRI, Sikkim |
| S5 | ICAR-RC, Nagaland |
| S6 | ICAR-RC, Manipur |
| S7 | SKUAST, Srinagar |
| S8 | ICAR-CCARI, Goa |
| S9 | ICAR-CIARI, Port Blair |
| S10 | PVNRTVU, Warangal |
| S11 | SVVU, Tirupati |
| S12 | ICAR-RC for NEHR, Barapani |

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# ICAR–DPR Annual Report 2019

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**Front Cover**
A pair of Vanashree birds

**Inside Front Cover**
Location of AICRP on Poultry Breeding
and Poultry Seed Project centres

**Inside Back Cover**
ICAR-DPR germplasm and App QR code

**Back Cover**
Extension activities of ICAR-DPR

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# Abbreviations

| | |
|---|---|
| AAU | Anand Agricultural University/Assam Agricultural University |
| AICRP | All India Coordinated Research Project |
| ARS | Agricultural Research Service |
| ASM | Age at Sexual Maturity |
| BW | Body Weight |
| CARI | Central Avian Research Institute |
| CBH | Cutaneous Basophile Hypersensitivity |
| CP | Crude Protien |
| CPCSEA | Committee for the Purpose of Control and Supervision of Experiments on Animals |
| CPDO | Central Poultry Development Organization |
| CRIDA | Central Research Institute for Dryland Agriculture |
| d | Day(s) |
| DARE | Department of Agricultural Research and Education |
| DBT | Department of Biotechnology |
| DNA | Deoxyribonucleic Acid |
| DPR | Directorate of Poultry Research |
| DST | Department of Science and Technology |
| EP | Egg Production |
| EW | Egg Weight |
| FCR | Feed Conversion Ratio |
| g | Gram(s) |
| GP | Glutathione Peroxidase |
| GR | Glutathione Reductase |
| H:L ratio | Heterophyl : Lymphocyte Ratio |
| HDEP | Hen Day Egg Production |
| HHEP | Hen Housed Egg Production |
| IAEC | Institutional Animal Ethics Committee |
| IBSC | Institute Bio-safety Committee |
| ICAR | Indian Council of Agricultural Research |
| IMC | Institute Management Committee |

| | |
|---|---|
| IPSA | Indian Poultry Science Association |
| IRC | Institute Research Committee |
| IU | International Unit(s) |
| IVRI | Indian Veterinary Research Institute |
| KVK | Krishi Vignan Kendra |
| LP | Lipid Peroxidase |
| MANAGE | National Institute of Agricultural Extension Management |
| MD | Marek's Disease |
| ME | Metabolizable Energy |
| mm | Millimeter(s) |
| NAARM | National Academy of Agricultural Research Management |
| NAIP | National Agricultural Innovation Project |
| NCBI | National Center for Biotechnology Information |
| NDV | Newcastle Disease Virus |
| NGO | Non-Governmental Organization |
| NIRDPR | National Institute of Rural Development & Panchayat Raj |
| No. | Number |
| NPP | Non-Phytate Phosphorus |
| NRC | National Research Centre |
| OUAT | Orissa University of Agriculture and Technology |
| PCR | Polymerase Chain Reaction |
| PDP | Project Directorate on Poultry |
| PHA-P | Phytohemagglutinin-P |
| PJTSAU | Professor Jayashankar Telangana State Agriculture University |
| ppm | Parts Per Million |
| QRT | Quinquennial Review Team |
| RAC | Research Advisory Committee |
| RBC | Red Blood Cell |
| SAU | State Agricultural University |
| SL | Shank Length |
| PVNRTVU | P.V. Narasimha Rao Telangana Veterinary University |
| SERB | Science and Engineering Research Board |
| SVU | State Veterinary University |
| SVVU | Sri Venkateswara Veterinary University |
| TSA | Total Sulfur-containing Amino Acids |
| U | Unit(s) |
| wks | Weeks |

# Preface

It gives me immense pleasure to present the Annual Report of this Directorate for the Year 2019. During this period, the Directorate has contributed immensely for the development of the poultry sector. The elite rural germplasm of this Directorate have been multiplied in leaps and bounds and supplied to the remotest corners of the country. The backyard poultry has been strongly recognized as a promising tool to alleviate rural poverty and bring about social security through sustainable livelihoods and nutritional security and the contribution of this Directorate in achieving this motto is commemorative and commendable.

The research in Poultry Genetics and Breeding front has resulted in a new cross which is in the pipeline for release. This cross has immense potential for backyard rearing for niche markets. The Directorate is constantly working on conservation of precious native breeds of chicken and acts as a repository for Aseel, Ghagus, Kadaknath and Nicobari. The pure lines of rural, broiler and layer varieties are continuously improved for their selection trait to bring about genetic gain in the terminal crosses.

The Directorate has done extensive research on utilization of unconventional feed resources in poultry nutrition to reduce the feed cost and overcome non availability of regular feed ingredients. Research on alleviating heat stress in birds by feed manipulation was explored in the NICRA project. Uses of DDGS, supplementation of QPM, herbal products as alternatives to AGPs, production of fortified eggs and gut microbiome analysis were extensively studied. Several advanced biotechnological tools like gene silencing, transgenics, gene polymorphism studies, miRNA profiling and development of chicken genome chip were applied to improve production and productivity in chicken.

The Directorate has evaluated the tolerance of native chicken breeds to various infectious agents, screened the field strains of MDV serotypes at molecular level and explored the use of medicinal herbs as alternatives to antibiotic growth promoters.

Preservation of chicken semen using various techniques and diluents, hormonal regulation of reproduction in various lines under different conditions were studied. The Directorate has made wealth from waste through its successful efforts in composting poultry litter and subsequently vermicomposting. A model of integrated farming system with Moringa and backyard poultry was developed for exhibiting to the rural farmers for obtaining better returns.

The Directorate acts as a nodal agency for coordinating the All India Coordinated Research Project on Poultry Breeding, which has 12

centres maintaining elite layer, broiler and rural germplasm. The Directorate monitors the 12 Poultry Seed Project centres spread all over the country and supplying improved germplasm in huge quantum to the needy farmers. These AICRP centres also conserve the native germplasm in their respective locations. It is heartening to share that the Directorate received its first patent from the Indian patent Office, Chennai during this year for "Diagnostic kit, primers and method of sex determination in chicks and adults of avian species".

The Directorate has been involving in various capacity building programmes for different stakeholders and conducted several meetings and training programmes under SCSP, TSP, MGMG and Skill development programmes. We also participated in various exhibitions, melas and farmers field programmes and showcased our technologies. A total of 4.89 lakhs germplasm including 0.40 lakhs parents which could produce commercials to a tune of 32 lakhs was distributed by the Directorate to various beneficiaries and total revenue of Rs. 211.73 lakhs was generated during this year. The AICRP centres and PSP centres supplied 8.75 and 5.75 lakhs germplasm, respectively, with a revenue generation of Rs. 222.01 lakhs and Rs. 152.14 lakhs, respectively.

I am extremely grateful and indebted to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR for the unstinted support and guidance extended for the development of this Directorate. I express my sincere gratitude to the Secretary, ICAR and Financial Advisor, ICAR for their support. I am thankful to Dr. J.K. Jena, DDG (AS), Dr. R.S. Gandhi, ADG (AP&B), Dr. Vineet Bhasin, Principal Scientist (AG&B) and other scientific and administrative staff of ICAR headquarters for their constant help and support rendered to this Directorate. I also place on record the committed nature of the Scientific, administrative, technical and supporting staff of this Directorate and also those working in the AICRP and PSP centres who have been sincerely working for the welfare of poultry farmers. I am sure that with unrelenting cooperation and efforts, we will be able to successfully march ahead to achieve the mandated objectives of this Directorate. I congratulate the editorial team for the commendable job in bringing out this Annual report in a noteworthy manner.

Date : 29 June 2020

**(R.N. Chatterjee)**
Director

# Contents

# Executive Summary

The ICAR-Directorate of Poultry Research, a premier Institute under Indian Council of Agricultural Research, is mandated to carryout basic and applied research to enhance productivity of poultry, develop new germplasm for rural poultry husbandry and impart capacity building. The Directorate also undertakes short term research projects sponsored by other funding agencies and contract research programs under PPP mode. The salient achievements for the year 2019 are summarized below.

## Research at the Directorate

### Genetics and Breeding

The research in genetics and breeding focuses on improvement of pure lines and development of varieties for rural poultry production, conservation and improvement of indigenous chicken germplasm, and maintenance and evaluation of layer, broiler and gene lines.

#### Germplasm for rural poultry farming

Two male lines, PD-1 (*Vanaraja* male line) and PD-6 (*Gramapriya* male line) and two female lines, PD-2 (*Vanaraja* female line) and PD-3 (Brown egg layer line) have been improved and are being used in production of rural chicken varieties. The egg production up to 40 wks in PD-1 line (S-13 generation) was 38.4 and the egg weight was 58.5g. The S-14 generation of the line was regenerated and a total of 2,633 chicks were hatched. In PD-6 population (S-8 generation), egg production and egg weight at 40 wks of age were 72.3 and 57.2g, respectively. The S-9 generation was regenerated and a total of 2,154 chicks were produced. Body weight at 4 and 6 wks of age was 501 and 832g, while the corresponding shank length was 70.2 and 87.4mm. The genetic and phenotypic response to selection for higher shank length at 6$^{th}$ wk in PD-6 was 2.39 and 1.44 mm, respectively over the last 9 generations.

The S-16 generation of PD-2 line was regenerated and a total of 3,477 chicks were produced. Body weight at 20 and 40 wks of age was 1856 and 2475g, respectively. The ASM was 159.1 days. The egg production and egg mass up to 40 wks of age were 84.72 eggs and 4477g, respectively, while the egg weight was 52.91g. The 40 wks egg production increased from the last generation. The S-8 generation of PD-3 line was regenerated and a total of 3,880 chicks were produced. The body weight at 4 and 6 wks of age was 170.3 and 308.6g, respectively, which showed improvement over the last generation. The heritability estimates were moderate to high for body weight and shank length. The trend in growth and production traits of PD-3 line over the last seven generations was studied. The average body weight at 4 and 6 wks of age was 168.1 and 320.1g, respectively. The selection intensity (i) ranged from 0.32 to 0.85, while rate of inbreeding ranged between 0.0031 and 0.0033. The direct selection response was 151.5g on genetic scale and 79.7g on phenotypic scale for EM at 40 wks, the primary trait of selection. Realized and estimated heritability estimates were 0.29 and 0.15, respectively for EM 40, while those for EP 40 were 0.06 and 0.18, respectively and EW 40 were 0.73 and 0.42, respectively.

#### Native chicken populations

In the S-10 generation of *Vanashree* (PD-4), a total of 731 good chicks were hatched. The shank length improved at 8 wks of age by 1.1 mm in this generation. Survivors' egg production up to 40 wks of age (80.16) improved by 6.15 eggs. There was increase in body weight of male (by 189 and 207g) and female (by 90 and 131g) birds at 20 and 40 wks of age as compared to previous generation. In Ghagus, an indigenous chicken breed, body weight and shank length of male birds at 40 wks were 2744g and 126.8mm, respectively (S-1 generation). There was increase of 1.13 eggs in survivors' egg production (34.93). A total of 931 good chicks were hatched in S-2 generation. Body weight at 8 wks of age (471.7 g) has increased by

36.5 g as compared to previous generation. Body weight of male and female birds at 20 wks of age was 2120 and 1514g, respectively, while the corresponding shank length was 129.9 and 103.4 mm, respectively, which were higher than in the previous generation.

The body weight in Nicobari breed at 40 wks of age increased by 81 and 43g, respectively in male and females. Similarly, there was increase in shank length of males and females at 40 wks by 5.5 and 3.3 mm, respectively. Hen housed egg production up to 40 wks of age (73.02 eggs) increased by 10.49 eggs. G-7 generation of Nicobari was produced. Body weight at 4 (211.4 g) and 8 (492.3 g) wks of age increased by 110 and 90.6 g, respectively. In the G-6 generation of Aseel, body weight at 4 and 6 wks of age was 169.6 and 326.7g, respectively. The body weight at 20 and 40 wks of age was 1424 and 2073g in female and 2072 and 3186g in males, respectively. The egg production up to 40 wks of age was 18.03 eggs and the egg weight was 45.57g. A total of 716 fertile eggs of Kadaknath were procured from Jabalpur centre and hatched. A total of 974 good chicks were hatched. Body weight at 0 day, 4 and 8 wks of age was 27.86, 126.7 and 376.3g, respectively. Body weight at 20 wks of age was 1574g in males and 1065g in females. The ASM was 176.2 days.

### Evaluation of crosses

A total of five crosses were produced by crossing Aseel males with females of PD-1, PD-2, PD-6, PB-1 and PB-2 lines and evaluated up to 12 wks of age. Aseel crosses with coloured broiler lines (PB-1 and PB-2) had higher body weights, while Aseel x PD-1 cross recorded higher shank length at all ages. The bone and meat proportion was higher in Aseel x PB-1 cross. The cluster analysis of means of all the traits revealed the least distance (6.85) between Aseel x PD-1 and Aseel x PD-6. Aseel crosses with PD-1 and PD-6 had suitable body weight, similar phenotypic appearance, ideal carcass traits and optimum meat quality traits with overall acceptability like native chicken meat.

A two-way cross (PD-1 x PD-4) was evaluated under farm and field conditions. The sixth wk body weight was 578.2 and 548g in male and females, respectively. A total of 150 birds at 6 wks were distributed to 15 farmers in Thatiguda village, Adilabad district, Telangana. The body weight at 12 wks was 1.6kg in cocks and 1.4kg in hens under farm conditions and 1.3kg in cocks and 1.0kg in hens under field conditions, respectively. The hens matured at 196 days of age under free range conditions and produced 39 eggs up to 40 wks of age with 50g egg weight. At the institute's farm, the hens matured at 158 days and produced 69 eggs up to 40 wks of age with egg weight of 58g. The hens weighed about 2 kg at 40 wks of age, while cocks weighed about 3 to 3.5 kg. At 12 wks, the males had strong legs with high proportion of thigh meat. The dressing percentage was 71.1 in males and 72.5 in females. The sensory evaluation indicated better consumer acceptability.

### Broiler populations

In the S-28 generation of PB-1 line, ASM decreased by 1 day, 20 wks body weight decreased by 150g, 40 wks body weight increased by 138g, egg weights were more or less similar and egg production increased by 5.7 eggs as compared to last generation. In PB-2 line (S-28 generation), the ASM increased compared to the last generation (174.7 days). The phenotypic and genetic response to selection for the 40 wks egg production over the last fifteen generations was 0.29 and 0.78 eggs per generation, respectively. To increase the variability and improve the juvenile growth traits of PB-2 line, settable eggs were obtained from Bengaluru centre of AICRP and a total of 1178 good chicks were hatched. The body weight, shank length and breast angle at 5 wks of age in this new population were 1042g, 83.5mm and 80.7°, respectively.

### Layer populations

Three layer lines, IWH, IWI and IWK are under selection for higher egg numbers up to 64 wks of age, whereas IWD, IWF and Layer Control (LC) are under random breeding programme. The ASM increased across all lines, which might be correlated with comparatively lower body weight at 16 wks of age resulting in decreased egg production across all lines, except IWH, which was almost static. The annual egg production of IWH was 297 eggs. The egg weight of IWH, IWI and IWK at 64 wks was 56.92, 55.28 and 56.90g, respectively.

## Molecular Genetics

Acetyl Co-A carboxylase type B (ACACB) gene involved in *de novo* lipid biosynthesis was silenced through RNA*i* under *in vitro* cell culture system. A total of 5 shRNA molecules namely, shRNA267, shRNA1628, shRNA3288, shRNA4113 and shRNA5424 were designed. The expression of ACACB gene in transfected chicken primary

fibroblast cells was analysed by qPCR. The knock down efficiency of shRNA267, shRNA1628, shRNA3288, shRNA4113 and shRNA5424 molecules for expression of ACACB gene in transfected fibroblast cells was 56, 87, 73, 89 and 58%, respectively.

The primary culture of chicken magnum cells was developed. The DPREGG1 vector was designed and developed by incorporating required sequences through multiple cloning and the total length of the vector was 2435bp. This vector was specific to use in magnum cells. Very good expression efficiency of this vector was observed under *in vitro* magnum primary cell culture, which will be further used to regulate expression of interferon alpha gene for therapeutic use. The bioinformatics/*Insilco* comparative study was done to identify the putative miRNAs regulating the $Ca^{2+}$ transport pathway during egg shell calcification in egg shell glands. Four crucial genes were selected based on previous studies and predicted miRNAs probably binding and inhibiting these genes using miRDB database.

Tapasin and Transporter associated with antigen processing (TAP1 and TAP2) genes were polymorphic. However, exon 2, 3, 4 and 10 of TAP2 gene were monomorphic and highly conserved compared with the chicken sequence available in the public domain. Whereas, Exon 5, 7, 8 and 9 were polymorphic. The point mutation observed at 446 of exon 7 and 579 codon of exon 8 was nonsynonymous. In exon 4 of TAP1 gene, two mutations were observed at position 128 and 130 codon. In TAP1, exon 8 had nonsynonymous substitution at 371 codon. In exon 5 of Tapasin gene, three nonsynonymous substitutions were observed at 293, 315 and 373 codons. In exon 6, 7 and 8, a single substitution was observed in the intron between exon 7 and exon 8.

## Nutrition

In a way to find out various dietary means to ameliorate the adverse effects of heat stress on chickens, various experiments were conducted. Including vegetable (soybean) oil (1.5%) in layer diets containing low ME (2500 vs 2400 kcal/kg) during pre-summer season (26.5 to 35.1 °C) sustained egg production, body weight, egg weight, egg shell quality and egg mass. A natural compound containing herbal extracts rich in vitamin C (*Amla* extract) in the diet of WL layers (65 to 70 wks) (200 g/ton) showed marginal beneficial effects on egg production. Fasting of layers (67-74 wks) from 9 am to 5 pm or 11 am to 5 pm during summer season (31.96 to 39.37 °C temperature and 20.4 to 59.6% RH) improved the egg production (EP), whereas feed efficiency improved with feed deprivation between 9 am and 5 pm.

The antimicrobial compounds like virginiamycin (Vir), chlorotetracyclin (CTC), bacitracin methylene disalicylate (BMD), lincomycin (Linco) and tylosin (Tylo) were evaluated in broiler diet. At 21d, the BWG in broilers fed Vir, CTC, Linco and Tylo was higher than the control. But, at the end of the trial, no such effect was observed. The activity of anti-oxidant enzymes reduced with inclusion of AGPs in broiler diet. The ND titre in Vir and CTC groups was lower than the control group. The residues of Vir and BMD were below the detectable level in breast meat, while the concentrations of CTC, Linco and Tylo were considerably lower than the levels suggested by FSSAI.

Rice-DDGS (15% in diet) depressed body weight of *Srinidhi* chicks, which could be countered by methionine supplementation at 110% level. Similar beneficial effects with methionine supplementation were observed either singly or in combination with lysine. Rice-DDGS could be safely included in the diet of WL laying hens at 7.5% without affecting performance and nutrient retention, while 15% DDGS was detrimental. Comparative community structure of gut microbiome of Ghagus (GH), Nicobari (N)and broiler (Br) were compared and breed specificity in microbiome structure was characterized. Principal coordinate analysis (PCoA) of the OTU data revealed distinct but overlapping profiles with the two indigenous breeds more closely related to each other than that of broiler line. *Firmicutes* was the dominant phylum in all the chicken groups (64.9 to 83.0%), followed by *Bacteroidetes* (9.5 to 19%). At genus level, *Lactobacillus* was the dominant in Br (32%), but *Bacteroides* was found to be the most dominant genus in GH (22.8%) and N (22%). High correlations among various bacterial genera were also detected indicating existence of strong host specific network of microbes in chicken gut.

Supplementation of moderate amount of lysine to QPM based diets favourably influenced egg quality in PD-2 hens. Availability of feed ingredients was surveyed in Palampur (Himachal Pradesh), Agartala (Tripura), Udaipur (Rajasthan) and Mahabunagar (Telangana) for formulating region specific diets for rural poultry germplasm. Basing on the nutrient concentration of the crop and gizzard contents of backyard chicken

reared in these regions, the energy, protein, Ca and protein were found to be highly deficient when compared to the BIS requirement. By supplementing inorganic iron, copper and zinc to the diet of WL layers, egg iron content increased, while performance was not affected. The highest egg iron concentration was obtained by feeding the hens with 150 mg iron/kg diet alongwith 70ppm zinc and 25ppm copper.

## Physiology

Cryopreservation of layer (IWK) line semen was explored using two diluents (Sasaki diluent and Lake & Ravie diluent) and two cryoprotectants (8% Ethylene Glycol-EG and 4% Dimethylsulfoxide-DMSO) in 0.5ml French straws. Low fertility rates of 7.5% and 1.98% were obtained in 8% EG and 4% DMSO in Sasaki diluent, respectively and no fertile eggs were obtained with other treatments. For cryopreservation of Ghagus semen, the protocol using 8% Ethylene Glycol in Lake and Ravie diluent and thawing at 37 °C for 30 sec gave higher fertility.

Nicobari chickens exposed to chronic heat stress under controlled conditions at 39 °C for 4h daily for three wks had lowered levels of leptin, ghrelin and growth hormone, and decreased body weight and feed intake. The expression of all the hormone receptors was up-regulated in the brain, but in the liver and magnum, it was down-regulated. Supplementation of fermented yeast culture negated these effects and in turn increased egg production. Supplementation of Se through yeast to Vanaraja parent birds increased body weight during 28-32 wks of age, whereas egg production was not affected. Se supplementation affected the plasma concentration of hormones (melatonin, progesterone and estrogen) independently. Compost was prepared using poultry litter with dry leaves as the supplement with different C/N ratios and C/N ratio of 25:1 was found optimum for Green gram in experimental pot study at the dose rate of 5g compost to 1.0kg of soil.

## Health

The native chicken breeds, Aseel, Ghagus, Nicobari and improved variety Vanaraja were evaluated for disease tolerance to fowl cholera. Higher tolerance was observed in Aseel than Ghagus and Nicobari, whereas higher levels of PM specific antibodies were induced in Aseel in comparison to Ghagus and Vanaraja chicken. A single dose of immune complex vaccine against IBD at day-old at hatchery was found to induce equivalent immune response as that of live vaccines, besides avoiding handling stress and reducing vaccination cost. PCR amplification along with gene sequencing was used for molecular characterization of field MDV. Phylogenetic analysis revealed that the field strains mostly clustered with virulent and very virulent MDV reference strains.

Dietary supplementation of two phytogenic feed additives, PFA1 and PFA2, developed at ICAR-DPR, could safely replace AGPs in the diet of Krishibro chicks. Microbial diversity of caecal samples indicated the major domain, phylum and order of bacteria, firmicutes and clostridiales, respectively. Above 50% abundance was seen in PFA1 and DPR-HF supplemented groups and <50% in the remaining groups.

# AICRP on Poultry Breeding

The AICRP on Poultry Breeding was operated at twelve centres viz. KVASU, Mannuthy; AAU, Anand; KVAFSU, Bangalore; GADVASU, Ludhiana; OUAT, Bhubaneswar; CARI, Izatnagar; ICAR Research Complex for NEH Region, Agartala; MPPCVVV, Jabalpur; AAU, Guwahati; BAU, Ranchi; MPUAT, Udaipur and CSKHPKVV, Palampur. The main objectives of the project were development of location specific chicken varieties; conservation, improvement, characterization and application of local native, elite layer and broiler germplasm; and development of package of practices for village poultry and entrepreneurships in rural, tribal and backyard areas. In addition, KVASU, Mannuthy and AAU, Anand centres were mandated to maintain two elite layer germplasm (IWN and IWP). KVAFSU, Bengaluru; GADVASU, Ludhiana; OUAT, Bhubaneswar, and CARI, Izatnagar maintained four elite broiler germplasm (PB-1, PB-2, CSML and CSFL).

The elite strains have been duplicated at different centres for coping up with exigencies, like IWF at Mannuthy, IWD and IWK at Anand and M-1 and M-2 at Jabalpur. Two pedigreed random bred control populations (one each for layer and broiler) were maintained at DPR and supplied to centres for measuring the genetic progress. During the year 2019, a total of 8,75,866 chicken germplasm was distributed to the farmers from different centres with a total revenue generation of Rs. 222.01 lakhs.

The Mannuthy centre evaluated IWN, IWP, native chicken and their crosses. In S-4 generation of native chicken, the body weight and egg

production at/upto 40 wks were 1320g and 78.95 eggs, respectively with average egg weight of 43.04g. The body weight at 16 wks was 1048g in IWN and 1082g in IWP strains, respectively. The egg production up to 64 wks of age increased by 5 eggs in IWN (268 eggs), whereas it decreased by 11 eggs in IWP strain (252 eggs) compared to the previous generation. The genetic response was 4.58 eggs in IWN per generation. The centre has distributed a total of 1,35,430 chicken germplasm to the farmers and generated a revenue of Rs. 19.68 lakhs during the year.

The Anand centre evaluated layer lines (IWN, IWP, IWD and IWF) and *Ankleshwar* chicken. The egg production of *Ankleshwar* chicken up to 40 wks of age was 71.06 eggs. Egg production up to 72 wks of age was 324.5 in IWN and 306.3 eggs in IWP strain. Egg production up to 40 wks of age was 116.7 in IWD and 114.7 in IWK strain. The centre distributed a total of 49,472 chicken germplasm to the farmers and generated Rs.22.29 lakhs revenue during the year.

The Bengaluru centre evaluated native chicken, PB-1 and PB-2 lines and their crosses. The five wk body weight was 1247 and 1093g in PB-1 and PB-2, respectively. The egg production at 40 wks of age in PB-1 and PB-2 lines was 55 and 53 eggs, respectively. The body weight of native chicken at 8 and 12 wks of age was 468.6 and 864.5g, respectively. A total of 2,03,222 chicken germplasm were distributed to farmers and revenue of Rs. 55.99 lakhs was generated during the year.

The Ludhiana centre carried out the evaluation of *Punjab Brown*, PB-1 and PB-2 lines. The 5 wk body weight was 1237 and 1156g in PB-1 and PB-2, respectively with corresponding FCR of 1.95 and 1.93. The egg production up to 40 wks of age was 65.63 and 67.26 in PB-1 and PB-2 lines, respectively. In *Punjab Brown*, the 8 wk body weight was 767.1g with FCR of 3.6. The egg production up to 40 wks of age was 56.12 eggs. The centre distributed 96,976 germplasm to the farmers and generated revenue of Rs. 21.17 lakhs.

The ICAR-CARI, Izatnagar centre evaluated the local native chicken, CSML and CSFL. The adult body weight at 40 wks of age was 3894 and 3643g in CSML and CSFL, respectively. The 40 wk egg production was 68 and 69 eggs in CSML and CSFL, respectively. A total of 59,852 improved chicken germplasm was distributed to farmers and realized an amount of Rs. 29.79 lakhs revenue.

The Bhubaneswar centre evaluated *Hansli*, CSML, CSFL and their crosses. *Hansli* birds matured at 176 days and laid 34 eggs up to 52 wks of age with an egg weight of 47.22g. The 5 wk body weight was 1032 and 1137g in CSFL and CSML, respectively. The phenotypic response in CSFL and CSML over the last eight generations was 38.38 and 59.57g, respectively. The Centre has distributed 18,543 chicken germplasm to farmers and generated revenue of Rs. 4.54 lakhs.

The Tripura centre evaluated Tripura Black, Dahlem Red, broiler dam line and their crosses. The body weight at 20 wks was 1821 and 1378g in male and females of three-way cross under farmer's backyards. The age at first egg in the flock was 168 days in field conditions. The annual egg production was 133 under field conditions and 162 in farm conditions. A total of 36,633 chicken germplasm was distributed to 395 beneficiaries and Rs. 10.75 lakhs revenue was generated.

The Jabalpur centre evaluated *Kadaknath,* Jabalpur colour and *Narmadanidhi* populations. The body weight at 40 wks was 2130 and 1570g in Jabalpur colour and *Kadaknath,* respectively. The ASM was 181 and 166 days, respectively. The egg production up to 52 wks of age was 161 eggs in JBC and 94 eggs in *Kadaknath*. *Narmadanidhi* produced 94 eggs under field conditions up to 52 wks of age. A total of 84,945 chicken germplasm was distributed to 478 farmers with revenue receipts of Rs. 17.98 lakhs.

The Guwahati centre evaluated native, *Doathgiri*, Dahlem Red, PB-2 and *Kamrupa* populations. The body weight at 20 and 40 wks of age was 1021 and 1681g, respectively in *Doathgiri* indigenous chickens. ASM was 210.8 days and egg production up to 40 wks of age was 17.9 eggs with an egg weight of 34.6g. The 40 wk body weight of *Kamrupa* was 1700g in field and 2300g in farm conditions. The egg production up to 52 wks was 76 eggs with an egg weight of 44g in *Kamrupa* variety. The centre supplied 41,166 improved germplasm to the farmers and generated Rs.8.15 lakhs revenue.

The Ranchi centre evaluated native chicken, Dahlem Red, PB-2 and Jharsim. The body weight of native chicken at 20 wks of age was 1476g in males and 1181g in females. The 64 wk egg production was 71 eggs in native chicken. The body weight of Jharsim at 20 wks of age was 1830 and 1670g in male and females, respectively. The annual egg production of Jharsim was 148 eggs under field conditions. The Centre distributed 35,243 chicken germplasm to the farmers with revenue of Rs. 6.5 lakhs.

The Palampur centre evaluated native germplasm, Dahlem Red and *Himsamridhi*. The body weight at 40 wks, ASM and EP40 of native chicken were 1490g, 182 days and 50 eggs, respectively. The annual egg production of *Himsamridhi* was 146 eggs under field conditions. A total of 65,560 chicken germplasm were supplied to farmers in tribal regions of Himachal Pradesh. The centre realised Rs 14.51 lakhs of revenue.

The Udaipur centre evaluated *Mewari,* RIR, CSFL and *Pratapdhan* populations. The body weight at 40 wks of age was 1700 and 2300g in female and male birds of *Mewari*, respectively, while the egg production up to 52 wks of age was 69 eggs. The annual egg production was 160 eggs in *Pratapdhan* under field conditions. A total of 48,824 improved chicken germplasm was distributed to 500 farmers. The centre realized Rs. 10.67 lakhs of revenue.

## Poultry Seed Project

The Poultry Seed Project was initiated during XII five year plan. During the period of report, the project was operated at 12 centres across the country. The main objective of this project is local production of improved chicken germplasm and supply to various stake holders in the remote areas to target production enhancement of egg and meat for augmenting rural poultry production, socio-economic condition of the target groups and linking small scale poultry producers with organized market.

The PSP centres are located at WBUAFS, Kolkata; BASU, Patna; ICAR-RC for NEH region, Jharnapani; ICAR-NOFRI, Gangtok; ICAR-RC for NEH region, Imphal; TANUVAS, Hosur; ICAR-CCARI, Panaji; ICAR-CIARI, Port Blair; PVNRTVU, Warangal; SVVU, Tirupati; ICAR-RC for NEH Region, Umiam and SKUAST, Srinagar.

