वार्षिक प्रतिवेदन
Annual Report
2023




भाकृअनुप – कुक्कुट अनुसंधान निदेशालय
ICAR - Directorate of Poultry Research
Rajendranagar, Hyderabad - 500 030

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Rajendranagar, Hyderabad - 500 030, Telangana, India.

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QR codes of social networking sites of ICAR-DPR, Hyderabad

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Adult Ducks

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PREFACE

I am immensely happy to put forth the achievements of the Directorate for the year 2023 through this Annual Report. The Directorate dedicatedly carried out the mandated activities of the Institute in its efforts to serve the poultry farmers, entrepreneurs and other stakeholders of the country.

The pedigreed populations of different pure lines and native chicken germplasm are maintained and improved for multiple economic traits of interest. A three-way cross (DKH) was evaluated at farm conditions for different production parameters. A complete, high-quality de novo genome for the Kadaknath breed has been successfully assembled at the chromosomal level. Research in biotechnology aimed in expressing transgenic protein under culture conditions which in future will be produced in live birds. Climate change is a very important happening affecting our lives. The contribution of poultry in this aspect was studied through life cycle analysis of layer and broiler production in representative places in different southern states of the country. Supplementing fibre hydrolyzing enzymes in broiler feed improved the commercial broiler performance. The relationship between different residual feed intake level and SNPs was explored. Using the power of AI and ML, non-intrusive technology development has been attempted. Effect of yeast supplementation on egg production during different laying periods was studied. As part of conservation the post-thaw live blastodermal cell population was improved through betaine supplementation in cryopreservation medium. Chicken Newcastle disease virus specific egg yolk immunoglobulins produced by hyperimmunization showed in vitro neutralization of vaccine as well as field ND strain. Using different extension methodologies, the technologies and research output were disseminated widely for different stakeholders.

At the Regional Station of the Directorate several research developments had occurred that addressed to increase productivity of ducks. It is noteworthy that promising duck crosses with better egg production were evaluated. Gonadal transplantation between species have been evaluated paving the path for biobanking. The dietary protein level could be reduced to 18% in ducks leading to saving in feed cost. Furthermore, antibiotic sensitivity to common pathogen was evaluated. Overall, comprehensive research was carried with the aim of improving the production and productivity in the ducks.

The Directorate attracted funding from several external agencies such as DST-SERB, DBT, NICRA, etc. and from the industry to address different issues affecting the poultry production. The research findings were published in high impact peer reviewed journals, magazines and

electronic media to disseminate information to all the stakeholders.

The layer and broiler pure lines undergoing selection at different centres under AICRP on Poultry Breeding have shown consistent improvement in the principal traits over the years. Several location specific crosses were developed and few were evaluated in the field and at Random Sample Broiler testing facility. The Directorate also monitored the Seed centres and supplied the improved germplasm to the farmers.

The Directorate has organized several meetings and training programmes under DAPSC, DAPST, and Skill development programmes. The institute showcased different technologies by participating in exhibitions, melas, and farmers field programmes. A total of 3.16 lakhs germplasm including 60,203 parents were distributed by the Directorate to various beneficiaries. A total of Rs. 253.36 lakhs revenue was generated during the year. The AICRP centres supplied 10.4 lakhs germplasm and generated revenue of Rs. 343.65 lakhs.

I am extremely grateful to Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR for his 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. B. N. Tripathi, former DDG (AS), Dr. Joykrushna Jena, former DDG (AS), Dr. Raghavendra Bhatta, DDG (AS), Dr.G.K.Gaur, ADG (AP&B) and other scientific and administrative staff of ICAR headquarters for their help and support from time to time. I am thankful to the scientific, technical, administrative and supporting staff of this Directorate and those working in the AICRP centres, who have been working hard for the welfare of poultry farmers. I thank the editorial team for bringing out this Annual report in an appreciable manner.

Date: 21 May, 2024

(R.N. Chatterjee)
Director

CONTENT

ABBREVIATIONS

AAU	Anand Agricultural University/Assam Agricultural University
AICRP	All India Coordinated Research Project
ARS	Agricultural Research Service
AFE	Age at first egg
AGP	Antibiotic growth promoters
AMR	Antimicrobial resistance
ASM	Age at Sexual Maturity
BW	Body Weight
BWG	Body weight gain
CARI	Central Avian Research Institute
CBH	Cutaneous Basophile Hypersensitivity
CD	Control diet
CMI	Cell mediated immunity
CP	Crude Protein
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
EM	Egg mass
EP	Egg Production
EW	Egg Weight
FCR	Feed Conversion Ratio
g	Gram(s)
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
LC	Layer Control
LP	Lipid Peroxidation
MANAGE	National Institute of Agricultural Extension Management
MD	Marek's Disease
ME	Metabolizable Energy
mm	Millimeter(s)
NAARM	National Academy of Agricultural Research Management
NCBI	National Center for Biotechnology Information
NDV	Newcastle Disease Virus
NGO	Non-Governmental Organization
NIRDPR	National Institute of Rural Development & Panchayat Raj
Nos.	Number
NPP	Non-Phytate Phosphorus
NRC	National Research Centre
OUAT	Odisha University of Agriculture and Technology
PCR	Polymerase Chain Reaction
PHA-P	Phytohemagglutinin-P
PJTSAU	Professor Jayashankar Telangana State Agriculture University
ppm	Parts Per Million
QRT	Quinquennial Review Team
RAC	Research Advisory Committee
RC	Rural Control
RBC	Red Blood Cell
RTC	Ready to cook
SAU	State Agricultural University
SL	Shank Length
PVNRTVU	P.V. Narasimha Rao Telangana Veterinary University
SEP	Survivor's Egg Production
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

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 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 2023 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

The pure line populations of PD-1, PD-3, RIR and Aseel were evaluated for important economic traits during the year 2023.

The PD-1 population was regenerated in a pedigree mating with selection index as selection criterion in S-1 generation using 50 sires and 250 dams. The S-1 generation was evaluated for growth and production traits in the year 2023. The fertility and hatchability were 79.06% and 89.91% (TES) and 71.15% (TES). The least squares mean for body weight and shank length at 6 weeks of age was 696.8±11.56 g and 78,64±1.5 mm, respectively. The selected population of PD-1 (367 hens) was evaluated for production traits. The LSMs for 20 and 40 week body weight was 2212±10.03and 2997±17.22 g, respectively. The ASM was 173.1±0.79 days. The 40 week egg production was 55.24±1.12 eggs with 59.76 ± 0.19 g egg weight. The body weight and egg production increased significantly in the S-1 generation.

In PD-2 line during the S-19 generation, the production traits were assessed up to 52 weeks