The Directorate as the coordinating unit, supplied parent chicks, co-ordinated and monitored the activities of different centres. The target set for supplying chicks during the year 2019 were between 0.3 and 1.0 lakhs chicks per annum for different centres and to collect feedback on the performance of the germplasm under backyard farm conditions. A total of 5,74,798 improved chicken varieties were distributed in their respective regions/states with a revenue receipt of Rs. 152.14 lakhs during the year 2019.

The Kolkata centre reared three batches of *Vanaraja* parents during the year. A total of 11,053 chicks were distributed to 18 farmers in West Bengal. An amount of Rs. 2.79 lakhs revenue was realized. The Patna centre reared two batches of *Vanaraja* and *Gramapriya* parents. A total of 71,700 *Vanaraja* chicken germplasm was distributed to the farmers in Bihar with an amount of Rs. 12.2 lakhs revenue.

Two batches of *Vanaraja* and *Srinidhi* parents were in position in Jharnapani centre. A total of 79,375 improved chicken germplasm was distributed to farmers of Nagaland and neighbouring states. A total of Rs. 34.63 lakhs revenue was generated at this Centre. The centre achieved the target of germplasm. One batch of *Vanaraja* parents was reared at ICAR-NOFRI, Gangtok, Sikkim. A total of 96,815 improved chicken germplasm of *Vanaraja* was distributed to 3,338 farmers in Sikkim with an amount of Rs. 21.84 lakhs revenue. Three batches of *Vanaraja, Gramapriya* and *Srinidhi* parents were reared at Manipur Centre. A total of 38,709 improved chicken germplasm was distributed to the farmers in Manipur. The Centre has generated Rs. 15.27 lakhs of revenue.

One batch of *Vanaraja* and two batches of *Gramapriya* parents were reared at Hosur Centre. A total of 1,27,327 improved rural chicken (*Vanaraja* and *Gramapriya*) germplasm was distributed to 1,122 farmers in Tamil Nadu. The centre has generated revenue of Rs. 32.40 lakhs. Three batches of *Srinidhi, Vanaraja* and *Krishibro* parents were reared at Goa centre. A total of 39,893 improved chicken germplasm was distributed to 1,263 farmers in Goa and 38 farmers in Karnataka and 4 in Maharastra with revenue of Rs. 7.54 lakhs.

Two batches of *Vanaraja* and *Srinidhi* parents were reared at Port Blair centre. A total of 22,063 improved chicken germplasm were distributed to 180 farmers in Andaman & Nicobar Islands with revenue of Rs. 2.83 lakhs during the year. One batch of *Vanaraja* parents were reared at SKUAST, Srinagar centre. A total of 18,605 chicks were supplied to the beneficiereies and a revenue of 4.03 lakhs was generated. Two batches of *Vanaraja* and *Srinidhi* parents were reared at ICAR-RC for NEH Region, Umiam, Barapani. A total of 12,606 improved chicken germplasm was distributed to the farmers in Meghalaya with an amount of Rs. 10.27 lakhs of revenue.

One batch of *Vanaraja* parents was maintained at SVVU, Tirupati. A total of 31,858 chicks were supplied to the farmers and revenue of Rs.4.5 lakhs was generated. Three batches of *Vanaraja, Gramapriya* and *Vanashree* parents were reared at PVNRTVU, Warangal. A total of 24,794 improved

rural chicken germplasm was distributed to the farmers. The centre has generated a revenue of Rs. 3.85 lakhs.

## Technologies Transferred

The Directorate participated in a number of exhibitions and farmers' fairs and propagated the technologies and varieties developed at the institute. Training programmes were organized for imparting knowledge on rural and commercial poultry production to the farmers, veterinary officers and other beneficiaries from across the country. Consultancy and contract research services were also extended to the stakeholders in the area of nutrition and health. A total of 1,76,482 hatching eggs, 2,64,425 day-old chicks and 8,814 grown-up birds of *Vanaraja*, *Gramapriya, Srinidhi, Krishibro, native chickens* etc. were supplied by DPR, to the farmers and different organizations including Government agencies across the country. In addition, 40,269 parent chicks of different varieties were also supplied.

From the AICRP and Poultry Seed Project centres, another 8,75,866 and 5,74,798 numbers of germplasm, respectively were supplied. Through functional linkages with line departments and other agencies, the Directorate has been playing a pioneering role in promoting rural poultry production in the country.

Under the Tribal Sub Plan, 7,818 grownup chicks of *Vanaraja* and *Gramapriya* were distributed to 584 farmers in Adilabad district, Telangana alongwith basic inputs. A mother unit facility was created by ITDA at Utnoor under the guidance of the institute to rear 3000 chicks during nursery phase up to 6 wks of age. Under the SC Sub Plan, 184 farmers from four districts of Telangana were trained on backyard poultry farming. Further, 4,122 grownup chicks of Vanaraja alongwith necessary inputs were distributed to 220 farmer families.

## Other activities

During the year, a total of 18 research papers, 3 review papers, 1 book chapter and 1 popular article were published by the scientists of the institute. In addition, 2 invited papers and 9 research abstracts were presented in different Conferences. Other priority programmes such as *Mera Gaon Mera Gaurav* and *Swacch Bharath* were implemented. The Institute Management Committee, Research Advisory Committee and Institute Research Committee continuously monitored and suggested improvement in research, administration and financial management of the Institute.

At the Directorate, the budget utilized during the period was Rs. 2179.15 lakhs and at AICRP and Poultry Seed Project centers, Rs. 634.17 and Rs. 582.58 lakhs, respectively were utilized. A total revenue of Rs. 585.88 lakhs (DPR-211.73, AICRP-222.01 and PSP-152.14 lakhs) was generated during the year.

# 1 Introduction

## History

The ICAR-Directorate of Poultry Research (formerly Project Directorate on Poultry) was established on 1st March 1988 at Hyderabad, Andhra Pradesh under the aegis of Indian Council of Agricultural Research. The Institute originated from All India Coordinated Research Project (AICRP) on Poultry Breeding, an all India Net Work project launched by the Indian Council of Agricultural Research during IV five year plan with the objective of augmenting commercial poultry production and achieving self-sufficiency in the country. In the beginning, the coordinating unit of AICRP was located at the Poultry Research Division, Indian Veterinary Research Institute, Izatnagar till 1979, which later functioned from Central Avian Research Institute, Izatnagar till its elevation to the Directorate status in 1988. The institute was elevated from the position of Project Directorate to Directorate on 18th September 2013. Further elevation to "Indian Institute of Poultry Research" (as recommended by QRT) is under active consideration with Council. The scientific cadre strength has been increased from 15 to 23 during the year 2019.

The primary research focus at the Institute has been towards the application of quantitative genetic principles to enhance productivity of various chicken germplasm with special emphasis to meet the needs of rural and tribal people of the country. To support the core research programme research on nutrition, health, physiology and molecular genetics has been made an integral component. In addition, several externally funded projects were also carried out at the Directorate to achieve the Institute's primary goals and objectives.

The AICRP on Poultry Breeding was started during IV plan and has made significant contribution in the development of poultry sector in India over a period of time. Seven promising varieties of chicken were released for commercial exploitation for the benefit of the intensive poultry farming. Rural component of the project was added during XI plan with two centres and further strengthened in XII plan period by adding 4 more centres to carryout research in rural poultry farming. The AICRP on poultry breeding was completely re-oriented towards the rural poultry from 2014-15 with all the 12 centres to cater to the needs of the rural/tribal farmers across the country. The primary objective of the AICRP centre is to develop location specific rural chicken varieties utilizing the local native germplasm. The constant efforts of the scientists led to the development of 5 location specific varieties, viz. *Pratapdhan* (MPUAT, Udaipur), *Kamrupa* (AAU, Guwahati), *Jharsim* (BAU, Ranchi), *Narmadanidhi* (MPUAT, Jabalpur) and *Himsamridhi* (CSKHPKVV, Palampur). During XI plan, the activities of the Directorate were further expanded by introduction of the Poultry Seed Project with six centres located in different states to increase the availability of rural chicken germplasm for rearing in remote areas of the nation. The Poultry Seed Project was further strengthened by addition of five new centres from 2014-15 and another centre from 2017-18, thus totalling to 12. The Directorate, besides coordinating the ICAR network projects, is carrying out research in core areas of Poultry Science and supplying rural chicken germplasm to meet the demand in rural and tribal areas.

At this Directorate, three promising chicken varieties for rural poultry farming were evolved i.e., *Vanaraja,* a dual-purpose bird, *Gramapriya*,

predominantly a layer, and *Srinidhi*, a dual purpose bird meant for free-range and backyard farming. Recently, a new variety *Vanashree* (PD-4) has been developed from Aseel and is being popularised as a high producing improved native bird. These chicken varieties have become extremely popular and are being reared in every part of the country. Several user agencies in the country are involved in dissemination of the varieties covering the southern, northern, eastern and northeastern states including Jammu and Kashmir, Lakshadweep, and Andaman and Nicobar Islands. The Directorate also developed two crosses viz. *Krishibro*, a multicolored broiler and *Krishilayer*, a high yielding egg producing bird for commercial purposes. Further research in this direction is underway for developing new crosses that could be tailor-made for better adaptability under diversified regions in rural and tribal backyard conditions.

Active research is being pursued to prepare package of practices for providing optimum nutrition, management and health coverage to the pure lines as well as crosses developed by the Directorate for intensive and backyard systems of rearing. Research in nutrition at this Directorate resulted in development of technologies that have been adopted by the commercial and rural farmers to reduce cost of production. Besides nutritional knowhow, the Directorate is also familiar among poultry farming community for its services in disease diagnosis, seromonitoring and health care. The nutritional and health care solutions are being offered to the stake holders of poultry farming including network programmes and contract research programmes being operated by the Directorate. The studies on advanced molecular genetic tools like RNAi (gene silencing), SNP typing, microsatellite analysis, DNA marker based selection, etc. have also been undertaken in evaluating and augmenting the productivity of various chicken germplasm maintained at this Directorate. The Directorate thus is actively engaged in augmenting the productivity of chicken by undertaking research in different aspects of Poultry Science to cater to the needs of the country.

## 1.2. Vision

- To enhance productivity of chicken for household nutritional security, income and employment generation.

## 1.3. Mission

- To develop and propagate improved varieties of chicken for sustainable production under intensive and extensive systems.

## 1.4. Mandate

- Basic and applied research to enhance productivity of poultry.
- Development of new germplasm for rural poultry husbandry.
- Capacity building.

## 1.5. Budget (2019)

Rs lakhs

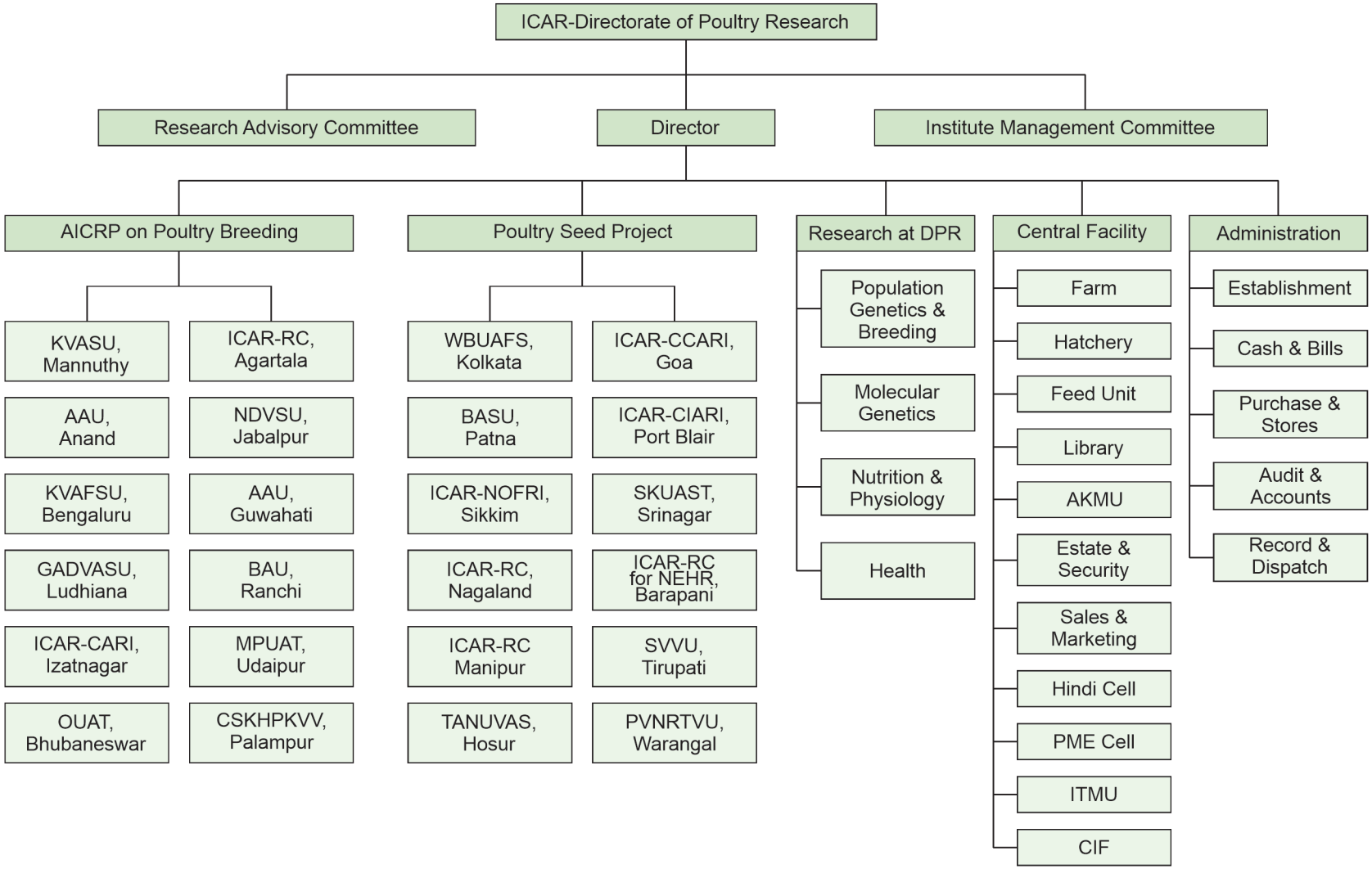
| Scheme | Budget | Utilization | Receipts |
|---|---|---|---|
| DPR | 2181.63 | 2179.15 | 211.73 |
| AICRP | 634.17 | 634.17 | 222.01 |
| PSP | 582.58 | 582.58 | 152.14 |

The Budget allocation is as per the financial year. However, the above figures are calculated proportionately from the allocations for the year 2018-19 and 2019-20.

## 1.6. Staff Position

| Cadre | Sanctioned | Cadre in position as on Dec 31, 2019 |
|---|---|---|
| RMP | 01 | - |
| Scientists | 23 | 22 |
| Technical | 16 | 13 |
| Administrative | 14 | 11 |
| Skilled support | 15 | 13 |
| Total | 69 | 59 |

# Organogram


ICAR-Directorate of Poultry Research
Research Advisory Committee
Director
Institute Management Committee
AICRP on Poultry Breeding
KVASU, Mannuthy
ICAR-RC, Agartala
AAU, Anand
NDVSU, Jabalpur
KVAFSU, Bengaluru
AAU, Guwahati
GADVASU, Ludhiana
BAU, Ranchi
ICAR-CARI, Izatnagar
MPUAT, Udaipur
OUAT, Bhubaneswar
CSKHPKVV, Palampur
Poultry Seed Project
WBUAFS, Kolkata
ICAR-CCARI, Goa
BASU, Patna
ICAR-CIARI, Port Blair
ICAR-NOFRI, Sikkim
SKUAST, Srinagar
ICAR-RC, Nagaland
ICAR-RC for NEHR, Barapani
ICAR-RC Manipur
SVVU, Tirupati
TANUVAS, Hosur
PVNRTVU, Warangal
Research at DPR
Population Genetics & Breeding
Molecular Genetics
Nutrition & Physiology
Health
Central Facility
Farm
Hatchery
Feed Unit
Library
AKMU
Estate & Security
Sales & Marketing
Hindi Cell
PME Cell
ITMU
CIF
Administration
Establishment
Cash & Bills
Purchase & Stores
Audit & Accounts
Record & Dispatch

# Genetics and Breeding

## Development of germplasm for backyard / free range farming for rural and tribal areas

### Male lines

U. Rajkumar, Santosh Haunshi, L.L.L. Prince and C. Paswan

#### PD-1 line (*Vanaraja* Male Line)

PD-1 line was evaluated for production traits up to 40 weeks of age in S-13 generation during the reporting period.

#### Production performance (S-13)

The ASM was 187.8±0.06 days, which decreased significantly from previous generation. The part period egg production at 40 weeks of age was 38.41±0.05 eggs, which was reduced from last generation. The egg weight at 40 weeks was 58.50 ±0.01 g. The heritability estimates of production traits were low to medium from sire and dam components variance. The heritability of EP 40 was 0.18, indicating reasonable estimate of $h^2$ from sire and dam components. The least squares means for body weight at 20 and 40 weeks were 2103±0.61 and 2836±0.81 g, respectively. The body weight increased from the previous generation marginally.

A pair of PD-1 birds

The S-14 generation of PD-1 line was regenerated in pedigreed mating with 50 sires and 250 dams in five hatches. A total of 2633 chicks were produced with the fertility of 82.6%. Hatchability on FES and TES was 85.70 and 70.80%, respectively. Hatchability reduced over the last generation.

#### PD-6 (*Gramapriya* Male Line)

PD-6 (GML) was evaluated for production traits (S-8) and juvenile growth (S-9) traits during the reporting period. The least square means of production traits recorded up to 40 weeks of age during S-8 generation are presented in Table 1. The heritability estimates for production traits were low to medium from sire and dam components of variance.

Table 1. Production performance in GML chicken (S-8)

| Traits | | Means | Heritability | | |
|---|---|---|---|---|---|
| | | | $h^2_S$ | $h^2_D$ | $h^2_{(S+D)}$ |
| ASM (days) | | 176.02 ±0.05 | 0.19 ± 0.11 | -- | -- |
| Body wt. (g) | 20 wks | 1895±0.54 | 0.09±0.12 | 0.64±0.33 | 0.39±0.27 |
| | 40 wks | 2931±0.64 | 0.73±0.26 | 0.39±0.31 | 0.56±0.32 |
| Egg wt. (g) | 28 wks | 49.55±0.01 | -- | -- | -- |
| | 32 wks | 53.35±0.01 | -- | -- | -- |
| | 36 wks | 55.54±0.01 | -- | -- | -- |
| | 40 wks | 57.17±0.01 | 0.78±0.27 | 0.54±0.48 | 0.66±0.27 |
| Egg prodn. (Nos.) | 40 wks | 72.31±0.04 | 0.09±0.11 | 0.17±0.18 | 0.13±0.24 |

The S-9 generation of GML population was regenerated with 50 sires and 250 dams in a pedigreed mating. A total of 2154 chicks were produced with 84.8% fertility and 93.0 and 78.9% hatchability on fertile and total eggs set, respectively. The least squares means for body weight at 4 and 6 weeks of age were 501±0.03 and 832±0.06 g, respectively. The shank length at 4 and 6 weeks was 70.2±0.001 and 87.4±0.002 mm, respectively. The body weight and shank length at 4 and 6 weeks increased from the last generation. The heritability estimates for body weight and shank length were moderate to high. The body weight and shank length were positively correlated with high degree of association. The genetic and phenotypic response to selection for higher shank length at 6th week was 2.39 and 1.44 mm, respectively over the last 9 generations (Fig. 1).

A pair of PD-6 Birds

## Female lines

U. Rajkumar, L.L.L. Prince, S.P. Yadav and C. Paswan

PD-2 (female parent line of *Vanaraja*) and PD-3 (female parent line of *Gramapriya*) lines along with rural and Dahlem Red control were evaluated for growth and production performance. The registration of PD-2 line was taken up and the revised application was submitted to NBAGR for further processing.

### PD-2 line

The S-16 generation of PD-2 population was regenerated with 50 sires and 250 dams in a pedigreed mating. A total of 3,477 chicks were produced with 77% fertility and 81 and 71% hatchability, respectively on fertile and total eggs set.

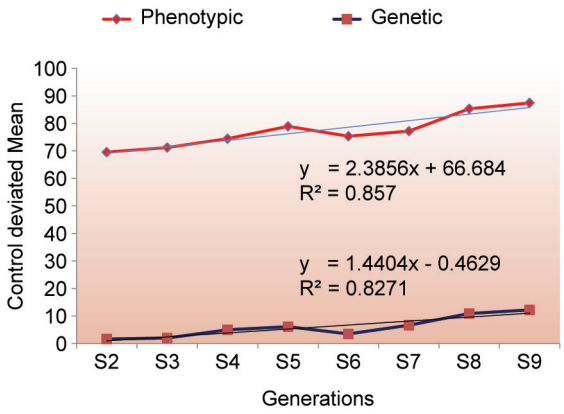



Fig. 1. Genetic and phenotypic response for Shank length in PD-6 line

Table 2. Juvenile performance in PD-2 line (S-16)

| Age | Body weight, g | Heritability | Shank length, mm | Heritability |
|---|---|---|---|---|
| 4 wks | 325.7±0.02 (278.84) | 0.32±0.11 | 56.10±0.001 (52.47) | 0.29±0.09 |
| 6 wks | 614±0.03 (606.14) | 0.39±0.18 | 73.53±0.001 (73.01) | 0.31±0.13 |

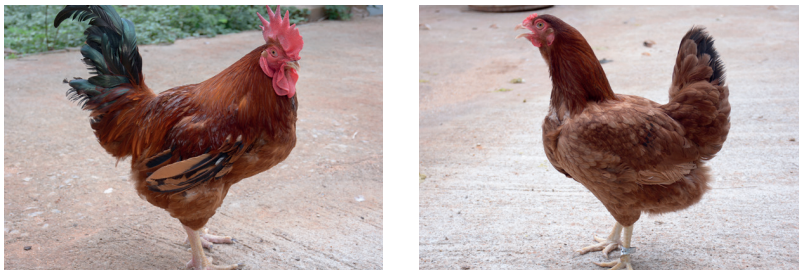
**values in parenthesis are for control population*

PD-2 population was evaluated for juvenile growth and conformatory traits utilizing data collected on 3,034 chicks. The means of body weight and shank length recorded at four and six weeks of age are presented in Table 2. The heritability ranged from moderate to high for both body weight and shank length.

The selected PD-2 population was evaluated for growth and production traits up to 40 weeks of age in S-16 generation. The mean body weight at 20 and 40 weeks of age was 1856±0.25 and 2475±0.34 g, respectively. The ASM was 159.1±0.06 days. The egg weight at 40 weeks of age was 52.91±0.005 g. The egg production and egg mass up to 40 weeks of age was 84.72±0.02 eggs and 4477±1.31g, respectively. The 40 week egg production increased from the last generation. The heritability estimate for 40 week egg production was 0.08 (8 %).

## PD-3 line

The PD-3 line is being improved for higher 40 week egg mass. The line was evaluated for production traits during S-7 generation (Table 3). The egg production and egg mass up to 40 weeks of age increased considerably from the last generation. The heritability estimates for production traits were low to medium from sire and dam components of variance.



A pair of PD-2 birds

Table 3. Production performance of PD-3 line (S-7)

| Traits | | Means | | Heritability | | |
|---|---|---|---|---|---|---|
| | | PD-3 | DRC* | $h^2_S$ | $h^2_D$ | $h^2_{(S+D)}$ |
| ASM (days) | | 171.47±0.01 | 182.37 | 0.07±0.07 | 0.24±0.11 | 0.16±0.07 |
| Body wt. (g) | 20 wks | 1322±0.15 | 1100 | 0.28 ±0.13 | 0.21±0.14 | 0.25±0.09 |
| | 40 wks | 1731±0.21 | 1586 | 0.31±0.12 | 0.36±0.12 | 0.33±0.08 |
| Egg wt. (g) | 24 wks | 45.34±0.002 | 41.25 | -- | -- | -- |
| | 28 wks | 50.22±0.003 | 49.86 | 0.63±0.18 | 0.26±0.10 | 0.45±0.12 |
| | 32 wks | 51.98±0.004 | 50.61 | 0.55±0.16 | 0.26±0.10 | 0.41±0.11 |
| | 36 wks | 54.08±0.004 | 52.86 | 0.87±0.21 | 0.20±0.08 | 0.53±0.13 |
| | 40 wks | 55.31±0.004 | 54.23 | 0.45±0.15 | 0.38±0.12 | 0.42±0.11 |
| Egg prodn. (Nos.) | 40 wks | 75.60±0.01 | 57.26 | 0.12±0.08 | 0.24±0.11 | 0.18±0.07 |
| Egg mass (g) | 40 wks | 4157.2±0.99 | 3106.3 | 0.13±0.07 | 0.17±0.10 | 0.15±0.06 |

**DRC - Dahlem Red Control*

The S-8 generation of PD-3 line was regenerated using 50 sires and 250 dams in a pedigreed mating. A total of 3880 chicks were produced. The fertility was 75% and hatchability on fertile and total eggs set was 72 and 54%, respectively. The body weight at 4 and 6 weeks of age was 170.3 and 308.6 g, respectively. The body weight improved from the last generation. The heritability estimates were moderate to high for body weight and shank length.

## Growth, production and short-term selection response in PD-3 line

A comprehensive study was carried out in *Gramapriya* female line (PD-3) with respect to growth, production, selection response and population structure utilizing the data generated for the last seven generations. The average fertility was 71.9 % and hatchability was 80.5 % on fertile eggs set and 57.1% on total eggs set. The least squares means (LSMs) for body weight at 4 and 6 weeks of age were 168.1±0.01 and 320.1±0.02 g, respectively. The heritability estimates from sire and dam components of variance were moderate to high for both body weights and shank length (0.27 to 0.35). The correlation coefficients (genetic and phenotypic) between body weights and shank length were positive and high in magnitude, except with day old body weight.

The egg production at 40 weeks of age was negatively associated with ASM, body weights and egg weights at different ages. Egg mass had significant (P≤ 0.05) positive association with egg production and egg weight at 40 weeks of age. The selection intensity (i) ranged from 0.32 to 0.85, while rate of inbreeding ranged between 0.0031 and 0.0033 in PD-3 line. The direct selection response was 151.5 g on genetic scale and 79.7 g (P<0.05) on phenotypic scale for EM 40, the primary trait of selection over the last seven generations (Fig. 2). Realized and estimated heritability estimates were 0.29 and 0.15, respectively for EM 40, while those for EP 40 were 0.06 and 0.18, respectively and EW40 were 0.73 and 0.42, respectively. The study concluded that PD-3 population was in ideal condition with respect to growth and production performance. Positive selection response for EM 40 was observed in the population maintaining both egg production and egg weight, the important traits for sustainable rural poultry farming.

A pair of PD-3 birds

## Evaluation of Aseel crosses for broiler traits

The suitability of Aseel crosses with *Vanaraja* male line (PD-1), *Gramapriya* male line (PD-6), *Vanaraja* female line (PD-2), Punjab Broiler -1 (PB-1) and Punjab Broiler-2 (PB-2) pure lines for small scale meat production with native chicken was studied. A total of five crosses were produced by crossing Aseel males with PD-1, PD-2, PD-6, PB-1 and PB-2 females and evaluated up to 12 weeks of age. The body weight and shank length significantly (P≤0.05) differed at all ages among the genotypes. Aseel crosses with coloured broiler lines (PB-1 and PB-2) had significantly (P≤0.05) higher body weights while Aseel x PD-1 cross recorded higher shank length at all ages. The protein and moisture content of breast meat did not differ significantly, while fat and ash proportion varied significantly (P≤0.05) among the crosses. The protein and fat proportion of breast meat ranged from 23.6 to 23.8 % and 3.28 to 3.69 %, respectively. The pH values of the breast meat were in the normal range (5.89 to 6.29) and did not show any significant differences among crosses. The Shear force values (SFV) differed significantly (P≤0.05) among the crosses with significantly lower SFV recorded in Aseel x PD-6 cross. Hydroxy proline (HP) concentration was significantly (P≤0.05) higher in Aseel x PB-1 and Aseel x PD-2 crosses. The meat colour differed significantly (P≤0.05) with respect to yellowness and red colouration.

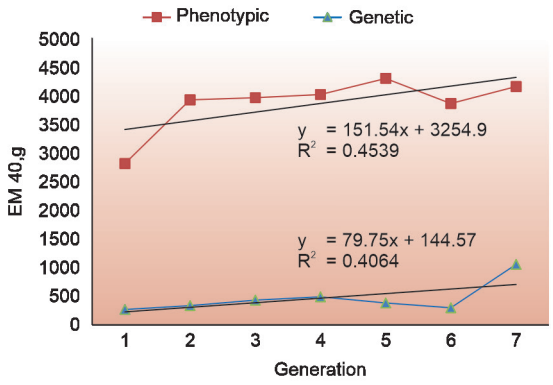



Fig. 2. Direct genetic and phenotypic response for egg mass at 40 weeks of age in PD-3 line

Aseel X PB-1 birds

Aseel X PD-2 birds

Aseel X PD-1 birds

Aseel X PD-6 birds

The sensory evaluation of meat revealed no significant variations for all attributes. The proportion of legs, wings, back, neck, meat and bone significantly (P≤0.05) differed among the crosses. The bone and meat proportion was significantly higher in Aseel x PB-1 cross. Liver proportion was significantly (P≤0.05) higher in crosses with rural pure lines than the broiler crosses. The cluster analysis of means of all the traits revealed the least distance (6.85) between Aseel x PD-1 and Aseel x PD-6. Aseel crosses with PD-1 and PD-6 had suitable body weight, similar phenotypic appearance, ideal carcass traits and optimum meat quality traits with overall acceptability like native chicken meat. The study concludes that, Aseel x PD-1 and Aseel x PD-6 crosses may be a viable and suitable alternative for native chicken farming with higher productivity.

## Evaluation of 2-way cross

A two-way cross was evaluated under farm and field conditions during the reporting period up to 40 weeks of age. A total of 150 birds were distributed to 15 farmers in Thatiguda village, Adilabad district, Telangana. The sixth week body weight was 578.2±8.22 and 548.3±7.20 g in male and females, respectively. The body weight at 12 weeks was 1.6 kg in cocks and 1.4 kg in hens under farm conditions and 1.3 kg in cocks and 1.0 kg in field conditions, respectively. The hens matured at 196 days of age under village free range conditions and produced 39 eggs up to 40 weeks of age with 50 g egg weight. They matured at 158 days and produced about 69 eggs up to 40 weeks of age with egg weight of 58 g at 40 weeks under farm conditions. The hens weighed about 2 kg at 40 weeks of age, while cocks weighed about 3 to 3.5 kg. On an average, each cock was sold at Rs. 700/bird irrespective of the body weight.

The growth, carcass and meat quality traits were evaluated in a 2-way cross developed and propagated for rural poultry farming. The data collected on 232 birds for growth, 40 birds for carcass and 20 birds for meat quality were utilized for the study. The body weight and shank length significantly (P≤0.05) differed between the sexes from six weeks onwards with higher body weights and longer shanks in males. The sixth week body weight and shank length were 578.2±8.22g and 78.93±6.22 mm in males and 548.3±7.20g and 76.15±5.28 mm in females, respectively. The Least squares mean for body weight at 12 weeks of age in males and females were 1653±21.49 and 1368±14.99g, respectively. Males had strong legs with significantly (P≤0.05) high proportion of thigh meat. Sex had no significant effect on

A tribal farmer with 2-way cross birds

A pair of Vanashree birds

dressing percentage (DP), neck, back and breast meat proportions. The DP was 71.1±0.22 % in males and 72.5±0.43 % in females, respectively.

The bone proportion was significantly (P≤0.05) higher in males. Abdominal fat proportion was significantly (P≤0.05) higher in pullets. Feather proportion was significantly (P≤0.05) higher in males. Sex did not show any significant variation on the pH, shear force value (SFV) and hydroxy proline (HP) values. The yellowness (b*) differed significantly (P≤0.05) between the sexes and it was lower in males. The fat and moisture content significantly (P≤0.05) differed between the sexes. Fat proportion was significantly (P≤0.05) higher in females (3.57±0.05%) than in males (2.97±0.01%). Protein and ash proportions were similar in both the sexes. The sensory attributes ranged from 6.6 to 7.0 on an eight point scale, indicating better consumer acceptability. The study concluded that the 2-way cross with ideal growth, carcass and optimum meat quality with reasonable consumer acceptability may be a suitable variety for propagating in rural and tribal areas under free range backyard conditions.

## Native germplasm

Santosh Haunshi, L.L.L. Prince and U. Rajkumar

### PD-4 (*Vanashree*)

The PD-4 line (*Vanashree*), evolved from Aseel, is being improved for body weight at 8 weeks of age through individual selection in males and also for egg production up to 40 weeks of age through independent culling level of selection in females. In S-10 generation, a total of 731 good chicks were hatched in three hatches by mating 50 sires with 150 dams in 1:3 ratio. Selection differential and intensity of selection for 8 weeks body weight was 37.4g and 0.41σ, respectively, while those for 40 weeks egg production were 12.6 eggs and 0.59σ. Effective population size and rate of inbreeding were 143.8 and 0.0035, respectively as 50 sires and 128 dams contributed progenies to the S-10 generation. The least square means and heritability estimates of growth traits on pooled sex up to 8 weeks of age are presented in Table 4. There was improvement in shank length at 8 weeks of age by 1.1 mm in this generation.

Heritability estimates of growth traits were higher in magnitude suggesting that there is scope for further improvement. The average body weights and shank length recorded sex wise up to 40 weeks of age are given in Table 5. There was increase in body weight of male (189 and 207 g) and female (90 and 131g) birds at 20 and 40 weeks of age as compared to previous generation. Also there was increase in shank length recorded at 20 and 40 weeks of age in male (5 and 3.9 mm) and female (3 and 2 mm) Vanashree birds. Liveability observed during 0-8 and 9-20 weeks of age was 84.3 and 98.1%, respectively. Liveability of males and females during 21-40 weeks of age was 95.7% and 100%, respectively.

Production traits of Vanashree are presented in Table 6. There was improvement in survivors' egg production up to 40 weeks of age by 6.15 eggs.

Table 4. Least square means and heritability estimates of juvenile growth traits of *Vanashree* on pooled sex (S-10)

| Traits | Mean ± S.E. | $h^2_{(Sire)}$ |
|---|---|---|
| Body weight, g | | |
| 0 day | 34.12±0.17 | 0.29±0.23 |
| 4 wks | 183.1±1.51 | 0.59±0.20 |
| 8 wks | 551.0±3.60 | 0.38±0.19 |
| Shank length, mm | | |
| 8 wks | 78.2±0.22 | 0.44±0.17 |

Table 5. Growth traits in adult male and females of Vanashree (S-10)

| Trait | Males | Females |
|---|---|---|
| Body weight, g | | |
| 16 wks | 1600±15.97 | 1266±9.26 |
| 20 wks | 1986±13.2 | 1588±8.71 |
| 40 wks | 3163±24.5 | 2202±16..3 |
| Shank length, mm | | |
| 20 wks | 131.3±0.32 | 107.5 ± 0.34 |
| 40 wks | 135.9±0.48 | 108.3± 0.36 |

## Characterization of Ghagus breed

Ghagus, an indigenous chicken breed has been selected for higher body weight at 8 weeks of age. The S-1 generation was evaluated for production traits up to 40 weeks of age and results are presented in Table 7. Average body weight and shank length of male birds recorded at 40 weeks of age were 2744±36.3g and 126.8±0.73mm, respectively. There was an improvement of 1.13 eggs in survivors' egg production. There was also improvement of 61 g in body weight and 2.42 mm in shank length of female birds recorded at 40 weeks of age. Liveability of Ghagus female and male birds during 21-40 weeks of age was 93.7 and 95.7%, respectively.

A total of 931 good chicks of Ghagus were hatched in S-2 generation in two hatches with the fertility of 89.6% and better hatchability of 92.8 and 83.2% on fertile eggs and total eggs set, respectively. There was improvement in hatchability in this generation compared to previous generation. Growth performance evaluation of S-2 generation birds was completed up to 20 weeks of age during the reporting period. Growth traits recorded on pooled sex up to 8 weeks of age are presented in Table 8. There was improvement of 36.5 g in 8 weeks body weight when compared to previous generation. Higher estimates of heritability of juvenile growth traits of Ghagus on sire+dam component basis were observed in S-2 generation

Table 6. Production traits of *Vanashree* hens (S-10)

| Traits | | Mean ±S.E. |
|---|---|---|
| ASM (d) | | 159.5±0.72 |
| Age at 50% production (d) | | 167.7 |
| Age at peak production (d) | | 189.3 (78.1%) |
| Survivors' EP (Nos.) | 40 wks | 80.60±1.24 |
| Hen housed EP (Nos.) | 40 wks | 78.89±1.35 |
| Hen day EP (Nos.) | 40 wks | 79.12 |
| Egg wt. (g) | | |
| | 28 wks | 43.90±0.17 |
| | 32 wks | 46.11±0.20 |
| | 36 wks | 47.99±0.21 |
| | 40 wks | 49.23±0.23 |

*Figure in parenthesis is production percentage*

Table 7. Production traits of Ghagus breed (S-1)

| Traits | | Mean ± S.E. |
|---|---|---|
| ASM (d) | | 184.3 ± 0.88 |
| Age at 50% production (d) | | 192 |
| Age at peak production (d) | | 198 (59.3%) |
| Survivors' EP (Nos.) | 40 wks | 34.93±1.23 |
| Hen housed EP (Nos.) | 40 wks | 34.87±1.22 |
| Body wt. (g) | 40 wks | 1723±22.9 |
| Shank length (mm) | 40 wks | 101.4±0.33 |
| Egg wt. (g) | | |
| | 28 wks | 42.44±0.33 |
| | 32 wks | 45.73±0.44 |
| | 36 wks | 45.98±0.44 |
| | 40 wks | 46.88±0.47 |

*Figure in parenthesis is production percentage*

Table 8. Juvenile growth traits of Ghagus breed on pooled sex (S-2)

| Traits | Mean ± S.E. | $h^2$ (Sire+Dam) |
|---|---|---|
| Body wt. (g) | | |
| 0 day | 33.25±0.11 | - |
| 4 wks | 166.4±1.55 | 0.45±0.09 |
| 8 wks | 471.7±4.42 | 0.41±0.09 |
| 16 wks | 1364±10.33 | 0.31±0.09 |
| Shank length (mm) | | |
| 8 wks | 70.09±0.30 | 0.33±0.08 |

A pair of Ghagus birds

as well. Body weight of male and female birds at 16 weeks of age was 1554±12.4 and 1203±8.76g, respectively. Body weight of male and female birds at 20 weeks of age was 2120±18.6 and 1514±11.1g, respectively. Shank length of male and female birds at 20 weeks of age was 129.9±0.58 and 103.4±0.30 mm, respectively. There was an improvement of 220 and 168 g in 20 week's body weight of males and females, respectively in this generation. Similarly, there was improvement of 2.8 and 2.0 mm in 20 week's shank length in males and females, respectively.

## Maintenance and evaluation of Nicobari breed

Random bred population of Nicobari breed is being maintained at the institute farm as resource population for experimental purposes. The G-6 generation was evaluated for growth and production traits up to 40 weeks of age. Body weight and shank length of male and females recorded at 20 and 40 weeks of age are presented in Table 9. There was increase in body weight at 40 weeks of age by 81 and 43g, respectively in male and females. Similarly there was increase in shank length at same age by 5.5 and 3.35 mm of males and females respectively in this generation as compared to previous generation. There was improvement of 10.49 eggs in hen housed 40 weeks egg production in this generation (Table 10). Liveability was higher in male (98.35%) and female (98.89%) Nicobari birds during 21-40 weeks of age.

Table 9. Growth performance of Nicobari birds (G- 6)

| Traits | Males | Females |
|---|---|---|
| Body wt. (g) | | |
| 20 wks | 1584±25.9 | 1116±15.7 |
| 40 wks | 2321±37.9 | 1583±20.7 |
| Shank length (mm) | | |
| 20 wks | 104.6±1.16 | 85.43±0.77 |
| 40 wks | 108.1±1.28 | 86.72±0.75 |

Table 10. Production performance of Nicobari birds (G-6)

| Traits | | Mean± S.E. |
|---|---|---|
| ASM (d) | | 172.2±1.43 |
| EP (Nos.) | 40 wks. | |
| Survivors' | | 73.69 ± 1.93 |
| Hen housed | | 73.02 ± 1.92 |
| Hen day | | 73.48 |
| Egg wt. (g) | | |
| | 28 wks | 42.00±0.39 |
| | 32 wks | 42.40±0.34 |
| | 36 wks | 43.84±0.37 |
| | 40 wks | 47.23±0.34 |

A total of 626 good chicks of Nicobari were produced in a single hatch in G-7 generation by

Table 11. Growth performance of Nicobari birds on pooled sex (G-7)

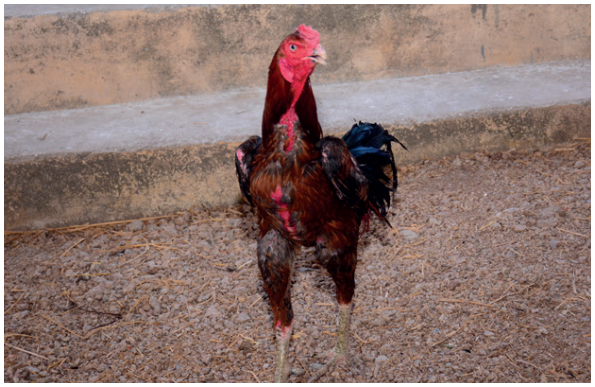
| Traits | Mean ±S.E |
|---|---|
| Body wt. (g) | |
| 0 day | 31.62±0.13 |
| 4 wks | 211.4±2.08 |
| 8 wks | 492.3±5.14 |
| Shank length (mm) | |
| 8 wks | 66.62±0.39 |

A Nicobari rooster

random mating using pooled semen. The fertility was 89.1%, while hatchability on fertile and total eggs set was 93.5 and 83.3%, respectively. There was improvement in fertility (6.72%) and hatchability on fertile eggs set (0.91%) and total eggs set (7.02%) in G-7 generation. Growth performance of Nicobari breed was evaluated on pooled sex up to 8 weeks of age (Table 11). There was an improvement in body weight at 4 (110 g) and 8 (90.6 g) weeks of age. Similarly there was improvement in shank length at 8 weeks of age (6.35 mm) as compared to previous generation.

### Evaluation of Aseel population

The G-6 generation of Aseel was evaluated for growth traits up to 40 weeks of age. The body weight at 4 and 6 weeks of age was 169.6 and 326.7 g, respectively. The body weight at 20 and 40 weeks of age was 1424 and 2073 g in female and 2072 and 3186 g in males, respectively. The egg weight at 40 weeks of age was 45.57 g. The part period egg production up to 40 weeks of age was 18.03 eggs.



Aseel roosters

### Evaluation of Kadaknath

To introduce variability and to increase the population size, a total of 716 fertile eggs were procured from Jabalpur Centre. The Kadaknath population available at DPR was regenerated by random mating. Fertility, hatchability on TES and FES basis were 91.1, 66.9 and 73.5 %, respectively. A total of 974 good chicks were hatched. Overall mean body weight at 0 day, 4 and 8 weeks of age was 27.86, 126.7 and 376.3 g, respectively. A total of 256 adult females were housed for performance recording and body weight at 20 weeks of age was 1574 g in male and 1065 g in female. ASM was 176.2 days and egg weight at 28 weeks was 38.55 g. Egg production up to 32 weeks of age was 37.72 eggs.

Kadaknath male and female birds

## Coloured broiler populations for intensive and semi intensive broiler farming

### Genetic improvement of synthetic coloured broiler male line (PB-1)

B.L.N. Reddy and L.L.L. Prince

The S-28 generation of synthetic coloured broiler male line (PB-1) was evaluated for growth and production traits up to 40 weeks of age (Table 12). As compared to last generation, ASM decreased by 1 day, 20weeks body weight decreased by 150g, 40 weeks body weight increased by 138g, egg weights were more or less similar and egg production increased by 5.7 eggs. Heritability estimates ($h^2_S$) of ASM, 20 weeks BW, 40 weeks BW, 32 weeks egg weight, 40 weeks egg weight and 40 weeks EP, respectively were 0.21±0.14, 0.38±0.17, 0.51±0.17, 0.68±0.34, 0.41±0.17 and 0.68±0.19. Genetic correlations among the adult body weights were higher in magnitude and in positive direction. Genetic correlation between body weights and ASM was negative in direction. Genetic correlation between body weights and egg production was negative in direction. Genetic correlation between

Table12. Growth and production traits in PB-1 line (S-28 )

| Traits | Mean±S.E (S-27) | Mean±S.E (S-28) |
|---|---|---|
| Body wt. (g) | | |
| 20 wks | 2432±0.72 | 2283±0.71 |
| 40 wks | 3030±0.89 | 3168±0.78 |
| ASM (days) | 175±0.10 | 174±0.21 |
| Egg wt. (g) | | |
| 32 wks | 55.50±0.06 | 54.43±0.08 |
| 40 wks | 58.94±0.09 | 59.26±0.07 |
| EP (Nos.) 40 wks | 52.24±0.10 | 57.95±0.18 |

egg weight and egg production was negative in direction. Regeneration of the S-29 generation is in Progress.

## Pedigreed random bred broiler control

The pedigreed random bred broiler control population was evaluated for production traits up to 40 weeks of age in G-17 generation. The ASM, 20 weeks body weight, 40 weeks body weight, 32 weeks egg weight, 40 weeks egg weight and 40 weeks egg production, respectively were 184±0.2days, 2222±0.69 g, 2957±0.72 g, 53.15±0.09g, 55.58±0.06g and 50.4±0.21eggs. As compared to last generation, production traits were more or less similar and they are almost stable. Heritability estimates ($h^2_S$) of ASM, 20 weeks body weight, 40 weeks body weight, 32 weeks egg weight, 40 weeks egg weight and 40 weeks egg production, respectively were 0.56±0.23, 0.23±0.19, 0.06±0.15, 0.45±0.12, 0.17±0.16 and 0.16±0.16. Genetic correlations among the adult body weights were higher in magnitude and positive in direction. Genetic correlation between body weights and ASM was negative in direction. Genetic correlation between body weights and egg production was negative in direction. Genetic correlation between egg weight and egg production was negative in direction. Lower 20 weeks body weight was

A pair of PB-1 birds

recorded in the present generation as compared to previous generation.

The G-18 generation of the control broiler was regenerated with 50 sires and 250 dams. Incubation and hatching performance is presented in Table.13. As compared to last generation, fertility and hatchability were improved.

Performance of the juvenile traits is presented in Table 14. The trend of juvenile body weights of control broiler over generations is presented in Fig. 3. Higher juvenile body weights were recorded in the present generation as compared to previous generation.

## Experiment on heat stress parameters in broilers

An experiment was conducted utilizing the three genetic groups of synthetic coloured broilers, i.e coloured synthetic broiler male line (G1), Naked neck broiler line (G2) and the cross of these two broiler lines (G3). Eight replicates were assigned with 5 birds in each and a total of 40 birds were kept in each genetic group. Two treatments, i.e control group and heat treated group were maintained in battery brooders. Birds in heat treated group were subjected to heat stress during 4 to 6 weeks of age in growth chambers maintained at 40 °C and 70 % relative humidity at the rate of three hours of exposure per day. Growth performance was evaluated and 2 ml of blood was collected

Table 13 : Incubation and hatching performance of broiler control population (G-18)

| Hatches | No of eggs set | No. of eggs transferred | Fertility (%) | Hatchability (%) | | Total No of chicks |
|---|---|---|---|---|---|---|
| | | | | TES | FES | |
| 1 | 1031 | 894 | 86.71 | 80.21 | 92.51 | 827 |
| 2 | 911 | 763 | 83.75 | 79.58 | 95.01 | 725 |
| Total/ Average | 1942 | 1657 | 85.32 | 79.92 | 93.66 | 1552 |

Table 14. Performance of juvenile traits in control broiler (G-18)

| Traits | | Mean±S.E (G-17) | Mean±S.E (G-18) |
|---|---|---|---|
| Body wt. (g) | | | |
| | 4 wks | 569±0.59 | 521±0.65 |
| | 5 wks | 740±0.72 | 755±0.81 |
| | 6 wks | 930±1.31 | 1042±1.95 |
| Shank length (mm), | 5 wks | 71.32±0.06 | 75.92±0.08 |
| Breast angle (⁰), | 5 wks | 72.18±0.08 | - |

from one bird in each replicate and serum was separated to estimate heat stress parameters. A 3X2 factorial general linear model was used to analyse the data. The juvenile body weights at 5, 6 and 7 weeks were significantly decreased in all the genetic groups subjected to heat stress. Genotype X treatment interactions were non-significant for all the genetic groups. Lipid peroxidase estimates were significantly different between the treatment groups. Glutathione peroxidase estimates were significantly different in genotype X treatment interactions. Superoxide dismutase was significantly different between the genetic groups.

## Genetic improvement of synthetic coloured broiler female line (PB-2)

L.L.L. Prince, B.L.N. Reddy and U. Rajkumar

During the period under report, the PB-2 line was evaluated for production traits in S-28 generation

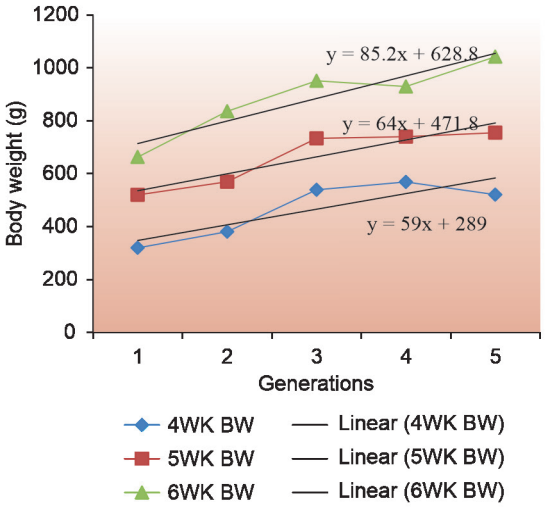



Fig. 3. Trend of juvenile body weights of control broiler over generations

PB-2 grower chickens

(Table 15). About 507 female and 65 male birds of PB-2 line were housed to evaluate the production performance. Body weight at 20 weeks of age was maintained by restricted feeding protocol. The ASM in the present generation increased compared to the last generation (174.68 days). The egg weights remained almost stable compared to the last few generations. There was decline in egg production compared to the last generation. The

Table 15 : Production parameters in PB-2 line (S-28)

| Traits | | Mean±S.E |
|---|---|---|
| ASM (days) | | 182.1±1.30 |
| EP (Nos) | 32 wks | 30.93±0.72 |
| | 40 wks | 60.72±0.95 |
| Egg wt. (g) | 28 wks | 50.68±0.33 |
| | 32 wks | 53.57±0.23 |
| | 36 wks | 56.79±0.22 |
| | 40 wks | 58.54±0.23 |
| Body wt. (g) | 20 wks | 2093±7.5 |
| | 40 wks | 2976±16.9 |

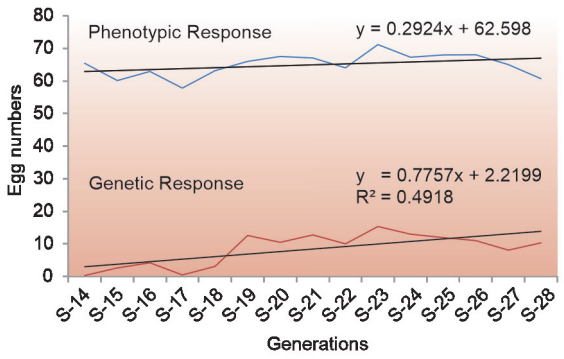



Fig. 4. Phenotypic and genetic response of 40 weeks egg production in PB-2 line

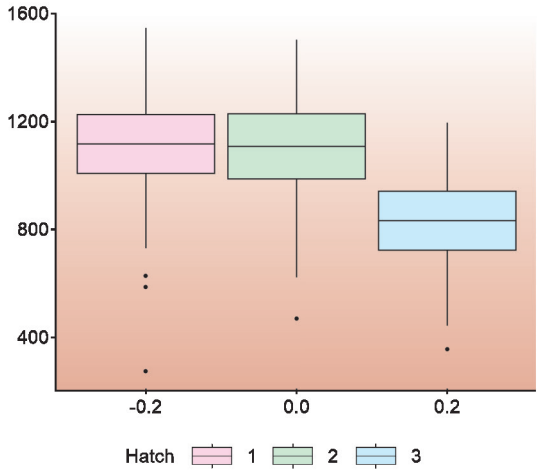



Fig. 6. Box plot showing the variability in BW 5 wks of PB-2 in three hatches

phenotypic and genetic response to selection for the 40 weeks part period egg production over the last fifteen generations was 0.29 and 0.78 eggs per generation, respectively (Fig. 4). The layer house mortality up to 52 weeks of age was 6.90%.

The mating plan was prepared and 20 sires and 100 dams were selected. 20 superior males with average body weight of 1192 g and 100 superior females with average body weight of 997 g at 5 weeks of age were selected. The selection differential for male and females was 282 and 212 g, respectively.

## Introduction of germplasm from Bengaluru centre

To increase the variability and improve the juvenile growth traits of PB-2 line, a total of 1,732 settable eggs were obtained from Bengaluru centre of AICRP on Poultry Breeding in 5 batches and a total of 1,178 good chicks were hatched. Overall fertility was 84.5% and hatchability on TES and FES basis were 70.7 and 83.7%, respectively (Fig. 5).

## Juvenile body weights (Bengaluru germplasm)

The body weight and conformational traits of PB-2 line (Bangalore) in G-0 generation were recorded. Three hatches completed the body weight at 5 weeks during the period. The overall average for body weight at day old and 5 weeks of age were 43.98 and 1,041.7 g, respectively (Fig. 6). Shank length and breast angle at 5 weeks of age were 83.5±0.26 g and 80.7±0.21°. The overall mortality up to 5 weeks of age was 5.79 %, which was lower than last generation.

## Maintenance of naked neck *(Na)* and Dwarf *(Dw)* genelines

The gene lines were evaluated for juvenile growth traits and production traits in the S-17 generation. The S-17 generation was regenerated using 30 sires and 90 dams in Naked neck and dwarf lines. Both the lines were regenerated as random bred maintenance population. In naked neck *(Na)* line,

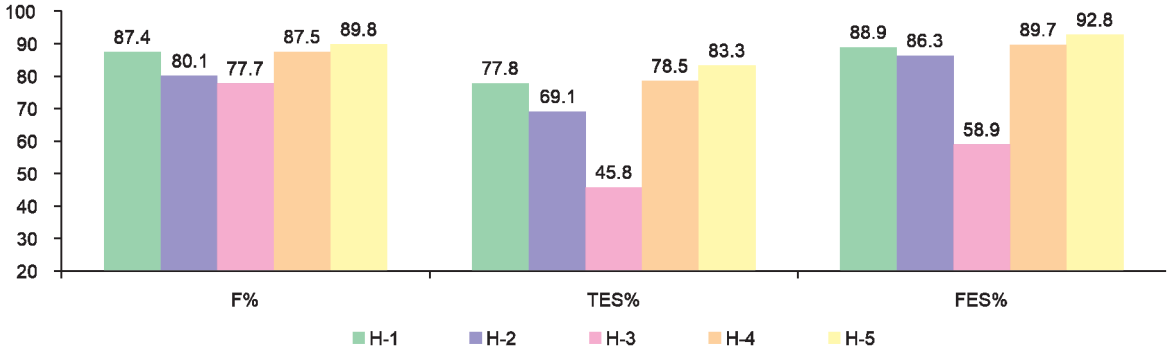



Fig. 5. Fertility (F%) and hatchability (TES and FES%) details in PB-2 line of Bengaluru centre

Table 16.The growth traits of Naked Neck (S-17) and Dwarf (S-17) gene lines

| Traits | | | Naked Neck | Dwarf |
|---|---|---|---|---|
| Body wt. (g) | Day old | | 39.28±0.12 | 34.87±0.15 |
| | 6 wks | | 995.±5.41 | 687.5±5.85 |
| Shank length (mm) | 6 wks | | 83.32±0.21 | 70.76±0.34 |
| Body wt. (g) | 20 wks | Male | 2362±22.54 | 2120±22.81 |
| | | Female | 2101±14.54 | 2062±19.34 |

864 chicks were produced with 89.8% fertility, 74.7% hatchability on TES and 83.2% hatchability on FES. The Dwarf *(Dw)* line was regenerated by mating 25 sires with 85 dams. A total of 680 chicks of Dwarf were produced with 84.4% fertility, 77.1% hatchability on TES and 91.5% hatchability on FES. Juvenile growth traits of *Na* and *Dw* lines are presented in Table 16. Body weight at 5 weeks of age in these two gene lines improved in the present generation when compared to last generation.

## Genetic evaluation of elite layer germplasm

Chandan Paswan, R.N. Chatterjee and
T.K. Bhattacharya

Under the layer project, three lines viz; IWH, IWI and IWK are under selection for higher egg numbers up to 64 weeks of age, whereas IWD, IWF and Layer Control (LC) are under random breeding programme. During 2019, egg production traits up to 40, 52, 64 and 72 weeks were recorded and analysed. The ASM increased across all lines, which might be correlated with comparatively lower body weight at 16 weeks of age in all six lines resulting in decreased egg production up to 40, 52, 64 and 72 weeks across all lines, except IWH, which was almost static (Table 17). The annual egg production of IWH was 297 eggs. The body weight of all the lines maintained standard body weight at various stages of egg production, except body weight at sixteen weeks, which was comparatively lesser. The egg weight of IWH, IWI and IWK at the age of selection i.e. 64 weeks was 56.92, 55.28 and 56.90 g, respectively. The birds of various lines were selected for regeneration of next populations. The breeding plans were prepared for six lines. The selection differential of EP64 in IWH and IWI was 13.43 and 18.99 eggs, respectively.

A pair of IWH birds

# Molecular Genetics

## Functional genomics, epigenetics and gene silencing technology for improving productivity in poultry (NF project)

T.K. Bhattacharya

Acetyl Co-A carboxylase type B (ACACB) gene involved in de novo lipid biosynthesis was silenced through RNAi under in *vitro* cell culture system. A total of 5 shRNA molecules namely, shRNA267, shRNA1628, shRNA3288, shRNA4113 and shRNA5424 were designed using BLOCK-iT™ RNAi designer software. These shRNA molecules were cloned in pENTR/U6 entry vector. Recombinant shRNA constructs of ACACB gene and scrambled shRNA were transfected into the chicken primary fibroblast cells by electroporation. The expression of ACACB gene in transfected fibroblast cells was analysed by qPCR. The knock down efficiency of shRNA267, shRNA1628, shRNA3288, shRNA4113 and shRNA5424 molecules for expression of ACACB gene in transfected fibroblast cells was 56, 87, 73, 89 and 58%, respectively (Fig. 7). These five molecules did not trigger any immune response as indicated by the parallel expression study of immune related genes viz; alpha and interferon beta. Therefore, these shRNA molecules may be used further, for development of knock-down chicken to produce egg/meat with low fat/cholesterol.

Table 17. Least square means and SE of body weights and egg production traits of layer lines

| Trait | IWH (S-6) | IWI (S-6) | IWK (S-14) | LC (S-14) | IWD (S-1) | IWF (S-1) |
|---|---|---|---|---|---|---|
| Egg prodn. (Nos.) | | | | | | |
| 40 wks | 117.25±0.78 (263) | 99.69±1.05 (376) | 91.51±0.87 (398) | 97.74±1.07 (273) | 109.83±1.52 (115) | 117.76±1.33 (141) |
| 52 wks | 187.53±1.12 (240) | 167.78±1.44 (351) | 151.76±1.31 (404) | 159.67±1.42 (264) | 178.20±2.22 (114) | 186.88±1.69 (140) |
| 64 wks | 256.10±1.59 (227) | 232.321±1.83 (324) | 216.28±1.45 (371) | 217.2±1.90 (250) | 235.06±3.44 (107) | 246.31±2.26 (128) |
| 72 wks | 297.27±1.72 (215) | 267 ±1.99 (250) | 249.38±1.89 (356) | 252.81±2.13 (237) | 270.58±3.53 (107) | 275.6±2.60 (128) |
| Egg wt. (g) | | | | | | |
| 28 wks | 48.85±0.20 (254) | 48.28 ±0.19 (384) | 48.80±0.19 (445) | 47.90±0.35 (105) | 46.76±0.32 (115) | 45.39±0.26 (139) |
| 40 wks | 50.20±0.23 (250) | 49.85±0.17 (458) | 51.64±0.20 (449) | 52.43±0.23 (275) | 53.53±0.36 (100) | 52.24±0.29 (131) |
| 64 wks | 56.92±0.27 (240) | 55.28±0.21 (395) | 56.90±0.22 (422) | 56.87±0.25 (209) | 58.26±0.19 (92) | 57.70±0.25 (103) |
| 72 wks | 57.98±0.14 (222) | 57.08±0.19 (315) | 58.55±0.17 (369) | 56.79±0.20 (186) | 56.13±0.41 (92) | 54.61±0.49 (91) |
| Body wt. (g) | | | | | | |
| 40 wks | 1524.34±10.81 (291) | 1466.61±8.23 (528) | 1476.92±9.58 (423) | 1624.15±14.66 (157) | 1525.97±16.76 (105) | 1508.75±28.88 (151) |
| 52 wks | 1612.38±11.67 (276) | 1579.06±9.28 (474) | 1622.23±10.24 (509) | 1685.83±12.53 (280) | 1503.87±15.9 (118) | 1527.01±16.84 149 |
| 64 wks | 1694.61±13.19 (268) | 1628.85±9.58 (378) | 1575.67±8.63 (517) | 1731.71±12.47 (270) | 1601.16±16.88 (114) | 1567.21±17.84 (139) |
| 72 wks | 1690±14.25 (264) | 1736.24±9.06 (378) | 1711.19±9.55 (510) | 1810.42±13.91 (269) | 1728.41±20.68 (114) | 1743.23±20.09 (139) |

*Figures in parenthesis are number of observations*

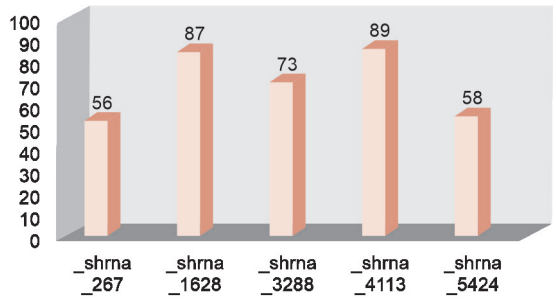



Fig. 7. Knock-down efficiency of shRNA molecules in silencing expression of ACACB gene under in vitro fibroblast cell culture system

## Development of transgenic chicken for production of human interferon alpha 2b: A therapeutic for treatment of viral diseases in human (DBT funded)

T.K. Bhattacharya, R.N. Chatterjee and C. Paswan

The primary culture of chicken magnum cells was developed. The purity of magnum cells in the culture was checked by analyzing the expression of the ovalbumin specific gene. The DPREGG1 vector was designed and developed by incorporating required sequences through multiple cloning and the total length of the vector was 2435bp. In this vector, the gene expression was regulated by the

ovalbumin promoter, which was detected under *in vitro* cell culture model. This vector was specific to use in magnum cells. The functional efficiency of this vector was examined through analyzing GFP marker gene under in vitro magnum primary cell culture. Very good expression efficiency of this vector was observed. This vector will be further used in the experiment to express interferon alpha gene of human, chicken, cattle and other species for therapeutic use.

## Understanding the epigenetic methylation and miRNA mediated gene regulation of transcellular calcium transport genes in avian uterus during egg calcification (DST-SERB)

Chandan Paswan, R.N. Chatterjee
and M. Shanmugam

Egg production industry in India and across globe constantly looks for high egg producing chicken lines. The major constraint in development of such high producing lines is that egg shell quality is compromised owing to the high requirement of calcium to meet the proportionate increase in egg production. A recent study provided insights to the differential gene expression in some crucial genes involved in $Ca^{2+}$ transportation across the egg shell gland. However, miRNA mediated, regulatory molecular mechanisms involved in regulating these genes are unknown. So in order to give predictive direction we adopted a bioinformatics/insilico comparative study and identified the putative miRNAs regulating the $Ca^{2+}$ transport pathway during egg shell calcification in egg shell glands. We selected 4 crucial genes based on previous studies and predicted miRNAs probably binding and inhibiting these genes using miRDB database and search protocols. We found that a large number of miRNAs are predicted to be targeting these selected genes (Fig. 8). It was also found that majority of the predicted miRNA have predicted target sites in the coding region.

## Genotyping MHC class I loading complex genes (TAP1, TAP2 and tapasin) for their association with immunocompetence traits in chicken

S.P. Yadav, T.R. Kannaki and T.K. Bhattacharya

The SSCP coupled with nucleotide sequencing revealed that the Tapasin and Transporter associated with antigen processing (TAP1 and TAP2) genes were polymorphic. However, exon 1, 2, 3 and 9 of TAP 2 gene were monomorphic and highly conserved compared with the chicken sequence available in the public domain. Whereas, Exon 4, 6, 7 and 8 were polymorphic. Nonsynonymous substitution was observed at in exon 7 (codon position AGG 579 AAG) leading to change in amino acid Arginine to Lysine. Synonymous mutations were observed at 581 and 615 codons of exon 7 and 8, respectively. In gene TAP1 exon 1, 2, 3, 5, 6 and 10 were observed to be monomorphic while in exon 4, two mutations were observed at position 128 and 130 codon. In exon 7, there was a synonymous substitution at 336 codon. In TAP1 exon 8 had nonsynonymous substitution at 371 codon. In Tapasin gene, exon 4 was monomorphic while exon 3 had a synonymous substitution at 96 codon. In exon 5 of Tapasin gene, three nonsynonymous substitution were observed at 293, 315 and 373 codons. In exon 6, 7 and 8 a single substitution was observed in the intron between exon 7 and exon 8.

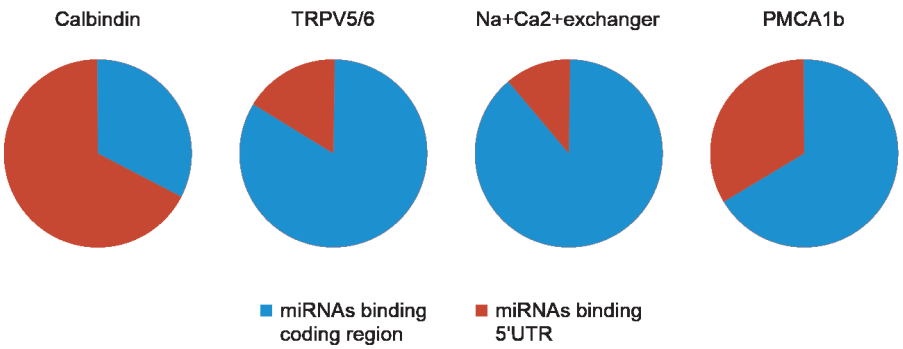



Fig. 8. Insilico prediction of miRNA binding regions in chicken.

# Nutrition

## Management and nutritional strategies to ameliorate thermal stress in poultry production (NICRA)

S.V. Rama Rao, M.V.L.N. Raju, U. Rajkumar,
B. Prakash and T.R. Kannaki

In a way to find out various dietary means to ameliorate the adverse effects of heat stress on chicken performance, immunity and stress variables (anti-oxidant responses), seven experiments were conducted during the period of report. One experiment on WL layers and three experiments each on broilers and rural chicken varieties (*Vanaraja* / *Gramapriya*) were conducted in open sided poultry house.

### Effect of supplemental oil on layers fed low calorie diet during pre-summer season

An experiment was conducted with WL layers (86 to 89 wks of age) to study the effects of including vegetable oil (1.5%) in diets containing low metabolizable energy (ME) (2500 vs 2400 kcal/kg) during pre-summer season (26.5 to 35.1 °C). Each diet was fed ad libitum to 16 replicates containing 88 layers from 86 to 89 wks of age. A control diet having 2550 kcal/kg and low ME (2400 kcal/kg) diet were prepared using practical feed ingredients. The low ME diet contained 1.5% crude soybean oil. The levels of maize, deoiled rice bran and soybean meal were altered to attain the desired levels of nutrients in the low ME diet. Egg production, body weight, egg weight, egg shell defects and egg mass were not affected ($P>0.05$) by reducing dietary ME having 1.5% supplemental oil in the diet (Table 18). Significant ($P<0.05$) increase in feed intake and reduction in feed efficiency were observed in layers fed low ME diet. However, body weight, egg weight, egg mass and egg shell defects (ESD) were not affected.

### Effect of supplementing herbal vitamin C (Amla extract) on performance and egg quality of WL layers during summer reason

Chicken is prone for severe stress at elevated ambient temperatures during summer season. Several nutritional modulations are being experimented as a means to reduce the ill effects of heat stress on the bird's performance. Compounds which minimize the oxidative stress are preferred as a potential tool to sustain the birds' performance during heat stress condition. A natural compound containing herbal extracts rich in natural vitamin C (Amla extract) was included (200 g/Ton) in the diet of WL layers (65 to 70 wks) during summer season. Each diet was fed ad libitum to 10 replicates of 20 birds in each. Maximum and minimum temperature and humidity in the experimental shed were 35.11 & 27.23 °C and 37.57 & 21.14%, respectively during the experimental period. Though there was a numerical increase in egg production (0.6%) and body weight (39 g), the performance (feed intake, feed efficiency and egg shell defects) and egg quality variables (egg density, egg breaking strength, egg weight, egg mass, Haugh unit score,

Table 18. Effect of supplemental oil on performance and egg quality of WL layers fed low calorie diet during pre-summer season

| ME, kcal/kg | EP, % | FI, g/b/d | FI/egg | FI/EM | BW, g | EW, g | ESD | EM, g/d |
|---|---|---|---|---|---|---|---|---|
| 2550 | 87.57 | 107.2$^{b}$ | 122.7$^{b}$ | 2.061$^{b}$ | 1559 | 59.69 | 1.380 | 52.29 |
| 2400 | 86.98 | 111.0$^{a}$ | 128.1$^{a}$ | 2.162$^{a}$ | 1558 | 59.43 | 1.021 | 51.68 |
| P | 0.13 | 0.001 | 0.001 | 0.001 | 0.842 | 0.924 | 0.520 | 0.163 |
| N | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| SEM | 0.462 | 0.407 | 0.794 | 0.014 | 7.498 | 0.171 | 0.099 | 0.315 |

*ME metabolizable energy; EP egg production; FI feed intake; EM egg mass; BW body weight; EW egg weight; ESD egg shell defects*

*$^{ab}$ means having common superscript in a column did not differ significantly ($P<0.05$)*

Table 19. Effect of supplementing herbal source of vitamin C (Amla extract) on performance of WL layers reared during pre-summer stress condition

| Trt. | EP, % | FI, g/b/d | FI/egg, g | FI/EM | BW, g | EW, g | ESD, % | EM, g/d |
|---|---|---|---|---|---|---|---|---|
| Control | 85.31 | 104.2 | 122.6 | 2.076 | 1495 | 59.13 | 2.230 | 50.43 |
| H vit C | 85.91 | 104.6 | 122.4 | 2.088 | 1534 | 58.65 | 1.953 | 50.39 |
| P | 0.098 | NS | NS | NS | NS | NS | NS | NS |

*EP egg production; FI feed intake; EM egg mass; BW body weight; EW egg weight; ESD egg shell defects*

shell weight and shell thickness) were not affected (P>0.05) with inclusion of herbal vitamin C in diets of layers during summer season (Table 19).

## Effect of fasting during peak heat stress time on performance and egg quality of WL layers during summer reason

Physiologically, body temperature increases after feeding due to specific dynamic activity and since the body of chicken is covered with feathers, the heat dissipation from the body is difficult and hence fasting of chicken during the peak ambient temperature is being recommended as a means to minimize the ill effects of heat stress in chicken during the summer season. An experiment was conducted with WL layers to study the possible benefits of feed withdrawal (restriction) on performance and egg quality variables during summer season (31.96 to 39.37 °C temperature and 20.4 to 59.6% RH). Feed withdrawal was followed in 3 phases, i.e. 9am to 5pm, 11am to 5pm and 1pm to 5pm and another group had ad libitum feed access, and served as the control. Each phase of feed withdrawal was replicated for 12 and each replicate had 20 layers. The experiment was conducted from 67 to 74 wks of age during April and May months, which experience peak temperature in the region. Fasting of layers during 9am to 5pm or 11am to 5pm significantly (P<0.05) improved the egg production (EP) compared to the ad libitum fed control group (Table 20). However, fasting between 1 to 5pm significantly (P<0.05) reduced the EP. Feed intake and feed efficiency (feed intake/egg and FI/EM) improved significantly (P<0.05) in the group starved between 9 to 5pm compared to other groups. Egg quality was not affected.

## Chicken or egg: Drivers of antimicrobial resistance in poultry in India (DBT funded)

S.V. Rama Rao and S.S. Paul

The project aims at identification of probable routes in poultry production chain which contribute to anti-microbial resistance (AMR) in different poultry pathogens and also to find out potential alternatives for anti-biotic growth promoters in chicken diet. The team of scientists at ICAR-DPR has focussed on testing and identification of potential alternatives for anti-biotic growth promoters (AGP). During this first year of the

Table 20. Production performance of layers fasted at different time durations during summer season

| Feed withdrawal | EP % | FI g/b/d | FI/egg g | FI/EM | BW g | EW g | ESD % | EM g/d |
|---|---|---|---|---|---|---|---|---|
| *Ad libitum* | 80.7 | $97.6^{a}$ | $121.9^{a}$ | $2.03^{ab}$ | $1459^{ab}$ | $60.2^{a}$ | 3.13 | 48.5 |
| 9am - 5pm | 81.7 | $91.4^{b}$ | $112.6^{b}$ | $1.90^{b}$ | $1463^{ab}$ | $59.3^{ab}$ | 2.22 | 48.4 |
| 11am - 5pm | 81.2 | $94.5^{a}$ | $116.9^{ab}$ | $2.00^{ab}$ | $1433^{b}$ | $58.4^{b}$ | 3.68 | 47.4 |
| 1pm - 5pm | 77.9 | $95.5^{a}$ | $124.0^{a}$ | $2.09^{a}$ | $1519^{a}$ | $59.3^{ab}$ | 4.46 | 46.2 |
| *P value* | *0.475* | *0.002* | *0.025* | *0.051* | *0.041* | *0.046* | 0.117 | 0.467 |
| N | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| SEM | 0.901 | 0.609 | 1.492 | 0.025 | 11.05 | 0.225 | 0.338 | 0.566 |

*EP egg production; FI feed intake; EM egg mass; BW body weight; EW egg weight; ESD egg shell defects*
*$^{ab}$ means having common superscript in a column did not differ significantly (P<0.05)*

Table 21. Effect of supplementation of different AGPs on performance of broiler chicken (Experiment 1)

| Treatment | 21d | | 42d | |
|---|---|---|---|---|
| | BWG, g | FI/BWG | BWG, g | FI/BWG |
| Control | 774.0$^{c}$ | 1.19$^{ab}$ | 2431 | 1.43 |
| Virg | 868.8$^{a}$ | 1.17$^{b}$ | 2503 | 1.44 |
| CTC | 836.3$^{ab}$ | 1.20$^{ab}$ | 2441 | 1.45 |
| BMD | 808.3$^{bc}$ | 1.21$^{ab}$ | 2439 | 1.47 |
| Linco | 828.7$^{ab}$ | 1.24$^{a}$ | 2451 | 1.44 |
| Tylo | 867.8$^{a}$ | 1.21$^{ab}$ | 2500 | 1.46 |
| P value | 0.001 | 0.058 | 0.852 | 0.946 |

*BWG body weight gain; FI feed intake; Virg Virginiamycin; CTC chlorotetracycline; BMD bacitracin methylene di salicylate; Linco lincomycine; Tylo tylosine*
*$^{abc}$ means having common superscript in a column did not differ significantly (P<0.05)*

project, three experiments were conducted under this project with an objective of testing / screening the efficacy of 5 different antimicrobial growth promoters on performance, slaughter variables, immune responses and antimicrobial residues in meat of broilers. The protocol of all the three trials was the same. The antimicrobial compounds like virginiamycin, chlorotetracyclin, bacitracin methylene di salicylate, lincomycine and tylosine were included in the diet as per the dose of each compound. A control diet without AGP was fed to the control group. Each diet was fed to 13 to 18 replicates of 5 broilers in each replicate from day 1 to 35/42d of age. Results of the experiment 1 indicated that the body weight gain (BWG) and feed efficiency were significantly influenced by supplementation of different AGPs in diet at day 21, but not at day 42 (Table 21). The results at 21d indicated that the BWG in broilers fed Vir, CTC, Linco and Tylo was significantly higher than the control. The BWG in CTC group was similar to those fed the control diet. The lack of response in performance of broilers fed different antibiotics at the end of the trial suggest that AGP had no significant role in improving the broiler performance when reared in battery brooders and fed with meat cum bone meal supplemented diet.

The activity of anti-oxidant enzymes (glutathione peroxidise and glutathione reductase) were studied in broilers fed different AGPs (Fig. 10). In general, the activities of both the anti-oxidant enzymes reduced significantly with inclusion of AGPs in broiler diet compared to those fed the AGP-free control diet.

The results of experiment 2 indicated that the broiler performance was not affected (P.0.05) with supplementation of any of the 5 AGPs included in diet (Table 22).

Antibody response to ND vaccination was significantly influenced with supplementation of AGPs in broiler diet (Fig. 10). The ND titre in Virg

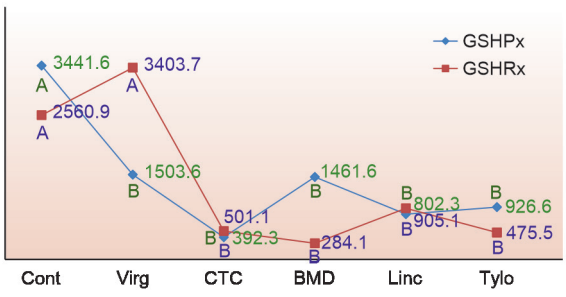



Fig. 9. Activities of anti-oxidant enzymes in broilers fed different AGPs (Expt 1)

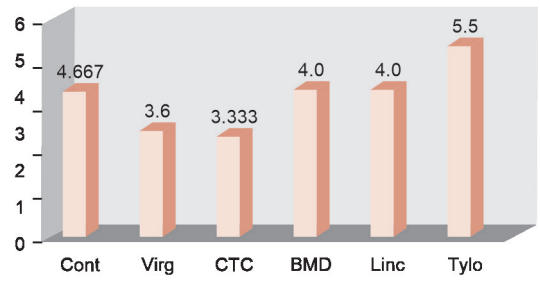



Fig. 10. ND titres (log2) of broilers fed different AGPs (Expt 2)

Table 22. Effect of supplementation of different AGPs on performance of broiler chicken (Experiment 2)

| Treatment | 21d | | 35d | |
|---|---|---|---|---|
| | BWG, g | FI/BWG | BWG, g | FI/BWG |
| Control | 854.2 | 1.28 | 2020 | 1.47 |
| Virg | 880.6 | 1.27 | 2016 | 1.49 |
| CTC | 856.2 | 1.30 | 2013 | 1.52 |
| BMD | 860.4 | 1.29 | 1960 | 1.52 |
| Linco | 878.6 | 1.29 | 1986 | 1.49 |
| Tylosine | 825.5 | 1.31 | 1931 | 1.53 |
| P value | 0.368 | 0.503 | 0.701 | 0.494 |

*BWG body weight gain; FI feed intake; Vigr Virginiamycin; CTC chlorotetracycline; BMD bacitracin methylene di salicylate; Linco lincomycine; Tylo tylosine; P probability*

and CTC was significantly lower than the control group. The Ab titre in BMD, Linco and Tylo was similar to those fed the control diet.

Similar to the results of experiment 2, the BWG and feed efficiency were not affected (P<0.05) with inclusion of AGPs in broiler diet (Table 23) compared to those fed the CD without any AGP supplementation.

Deposition of antibiotic residues in breast meat and liver were analysed (Fig. 11 and 12). The maximum permissible levels of Virginiamycin, CTC, Lincomycin and Tylosin were 10, 200, 200 and 200 mg/kg, respectively. Virginiamycin and BMD were below the detectable level in breast meat, while the concentrations of CTC, lincomycin and tylosin were considerably lower than the levels suggested by FSSAI.

Inclusion of recommended doses of BMD and Tylosin did not impart any residues in liver of broilers fed the antimicrobial compounds from day 1 to 42d of age (Fig. 12). Similarly, the residues of other AGPs were also considerably lower than the prescribed maximum levels in liver of broilers.

## Utilization of distillery by products in poultry diets: the nutritional implications and strategies for improving the nutritional value

M.V.L.N. Raju, S.V. Rama Rao, B. Prakash, S.S. Paul and A. Kannan

### Rice DDGS with critical amino acid supplementation in *Srinidhi* diet

A feeding experiment was conducted to evaluate the effect of supplementation of critical amino

Table 23. Effect of supplementation of different AGPs on performance of broiler chicken (Experiment 3)

| Treatment | 21d | | 35d | |
|---|---|---|---|---|
| | BWG, g | FI/BWG | BWG, g | FI/BWG |
| Control | 792.6 | 1.385 | 1842 | 1.622 |
| Virg | 829.9 | 1.366 | 1807 | 1.679 |
| CTC | 795.3 | 1.375 | 1834 | 1.604 |
| BMD | 810.7 | 1.393 | 1876 | 1.617 |
| Linco | 806.0 | 1.397 | 1833 | 1.614 |
| Tylosine | 767.3 | 1.393 | 1798 | 1.601 |
| P value | 0.137 | 0.489 | 0.691 | 0.570 |

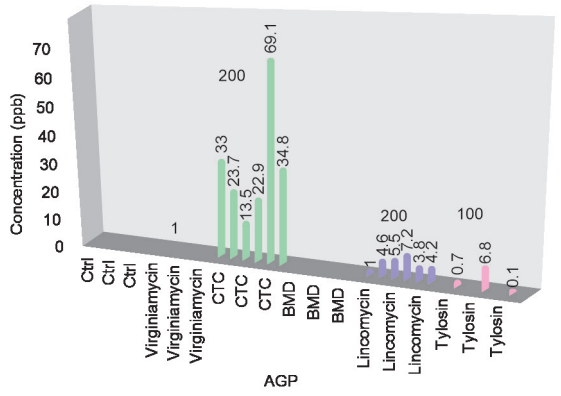



Fig. 11. Residues of AGPs in Breast meat

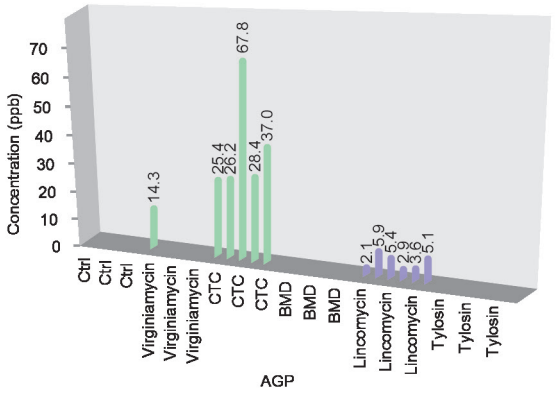



Fig. 12. Residues of AGPs in Liver

acids on *Srinidhi* chicks fed rice DDGS. A total of 360 day-old *Srinidhi* chicks were divided into 6 experimental groups with 10 replicates of 6 chicks each. Rice DDGS was included in diet at 15% on isocaloric and isonitrogenous basis and was evaluated with normal (100%) levels of lysine and total sulphur containing amino acids (TSA) or higher levels (110 and 120% of that of normal levels). DDGS significantly depressed body weight and TSA at 110% level significantly improved body weight, which was on par with that of control group. The response in lysine supplemented groups was intermediate. Feed intake was not affected, while FCR was poor in all the groups fed DDGS, among which it was the lowest in the group fed 120% TSA (Table 24).

## Rice DDGS with critical amino acid supplementation in combination in *Vanaraja* diet

A feeding experiment was conducted to evaluate the effect of additional supplementation of critical amino acids on *Vanaraja* chicks fed rice DDGS. A total of 390 day-old *Vanaraja* chicks were divided into 5 experimental groups with 13 replicates of 6 chicks each. Rice DDGS was included in diet at 15% on isocaloric and isonitrogenous basis and was evaluated with normal (100%) or higher levels (110% of that of normal levels) of lysine and total sulphur containing amino acids (TSA), either singly or in combination. DDGS showed no effect on body weight (Table 25). Feed intake was also not affected, except at 2 wks where it was significantly higher in the groups fed DDGS compared to control. Similarly, FCR was not affected, but for poor feed efficiency recorded with DDGS feeding. Abdominal fat content increased with DDGS feeding and TSA supplementation either singly or in combination with lysine significantly decreased to a level, which was comparable to the control group.

## Rice DDGS in layer chicken diet : effects on performance and nutrient retention

The rice based Distillers Dried Grains with Solubles (DDGS), a by-product of alcohol production from rice grain fermentation, was tested in the diet

Table 24. Effect of lysine and total sulphur containing amino acids levels in diet on *Srinidhi* chicks fed rice DDGS

| DDGS, 15% in diet | AA % | Body wt., g | | Feed intake, g | | FCR | |
|---|---|---|---|---|---|---|---|
| | | Wk-3 | Wk-6 | Wk-3 | Wk-6 | Wk-3 | Wk-6 |
| - | Control | 274.1$^{a}$ | 710.0$^{a}$ | 422.3 | 1467.8 | 1.54$^{c}$ | 2.07$^{b}$ |
| + | Normal AA | 247.4$^{b}$ | 643.2$^{b}$ | 401.7 | 1415.8 | 1.62$^{b}$ | 2.22$^{a}$ |
| + | 110 Lys | 242.4$^{b}$ | 686.1$^{ab}$ | 402.9 | 1449.5 | 1.66$^{b}$ | 2.11$^{ab}$ |
| + | 120 Lys | 242.2$^{b}$ | 679.3$^{ab}$ | 419.5 | 1438.4 | 1.73$^{a}$ | 2.12$^{ab}$ |
| + | 110 TSA | 269.7$^{a}$ | 702.8$^{a}$ | 433.7 | 1484.0 | 1.61$^{bc}$ | 2.11$^{ab}$ |
| + | 120 TSA | 260.0$^{ab}$ | 700.7$^{a}$ | 423.9 | 1459.9 | 1.63$^{b}$ | 2.09$^{b}$ |
| | N | 10 | 10 | 10 | 10 | 10 | 10 |
| | P | 0.000 | .035 | 0.192 | 0.514 | 0.000 | 0.083 |
| | SEM | 2.845 | 6.539 | 4.231 | 10.420 | 0.012 | 0.016 |

Table 25. Effect of lysine and total sulphur containing amino acids supplementation in diet on *Vanaraja* chicks fed rice DDGS

| DDGS, 15% in diet | Lysine, 10% addtnl. | TSA, 10% addtnl. | Body wt., g | | Feed intake, g | | FCR | | Abd.fat, % |
|---|---|---|---|---|---|---|---|---|---|
| | | | Wk-3 | Wk-6 | Wk-2 | Wk-6 | Wk-4 | Wk-6 | |
| - | - | - | 320.2 | 919.2 | 248.0$^{b}$ | 1886.3 | 1.94$^{b}$ | 2.14 | 1.94$^{c}$ |
| + | - | - | 316.3 | 901.8 | 265.1$^{a}$ | 1911.6 | 2.05$^{a}$ | 2.21 | 2.70$^{a}$ |
| + | + | - | 312.8 | 911.0 | 260.1$^{a}$ | 1887.9 | 2.03$^{a}$ | 2.16 | 2.45$^{ab}$ |
| + | - | + | 318.9 | 903.6 | 260.7$^{a}$ | 1862.3 | 2.00$^{b}$ | 2.14 | 2.08$^{bc}$ |
| + | + | + | 318.4 | 894.6 | 262.3$^{a}$ | 1855.4 | 2.02$^{a}$ | 2.16 | 1.80$^{c}$ |
| N | | | 13 | 13 | 13 | 13 | 13 | 13 | 10 |
| P | | | 0.870 | 0.863 | 0.049 | 0.706 | 0.022 | 0.294 | 0.002 |
| SEM | | | 2.270 | 7.269 | 1.926 | 13.449 | 0.012 | 0.011 | 0.086 |

of White Leghorn laying chickens (BV 300) at graded levels (0, 7.5 and 15%) on iso-caloric and iso-nitrogenous basis. A total of 4752, 24-wks old laying chickens were divided at random into 54 replicate groups of 88 birds each and housed in an open sided 3-tiered California cage house. Each of the three experimental diets was fed to chickens in 18 replicate groups from 24 to 47 wks of age. The response of chickens to diets was assessed in terms of egg production, feed conversion efficiency, egg weight, egg shell quality and nutrient retention. The overall response of the chickens during the whole experimental period indicate that the egg production was not affected at 7.5% DDGS, but was significantly ($P \leq 0.05$) depressed at 15% (Table 26). Feed intake at 15% DDGS was significantly ($P \leq 0.05$) higher than in control and was intermediate in the group fed 7.5% DDGS. Feed intake for one egg and unit egg mass was significantly ($P \leq 0.05$) higher with 15% DDGS, while no difference was observed between control and 7.5% DDGS.

Egg weight decreased with both levels of DDGS, but egg mass (g/bird/day) decreased only at 15% level of DDGS. Egg shell quality was not affected, while mortality showed a trend of increase with DDGS inclusion in diet. Nutrient retention (dry matter, energy and nitrogen) was significantly ($P \leq 0.05$) lower at 15% DDGS, whereas at 7.5%DDGS, the values were intermediate. From the overall results it is concluded that rice based DDGS could be fed to laying chickens at 7.5% in diet without any adverse effect, while 15% DDGS was detrimental.

## Development of a composite feed additive using promising organic acids and plant bioactive compounds for improving gut health and productivity in chicken

S.S. Paul, M.V.L.N. Raju, B. Prakash, S.V. Rama Rao and S.P. Yadav

Table 26. Effect of graded levels of rice based DDGS on performance of WL layers (24-47 wks of age)

| Parameter | DDGS in diet (g/kg) | | | N | P | SEM |
|---|---|---|---|---|---|---|
| | 0 | 75.0 | 150.0 | | | |
| Egg prodn., % | 90.28$^{a}$ | 90.40$^{a}$ | 88.12$^{b}$ | 18 | 0.001 | 0.299 |
| Egg wt., g | 53.12$^{a}$ | 52.65$^{b}$ | 52.32$^{b}$ | 18 | 0.002 | 0.096 |
| Egg mass, total, g | 1342.7$^{a}$ | 1332.6$^{a}$ | 1291.4$^{b}$ | 18 | 0.0001 | 5.254 |
| Feed intake, g/b | 101.0$^{b}$ | 101.8$^{ab}$ | 103.7$^{a}$ | 18 | 0.042 | 0.457 |
| Feed/egg, g | 111.4$^{b}$ | 111.8$^{b}$ | 115.9$^{a}$ | 18 | 0.002 | 0.594 |
| Feed intake/egg mass | 2.11$^{b}$ | 2.14$^{b}$ | 2.26$^{a}$ | 18 | 0.001 | 0.016 |

During the period under report, a feeding trial was conducted involving 360 day-old *Vanaraja* chicken for a period of 42 days. Five treatments including a no-additive control, an antibiotic control and three different doses of additives were tested. Each treatment was allotted to 12 replicates each containing 6 birds. One digestion trial was also conducted during fourth wk of experiment. Performance data indicated some trend in response due to treatments on serum antioxidant enzymes and digestibility of nutrients with some numerical but statistically insignificant increase in performance or FCR. During the period, comparative community structure of gut microbiome of Ghagus, Nicobari and broiler were compared and breed specificity in microbiome structure was characterized. On an average, 123430 (range 100784 to 169222) good quality reads (phred score > 20) of 301 bp length per sample were generated through 16SrRNA amplicon sequencing using Illumina MiSeq 2 x 300 bp paired end sequencing platform. Obtained reads were quality checked, subjected to preprocessing (end trimming, adaptor removal, merging), chimera removal, de replication, singleton removal, OTU clustering, OTU taxonomic annotation, data normalization and analysis of diversity metrices using QIIME 1.9.1 and Greengene database (v13.8). Statistical analysis and graphical presentation was carried out using web version of Metageneassist.

A total of 1398 non singleton OTUs were obtained from the dataset. Principal coordinate analysis (PCoA) of the OTU data for each chicken breed or line revealed distinct but overlapping profiles with the two indigenous breeds more closely related to each other than that of broiler line (Fig. 13). Firmicutes was the dominant phylum in all the chicken groups and accounted for 83, 68.9 and 64.9 % of total bacterial sequences in Broiler (BR), Ghagus (GH) and Nicobari (N), respectively. Bacteroidetes (BR, 9.5%, GH, 17%, N, 19% of total bacteria) was the second most predominant phylum followed by Proteobacteria (BR, 4.7%, GH, 6.1%, N 7.6%) in all the breeds/lines.

At genus level, Lactobacillus was the dominant in broiler (32%) but Bacteroides was found to be the most dominant genus in Ghagus (22.8%) and Nicobari (22%). Campylobactor (0.4%) and Enterococcus (1.6%) population was detected in significant proportion only in broiler. Fusobacterium, and Parabacteroides were present in significant number only in Nicobari whereas, Clostridium and Meganomonas were present in significant number only in Ghagus. Faecalibacterium, Sutterella and Prevotella were

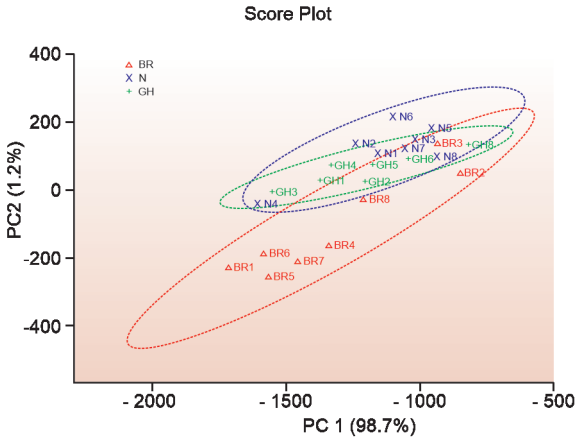



Fig. 13. PCoA at genus level classification of gut microbiome of Broiler (BR), Nicobar (N) and Ghagus (GH)

only found in significant numbers in both the indigenous breeds and not in broilers. High correlation among various bacterial genera were also detected indicating existence of strong host specific network of microbes in chicken gut.

The study presents the first report of comparison of diversity and community structure of bacteria in the gut of broiler vs indigenous Ghagus and Nicobari chickens reared under commercial setup without use of antibiotics. The study has indicated clear breed specific variation or network of gut bacteria and stark difference between commercial and indigenous breeds. Improved understanding of host microbiome interaction as emanated from the current study may support development of differential strategy in indigenous and commercial lines of chicken for greater productivity from low value diets and greater resistance to colonization of zoonotic or pathogenic organism.

## Effect of dietary supplementation of biofortified maize (QPM) on performance of broiler chickens

B. Prakash, S.V. Rama Rao and M.V.L.N. Raju

An experiment was conducted to determine the effect of feeding diet with QPM/normal maize with varying supplemental levels of lysine. For the purpose, laying PD-2 female line (n=180) hens were randomly divided into 6 dietary groups having 6 birds with 5 replicates in the colony cages. Six diets were formulated to contain Diet I (normal maize without lysine), Diet II (QPM without lysine), Diet III (normal maize with moderate lysine), Diet IV (QPM with moderate lysine), Diet V normal maize with optimum lysine and Diet VI (QPM with optimum lysine). The experiment was carried out for 2 periods (32-35

Table 27. Effect of feeding diets with QPM/normal maize along with varying supplemental levels of lysine on egg production and egg quality parameters in PD-2 female line during 32-35 wks

| Experimental Diets | Lysine | EP % | Egg weight (g) | Egg density | Breaking strength (N) | HU | Yolk Colour | Egg shell | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Weight (g) | Thickness (mm) |
| Diet I NM | - | 60.8 | 48.2 | 1.08 | 23.5 | $78.0^{AB}$ | $2.8^{B}$ | 4.27 | 0.37 |
| Diet II QPM | - | 62.2 | 49.7 | 1.08 | 26.4 | $69.0^{B}$ | $3.0^{B}$ | 4.54 | 0.38 |
| Diet III NM | + | 63.4 | 49.0 | 1.08 | 19.2 | $82.9^{A}$ | $6.7^{A}$ | 4.26 | 0.36 |
| Diet IV QPM | + | 57.1 | 49.3 | 1.08 | 22.8 | $84.9^{A}$ | $5.3^{AB}$ | 4.48 | 0.37 |
| Diet V NM | ++ | 65.1 | 52.6 | 1.08 | 22.6 | $77.6^{AB}$ | $6.1^{A}$ | 4.88 | 0.39 |
| Diet VI QPM | ++ | 56.1 | 49.4 | 1.08 | 20.9 | $73.7^{AB}$ | $5.1^{AB}$ | 4.45 | 0.38 |
| SEM | | 1.86 | 0.53 | 0.001 | 0.88 | 12.8 | 2.33 | 0.53 | 0.03 |
| P value | | 0.73 | 0.24 | 0.56 | 0.29 | 0.05 | 0.01 | 0.1 | 0.32 |

*- without; + moderate; ++ optimum*

and 36-39 wks) and recorded daily feed intake, egg production and egg quality parameters. It has been observed that the egg production, egg weight, egg density, breaking strength and egg shell thickness did not differ (P>0.05) among different dietary groups (Tables 27 and 28). The better HU, yolk colour score and egg shell weight among the groups supplemented moderate amount of lysine in QPM based diets compared to those groups fed without lysine in QPM/normal maize based diets. However, the HU did not differ among groups fed diets with normal or QPM based diets with moderate lysine supplementation in the present experiment.

## Development of nutritional package of practices for backyard chicken production

B. Prakash, A. Kannan and S.S. Paul

Availability of feed ingredients in Palampur (Himachal Pradesh), Agartala (Tripura), Udaipur (Rajasthan) and Mahabubnagar (Telangana) for formulating region specific poultry diets was surveyed and information was collected. In

Table 28. Effect of feeding diets with QPM/normal maize along with varying supplemental levels of lysine on egg production and egg quality parameters in PD-2 female line during 36-39 wks

| Experimental Diets | Lysine | EP % | Egg wt (g) | Egg density | Breaking strength (N) | HU | Yolk Colour | Egg shell | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Weight (g) | Thickness (mm) |
| Diet I NM | - | 63.3 | 51.3 | 0.88 | 19.77 | $73.4^{B}$ | $1.20^{C}$ | $4.77^{AB}$ | 0.37 |
| Diet II QPM | - | 59.7 | 54.9 | 1.08 | 17.93 | $83.6^{AB}$ | $3.80^{B}$ | $5.15^{A}$ | 0.36 |
| Diet III NM | + | 62.0 | 53.9 | 1.07 | 18.60 | $81.0^{AB}$ | $1.20^{C}$ | $4.65^{B}$ | 0.35 |
| Diet IV QPM | + | 60.6 | 53.9 | 1.08 | 19.38 | $83.2^{AB}$ | $5.40^{A}$ | $5.24^{A}$ | 0.38 |
| Diet V NM | ++ | 63.4 | 53.5 | 1.08 | 17.49 | $79.6^{AB}$ | $1.20^{C}$ | $5.17^{A}$ | 0.38 |
| Diet VI QPM | ++ | 50.0 | 54.2 | 1.08 | 19.15 | $85.6^{A}$ | $4.0^{AB}$ | $5.17^{A}$ | 0.37 |
| SEM | | 6.62 | 1.49 | 0.08 | 1.45 | 2.45 | 0.33 | 0.15 | 0.01 |
| P value | | 0.71 | 0.65 | 0.43 | 0.86 | 0.02 | 0.01 | 0.04 | 0.16 |

*- without; + moderate; ++ optimum*

Palampur area, rice, ragi, wheat and barley were found to be the source of energy and soybean meal, till cake, toria, linseed and mustard oil cake were found to be the source of crude protein. In Udaipur area, maize, barley, bajra, sorghum, wheat, broken rice and rice polish are available as source of energy and cotton seed cake, groundnut cake, mustard oil cake, soybean meal, coconut cake, till cake and gram chuni are available as source of crude protein. In Agartala area, broken rice, rice bran, colocasia, tapioca, banana pseudo stem and elephant foot yam *(Amorphophallus paeoniifolius)* are available.

Basing on the nutrient concentration of the crop and gizzard contents of backyard chicken reared in Telangana, Himachal Pradesh, Tripura and Rajasthan, the energy, protein, calcium and protein were deficient when compared to the BIS requirement (Fig. 14). By using the locally available ingredients, the region specific grower and adult diets were computed to meet the nutrient needs of backyard chicken that are reared in different localities.

## Production of designer eggs enriched with critical trace minerals relevant to human nutrition

A. Kannan, B. Prakash, S.V. Rama Rao and M.V.L.N. Raju

In the production of designer eggs enriched with minerals, interaction among minerals such as iron, zinc and copper play an important role in influencing mineral absorption and retention. Therefore, a study was conducted in White Leghorn layers of 61 wks age to evaluate the effect of supplementing different levels of inorganic iron (ferrous sulphate), copper (copper sulphate) and zinc (zinc sulphate) on layer performance, egg quality traits and egg mineral contents. For the study, 240 White Leghorn layers were selected, randomly divided into 8 treatments with six replicates (five birds per replicate). Experimental groups were $T_1$-control (basal diet), $T_2$- basal diet + iron 150ppm, $T_3$- basal diet + zinc 70 ppm, $T_4$- basal diet + copper 25ppm, $T_5$- basal diet + iron 150ppm + zinc 70ppm + copper 25 ppm, $T_6$- basal diet + iron 150ppm + zinc 70ppm, $T_7$- basal diet + iron 150ppm + copper 25ppm, $T_8$- basal diet + zinc 70ppm + copper 25ppm. The birds were fed with respective experimental diets during the entire trial period. Basal diet consisted primarily of maize and soybean meal. Feed and water were provided ad libitum. Daily egg production and weekly egg quality traits and egg mineral contents were studied. Results indicated that egg quality traits were not affected by inorganic iron supplementation. However, zinc supplemented group showed significant improvement in egg shell percentage. Zinc and copper supplemented group showed significant improvement in Haugh units. In all the experimental groups ($T_2$-$T_8$), egg iron content increased as compared to control (Fig. 15). The highest egg iron concentration was obtained by feeding the laying hen diets with 150 mg iron/kg diet with zinc 70ppm + copper 25ppm as compared to other groups. Three wks after supplementation, iron content in eggs started increasing and reached peak level at 4 to 6 wks and the levels stabilized. From the study, it can be concluded that feeding the laying hen with 150 mg iron/kg diet with zinc 70ppm and copper 25ppm gave the highest concentration of egg iron as compared to other groups without any adverse effect on the performance of laying hens.

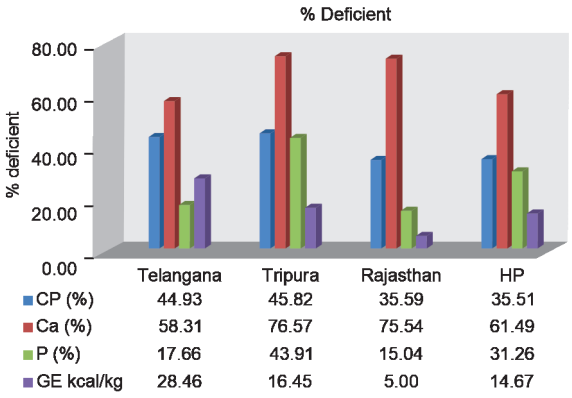



Fig. 14. Deficiency of nutrients in the crop contents of backyard chicken

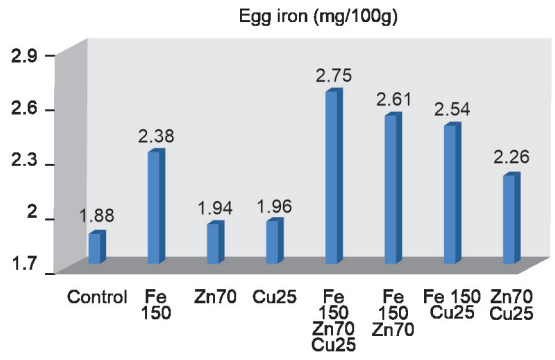



Fig. 15. Effect of supplementation of inorganic iron, zinc and copper on iron content of egg (mg/100g egg)

# Health

## Disease diagnosis, Vaccination & Sero-monitoring in pureline chickens

T.R. Kannaki and S.K. Bhanja

### Disease tolerance to *Pasteurella multocida* experimental infection in native chicken breeds and backyard chicken varieties

The native chicken breeds, Aseel, Ghagus, Nicobari and backyard variety *Vanaraja* were evaluated for disease tolerance to fowl cholera by inoculating birds with 1.9 X $10^5$ CFU/ml through intraperitoneal (I/P) and intranasal (I/N) routes at 16 weeks of age. Serum from surviving birds of different groups from both breeds were collected at 5, 14, 21, 28, 35 and 42 days and specific antibody titres were measured by indirect ELISA. Significantly higher tolerance was observed in Aseel breed than Ghagus and Nicobari in terms of morbidity, mortality, mean death time and severity of the disease. Significantly higher levels of PM specific antibodies were induced in Aseel breed in comparison to Ghagus and *Vanaraja* chicken.

### Comparative efficacy of immune complex IBD vaccine in coloured broiler chicks

The efficacy of immune complex vaccine for IBD was evaluated in coloured broilers. A total of 240 chicks were divided into different groups and immunized with immune complex vaccine, live IBD intermediate vaccine and live intermediate plus vaccine at day old and 14 days of age respectively. Only for live vaccines, booster dose was given on 24$^{th}$ day of age. Serum samples were collected at weekly intervals till 42 days of age for evaluating IBD specific antibody titres by indirect ELISA. Immune complex vaccine induced good serum antibody response with minimal bursal lesions. The maternal antibody titres declined relatively at slow rate in immune complex vaccine group compared to IBD live vaccines and also higher IBD specific antibody titres were induced in immune-complex group than others. Thus, single dose of immune complex vaccine at day-old at hatchery for commercial varieties was found to induce equivalent immune response as that of live vaccines, besides avoiding handling stress and reducing vaccination cost.

### Molecular characterization and phylogenetic analysis of Marek's disease virus (MDV) serotype I field strains from vaccinated flocks

A total of 93 tumor cases from the deceased birds from 11 pureline coloured broiler and layer breeder flocks were collected for investigation. All the DPR flocks were vaccinated with serotype 3 (HVT) vaccine at day-old at hatchery. All tumor cases were tested for MDV infection through PCR using Serotype-1 specific Meq oncogene gene primers and 34 samples were positive for Marek's disease. PCR amplification along with sequencing of Meq (Marek's EcoRI-Q encoded), lytic antigen Phosphoprotein (pp38) and Viral interleukin 8 (vIL-8) genes was used for molecular characterization of positive field MDV. Phylogenetic analysis of field MDV sequences with MDV nucleotide data base revealed that the field strains mostly clustered with virulent and very virulent MDV reference strains. Further, 132 bp repeat region of Meq gene was also used to confirm the findings.

## Exploring medicinal plants as alternatives to antibiotic growth promoters (AGP's) in broiler production

D. Suchitra Sena and B. Prakash

### In vivo experimental trial using herbal alternatives to AGPs

An in vivo trial in *Krishibro* colored broilers was conducted utilizing two phytogenic feed additives PFA1 and PFA2, developed at ICAR-DPR. The PFAs were given at two different dose rates with and without coccidiostats. 480 birds divided equally into 12 groups with 5 replicates having 8 birds in each replicate were considered for the study. These birds were raised under standard rearing conditions. The study on carcass parameters of these groups showed that when the diet was supplemented with phytogenic feed additives, no significant variation was observed in the percent yield of different organs, depicting their safe role in immunity and meat yield, when AGPs are replaced.

#### Microbial diversity of caecal samples using 16S rRNAamplicon sequencing

In each group, 5 birds were slaughtered and the pooled caecal samples were subjected to amplicon sequencing of 16S rRNA gene (V3-V4 region) on Illumina Miseq platform. Major domain, phylum and order were Bacteria, Firmicutes and Clostridiales, respectively. Above 50% abundance was seen in PFA1 and DPR-HF supplemented

groups and < 50% in the remaining groups. The abundance level of these genera in different groups is shown in Fig. 16.

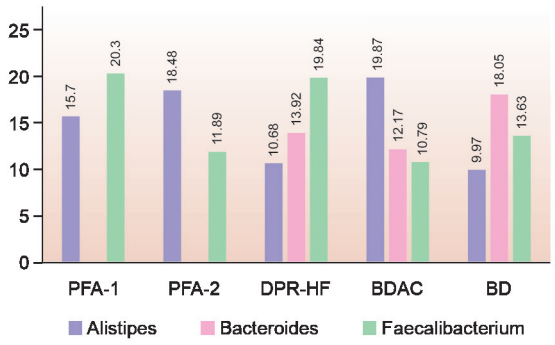



Fig. 16. Abundant genera (>10%) in different groups

# Physiology

## Evaluation and standardization of protocol for cryopreserving semen of DPR pure lines

M. Shanmugam and R.K. Mahapatra

### Cryopreservation of IWK line semen

An experiment was carried out to cryopreserve IWK line semen using two diluents (Sasaki diluent and Lake & Ravie diluent) and two cryoprotectants (8% Ethylene Glycol-EG and 4% Dimethyl sulfoxide-DMSO) in 0.5ml French straws. The semen straws were thawed at 5 °C for 100 sec and inseminated in hens per vagina with a sperm concentration of 200 million/0.1 ml. Post thaw sperm motility, live sperm, acrosome intact sperm, and fertility were significantly (P<0.05) lower in cryopreservation treatments. Low fertility rates of 7.5% and 1.98% were obtained in 8% EG and 4% DMSO in Sasaki diluent, respectively and no fertile eggs were obtained in other treatments. In conclusion, 8% ethylene glycol in Sasaki diluent may be used for cryopreserving IWK line semen, however, the fertility obtained needs to be improved with further experiments.

### Cryopreservation of Ghagus semen

Ghagus chicken, an indigenous poultry breed has breeding tract in Kolar district of Karnataka and adjoining border areas of Andhra Pradesh. Four experiments were carried out for cryopreserving Ghagus rooster semen in 0.5ml French straws.

Experiment 1 : semen was cryopreserved using 6% dimethylacetamide (DMA) and 2% dimethylsulfoxide (DMSO) in Sasaki diluent (SD) and Lake and Ravie diluent (LRD). Experiments 2 and 3 : semen was cryopreserved using 8% Ethylene Glycol (EG) in SD, LRD and Red Fowl Extender (RFE). Experiment 4 : semen was cryopreserved using 6% dimethylformamide (DMF) in SD, LRD and Beltsville Poultry Semen Extender (BPSE). The semen and cryoprotectant mixture filled in straws were exposed to liquid nitrogen vapours for 30 minutes and then plunged in liquid nitrogen where it was stored for a minimum of seven days before evaluation/insemination. In Experiments 1, 2 and 4, the semen straws were thawed at 5 °C for 100 sec in ice water for evaluation and insemination, whereas the straws were thawed at 37 °C for 30 sec in Experiment 3. The post-thaw sperm motility, live sperm and percent acrosome intact sperm were significantly (P<0.05) lower in cryopreserved samples in all the experiments. No difference in percent abnormal sperm was observed in first three experiments and in Experiment 4, cryopreserved semen had

Table 29. Effect of ethylene glycol on post-thaw semen parameters and fertility parameters in Ghagus chicken

| Parameters | Control | 8% EG SD | 8% EG LR | 8% EG RFE |
|---|---|---|---|---|
| Progressive sperm motility (%) | 64.2 ± 1.54$^{a}$ | 17.5 ± 1.12$^{b}$ | 17.5 ± 1.12$^{b}$ | 11.7 ± 1.05$^{c}$ |
| Live sperm (%) | 80.2 ± 3.30$^{a}$ | 26.0 ± 2.03$^{b}$ | 24.7 ± 2.0$^{b}$ | 20.3 ± 0.71$^{b}$ |
| Abnormal sperm (%) | 1.48 ± 0.27 | 1.87 ± 0.24 | 1.93 ± 0.18 | 1.8 ± 0.17 |
| Acrosome intact sperm (%) | 97.2 ± 0.31$^{a}$ | 84.6 ± 3.84$^{ab}$ | 70.0 ± 8.11$^{b}$ | 62.7 ± 9.60$^{b}$ |
| Fertility (%) | 81.2 ± 5.39$^{a}$ | 18.4 ± 8.89$^{b}$ | 48.1 ± 11.1$^{ab}$ | 38.3 ± 10.3$^{b}$ |
| Hatchability on FES (%) | 72.5 ± 4.18 | 69.1 ± 14.98 | 69.0 ± 6.4 | 58.1 ± 9.85 |
| No. of eggs incubated | 82 | 101 | 84 | 111 |

*Values given are mean±SE.*
*Figures bearing different superscripts in a row differ significantly (P<0.05).*

Table 30. Effect of dimethylformamide on post-thaw semen and fertility parameters in Ghagus chicken

| Parameters | Control | 6% DMF SD | 6% DMF LR | 6% DMF BPSE |
|---|---|---|---|---|
| Progressive sperm motility (%) | 66.4 ± 1.43$^{a}$ | 18.6 ± 1.8$^{b}$ | 20.0 ± 2.44$^{b}$ | 15.0 ± 1.54$^{b}$ |
| Live sperm (%) | 79.5 ± 4.48$^{a}$ | 26.0 ± 1.73$^{b}$ | 23.8 ± 2.79$^{b}$ | 23.5 ± 1.06$^{b}$ |
| Abnormal sperm (%) | 1.32 ± 0.15$^{b}$ | 2.32 ± 0.34$^{ab}$ | 3.44 ± 0.54$^{a}$ | 3.34 ± 0.5$^{a}$ |
| Acrosome intact sperm (%) | 97.8 ± 0.14$^{a}$ | 55.6 ± 8.51$^{b}$ | 22.0 ± 6.23$^{c}$ | 12.8 ± 2.21$^{c}$ |
| Fertility (%) | 78.9 ± 4.82$^{a}$ | 24.8 ± 5.10$^{b}$ | 30.9 ± 10.67$^{b}$ | 19.3 ± 8.53$^{b}$ |
| Hatchability on FES (%) | 75.3 ± 5.17 | 60.0 ± 12.10 | 81.3 ± 13.15 | 90.0 ± 10.00 |
| No. of eggs incubated | 105 | 108 | 83 | 124 |

*Values given are Mean±SE.*
*Figures bearing different superscripts in a row differ significantly (P<0.05).*

significantly (P<0.05) higher abnormal sperm. No fertile eggs were obtained from cryopreserved samples in Experiments 1 and 2, except for 8% EG RFE treatment, where the fertility was 0.83%. In Experiment 3, the percent fertility in SD, LRD and RFE treatments was 18.4, 48.1 and 38.3, respectively (Table 29). In Experiment 4, the percent fertility in SD, LRD and BPSE treatments was 24.8, 30.9, and 19.3, respectively (Table 30). In conclusion, the semen cryopreservation protocol using 8% Ethylene Glycol in Lake and Ravie diluent and thawing at 37 °C for 30 sec gave higher fertility for Ghagus chicken.

## Role of plasma leptin, ghrelin and growth hormone in regulation of physiological functions of chicken during summer season

N. Anand Laxmi, M. Shanmugam and R.K. Mahapatra

Nicobari chickens exposed to chronic heat stress under controlled conditions at 39 °C for 4h daily for three weeks had lowered levels of leptin, ghrelin and growth hormone (P<0.01). These birds also had decreased body weight and feed intake (P≤0.05). Increased plasma cholesterol, malondialdehyde and AMP kinase heat stress markers (P≤0.05) and necrosis of jejunum villi was of medium severity in control group. The expression of all the hormone receptors was upregulated in the brain significantly, but in the liver and magnum, it was downregulated when compared with the heat stressed control group. Supplementation of fermented yeast culture negated these effects and in turn increased egg production parameters, thus, proving to be beneficial on production performance.

## Comparative studies on different factors influencing egg production in chickens

N. Anand Laxmi, R.K. Mahapatra and M. Shanmugam

An experiment was conducted in *Vanaraja* parent birds to evaluate Se yeast supplementation.

The study was divided in to two phases, early laying period (24-28 weeks) and mid laying period (32-36 weeks). Control group (C) was offered standard feed ad libitum, while the supplemented group (T) was offered selenium yeast supplement @ 150mg/kg of feed. Weekly blood samples were collected from 24-28 weeks and 32-36 weeks of age for estimation of Melatonin, Ghrelin hormones, and amino acids. Jejunum and Magnum tissue samples were collected at 26 and 34 weeks of age for studies on expression of amino acid transporter enzymes, hormone receptors and mi RNAs.

Supplementation of Se to *Vanaraja* birds increased body weight significantly (P<0.05) during 28-32 weeks of age, whereas egg production was not affected. The concentration of plasma melatonin increased significantly (P<0.05) in the Se supplemented group during 32-36 weeks period. The concentration of plasma ghrelin was not affected. On the other hand, the concentration of progesterone and estrogen during 24-28 weeks was significantly less (P<0.01) in the Se group, but during 32-36 weeks Se supplementation increased their concentration (Fig. 17).

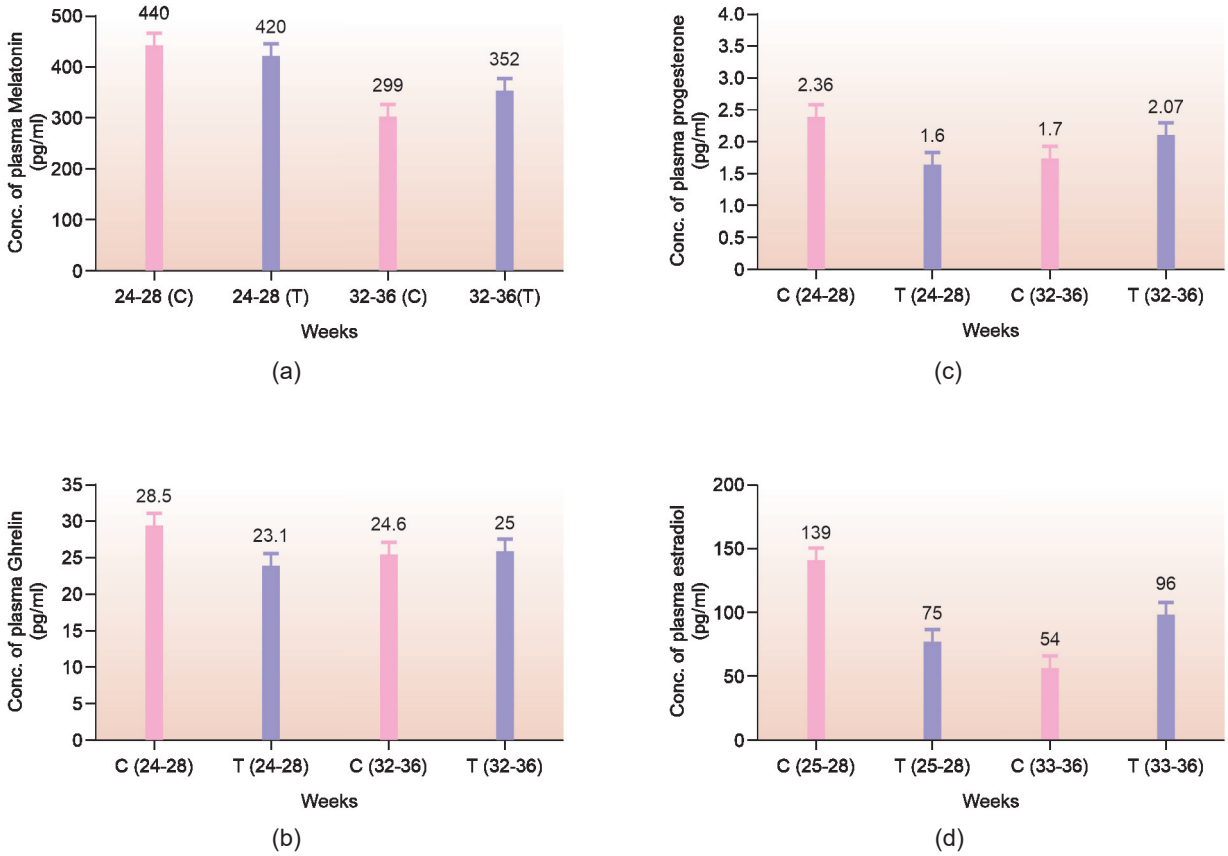



Fig. 17. a) Concentration of plasma Melatonin b) Ghrelin c) Progesterone and d) Estrogen during early (24-28) and mid (32-36) laying period in *Vanaraja* birds. Values are expressed as Mean±SE. C- Control, T-Treatment with Selenium (*P<0.05,**P<0.01)

## Sustainable Poultry Waste Management through composting

R.K. Mahapatra, N. Anand Laxmi, M. Shanmugam, B. Prakash, S.K. Bhanja, P.K. Pankaj and Md. Osman

Compost was prepared using poultry litter with dry leaves as supplement. The average temperature and humidity were maintained at 45$^0$C and 50% respectively, while pH was maintained at 5.3. The compost was used in the pot trial where the effect of compost application having different C/N ratios was observed. In experimental pots, the prepared compost was added at the rate of 5 g to 1.0 kg of soil. The three groups of composts were having C/N ratios of 35:1, 25:1 and 15:1. Green gram (LGG 460 High Yielding Variety), a versatile grain legume was sown in different treatment pots. During the time of establishment of crop, 548 ml of water was given in each pot and every third day 274 ml of water was poured in all pots. Four pots for each type of compost were taken as replicates. The effect of compost application on plant height (cm) and number of branches per plant, no. of pods, pod length, no. of seeds per pod, seed index, stover and seed yield (per pot) was observed. Compost having C/N ratio of 25:1 showed better results as compared to other groups.

## Poultry rearing with Moringa and other feed base - an Integrated Farming System

Integrated farming helps in lowering the cost of production. The leaves of *Moringa oleifera*, which is a widely grown plant in India, are good source of protein. In the institute's farm, Moringa plants were grown in an area of 19,450 sft. A total of 150 *Gramapriya* birds of 18 weeks of age were housed in night shelter having an area of 345 sft, which was constructed within the Moringa plantation. The birds were raised on dried Moringa leaf

Table 31. Effect of different compost treatments on plant height (cm) and number of branches per plant

| Compost type | Plant height (cm) | | | No. of branches per plant |
|---|---|---|---|---|
| | 30 Days After Sowing | 45 Days After Sowing | At harvest | |
| I (35:1) | 15.75±0.32 | 31.33±1.12 | 36.76±1.27 | 10.34±0.14 |
| II (25:1) | 19.21±0.54 | 35.42±1.03 | 42.35±1.33 | 11.42±0.13 |
| III (15:1) | - | - | - | - |
| CD at 5% | 1.51 | 2.93 | 3.54 | 0.32 |

Table 32. Effect of different fertilizer treatments on no. of pods, pod length, no. of seeds per pod, seed index, stover and seed yield (q $ha^{-1}$)

| Compost type | No. of pods per plant | Pod length (cm) | No. of seeds per pod | Seed index/ 100 grain wt (g) | Stover yield (g $pot^{-1}$) | Seed yield (g $pot^{-1}$) |
|---|---|---|---|---|---|---|
| II (35:1) | 33.21±1.15 | 8.79±0.17 | 11.23±0.12 | 3.42±0.03 | 20.13±0.42 | 11.14±0.15 |
| III (25:1) | 38.02±1.23 | 9.87±0.13 | 13.22±0.11 | 3.61±0.04 | 22.31±0.31 | 12.54±0.12 |
| I (15:1) | - | - | - | - | - | - |
| CD at 5% | 3.61 | 0.38 | 0.42 | 0.16 | 1.02 | 0.32 |

powder (300g/day for the total flock) and other supplementary diets like earthworms, kitchen waste and maggots. The average weight of the birds at the age of 20 wks was 1361g, which has increased to 1515g by 24 wks. The egg production at 24 and 26 wks of age was 42% and 53%, respectively.

Moringa plantation


Hens foraging in Moringa plantation


Night shelter for hens


Hen feeding on Moringa leaf powder

# 3 Technologies assessed and Transferred

## Brainstorming meet on Upscaling Backyard Poultry

The Directorate organized a "Brainstorming Meet on Upscaling Backyard Poultry" to improve its share and total poultry production in India on 8-9th August 2019. Higher officials (Director, Additional Directors, Joint Director and Assistant Directors) from 9 state animal husbandry departments and 4 ATARI's (Directors and Principal Scientists) participated in the meeting.

Dr. J K Jena, Deputy Director General (Fisheries and Animal sciences), ICAR New Delhi was the Chief Guest. He emphasized the importance of line departments and KVKs in disseminating the technologies developed by ICAR institutes to end users and farmers. Dr. R.S. Gandhi, ADG (Animal Production and Breeding), the Guest of Honour described the various statistics of poultry development and how backyard poultry can help in doubling farmers income. Dr. R.N. Chatterjee, Director, ICAR-DPR narrated in detail the objectives of conducting this meet and how backyard poultry varieties developed by the Directorate and at AICRP centres are improving soci-economic and nutritional status of farmers across length and breadth of the country. Dr. C. R. Prasanna (IAS), Director, Directorate of Veterinary Services, Chhattisgarh stated the importance of quality germplsam, alternate feed ingredient and developing skilled work force through scientific training.

Inaugural function of brainstorming meet


DDG (FS&AS) chairing the meeting

Participants of the brainstorming meeting

## Scientists - Farmers' Meet

The Directorate organized a "Scientists- Farmers' Meet" on 9th December 2019 with an aim to understand the issues and solutions related to egg and chicken meat consumption. The event was organized in collaboration with Dr.Chicken, RR Foods, Hyderabad. Dr. V. Ramasubba Reddy, Retd. Professor (Poultry Science), ANGRAU explained in detail about the nutritional value of eggs and chicken and their health benefits. An interactive session was held, where in poultry farmers and technical persons involved in poultry industry interacted and offered suggestions for developing a suitable action plan to create

Director, DPR, Dr. V.R. Reddy and others in the meet


Dairy farmers participating in Backyard Poultry Rearing


Participants of scientists-farmers meet

Director, DPR distributing birds to beneficieries

awareness and to counter the false propaganda about chicken egg and meat consumption. A total of 84 participants attended the event, which included the Scientific staff from DPR, faculty and PG/PhD students from PVNR Telangana Veterinary University, representative from National Egg Coordination Committee (NECC), poultry farmers, senior poultry professionals, representatives, field veterinarians and persons involved in marketing chain of the poultry industry.

## Induction of improved backyard chicken with dairy farming in Gujarat

Mixed farming of backyard poultry with buffalo farming was initiated by ICAR-DPR at Dahevan village (Anand) on 26-08-2019 in collaboration with National Dairy Development Board (NDDB) and Anand Agricultural University (AAU), Anand. Dr. R. N. Chatterjee, Director, ICAR-DPR distributed the *Gramapriya* birds to dairy farmers registered under NDDB programme. The Director interacted with the farmers and highlighted the advantage of rearing improved backyard chicken varieties towards improving the farmer's income. Shri. Meenesh Shah, Executive Director, NDDB addressed the farmers. Executives and technical officers of NDDB and Dr. F.P. Savaliya and Dr. A.B.Patel, AAU participated in the event. Grownup birds, night shelter, chick feed and literature in vernacular language on package of practices for rearing backyard chicken under rural conditions were distributed to 10 dairy farmers.

## Transfer of technology

Transfer of technology Unit of the Directorate is engaged in propagation of technologies developed at the institute to different stakeholders of poultry and other allied sectors. The propagation of the improved rural chicken varieties across the country is the main objective of the section. The institute popularized the technologies through participation in exhibitions, kisan melas, farmer's days, etc across the country. The scientists delivered TV talks on various aspects of poultry farming. Brochures, pamphlets, bulletins on different chicken varieties are prepared for distribution to the farmers during different kisan melas, exhibitions, etc. The details of the activities are as follows.

### Germplasm supply

A total of 4,89,990 improved rural chicken germplasm was distributed to the farmers and other stake holders across the country during 2019. Out of this 40,269 are parents, which are further used for multiplication at different PSP centres and other Govt agencies. In addition, a total of 8,75,866 and 5,74,798 germplasm were supplied from the centres of AICRP and PSP, respectively.

Table 1 Germplasm supplied in 2019

| Sl. No. | Particulars | Number |
|---|---|---|
| A. | Hatching Eggs | |
| | *Vanaraja* | 1,14,198 |
| | *Gramapriya* | 43,715 |
| | *Srindhi* | 6,607 |
| | Aseel | 463 |
| | PD-4 | 976 |
| | Ghagus | 724 |
| | Kadaknath | 1,189 |
| | *Krishibro* | 181 |
| | Control Layer | 1,470 |
| | Colored broiler | 1,033 |
| | Layer | 743 |
| | Embryonated eggs | 5,183 |
| | Total | 1,76,482 |
| B. | Day Old Chicks | |
| | *Vanaraja* | 1,06,786 |
| | *Gramapriya* | 96,764 |
| | *Srindhi* | 31,692 |
| | *Krishibro* | 12,702 |
| | Aseel | 1,435 |
| | PD-4 | 6,219 |
| | Ghagus | 3,047 |
| | Kadaknath | 5,780 |
| | Total | 2,64,425 |
| C | Parents | |
| | *Krishibro* | 420 |
| | *Vanaraja* | 28,777 |
| | *Gramapriya* | 10,922 |
| | *Srindhi* | 150 |
| | Total | 40,269 |
| D | Grownup birds supplied in TSP, SCSP and at DPR | 8,814 |
| | Net Total (A+B+C+D) | 4,89,990 |
| E | AICRP on Poultry Breeding | 8,75,866 |
| F | Poultry Seed Project | 5,74,798 |
| | Grand total (DPR+AICRP+PSP) | 19,40,654 |

## Participation in Exhibitions

### a) Poultry India 2019, Hyderabad

DPR participated in the "Poultry India 2019" exhibition organized by IPEMA at Hitex, Hyderabad from 27th to 29th November 2019. DPR stall attracted the attention of all the delegates and poultry farmers. The technologies developed by the institute especially the improved chicken varieties; *Vanaraja*, *Gramapriya*, *Srinidhi* and native chickens attracted the poultry farmers. About 4-5 thousand farmers, technocrats and scientists visited the stall in 3 days.

### b) Maha Pashudhan Expo, 2019, Jalna

ICAR-DPR participated in the Maha Pashudhan Expo, 2019 from 2-4th February 2019 at Jalna, Maharastra. About 4500-5000 farmers visited the stall during 3 days of exhibition. The live birds (Aseel, Kadaknath, *Vanaraja* and *Gramapriya*) and other technologies displayed at the exhibition attracted many farmers and visitors. The literature on the improved chicken varieties was distributed to the farmers.

### c) Agricultural Science Congress Expo 2019, New Delhi

ICAR-DPR participated in the Agricultural Science Congress Expo 2019 from 20-24th February 2019 at IARI, New Delhi. Hon'ble DG (ICAR) and Secretary (DARE) and DDG (AS) along with other dignitaries visited the stall and appreciated the technologies. About 3000-3500 farmers visited the stall during 4 days of exhibition. The technologies displayed at the exhibition attracted many farmers and visitors. The literature on the improved chicken varieties was distributed to the farmers.

### d) Seed Mela exhibition, PJTSAU, Hyderabad

DPR Participated in the Seed Mela exhibition on 24th May2019 at University Auditorium, PJTSAU, Hyderabad. DPR stall attracted the attention of the farmers and visitors at the exhibition. About 1500-2000 farmers visited the stall. The literature on the improved chicken varieties was distributed to the farmers.

e) Farmer's day at CRIDA, Hyderabad

Participated in the farmer's day organized by ICAR-CRIDA on 3rd September2019, at Hayatnagar, Hyderabad. DPR stall attracted the attention of the farmers and visitors at the exhibition. The literature on the improved chicken varieties was distributed to the farmers.

f) NASI, Exhibition at ICAR-NAARM, Hyderabad

DPR participated in scientific exhibition organized at ICAR-NAARM from 21st -23rd December 2019 on the occasion of the Annual Conference of NASI. About 500 delegates and technocrats visited the DPR stall.

## Tribal Sub Plan

The Directorate carried out TSP work in Adilabad district, identified by the Govt of India and ICAR for implementation of Tribal Sub Plan. Under this program, 7818 grownup chicks of *Vanaraja* and *Gramapriya* were distributed to 584 farmers in 7 tribal hamlets of Adilabad district. Each farmer was provided with 10-20 birds, feeders, drinkers, 25-40 kg feed and some essential medicines. Technical inputs and suggestions were provided to the farmers by the DPR scientists and technical officers from time to time. Periodically, scientists visited the farmers and evaluated the performance of the birds and collected the feedback.

A mother unit facility was functioning at ITDA, Utnoor to grow the chicks during nursery phase up to 6 weeks of age. ITDA has created a facility to rear 3000 chicks. During the year, 2 batches of chicks were reared and distributed to the farmers.

Further, four training programs were organized during the year. A total of 82 farmers including women were trained on poultry farming. Subsequently, they were provided with birds and other inputs.

## SC Sub Plan

ICAR-DPR initiated the SC Sub Plan work in four districts (Ranga Reddy, Vikarabad, Warangal and Jangaon Districts) of Telangana. Under the plan, five training programmes were organized and 184 farmer families were trained on different aspects of backyard poultry farming. The farmers had hands on training on farm management including brooder preparation, brooding management, grower and layer management. To encourage backyard poultry farming and to improve livelihood of farmers, 4122 grown up chicks of *Vanaraja* were distributed to 220 farmer families in the four districts of Telangana. Each farmer family was provided with 16-20 birds, 20-30 kg feed, feeders, drinkers, and some essential medicines. Scientists of the Directorate visited different villages and evaluated the performance of birds under village conditions and provided suitable suggestions to farmers.

## Skill development / Capacity Building in Poultry production

A total of thirteen training programs were organized for different stake holders (farmers, Veterinary Officers, agriprenuers etc.) during the year 2019. The list of the trainings organized is as follows.

## MGMG Program

ICAR-DPR actively involved in Mera Gaon Mera Gaurav program in the adopted villages. Improved chicken varieties were distributed to the farmers in the villages at subsidized rates. Required technical advises in health care and nutrition were provided as and when required.

## Technical advisories

Technical advisories were provided to farmers, filed veterinarians from all parts of the country on both intensive and rural/backyard poultry farming in the areas of health care, management and nutrition. A total of 831 farmers visited the institute during the year for technical advisories. Issues/ problems of poultry farmers were attended over phone and mails regularly.

Apart from the above, many graduate and post graduate students across the country visited the Directorate on their educational tours during the period.

## Genbank submissions

Kanaka,K.K., Chatterjee,R.N., Bhattacharya,T.K., Kumar,P., Bhushan,B., Paswan,C., Sagar,N.G. and Prasad,A.R. (2019). Gallus gallus breed IWI White Leghorn ovalbumin mRNA, complete cds. Accession No. MH360741.

Kanaka,K.K., Chatterjee,R.N., Bhattacharya,T.K., Kumar,P., Bhushan,B., Paswan, C., Sagar,N.G. and Prasad,A.R. (2019). Gallus gallus breed IWK White Leghorn ovalbumin mRNA, complete cds. Accession No. MH360742.

Table 1 Training programs organized during 2019

| Sl.No | Program | Participants | Date(s) |
|---|---|---|---|
| 1 | Training programme on “Scientific Poultry Rearing” | 8 Farmers from different states | 22 - 24 January 2019 |
| 2 | Training for Tribal Farmers on “Backyard Poultry Rearing” under TSP | 17 tribal farmers from Adilabad district, Telangana | 4 - 5 February 2019 |
| 3 | Training programme on “Backyard Poultry Management” in collaboration with MANAGE, Hyderabad | 14 Veterinarians from 6 states | 19 - 23 February 2019 |
| 4 | Training for Tribal Farmers on “Backyard Poultry Rearing” under TSP | 23 tribal farmers from Adilabad district, Telangana | 1-2 March 2019 |
| 5 | Training on “Backyard Poultry Rearing” to Scheduled Caste farmers under Schedule Caste Sub Plan (SCSP) | 30 farmers from Gudur village of Ranga Reddy district, Telangana | 13 March 2019 |
| 6 | Training programme on “Scientific Poultry Rearing” | 13 farmers (11- Telangana, 1-UP, 1-Andhra Pradesh) | 15-17 May 2019 |
| 7 | Training programme on “Modern poultry management for established agripreneurs” (collaboration with MANAGE) | 15 agriprenuers from different states and 4 farmers from Institute side | 25-28 June 2019 |
| 8 | Training on “Backyard Poultry Rearing” to Scheduled Caste farmers under Schedule Caste Sub Plan (SCSP) | 31 farmers from Chinchalpet village of Vikarabad district, Telangana | 14 August 2019 |
| 9 | Training for Tribal Farmers on “Backyard Poultry Rearing” under TSP | 21 tribal farmers from Adilabad district, Telangana | 20-21 August 2019 |
| 10 | Training on “Backyard Poultry Rearing” to Scheduled Caste farmers Schedule Caste Sub Plan (SCSP) | 25 farmers from Bomraspet and 10 farmers from Chadurpalle village of Vikarabad district, Telangana | 28 August 2019 |
| 11 | Training on “Backyard Poultry Rearing” to Scheduled Caste farmers Schedule Caste Sub Plan (SCSP) | 44 farmers from Chinchalpet village of Vikarabad district, Telangana | 25 October 2019 |
| 12 | Certified Livestock Advisor Programme on Poultry-Module II (Sponsored by MANAGE) | 15 Veterinarians from all over India | 03-17 December 2019 |
| 13 | Training on “Backyard Poultry Rearing” to Scheduled Caste farmers Schedule Caste Sub Plan (SCSP) | 35 farmers from Warangal district, Telangana | 06 December 2019 |

Kanaka,K.K., Chatterjee,R.N., Bhattacharya,T.K., Kumar,P., Bhushan,B., Paswan,C., Sagar,N.G., Prasad, A.R. and Shukla, R. (2019). Gallus gallus haplotype h1 ovalbumin (OVAL) gene, promoter region. Accession No. MH368655.

Kanaka,K., Chatterjee,R.N., Bhattacharya,T.K., Kumar, P., Bhushan,B., Paswan,C., Sagar,N.G., Prasad,A.R. and Shukla,R. (2019). Gallus gallus haplotype h2 ovalbumin (OVAL) gene, promoter region. Accession No. MH368656.

Kanaka,K., Chatterjee,R.N., Bhattacharya,T.K., Kumar,P., Bhushan,B., Paswan,C., Sagar,N.G., Prasad,A.R., Shukla,R. and Dange,M. (2019). Gallus gallus haplotype h3 ovalbumin (OVAL) gene, promoter region. Accession No. MH368657.

Divya,D., Gnana Prakash, M., Chatterjee,R.N. and Bhattacharya,T.K. (2019). Gallus gallus bone morphogenetic protein 4 (BMP4) mRNA, complete cds. Accession No. MH553645.

Divya,D., Gnana Prakash, M., Chatterjee,R.N. and Bhattacharya,T.K. (2019). Gallus gallus bone morphogenetic protein 4 (BMP4) mRNA, complete cds. Accession No. MH553646.

Dushyanth,K., Bhattacharya, T.K. and Chatterjee, R.N. (2019). Gallus gallus haplotype h3 follistatin (fst) gene, exons 2 through 5 and partial cds. Accession No. MK455102.

Dushyanth, K., Bhattacharya,T.K. and Chatterjee, R.N. (2019). Gallus gallus haplotype h4 follistatin (fst) gene, exons 2 through 5 and partial cds. Accession No. MK455103.

# 4 Trainings attended by DPR Staff

| S. No. | Name of the Staff and Designation | Title of the Training | Duration | Name of the Institute |
|---|---|---|---|---|
| 1 | Shri J. Srinivas Rao, ACTO | Rajbhasha Vichar Goshti | January 10, 2019 | NMDC, Hyderabad |
| 2 | Shri J. Srinivas Rao, ACTO | Technical workshop in Hindi | February 5, 2019 | ICAR-NAARM, Hyderabad |
| 3 | Dr. D. Suchitra Sena, Principal Scientist | MDP on leadership development | June 11-22, 2019 | ICAR-NAARM, Hyderabad |
| 4 | Dr. B. Prakash, Senior Scientist | Hospitality management | June 26 - July 02, 2019 | ICAR-NAARM, Hyderabad |
| 5 | Dr T.K. Bhattacharya, National Fellow | Priority setting, monitoring and evaluation of agricultural research projects | July 18-23, 2019 | ICAR-NAARM, Hyderabad |
| 6 | Dr. R.K. Mahapatra, Principal Scientist | Leading with emotional intelligence | October 14-18, 2019 | ASCI, Hyderabad |
| 7 | Smt. T.R. Nirmala Veronica, AAO | Assets management | November 6-8, 2019 | ICAR-IARI, New Delhi |
| 8 | Dr. L. Leslie Leo Prince, Principal Scientist | Training programme on multivariate analysis using R | November 22-28, 2019 | ICAR-NAARM, Hyderabad |
| 9 | Dr. B. Prakash, Sr. Scientist<br>Dr. Shanmugam, M., Sr. Scientist<br>Dr. Chandan Paswan, Sr. Scientist | Trainers (TOT) programme under skill training programme | November 27-29, 2019 | Agricultural Skill Council of India (ASCI) |

| S. No. | Name of the Staff and Designation | Title of the Training | Duration | Name of the Institute |
|---|---|---|---|---|
| 10 | Shri Mohammed Maqbul, Technical Officer | Automobile maintenance, road safety and behavioural skills for regular drivers of technical grade | November 27 - December 03, 2019 | ICAR-Central Institute of Agricultural Engineering, Bhopal |
| 11 | Dr. M.V.L.N. Raju, Principal Scientist<br>Dr. L. Leslie Leo Prince, Principal Scientist<br>Shri A.V.G.K. Murthy, A.O.<br>Smt. O. Suneetha, PPS | Hands on training on e-office file management system | December 5-6, 2019 | ICAR-NAARM, Hyderabad |
| 12 | Shri J. Srinivas Rao, ACTO | Hindi me computer par basic prashikshan karyakram | December 2-6, 2019 | CHTS, Hyderabad |

# 5 Awards


Dr. Santhosh Haunshi receiving the appreciation certificate from Director General, ICAR

- Dr. Santhosh Haunshi, Pr. Scientist received the appreciation certificate from Director General, ICAR, New Delhi, which was awarded to the Directorate for proactively implementing ICAR data management guidelines and uploading of its all technologies for the last 6 years in KRISHI Portal.

- Dr. Santhosh Haunshi, Pr. Scientist received the best reviewer award from Indian Journal of Animal Research, Karnal

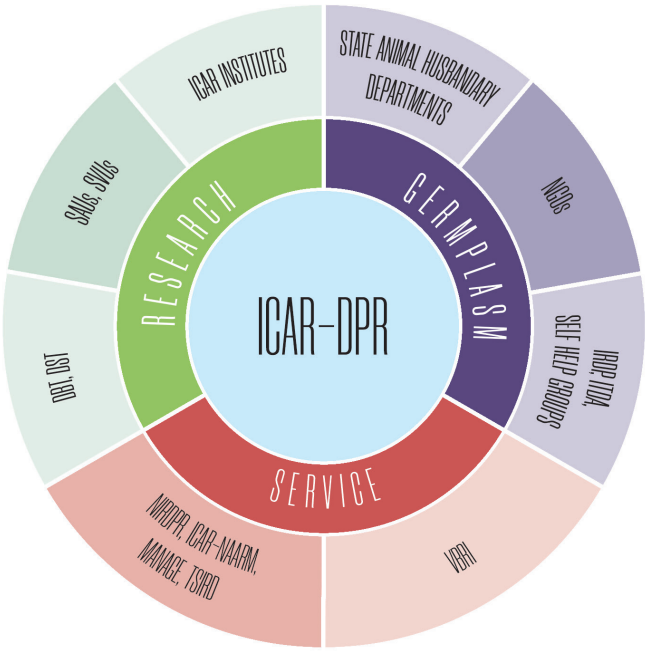
- Dr. S.S. Paul, Pr.Scientist received the best poster award (First) for the poster on "Diversity and community structure of gut microbiome in commercial and indigenous Indian chickens determined using high throughput sequencing" authored by S.S. Paul, R.N. Chatterjee, M.V.L.N. Raju, B. Prakash, S.V. Rama Rao, S.P. Yadav and A. Kannan at the International Animal Nutrition conference (INCAN 2019), Kolkata, Dec 17-19, 2019, pp 126, abst no PSN 050.

- Dr. M. Shanmugam, Sr. Scientist and co-workers received the second best oral presentation in XVI National Symposium of Society for Conservation of Domestic Animal Biodiversity held at ICAR-National Bureau of Animal Genetic Resources, Karnal, 07-08 February 2019.

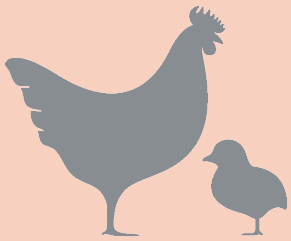
- Dr. T.K. Bhattacharya, National Fellow, received the "Prof. P.K. Pani Research Award" for the best research article "Expression profile of fatty acid synthase gene (FASN) in chicken during juvenile stage" authored by A.R. Prasad, T.K. Bhattacharya, N.G. Sagar, R.N. Chatterjee, P. Kumar, S.K. Bhanja, G. Vishnu and B. Bhushan, published in the Indian Journal of Poultry Science [Vol. 53 (1):11-14] in the field of Poultry Genetics & Breeding, which was conferred during IPSACON-2019 held at College of Veterinary Sciences and Animal Husbandry, Anjora, Durg, Chhatisgarh during 11-13 December 2019.

# 6 Linkages and Collaboration

The state-of-the-art infrastructure facilities available at the Directorate make it the premier institute in the country for carrying out advanced research in various branches of poultry science. The institute extended these facilities to the PG and PhD students of institutions like Indian Veterinary Research Institute, PVNR Telangana Veterinary University, Sri Venkateswara Veterinary University, PJTSAU etc. for carrying out their thesis research work. The Scientists of the Directorate guided the research work of the students as co-chairmen/members of their Advisory Committee. Further, the library and information facilities were utilized by the faculty and students of the neighboring Veterinary College. Several trainees/ students from sister Institutes like PVNRTVU, PJTSAU, NAARM, MANAGE, NIRDPR, TSIRD etc. visited the Directorate to have an exposure to practical aspects of poultry farming. The Directorate is in network mode having research and extension linkages with various SAUs, SVUs and ICAR institutions across the country. A DBT funded research project was underway during the period of report in collaboration with NIAB, Hyderabad and other institutions. Besides the two network research programmes (AICRP and PSP), the Directorate is actively working with various stake holders of rural and commercial poultry farming fraternity like NDDB and Animal Husbandry departments of Telangana, Andhra Pradesh, Madhya Pradesh etc.



# 7



# All India Coordinated Research Project on Poultry Breeding

The AICRP on Poultry Breeding is one of the successful projects of ICAR. It has been operated at twelve centres viz. KVASU, Mannuthy; AAU, Anand; KVAFSU, Bengaluru; GADVASU, Ludhiana; OUAT, Bhubaneswar; CARI, Izatnagar; ICAR RC for NEH Region, Agartala; NDVSU, Jabalpur; AAU, Guwahati; BAU, Ranchi; MPUAT, Udaipur and CSKHP KVV, Palampur. The main objectives of the project are development of location specific chicken varieties, conservation, improvement, characterization and application of local native, elite layer and broiler germplasm development of package of practices for village poultry and entrepreneurships in rural, tribal and backyard areas. In addition, KVASU, Mannuthy and AAU, Anand centres are mandated to maintain two elite layer germplasm (IWN and IWP), while KVAFSU, Bangalore; GADVASU, Ludhiana; OUAT, Bhubaneswar and ICAR-CARI, Izatnagar are maintaining four elite broiler germplasm (PB-1, PB-2, CSML and CSFL).

Pedigreed random bred control populations (one for layer and the other for broiler) were maintained at the Directorate. Samples of hatching eggs from these populations are being sent by ICAR-DPR to different centres of AICRP on Poultry Breeding to measure the genetic progress. As per the decision taken by the Council, the strains maintained at different AICRP centres and ICAR-DPR were duplicated at various AICRP centres to be utilized in case of exigencies and as a resource population by the centre for production of three and four-way crosses. The strains being duplicated at different AICRP centres are IWD and IWK at Anand and M-1 and M-2 at Jabalpur. During the year, a total of 8,75,866 chicken germplasm was distributed to the farmers from different centres and an amount of Rs. 222.01 lakhs revenue was generated through distribution and propagation of the improved chicken germplasm.

The Mannuthy centre evaluated IWN, IWP, native chicken and their crosses during the year. The body weight at 40 weeks was 1320±8.92 g in native chicken. Egg production of native chicken germplasm up to 40 weeks of age in S-4 generation was 78.95 eggs with average egg weight of 43.04 g. The body weight at 16 weeks was 1048±3.21 g in IWN and 1082±2.95 in IWP strains, respectively. The egg production up to 64 weeks of age increased by 5 eggs in IWN (268 eggs), whereas it decreased by 11 eggs in IWP strain (252 eggs) compared to the previous generation. The genetic response was 4.58 eggs in IWN and -10.7 eggs in IWP strain per generation. The centre has distributed a total of 1,35,430 chicken germplasm to the farmers during the year. The centre has generated a revenue of Rs. 19.68 lakhs.

The Anand centre evaluated White Leghorn lines (IWN, IWP, IWD and IWF) and Ankleshwar chicken during the year. The egg production of Ankleshwar chicken (S.0) up to 40 weeks of age was 71.06 eggs. Egg production up to 72 weeks of age was 324.46 in IWN and 306.28 eggs in IWP strain. Egg production up to 40 weeks of age was 116.74 in IWD and 114.71 in IWK strain. The centre distributed a total of 49,472 chicken germplasm to the farmers during the year. The centre has generated Rs.22.29 lakhs revenue.

The Bengaluru centre evaluated native chicken, PB-1 and PB-2 lines and their crosses during the year. The five week body weight was 1247 ±3.81 and 1093±6.40 g in PB-1 and PB-2 lines, respectively. The phenotypic response for five week body weight was 0.73 g over the last 12 generations. The egg production at 40 weeks of age in PB-1 and PB-2 lines was 55 and 53 eggs, respectively. The body weight of native chicken at 8 and 12 weeks of age was 468.6±6.50 and 864.5±9.23 g, respectively. A total of 2,03,222 chicken germplasm were distributed to farmers. The centre generated revenue of Rs. 55.99 lakhs during the year.

The Ludhiana centre carried out the evaluation of Punjab Brown, PB-1 and PB-2 lines during the year. The 5 week body weight was 1237 and 1156 g in PB-1 and PB-2 lines, respectively with corresponding FCR of 1.95 and 1.93, respectively. The egg production up to 40 weeks of age was 65.63 and 67.26 in PB-1 and PB-2 lines, respectively. In Punjab Brown, the 8 week body weight was 767.1 g with FCR of 3.6. The egg production up to 40 weeks of age was 56.12 eggs. The centre distributed 96,976 germplasm to the farmers and generated revenue of Rs.21.17 lakhs.

ICAR-CARI, Izatnagar centre evaluated the local native chicken, CSML and CSFL during the year. The adult body weight at 40 weeks of age was 3894 ±11.6 and 3643±22.36 g in CSML and CSFL, respectively. The 40 week egg production was 68 and 69 eggs in CSML and CSFL, respectively. A total of 59,852 improved chicken germplasm was distributed to 39 farmers. The centre realized an amount of Rs. 29.79 lakhs revenue.

The Bhubaneswar centre evaluated Hansli, CSML, CSFL and their crosses during the year. Hansli birds matured at 176 days and laid 34 eggs up to 52 weeks of age with an egg weight of 47.22 g. The 5 week body weight was 1032 and 1137 g in CSFL and CSML, respectively. The phenotypic response in CSFL and CSML over last eight generations was 38.38 and 59.57 g, respectively. The Centre has distributed 18,543 chicken germplasm to farmers and generated revenue of Rs. 4.54 lakhs during the year.

The Tripura centre evaluated Tripura Black, Dahlem Red, broiler dam line and their crosses during the year. The body weight at 20 weeks was 1821±37.13 and 1378±18.69 g in male and females of three-way cross under farmer's backyards. The age at first egg in the flock was 168 days in field conditions. The annual egg production was 133 under field conditions and 162 in farm conditions. Nine awareness cum training programs were organized for 500 farmers on backyard poultry rearing. A total of 36,633 chicken germplasm was distributed to 395 beneficiaries. The centre generated revenue of Rs. 10.75 lakhs during the year.

The Jabalpur centre evaluated Kadaknath, Jabalpur colour and Narmadhanidhi populations during the year. The adult body weight at 40 weeks was 2130 ±17.1 and 1570 ±24.2 g in Jabalpur colour and Kadaknath, respectively. The ASM was 181 and 166 days, respectively. The egg production up to 52 weeks of age was 161 eggs in JBC and 94 eggs in Kadaknath. Narmadanidhi produced 94 eggs under field conditions up to 52 weeks of age. A total of 84,945 chicken germplasm was distributed to 478 farmers in Madhya Pradesh with revenue receipts of Rs. 17.98 lakhs during the year.

The Guwahati centre evaluated native, Doathgiri, Dahlem Red, PB-2 and Kamrupa populations during the year. The body weight at 20 and 40 weeks of age was 1021 ± 104.9 and 1681 ± 135.6 g, respectively in Doathgiri indigenous chicken breed. ASM was 210.8 ± 5.20 days. The egg production up to 40 weeks of age was 17.9 eggs with an egg weight of 34.60 g. The 40 week body weight of Kamrupa was 1700 g in field and 2300 g in farm conditions. The egg production up to 52 weeks of age was 76 eggs with an egg weight of 44 g in Kamrupa variety. Six small scale entrepreneurs were developed who started the poultry farming activity. The centre supplied 41,166 improved germplasm to the farmers. A total of 196 farmers were benefited with backyard poultry farming in Assam. The centre realized receipt of Rs.8.15 lakhs which was 53% of expenditure on feed cost.

The Ranchi centre evaluated native chicken, Dahlem Red, PB-2 and Jharsim. The body weight at 20 weeks of age in native chicken was 1476±15.93 in males and 1181±10.63 g in females. The 64 week egg production was 71 eggs in native chicken. The body weight of Jharsim at 20 weeks of age was 1830±4.81 and 1670±4.78 g in male and females, respectively. The annual egg production of Jharsim was 148 eggs under field conditions. The Centre distributed 35,243 chicken germplasm to the farmers with revenue of Rs. 6.5 lakhs during the year 2019.

The Palampur centre is focussing on propagation of Himsamridhi variety in Himalayan hill regions. Native germplasm, Dahlem Red and Himsamridhi were evaluated during the year. The body weight

at 40 weeks, ASM and EP40 in native chicken were 1490±23.80 g, 182 days and 50 eggs, respectively. The annual egg production of Himsamridhi was 146 eggs under field conditions. Three training programs on backyard poultry farming were conducted to the farmers. A total of 65,560 chicken germplasm were supplied to 578 backyard poultry farmers including 390 TSP units (19500 chicks) in tribal regions of Himachal Pradesh. The centre realised Rs 14.51 lakhs of revenue during the year.

The Udaipur centre evaluated Mewari, RIR, CSFL and Pratapdhan populations during the year. The body weight at 40 weeks of age was 1700 and 2300 g in female and male birds of Mewari, respectively. The egg production up to 52 weeks of age was 69 eggs in Mewari chicken. The annual egg production (up to 72 weeks) was 160 eggs in Pratapdhan under field conditions. Nine training programs were organized to 446 tribal farmers under TSP. A total of 48,824 improved chicken germplasm was distributed to 500 farmers during the current year. The centre realized Rs. 10.67 lakhs of revenue from the germplasm distribution.

Table 1 Germplasm distribution and revenue generation during 2019

| Centre | Germplasm (Nos.) | Revenue (Rs. In Lakhs) |
|---|---|---|
| KVASU, Mannuthy | 1,35,430 | 19.68 |
| AAU, Anand | 49,472 | 22.29 |
| KVAFSU, Bengaluru | 2,03,222 | 55.99 |
| GADVASU, Ludhiana | 96,976 | 21.17 |
| OUAT, Bhubaneswar | 18,543 | 4.54 |
| ICAR-CARI, Izatnagar | 59,852 | 29.79 |
| MPUAT, Udaipur | 48,824 | 10.67 |
| NDVSU, Jabalpur | 84,945 | 17.98 |
| AAU, Guwahati | 41,166 | 8.15 |
| CSKHPKVV, Palampur | 65,560 | 14.50 |
| BAU, Ranchi | 35,243 | 6.50 |
| ICAR-RC, Agartala | 36,633 | 10.75 |
| **Total** | **8,75,866** | **222.01** |

# 8 Poultry Seed Project

The Poultry Seed Project was evolved with an objective to increase the availability of rural chicken germplasm in remote areas of our country. In this endeavour, the Indian Council of Agricultural Research has initiated "Poultry Seed Project" during the XI Five-year Plan with six centres, three in the northeast region and three in different state veterinary/agricultural universities. The project has been strengthened during the XII plan by adding five more centres to cater to needs of the farmers in their respective regions. At present, the project is being operated at 12 centres across the country. The main objective of this project is local production of improved chicken germplasm (fertile eggs, day old chicks and grownup chicks) and supply to various stake holders in the remote areas to target production enhancement of egg and meat for augmenting rural poultry production, socio-economic condition of the target groups and linking small scale poultry producers with organized market.

The PSP centres are located at West Bengal University of Animal and Fishery Sciences, Kolkata; Bihar Animal Sciences University, Patna; ICAR Research complex for NEH region, Nagaland regional centre, Jharnapani; ICAR –National Organic Farming Research Institute, Gangtok; ICAR Research complex for NEH region, Manipur regional centre, Imphal; Tamil Nadu Veterinary and Animal Sciences University, Hosur, ICAR-Central Coastal Agricultural Research Institute, Panaji; ICAR-Central Island Agricultural Research Institute, Port Blair; Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, PVNR Telanagna Veterinary University, Warangal; Sri Venkateswara Veterinary University, Tirupati and ICAR Research Complex for NEH Region, Umiam.

The Directorate as a coordinating unit, supplies parent chicks, co-ordinates and monitors the activities of different centres to enable them to achieve the set targets for each centre. The target set for supplying chicks for mainland and north-east centres during the year 2019 were between 0.3 and 1.0 lakhs chicks per annum for different centres and to collect feedback on the performance of the germplasm under backyard farm conditions. A total of 5,74,798 improved chicken varieties have been distributed in their respective regions/states with a revenue receipts of Rs. 152.14 lakhs during the year.

Kolkata centre reared three batches of *Vanaraja* parents during the year. Peak production of 79% was achieved at 39 weeks of age. A total of 11,053 chicks were distributed to 18 farmers in West Bengal. An amount of Rs. 2.79 lakhs revenue was realized during year. Patna centre reared two batches of *Vanaraja* and *Gramapriya* parents. The egg production of 50% was achieved at 32 weeks and at 40 weeks it was 73%. A total of 71,700 *Vanaraja* chicken germplasm was distributed to the farmers in Bihar during the year 2019 with an amount of Rs. 12. 2 lakhs revenue.

Two batches of *Vanaraja* and *Srinidhi* were in position at present in Jharnapani centre. A total of 79,375 improved chicken germplasm was distributed to farmers of Nagaland and neighboring states during the year 2019. A total of Rs. 34.63 lakhs revenue was generated under PSP at Jharnapani Centre. The centre achieved the target of germplasm. One batch of *Vanaraja* parents was reared at ICAR, NOFRI, Gangtok, Sikkim. A total of 96,815 improved chicken germplasm of *Vanaraja* was distributed to 3338 farmers covering 267 village habitats in Sikkim with an amount of

Rs. 21.84 lakhs revenue. Three batches of *Vanaraja, Gramapriya* and *Srinidhi* parents were reared at Manipur Centre during the year. A total of 38,709 improved chicken germplasm was distributed to the farmers in Manipur. The Centre has generated Rs. 15.27 lakhs of revenue during the year 2019.

One batch of *Vanaraja* and two batches of *Gramapriya* parents were reared at Hosur Centre during the reporting period. A total of 1,27,327 improved rural chicken (*Vanaraja* and *Gramapriya*) germplasm was distributed to 1122 farmers in Tamil Nadu. The Centre has generated total revenue of Rs. 32.40 lakhs during the year. Three batches of *Srinidhi, Vanaraja* and *Krishibro* parents were reared at Goa during the year. A total of 39,893 improved chicken germplasm was distributed to 1263 farmers in Goa and 38 farmers in Karnataka and 4 in Maharastra with revenue of Rs. 7.54 lakhs

Two batches of *Vanaraja* and *Srinidhi* parents were reared under deep litter system at Port Blair. A total of 22,063 improved chicken germplasm were distributed to 180 farmers in Andaman & Nicobar Islands with revenue of Rs. 2.83 lakhs during the year. One batch of *Vanaraja* parents were reared at SKUAST, Srinagar centre. A total of 18,605 chicks were supplied to the beneficiereies and a revenue of 4.03 lakhs was generated. Two batches of *Vanaraja* and *Srinidhi* parents reared at ICAR RC for NEH Region, Umiam, Barapani. A total 12,606 improved chicken germplasm was distributed to the farmers in Meghalaya with an amount of Rs. 10.27 lakhs of revenue during the year 2019.

One batch of *Vanaraja* parents were maintained at SVVU, Tirupati, Andhra Pradesh. A total of 31,858 chicks were supplied to the farmers and generated Rs.4.5 lakhs as revenue by sale of chicks and eggs during the period. Three batches of *Vanaraja, Gramapriya* and *Vanasree* parents were reared at PVNRTVU, Warangal, Telangana during the reporting period. A total of 24,794 improved rural chicken (*Vanaraja* and *Gramapriya*) germplasm was distributed to the farmers. The centre has generated total revenue of Rs. 3.85 lakh during the year.

Table 1. Centre wise distribution of germplasm under Poultry Seed Project

| Sl. No. | Centre | Germplasm (Nos.) | Revenue (Rs. in lakhs) |
|---|---|---|---|
| 1 | WBUAFS, Kolkata | 11,053 | 2.79 |
| 2 | BASU, Patna | 71,700 | 12. 2 |
| 3 | ICAR-RC, Jharnapani | 79,375 | 34.63 |
| 4 | ICAR-NOFRI, Gangtok | 96,815 | 21.84 |
| 5 | ICAR-RC, Imphal | 38,709 | 15.27 |
| 6 | TANUVAS, Hosur | 1,27,327 | 32.40 |
| 7 | ICAR-CCARI, Goa | 39,893 | 7.53 |
| 8 | ICAR-CIARI, Port Blair | 22,063 | 2.83 |
| 9 | SKUAST, Srinagar | 18,605 | 4.03 |
| 10 | ICAR-RC for NEHR, Umiam | 12,606 | 10.27 |
| 11 | PVNRTVU, Warangal | 24,794 | 3.85 |
| 12 | SVVU, Tirupati | 31,858 | 4.5 |
| | **Total** | **5,74,798** | **152.14** |

# 9 Publications

## Research papers

Anand Laxmi, N., Prince, L.L.L., Rama Subbaiah K. and Mahapatra, R.K. 2019. Relationship between plasma GH, metabolites, lipogenic genes and MMP3 expression in different tissues of PD3 chicken line during summer season and role of fermented yeast culture in alleviating heat stress. *Journal of Applied Poultry Research,* 28:669-678. DOI:10.3382/japr/pfz018. http://krishi.icar.gov.in/jspui/handle/123456789/27823.

Anand Laxmi, N., Rama Subbaiah, K., Mahapatra, R.K. and Shanmugam, M. 2019. Effect of supplementation of fermented yeast culture during summer on plasma leptin and ghrelin and expression of their receptors in different tissues and on production performance during-post summer period in PD 3 chicken line. *Animal Nutrition and Feed Technology,* 19: 1-13. http://krishi.icar.gov.in/jspui/handle/123456789/27423.

Bhattacharya, T.K., Shukla, R., Chatterjee, R.N. and Bhanja, S.K. 2019. Comparative analysis of silencing expression of myostatin (MSTN) and its two receptors (ACVR2A and ACVR2B) genes affecting growth traits in knock down chicken. *Scientific Reports*, 9:77-89. http://krishi.icar.gov.in/jspui/handle/123456789/27375.

Chandan, P., Bhattacharya, T.K., Rajkumar, U., Prince, L.L.L. and Chatterjee, R.N. 2019. Estimation of genetic parameters of growth and egg production traits by animal model in IWK layer strain. *Indian Journal of Animal Research,* DOI: 10.18805/ijar.B-3638. http://krishi.icar.gov.in/jspui/handle/123456789/28014.

Guru Vishnu, P., Bhattacharya, T.K., Bhushan, B., Kumar, P., Chatterjee, R.N., Paswan, C., Dushyanth, K., Divya, D. and Rajendra Prasad, A. 2019. In silico prediction of short hairpin RNA and in vitro silencing of activin receptor type IIB in chicken embryo fibroblasts by RNA interference. *Molecular Biology Reports,* 46:2947-2959. http://krishi.icar.gov.in/jspui/handle/123456789/27683.

Guru Vishnu, P., Bhattacharya, T.K., Bhushan, B., Kumar, P., Chatterjee, R.N., Paswan, C., Rajendra Prasad, A., Divya, D. and Dushyanth, K. 2019. Molecular characterization and computational structure prediction of activin receptor type IIB in Aseel and broiler chicken. *Research in Veterinary Science,* 126:139-149. http://krishi.icar.gov.in/jspui/handle/123456789/27681.

Guru Vishnu, P., Bhattacharya, T.K., Bhushan, B., Paswan, C., Rajendra Prasad, A. and Divya, D. 2019. Genetic polymorphism in core promoter sequence of ACTRIIB gene and association analysis with growth traits in chicken. *Reproduction in Domestic Animals,* 54:1330-1340. http://krishi.icar.gov.in/jspui/handle/123456789/27679.

Haunshi, S., Arun Kumar, B., Kannaki, T.R. and Rajkumar, U. 2019. Survivability, immunity, growth and production traits in indigenous and White Leghorn breeds of chicken. *British Poultry Science*, 60(6): 683-690. http://krishi.icar.gov.in/jspui/handle/123456789/26866.

Haunshi, S., Padhi, M.K., and Rajkumar, U. 2019. Improvement of PD-4 (Aseel), an indigenous chicken breed for growth and production

performance. *Indian Journal of Animal Sciences,* 89(4): 419–423. http://krishi.icar.gov.in/jspui/handle/123456789/19216.

Kanaka, K.K., Chatterjee, R.N., Shukla, R., Kumar, P., Bhushan, B. and Bhattacharya, T.K. 2019. Development of protocol for production of primary antibody against ovalbumin protein in chicken for detection of the protein through Western Blotting. *Journal of Animal Research,* 9: 849-853. http://krishi.icar.gov.in/jspui/handle/123456789/38071.

Kannaki, T.R., Priyanka, E. and Reddy, M.R. 2019. Co-administration of toll-like receptor (TLR)-3 and 4 ligands augments immune response to Newcastle disease virus (NDV) vaccine in chicken. *Veterinary Research Communications*, DOI: 10.1007/s11259-019-09763-x. http://krishi.icar.gov.in/jspui/handle/123456789/26390.

Prakash, B., Verma, S. K., Rama Rao, S. V., Raju , M.V.L.N., Paul, S. S., Kannan, A., Mishra, S., Singh ,V. and V. Sankhyane. 2019. Feeding status of free-range scavenging chickens in different agro-climatic regions of India. *British Poultry Science*, DOI:10.1080/00071668. 2019.1671956. http://krishi.icar.gov.in/jspui/handle/123456789/37526.

Pranay Kumar, K., Swathi, B. and Shanmugam M. 2019. Effect of supplementing L-Glycine and L-Carnitine on post thaw semen parameters and fertility in chicken. *Slovak Journal of Animal Science*, 52(1):1-8. http://krishi.icar.gov.in/jspui/handle/123456789/23526.

Pranay Kumar, K., Swathi, B., Shanmugam M. 2019. Effect of supplementing vitamin E analogues on post thaw semen parameters and fertility in chicken. *British Poultry Science*, 60(3):340-345. DOI:10.1080/ 00071668.2019.1602249. http://krishi.icar.gov.in/jspui/handle/123456789/37450.

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Shanmugam M. and Mahapatra, R.K. 2019. Pellet method of semen cryopreservation: Effect of cryoprotectants, semen diluents and chicken lines. *Brazilian Archives of Biology and Technology* 62: e19180188. DOI: 10.1590/1678-4324-2019180188. http://krishi.icar.gov.in/jspui/handle/123456789/23525.

Yadav, S.P., Sarkar, S. K., Mahapatra, R. K., Kannaki, T. R., Dange, M., Bhattacharya, T. K. and Chatterjee, R. N. 2019. Modelling growth curves for Indian Native vs Exotic chicken breeds to assist in selection strategies. *Indian Journal of Animal Sciences*, 89(8): 898–902. http://krishi.icar.gov.in/jspui/handle/123456789/26303.

## Review Papers

Anand Laxmi, N. 2019. The chicken heterophil – A short review. *Open Access Journal of Veterinary Science And Research*, 4(1): 000168. http://krishi.icar.gov.in/jspui/handle/123456789/27418

Chatterjee, R.N., Bhattacharya, T.K. and Paul, S.S. 2019. Breeding poultry for improved input use efficiency and nutrient quality of products. *Indian Journal of Genetics*, Pl. BR. 79 (1 Suppl 204): 204-207. http://krishi.icar.gov.in/jspui/handle/123456789/37524

Chatterjee, R.N., Paul, S.S. and Rama Rao, S.V. 2019. Global use of antimicrobials in food animals, emergence of antimicrobial resistance and way forward: an overview. *Indian Journal of Animal Health* 58(2):19-32. http://krishi.icar.gov.in/jspui/handle/123456789/37525

## Invited Papers in Seminars/Symposia/Conferences

Paul, S.S. 2019. Reducing emission of methane and gaseous nitrogen from food animals : emerging options. International Animal Nutrition conference, INCAN 2019, Kolkata December 17-19, pp 221-232.

Paul, S.S., Rama Rao, S.V., Raju, M.V.L.N., Prakash, B. and Kannan, A. 2019. Newer feed additives for improving poultry health and production: the trends and advances-a review. IPSACON 2019, Durg, December 11-13.

## Research Abstracts presented in Symposia/ Conferences

Anand Laxmi, N. 2019. Effect of summer season on leptin Ghrelin GH hormones receptors metabolites during summer season and their modulation by supplementation of yeast culture in Nicobari chicken, *Universal Academic Cluster International Conference*, Bangkok, 14-15th Nov.

Kannan, A. Prakash, B., Paswan, C. Paul, S.S., Rao, S.V.R and Raju, M.V.L.N. 2019. Effect of feeding different levels of iron on performance and egg iron contents in white leghorn layers. *Proceedings of International Conference of Animal Nutrition*, December 17-19, Kolkata, West Bengal, pp.95.

Prince, L.L.L., Rajaravindra, K.S., Rajkumar, U., Reddy, B.L.N., Paswan, C. and Chatterjee, R.N. 2019. Estimates of genetic parameters for juvenile traits in a long-term selected coloured broiler female line (PB-2). *Proceedings of XVI National Symposium of Society for Conservation of Domestic Animal Biodiversity,* ICAR-National Bureau of Animal Genetic Resources, Karnal, February 7-8, pp-115.

Mahapatra, R.K., Pankaj P.K., Bhanja S.K., Anand Laxmi N., Shanmugam M., Osman, Md., Yadav, S.P. and Chatterjee, R.N. 2019. Sustainable Poultry Waste Management through composting. *International Conference on "Recent trends in Botany, Zoology, Microbiology and Biotechnology"*, Andhra Loyola College, 1-2 November. Pp34.

Mahapatra, R.K., Pankaj, P.K., Prakash, B., Anand Laxmi, N., Shanmugam, M., Bhanja, S.K., Osman, Md. and Yadav, S.P. 2019. Composition of supplements for poultry litter compost preparation. *Proceedings of XIV Agricultural Science Congress*, New Delhi, February 20-23.

Shanmugam, M. and Mahapatra, R.K. 2019. Development of cryopreservation protocol for Ghagus chicken semen. *Proceedings of XXXV Annual Convention of The Indian Society for Study of Animal Reproduction (ISSAR) and International Symposium,* Veterinary College and Research Institute, Namakkal, Tamilnadu, December 18-20, pp 153.

Shanmugam, M., Pranay Kumar, K., Mahapatra R. K. and N. Anand Laxmi. 2019. Effect of different cryoprotectants in Nicobari chicken semen cryopreservation. *Proceedings of XVI National Symposium of Society for Conservation of Domestic Animal Biodiversity,* ICAR-National Bureau of Animal Genetic Resources, Karnal, February 7-8, pp 229.

Yadav, S.P., Kannaki, T.R., Mahapatra, R.K., Prince, L.L.L., Bhattacharya, T.K. and Chatterjee, R.N. 2019. Genotyping the Tapasin and TAP2 gene in three breeds of chicken. *Proceeding of the International Conference on recent trends in Botany, Zoology, Microbiology and Biotechnology*, Vijayawada, 01-02 November, pp 33.

Paul, S.S., Chatterjee, R.N., Raju, M.V.L.N., Prakash, B., Rama Rao, S.V., Yadav, S.P. and Kannan, A. 2019. Diversity and community structure of gut microbiome in commercial and indigenous Indian chickens determined using high throughput sequencing. *Proceedings of International Animal Nutrition Conference, INCAN 2019*, Kolkata, December 17-19, pp 126.

## Popular articles/Technical articles

Kannan, A. and Sathish Kumar. 2019. Producing good quality pellet feed for poultry: Effect of feed and ingredient characteristics on pellet quality. *Poultry Valley*, 3(4): 8-14.

## Books/Book Chapter

Bhattacharya, T.K. 2019. Application of genomic tools in meat quality evaluation. In: Meat quality analysis-Advanced evaluation methods, techniques and technologies. Academic Press, Elsevier, U.K. pp. 369-389.

## Training manuals

R. K. Mahapatra and S. P. Yadav, 2019. Poultry litter waste management. *Training programme on "Certified Livestock Advisor Programme on Poultry-Module II"*, 3rd to 17th December, 2019, ICAR-DPR in collaboration with MANAGE, Hyderabad. Pp 108-110.

S. P. Yadav and R. K. Mahapatra, 2019. Recent advances in improving poultry productivity through biotechnological approaches. *Training programme on "Certified Livestock Advisor Programme on Poultry-Module II"* 3rd to 17th December, 2019, ICAR-DPR in collaboration with MANAGE, Hyderabad. Pp 120-122.

Prince, L.L.L. and Rajaravindra, K.S. 2019. Introduction to Indigenous and exotic chicken breeds. In: Prakash, B. and C. Paswan. 2019. *Training programme on "Certified Livestock Advisor Programme on Poultry-Module II"* 3rd to 17th December, 2019, ICAR-DPR in collaboration with MANAGE, Hyderabad. pp. 6-16.

S.S.Paul. 2019. Antimicobial resistance and alternatives to antimicrobials. *Training programme on "Certified Livestock Advisor Programme on Poultry-Module II"* 3rd to 17th December, 2019, ICAR-DPR in collaboration with MANAGE, Hyderabad.

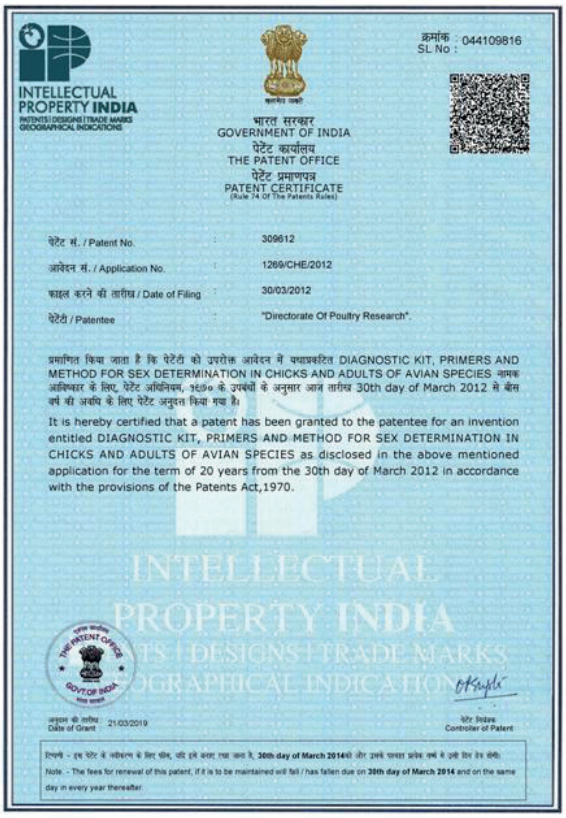
# 10 Research Projects in Operation During 2019

| Sl. No. | Project Title | PI & Co-PIs | Project Duration |
|---|---|---|---|
| A | Institute Funded Projects | | |
| 1 | Development and improvement of male lines for production of backyard chicken varieties for free range farming (Project No. - ANSCDPRSIL201500100050) | Dr. U. Rajkumar (PI)<br>Dr. Santosh Haunshi<br>Dr. L.L.L. Prince<br>Dr. C. Paswan | 2015-20 |
| 2 | Improvement and evaluation of female lines for backyard/ free range farming (Project No. - ANSCDPRSIL201500200051) | Dr. U. Rajkumar (PI)<br>Dr. L.L.L. Prince<br>Dr. S.P. Yadav<br>Dr. C. Paswan | 2015-20 |
| 3 | Genetic characterization and conservation of indigenous chicken germplasm (Project No. - ANSCDPRSIL201500300052) | Dr. Santosh Haunshi (PI)<br>Dr. U. Rajkumar | 2015-20 |
| 4 | Genetic evaluation of elite layer germplasm (Project No. - ANSCDPRSIL201500400053) | Dr. C. Paswan (PI)<br>Dr. R.N. Chatterjee<br>Dr. T.K. Bhattacharya | 2015-20 |
| 5 | Maintenance of coloured broiler populations for intensive and semi intensive broiler farming (Project No. - ANSCDPRSIL201500500054) | Dr. B.L.N. Reddy (PI)<br>Dr. L. Leslie Leo Prince | 2015-20 |
| 6 | Genetic evaluation and improvement of the coloured broiler female line (PB-2) (Project No. -ANSCDPRSIL201900100068) | Dr. L. Leslie Leo Prince (PI)<br>Dr. B.L.N. Reddy<br>Dr. U. Rajkumar | 2019-24 |
| 7 | Genotyping MHC class I loading complex genes (TAP1, TAP2 and Tapasin) for their association with immunocompetence traits in chicken (Project No. - ANSCDPRSIL201500600055) | Dr. S.P. Yadav (PI)<br>Dr. T.R. Kannaki<br>Dr. T.K. Bhattacharya | 2015-19 |
| 8 | Development of nutritional package of practices for backyard chicken production (Project No. – ANSCDPRSIL201600200060) | Dr. B. Prakash (PI)<br>Dr. A. Kannan<br>Dr S.S. Paul | 2016-19 |

| Sl. No. | Project Title | PI & Co-PIs | Project Duration |
|---|---|---|---|
| 9 | Utilization of distillery by-products in poultry diet : the nutritional implications and strategies for improving the nutritional value (Project No. – ANSCDPRSIL201700100062) | Dr. M.V.L.N. Raju (PI)<br>Dr. S.V. Rama Rao<br>Dr. B. Prakash<br>Dr. S.S. Paul<br>Dr. A. Kannan | 2017-20 |
| 10 | Development of a composite feed additive using promising organic acids and plant bioactive compounds for improving gut health and productivity in chicken (Project No. ANSCDPRSIL201700300065) | Dr. S.S. Paul (PI)<br>Dr. M.V.L.N. Raju<br>Dr. B. Prakash<br>Dr. S.V. Rama Rao<br>Dr. S.P. Yadav | 2017-20 |
| 11 | Production of designer eggs enriched with critical trace minerals relevant to human nutrition (Project No. ANSCDPRSIL201700400066) | Dr. A. Kannan (PI)<br>Dr. B. Prakash<br>Dr. S.V. Rama Rao<br>Dr. M.V.L.N. Raju | 2017-19 |
| 12 | Exploring medicinal plants as alternative to antibiotic growth promoters (AGP) in broiler production (Project No. ANSCDPRSIL201500700056) | Dr. D. Suchitra Sena (PI)<br>Dr. B. Prakash | 2015-20 |
| 13 | Disease diagnosis, Vaccination & Sero-monitoring in pureline chickens (Project No. ANSCDPRSIL201700200064) | Dr. T.R. Kannaki (PI)<br>Dr. S.K. Bhanja | 2017-20 |
| 14 | Comparative studies on different factors influencing egg production in chicken (Project No. – ANSCDPRSIL201900200069) | Dr. Anand Laxmi (PI)<br>Dr. R.K. Mahapatra<br>Dr. M. Shanmugam | 2019-22 |
| 15 | Sustainable poultry waste management through composting (Project No. ANSCDPRSIL201700100063) | Dr. R.K. Mahapatra (PI)<br>D r. N. Anand Laxmi<br>Dr. M. Shanmugam<br>Dr. B. Prakash<br>Dr. S.K. Bhanja<br>Dr. P.K. Pankaj (ICAR-CRIDA)<br>Dr. Md. Osman (ICAR-CRIDA) | 2017-22 |
| 16 | Evaluation and standardization of protocol for cryopreserving semen of DPR pure line (Project No. – ANSCDPRSIL201800100067) | Dr. M. Shanmugam (PI)<br>Dr. R.K. Mahapatra | 2018-21 |
| B | Externally Funded Research Projects | | |
| 1 | Functional genomics, epigenetics and gene silencing technology for improving productivity in poultry (National Fellow) | Dr. T.K. Bhattacharya (PI) | 2016-21 |
| 2 | Adaptation and mitigation strategies in poultry to thermal stress through nutritional and environmental manipulation (NICRA) | Dr. S.V. Rama Rao (PI)<br>Dr. M.V.L.N. Raju<br>Dr. U. Rajkumar<br>Dr. B. Prakash<br>Dr. T.R. Kannaki | 2017-20 |
| 3 | Effect of dietary supplementation of biofortified maize (QPM) on productive performance in broilers chickens (Network project) | Dr. B. Prakash (PI)<br>Dr. S.V. Rama Rao<br>Dr. M.V.L.N. Raju | 2015-20 |

| Sl. No. | Project Title | PI & Co-PIs | Project Duration |
|---|---|---|---|
| 4 | Development of transgenic chicken for production of human interferon alpha 2b: A therapeutic for treatment of viral diseases in human (DBT) | Dr. T.K. Bhattacharya (PI)<br>Dr. R.N. Chatterjee<br>Dr. C. Paswan | 2018-21 |
| 5 | Chicken or egg: Drivers of antimicrobial resistance in poultry in India (DBT) | Dr. S.V. Rama Rao (PI)<br>Dr. S.S. Paul | 2018-21 |
| 6 | Understanding the epigenetic methylation and miRNA mediated gene regulation of transcellular calcium transport genes in avian uterus during egg calcification (DST) | Dr. C. Paswan (PI)<br>Dr. R.N. Chatterjee<br>Dr. M. Shanmugam | 2018-21 |
| 7 | Development of Gene Knock out Chicken by Genome Editing with CRISPR/Cas for augmentation of productivity in poultry (DST) | Dr. T.K. Bhattacharya (PI)<br>Dr. C. Paswan | 2019-22 |
| 8 | Genome wide association study in Indigenous poultry breeds (ILRI) | Dr. T.K. Bhattacharya (PI)<br>Dr. R.N. Chatterjee<br>Dr. S.P. Yadav<br>Dr. C. Paswan | 2019-22 |

# 11 Consultancy, Contract Research and Commercialization of Technologies



INTELLECTUAL PROPERTY INDIA
PATENTS | DESIGNS | TRADE MARKS
GEOGRAPHICAL INDICATIONS

क्रमांक : 044109816
SL No :

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 Of The Patents Rules)

| | |
|---|---|
| पेटेंट सं. / Patent No. | 309612 |
| आवेदन सं. / Application No. | 1269/CHE/2012 |
| फाइल करने की तारीख / Date of Filing | 30/03/2012 |
| पेटेंटी / Patentee | "Directorate Of Poultry Research". |

प्रमाणित किया जाता है कि पेटेंटी को उपरोक्त आवेदन में यथाप्रकटित DIAGNOSTIC KIT, PRIMERS AND METHOD FOR SEX DETERMINATION IN CHICKS AND ADULTS OF AVIAN SPECIES नामक आविष्कार के लिए, पेटेंट अधिनियम, १९७० के उपबंधों के अनुसार आज तारीख 30th day of March 2012 से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled DIAGNOSTIC KIT, PRIMERS AND METHOD FOR SEX DETERMINATION IN CHICKS AND ADULTS OF AVIAN SPECIES as disclosed in the above mentioned application for the term of 20 years from the 30th day of March 2012 in accordance with the provisions of the Patents Act,1970.

INTELLECTUAL PROPERTY INDIA

THE PATENT OFFICE GOVT OF INDIA

अनुदान की तारीख Date of Grant : 21/03/2019

पेटेंट नियंत्रक Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, 30th day of March 2014 को और उसके पश्चात प्रत्येक वर्ष में उसी दिन देय होगी।

Note : - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 30th day of March 2014 and on the same day in every year thereafter.

The Institute Technology Management Unit at the Directorate coordinated various activities concerning the IP protection of technologies and their commercialization, besides processing the proposals received under Contract research mode.

## ICAR-DPR receives the 1st Patent

The first patent for the Directorate was granted by the Indian Patent Office, Chennai during March 2019.

Title of the patent: Diagnostic kit, primers and method for sex determination in chicks and adults of avian species.

Patent No.: 309612
Inventor: T.K. Bhattacharya, National Fellow

## Contract research

Two contract research projects were carried out during the year on poultry feed supplements on the request of leading feed supplement

manufacturers as per ICAR Guidelines. The details are as follows.

- Evaluation of seaweed plant extract in broiler chicken diet for M/s Sea6 Energy Private Ltd., Bellary Road, Bangalore-560065 for 8 months from August 2018 (Rs. 8.58 lakhs)

- Evaluation of shea olein and lecithinated bypass fat in broiler chicken diet for M/s 3F Industries Ltd., Hyderabad for 8 months from August 2019 (Rs.9.15 lakhs)

## Workshop on Intellectual Property Rights

The ITMU of ICAR-DPR organized a workshop on "IPR Management vis-à-vis ICAR Guidelines" on 18 February, 2019. The Director, scientists and technical staff participated in the workshop. The


purpose of the workshop was to enhance awareness about Intellectual Property Rights for effective IP management. The programme included two guest lectures by Dr. M. Elangovan, Principal Scientist and I/c ITMU, ICAR-IIMR, Hyderabad and Dr. Poornima Chandran, Prometheus Patent Services, Hyderabad.

# 12 Committees

## Research Advisory Committee

The meeting of Research Advisory Committee of ICAR-DPR was held on 24th and 25th April, 2019 under the Chairmanship of Prof. B.B. Mallick, Founder Vice Chancellor, WBUAFS, Kolkata and Former Director and Vice Chancellor, IVRI, Izatnagar. The meeting was attended by the RAC members, Dr. Arjava Sharma, Former Director, NBAGR, Karnal; Dr. K,T. Sampath, Former Director, NIANP, Bangalore; Dr. J.R. Rao, Retd. HOD, IVRI, Izatnagar and Dr. R.S. Gandhi, ADG (AP&B), ICAR. The RAC visited various units of the institute including hatchery, farm and laboratories and had an overview of the infrastructure available at the institute. Dr. R.N. Chatterjee, Director presented an overall view of the activities of the institute and the salient achievements during the past one year. The action taken on previous RAC recommendations and research progress in various ongoing programs were reviewed. The meeting ended with finalization of recommendations.


Dr. B.B. Mallick conducting the RAC meeting

RAC visiting farm

## Annual Review of AICRP on Poultry Breeding and Poultry Seed Project organized

The Annual Review Meeting of All India Coordinated Research Project (AICRP) on Poultry Breeding and Poultry Seed Project (PSP) was held during 13-14 September, 2019 at College of Poultry Production and Management (TANUVAS) at Hosur (Tamil Nadu). Dr.J.K.Jena, Deputy Director General (Animal Science) graced the occasion as Chief Guest. He appreciated the research work carried out by the participating centres under the scheme and urged upon the scientists to work hard to achieve the target of "Doubling Farmers Income". Dr.R.S.Gandhi, ADG (AP&B), ICAR, New Delhi emphasized on the need of large scale dissemination of superior backyard poultry by involving entrepreneurs and State Animal Husbandry Departments.

Dr.R.N.Chatterjee, Director, ICAR-Directorate of Poultry Research, Hyderabad, appraised about the genesis of project and its salient achievements.

Participants of the AICRP/PSP review meeting

DDG (FS&AS) and other dignitaries

DDG (FS&AS) chairing the meeting

ADG (AP&B) releasing the AICRP/PSP Annual report

He also presented the action plan for the next five years. The Annual Report for the Year 2018-19 was released during the occasion. Annual Progress made during 2018-19 for the twelve AICRP and twelve PSP Centres were presented by the respective Principal Investigator/ Incharges of the centre. The annual progress was reviewed and suitable suggestions were offered for improvement of the scheme.

Dr.T.Tensingh Gnanaraj, Registrar, TANUVAS participated in the review meeting. Earlier, Dr.K.Mani, Dean, College of Poultry Production and Management, Hosur delivered welcome address. Centre In-charges of 12 AICRP-PB and 12 Poultry Seed Project centres covering different states of the country, scientists from ICAR-DPR, Hyderabad and faculty of CPPM, Hosur participated in the review meeting.

## Institute Research Committee

The Annual IRC meeting for the year 2018-19 and half yearly IRC meeting for the year 2019-20 were held at the Directorate on 2nd May 2019 and 24th December 2019, respectively. Dr. R.N. Chatterjee, Director chaired both the meetings. Dr. Vineet Bhasin, Principal Scientist from ICAR Head Quarter, New Delhi graced the Annual meeting and offered valuable comments and

Annual IRC meeting in progress

Half yearly IRC in progress

suggestions on the targets and achievements of various projects. Principal investigators of various projects presented the research achievements during the respective periods. The Chairman, IRC suggested measures for overcoming the difficulties in achieving the desired targets.

## IAEC meeting

XXIII Institutional Animal Ethics Committee Meeting was conducted on 2nd March, 2019 at ICAR-DPR, Hyderabad, wherein proposals on animal experiments were reviewed and approved.

IAEC members visiting DPR farm

## Institute Management Committee

During the year 2019, three meetings (38th, 39th and 40th) of the Institute Management Committee were held under the Chairmanship of Dr. R.N. Chatterjee, Director on 6-3-2019, 30-4-2019 and 16-12-2019. Several issues concerning administration and finance were discussed and recommended for approval by Council. The research and extension activities at the Directorate were also discussed in the meetings.

## Institute Joint Staff Council

The Institute Joint Staff Council of the Directorate met twice during the year 2019. The 6th and 7th meetings of the 10th IJSC were held on 29th March, 2019 and 18th June, 2019, respectively. There were no specific agenda points for the meetings and general issues were discussed.

# 13 Seminars, Conferences, Workshops

## ICAR-DPR conducts Seminar on "Antimicrobial resistance"

A Seminar on "Antimicrobial resistance and its implications in poultry" was conducted on 31.7.2019 by ICAR-Directorate of Poultry Research, Hyderabad in collaboration with AP (Hyderabad) Chapter of Indian Poultry Science Association. Dr. K.M.L. Pathak, Former DDG (AS), ICAR has graced the occasion as the Chief Guest. Dr. R.N. Chatterjee, Director, ICAR-DPR has introduced the theme of the Seminar. Two invited lectures were delivered. Dr. K.S. Prajapati, Prof. & Head (retd.), AAU, Anand spoke on "Antibiotic usage in poultry production and the possibilities for their reduction in view of antimicrobial resistance" and Dr. M.R. Reddy, Prl. Scientist, IVRI, Izatnagar gave a talk on "Antibiotics in poultry production – the codex regulations, MRLs and their implications in development of antimicrobial resistance". At the end, Dr. V.R. Reddy, Prof. & Head (retd.), ANGRAU, Hyderabad, the Guest of Honor for the Seminar, concluded the proceedings. A total of 98 participants attended the event, which included the Scientific and technical staff from DPR; faculty and PG/PhD students from PVNR Telangana Veterinary University, scientists from NRC on Meat, senior poultry professionals, representatives and field veterinarians from the poultry industry.

Participants of the seminar


Dr. K.S. Prajapati delivering talk


Dr. K.M.L.Pathak addressing the participants

Dr. M. R. Reddy delivering talk

## Participation of Scientists in Seminars, Conferences, Workshops etc

| Sl. No. | Particulars of Conference/Seminar/ Workshop | Official(s) | Schedule | Venue |
|---|---|---|---|---|
| 1 | National Symposium on Animal Genetic Resources for Food and Social Security & XVI Annual Convention of society for conservation of Domestic Animal Biodiversity (SOCDAB) | Dr. L.L.L. Prince, Pr. Scientist<br>Dr. M. Shanmugam, Sr. Scientist | 07 February, 2019 | NBAGR, Karnal |
| 2 | XIV Agril. Science Congress on "Innovation for Agril. Transformation" | Dr. T.K. Bhattacharya, National Fellow<br>Dr. R.K. Mahapatra, Pr. Scientist<br>Dr. Chandan Paswan, Sr. Scientist | 20-23 February, 2019 | NASC Complex, New Delhi |
| 3 | Workshop on Mass spectrometry-based Metabolomics | Dr. N. Anand Laxmi, Pr. Scientist | 11-13 July, 2019 | Yenepoya University, Mangalore |
| 4 | Brainstorming Meet on "Upscaling the Backyard Poultry and strategies to improve its share in poultry production" | All the Scientists | 8-9 August, 2019 | ICAR-DPR, Hyderabad |
| 5 | Scoping workshop on ICAR-NAARM as a Think tank | Dr S.V. Rama Rao, Pr. Scientist<br>Dr. B.L.N. Reddy, Pr. Scientist<br>Dr. N. Anand Laxmi, Pr. Scientist | 31 August, 2019 | ICAR-NAARM, Hyderabad |
| 6 | International Conference on Recent Trends in Botany, Zoology, Microbiology & Biotechnology – Andhra Loyola 2019 | Dr. R.K. Mahapatra, Pr. Scientist<br>Dr. S.P. Yadav, Pr. Scientist | 01-02 November, 2019 | Vijayawada |
| 7 | Universal Academic Cluster International Conference | Dr. Anand Laxmi Pr. Scientist | 14-15 November, 2019 | Bangkok |
| 8 | Poultry Knowledge Day - 2019 | Dr. M.V.L.N. Raju, Pr. Scientist<br>Dr. T.K. Bhattacharya, National Fellow<br>Dr. R.K. Mahapatra, Pr. Scientist<br>Dr. D. Suchitra Sena, Pr. Scientist<br>Dr. Santosh Haunshi, Pr. Scientist<br>Dr. S.P. Yadav, Pr. Scientist<br>Dr. Shanmugam M, Sr. Scientist<br>Dr. T.R. Kannaki, Sr. Scientist<br>Dr. Chandan Paswan, Sr. Scientist | 26 November, 2019 | HICC Complex, Hyderabad |

| Sl. No. | Particulars of Conference/Seminar/ Workshop | Official(s) | Schedule | Venue |
|---|---|---|---|---|
| 9 | 4th National Workshop of Officer In-charge, Data Management, ICAR Research Data Repository for Knowledge Management | Dr. S Haunshi, Pr. Scientist | 10-11 December, 2019 | NASC, PUSA, New Delhi |
| 10 | IPSACON-2019, XXXVI Annual Conference of Indian Poultry Science Association | Dr. R.N. Chatterjee, Director<br>Dr. U. Rajkumar, Pr. Scientist | 11-13 December, 2019 | Durg, Chattisgarh |
| 11 | International Conference on Animal Nutrition (INCAN) 2019 | Dr. R.N. Chatterjee, Director<br>Dr. S.S. Paul, Pr. Scientist | 18 December, 2019 | WBUAFS, Kolkata |
| 12 | XXXV Annual Convention of the Indian Society for Study of Animal Reproduction (ISSAR) | Dr. M. Shanmugam Sr. Scientist | 18-20 December, 2019 | TANUVAS, Namakkal |

# 14 Distinguished Visitors

**Shri Giriraj Singh**
Hon'ble Minister of FAH & D,
Govt. of India, New Delhi

**Dr. Panjab Singh**
Former Director General,
ICAR, New Delhi

**Dr. J.K. Jena**
DDG (FS&AS),
ICAR, New Delhi

**Dr. Ashok Kumar**
ADG (AH),
ICAR, New Delhi

**Dr. K.M.L. Pathak**
Former DDG (AS),
ICAR, New Delhi

**Dr. B.B. Mallick**
Former Vice Chancellor,
WBUAFS, Kolkata

**Dr. C.S. Prasad**
Former ADG (AN&P),
ICAR, New Delhi

**Dr. V. Ayyagari**
Former Director,
PDP, Hyderabad

**Dr. K.T. Sampath**
Former Director,
NIANP, Bangalore

**Dr. S.T. Viroji Rao**
Registrar,
PVNRTVU, Hyderabad

**Dr. E. Raghava Rao**
Director of Research,
SVVU, Tirupathi

**Dr. A.K. Srivastav**
Chairman (Acting),
ASRB, New Delhi

**Dr. R.S. Gandhi**
ADG (AP&B),
ICAR, New Delhi

**Dr. S. Vaithiyanathan**
Director,
ICAR-NRC on Meat, Hyderabad

**Dr. H.R. Rehman**
Former DDG (AS),
ICAR, New Delhi

**Dr. A. Padma Raju**
Former Vice Chancellor,
ANGRAU, Hyderabad

**Shri Sandeep Sultania**
Secretary( Animal Husbandry),
Govt. of Telangana

**Dr. R.P. Sharma**
Former Director,
PDP, Hyderabad

**Dr. Arjava Sharma**
Former Director,
NBAGR, Karnal

**Dr. Y.N. Reddy**
Dean of Faculties,
PVNRTVU, Hyderabad

**Dr. Rick**
Professor,
Wageningen University, Netherlands

# 15 Personnel

## Research & Management Position

1. **Dr. R.N. Chatterjee,** Director (Acting)

## Scientific

1. **Dr. S.V. Rama Rao,** Pr. Scientist
2. **Dr. M.V.L.N. Raju,** Pr. Scientist
3. **Dr. B.L.N. Reddy,** Pr. Scientist
4. **Dr. N. Anand Laxmi,** Pr. Scientist
5. **Dr. Shyam Sundar Paul,** Pr. Scientist
6. **Dr. M.R. Reddy,** Pr. Scientist
7. **Dr. M. Niranjan,** Pr. Scientist
8. **Dr. U. Rajkumar,** Pr. Scientist
9. **Dr. R.K. Mahapatra,** Pr. Scientist
10. **Dr. D. Suchitra Sena,** Pr. Scientist
11. **Dr. Santosh Haunshi,** Pr. Scientist
12. **Dr. L. Leslie Leo Prince,** Pr. Scientist
13. **Dr. S.P. Yadav,** Pr. Scientist
14. **Dr. A. Kannan,** Pr. Scientist
15. **Dr. B. Prakash,** Sr. Scientist
16. **Dr. M. Shanmugam,** Sr. Scientist
17 **Dr. T.R. Kannaki,** Sr. Scientist
18. **Dr. K.S. Rajaravindra,** Sr. Scientist
19. **Dr. Chandan Paswan,** Sr. Scientist
20. **Dr. Vijay Kumar,** Scientist

## National Fellow

1. **Dr. T.K. Bhattacharjya,** National Fellow

## Administration

1. **Sri A.V.G.K. Murthy,** A.O.
2. **Sri C. Bagaiah,** A.F. & A.O.
3. **Smt. O. Suneeta,** P.S.
4. **Smt. R.T. Nirmala Veronica,** A.A.O.
5. **Sri R. Sudarshan,** J.A.O.
6. **Smt. T.R. Vijaya Lakshmi,** Assistant
7. **Smt. M. Kamala,** Assistant
8. **Sri Rajesh Parashar,** U.D.C.
9. **Sri L.V.B. Prasad,** U.D.C.
10. **Miss N. Siva Dharani,** L.D.C.
11. **Sri R. Ganesh,** L.D.C.

## Technical

1. **Dr. S.K. Bhanja,** C.T.O.(Farm Manager)
2. **Sri V.V. Rao,** A.C.T.O.
3. **Smt. Minakshi Dange,** A.C.T.O.
4. **Sri D. Pratap,** A.C.T.O.
5. **Sri J. Srinivas Rao,** A.C.T.O.
6. **Sri A. Ravi Kumar,** Tech. Officer

7. **Sri G. Rajeshwar Goud,** Tech. Officer
8. **Sri A. Subrahmanyam,** Tech. Officer
9. **Sri Md. Maqbul,** Tech. Officer (Driver)
10. **Smt. N.R. Dhanutha,** Sr. Tech. Asst.
11. **Sri M. Pantulu,** Sr. Tech. Asst. (Driver)
12. **Sri Md. Yousufuddin,** Sr. Tech. Asst. (Driver)
13. **Sri P. Santosh Phani Kumar,** Tech. Asst.

## Skilled Support Staff

1. **Sri Syed Mujtaba Ali**
2. **Sri D. Ashok Kumar**
3. **Sri N. Manyam**
4. **Sri K. Charles**
5. **Sri G. Narsimha**
6. **Sri Manzoor Ahmed**
7. **Sri D. Srinivas**
8. **Sri M. Narsing Rao**
9. **Sri V. Ravinder Reddy**
10. **Sri P. Shankaraiah**
11. **Sri K. Venkataiah**
12. **Sri D. Shiva Kumar**
13. **Smt. K. Vimala**

## Promotions

**Dr. L.L.L. Prince,** Sr. Scientist has been promoted to the next higher grade of Pr. Scientist w.e.f. 21-01-2016.

The following SSS personnel have been granted 3rd and Final Financial upgradation under MACPS:

**Sri Syed Mujtaba Ali,** SSS

**Sri D. Ashok Kumar,** SSS

**Sri N. Manyam,** SSS

**Sri K. Charles,** SSS

**Late Sri G. Vijay Kumar,** SSS (posthumously)

**Sri Md. Yousufuddin,** Tech. Assistant (T-3) (Driver) has been promoted to the next higher grade of Sr. Tech. Assistant (T-4) (Driver) w.e.f. 31-01-2019.

## New Joinings

**Sri P. Demudunaidu** has joined as Technician (T-1) on 11-01-2019.

**Sri Shivam Sachan** has joined as Stenographer Grade-III on 06-05-2019.

**Dr. M.R. Reddy,** Pr. Scientist has joined on 02-12-2019 on transfer from IVRI, Izatnagar.

**Dr. M. Niranjan,** Pr. Scientist has joined on 02-12-2019 on transfer from ICAR RC – NEH Region, Umiam, Meghalaya.

**Dr. K.S. Rajaravindra,** Sr. Scientist has joined on 02-12-2019 on transfer from North Temperate Regional Station (Central Sheep & Wool Research Institute), Garsa, Kullu.

**Dr. Vijay Kumar,** Scientist has joined on 11-12-2019 on transfer from Central Institute for Research on Goats, Makhdoom, Mathura.

## Resignations

**Sri P. Demudunaidu** has resigned to the post of Technician (T-1) on 15-03-2019.

**Sri Shivam Sachan** has resigned to the post of Stenographer Gr.-III on 20-07-2019.

# 16 Other Relevant Information

## Shri Giriraj Singh, Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying visits ICAR-DPR, Hyderabad

Shri Giriraj Singh, Hon'ble Minister of Fisheries, Animal Husbandry and Dairying, Govt. of India visited the Directorate on 5th October 2019. He was accompanied by Dr. J.K. Jena, DDG (Fisheries and Animal Sciences), ICAR. The Minister visited the hatchery, pure line and native breed farm, poultry waste management unit and Moringa cultivation farm and reviewed the progress. He appreciated the activities of the Directorate in developing several rural chicken varieties. Later, the Hon'ble Minister laid the foundation stone for committee hall.

Hon'ble Minister unveiling the foundation stone

Hon'ble Minister interacting with farmers and Scientists

Hon'ble Minister visiting the DPR farm

Hon'ble Minister distributing Kadaknath chickens to tribal woman farmer

Shri Singh interacted with tribal and scheduled caste farmer beneficiaries and distributed Kadaknath and Improved Aseel chickens alongwith other inputs under the Scheduled Caste Sub Plan and Tribal Sub Plan. During his interaction with the farmers, the Minister stressed upon rearing more number of low input birds under cluster mode with involvement of entrepreneur at village level. Shri Giriraj Singh urged the scientists to be result-oriented and work to cater to the needs of farmers and entrepreneurs. He stressed upon the need to develop suitable models incorporating measures for minimizing the feed cost such as vermicomposting and moringa cultivation for efficient rearing of low input birds to achieve the target of doubling the farmers' income.

## "Poultry Waste Management Unit" facility created at ICAR-DPR

Director, ICAR-DPR inaugurated the "Poultry Waste Management Unit" facility on 14th June, 2019 in presence of all the staff members of the institute. This facility was created for sustainable management of poultry waste through composting. Concept of Poultry Waste Management Unit was initiated with an aim to overcome the major issues in waste management such as accumulation of large amount of wastes, especially manure and litter, causing major environmental problem. Expected outcome is to produce environmentally safe, sustainable and economical technology for sustainable management of poultry waste for the production of compost.

Poultry waste management unit

Director, DPR discussing with scientists at the PWMU

## Agricultural Knowledge Management Unit

***NKN Connectivity:*** Leased line connectivity of 100Mbps under National Knowledge Network (NKN) has been maintained with suitable firewall hardware. Backup connectivity with BSNL leased line is also maintained for continuous connectivity without interruption.

***Payment Gateway:*** Payment Gateway link has been updated in DPR webpage. Online payment through State Bank Collect pertaining to "Booking or purchase of germplasm" and "Unspent advances (TA/ LTC / Contingency) by DPR staff" has been provided in the webpage.

***ICAR-DPR Mobile App:*** An Android mobile App has been developed in English named "ICAR-DPR". It provides information about Institute, Director, Staff, Chicken Germplasm developed, Breeds and Lines, Technologies developed, AICPR on Poultry Breeding, Poultry Seed Project, Germplasm Availability and Price etc. The link of this app is available in the Google Play store as "ICAR DPR".

***DOR Profile film :*** Film on profile of DPR "DPR Marching ahead" is available in YouTube. This film is available in English, Hindi and Telugu.

***You Tube Link:*** https://www.youtube.com/channel/UCDL2gnmjtzabrxX39waOITA

QR code of App

## Farm Unit

The ICAR-DPR experimental farm has two units viz. Pureline and Commercial Units. Pureline farm is for the scientific research related to breeding, nutrition and health experiments whereas the commercial unit serves the purpose of technology transfer by means of producing commercial hatching eggs and other allied activities. During the current year, 2000 square feet floor space has been added in the form of vertical extension of

Modern Grower House. The monthly average of livestock reared in the farm was 27,053 birds. A total of 18,55,188 of eggs were produced, out of which 7,19,844 were hatching eggs and the remaining were table eggs.

## Experimental Hatchery

The experimental hatchery of the institute has the state of art equipment and infrastructure to carry out pedigree hatching of pureline populations as well as hatching and supply of improved germplasm developed by the Directorate to farmers, NGOs, Govt. agencies and other stakeholders. The Unit has 4 setters of 15,000 eggs capacity each and 4 hatchers of 9000 capacity each, besides the facility for fumigating the hatching eggs upon receipt from the Farm and a walk-in-cold room with storage capacity of 40,000 eggs. The Incubators have been fitted with data loggers to monitor and control humidity and temperature in the setters, hatchers and in cold room 24/7. During the year 2019, a total of 1,76,482 hatching eggs, 2,64,425 day old chicks, 40,269 parents and 8,814 grown up birds were sold/supplied to the farmers across the country. In addition, 5,183 embryonated eggs were supplied to different organizations for diagnosis and vaccine production.

## Feed Compounding Unit

The Feed Compounding Unit served as the Central Facility for supplying feed required for the various purelines and commercial stocks of the Directorate. The raw materials, like maize, soyabean meal, DORB, shell grit, vitamins, minerals etc. were procured and balanced rations were compounded for chick, grower and adult breeding stocks of layer, broiler and rural type of birds. During the year, a total quantity of 964.8 MT of feed was compounded and supplied to the experimental farm. In addition, 6.32 MT of feed was supplied to the farmers and beneficiaries under TSP and SCSP programs.

## Sales and Marketing Unit

The Sales and Marketing Unit was the core unit for coordinating and undertaking various activities related to sales and marketing of hatching eggs and day-old chicks of parent stock and terminal crosses of germplasm developed by the Directorate. Besides, the birds culled in the breeding programme, dressed birds and surplus eggs for table purpose were sold for table purpose to the consumers. The grownup birds of about

DPR Sale counter

4-6 weeks age were supplied to the farmers for rearing purpose.

## Library and Information Centre

The Library of the Directorate has an impressive collection of literature on poultry Science and related subjects. At present, more than 800 books on different aspects of poultry science, livestock as well as other general subjects are available in the library. The library is subscribing six foreign journals and six Indian research journals to keep the scientists and technical staff abreast of the latest scientific and technical developments. Additionally, the library subscribes general magazines, six newspapers in Hindi, Telugu and English (two from each language) and Employment News for the benefit of staff and visitors. This library is an active partner of CeRA (Consortium for e-Resources in Agriculture) and provides single point search for consortia subscribed, Library subscribed and open access journals to its users under institute's IP addresses. The Library facilities are also offered to the officials and students of the Veterinary Colleges, Universities, researchers and other ICAR Institute officials for their reference work. The library also provides document delivery services to users of ICAR Institutes, SAUs and other participating Institutions on their request. Besides this, the library is also equipped with good reprographic facilities like color and black & white copiers, scanner and binding facilities, which are routinely availed by the staff and other visitors.

## Hindi Implementation Activities

The Directorate conducted the quarterly meetings of Official Language Implementation Committee on 27-03-2019, 27-06-2019, 22-08-2019 and 17-12-2019, in which different issues related to effective implementation of Hindi Language in office were discussed. The Directorate also conducted


Hindi Pakhwada function

four Hindi workshops on 23-03-2019, 27-06-2029, 7-09-2019 and 18-12-2019 for upgrading the Hindi skills of staff in day to day official work. The Directorate also celebrated "*Hindi Pakhwada*" celebrations during 03-16 September 2019 and Hindi Day on 16th September 2019. During these celebrations, different literary competitions were conducted for the staff. Dr. Akanksha Shukla, Associate Professor, NIRDPR, Rajendranagar, Hyderabad graced the occasion as the Chief Guest and she emphasised the importance of Hindi language and its history. All the winners/ runners of different competitions were awarded with cash prizes and certificates on this occasion. Three staff members of the Directorate have also passed *"Prabodh Hindi"* Training Course during October 2019, which was conducted by Central Hindi Teaching Scheme, Hyderabad.

## Swachh Bharat Activities

The Directorate conducted cleaning activities within and outside the institute premises once in a week. The International Yoga Day was conducted on 21st June, 2019 where the staff of the institute actively participated at NAARM campus. For the utilization of clean energy, installation of Rooftop Solar panels was being initiated for which required funds were deposited with CPWD. Conducted "*Swachhta Hi Sewa Campaign*" from 15th September – 2nd October, 2019, under which different activities were conducted like "*Swachhta Hi Sewa*" pledge was taken by the staff, Swachh Bharat Quiz was organized, plantation was done by the staff, formed human chain in public place by the staff members to spread awareness about Swachhta among general public. "*Swachhata Pakhwada*" was organised from 16th December – 31st December, 2019. Organized Kisan Diwas on 23rd December, 2019 where the staff members visited the village Hanuman nagar, near Rajendranagar and shared knowledge about Swachhata, compost preparation, minimizing the use of plastics etc.


Constitution Day celebration-Rally by staff

Cleaning activity at village

Prize distribution to school students

Constitution Day Celebration - Reading Preamble

## Independence Day and Republic Day

The Directorate celebrated the Republic Day on 26th January 2019 and Independence Day on 15th August 2019. Dr. R.N. Chatterjee, Director hoisted the National Flag and addressed the staff of the institute and their families.

Director, DPR Dr. R.N. Chatterjee addressing the staff on the Republic Day

Director, DPR planting a sapling

## National Science Day

ICAR-DPR celebrated National Science Day on 28 February, 2019. To commemorate this occasion, a host of activities were organized. Dr. R. N. Chatterjee, Director inaugurated the poultry exhibition, in presence of invited guest speakers and school children from various schools. School students were explained about scientific


National Science Day celebrations

School children depicting models on Science Day

poultry rearing. In the poultry exhibition, school students exhibited models on different scientific themes related to climatic change, cleanliness etc. Posters on institute's research activities were also displayed. Guest speakers delivered lectures on the topics of "Artificial Intelligence and IOT and their applications in poultry rearing". At the end, prizes and appreciation certificates were distributed to school students by the Director for exhibiting scientific models.

## Institute Foundation Day

ICAR-DPR celebrated its 32nd Foundation Day on 1 March, 2019. Dr. Ashok Kumar, ADG (Animal Health), ICAR, New Delhi was the Chief Guest. He visited the poultry exhibition and labs of the institute. Dr. R. N. Chatterjee, Director ICAR-DPR welcomed the Chief Guest, Directors of


Dr. Ashok Kumar, ADG (AH), ICAR addressing the staff

Dr. Ashok Kumar, ADG (AH) interacting with school children at the exhibition

Director addressing the participants during the National productivity week celebration

different ICAR institutes located at Hyderabad, tribal farmers, and school children. Chief Guest, Dr. Ashok Kumar, applauded the achievements of the scientists of the institute. He emphasized on focused approach towards poultry research. Children from different schools invited on this occasion exhibited scientific models on different themes. On this occasion, games were conducted for the employees of this institute.

## National Productivity Week

ICAR- DPR celebrated National Productivity Week during 12-18 February 2019 with the aim to generate productivity consciousness among staff of the institute. Dr.R.N. Chatterjee, Director, inaugurated the programme and highlighted the importance of the theme "Circular Economy for Productivity and Sustainability". Dr. K. Alwal Reddy, MD, Venkateshwara Hatcheries and Mr. Shravan Gattu, Senior Engineer, Viven Farms Pvt. Ltd., Hyderabad spoke on topics "Practical aspects of poultry production" and "Usage of poultry waste" respectively. Different competitions such as essay writing, quiz and slogan writing were conducted for the staff during the week.

## International Women's Day

ICAR - DPR celebrated International Women's Day on 8 March 2019.The Director of the institute chaired the meeting and also spoke on the varied responsibilities of the working women. Women employees of the institute discussed issues related to welfare, grievances etc. Some of the employees gave a talk on women's contribution in different fields for the wellbeing of the society.


National productivity week celebration

Director with women staff











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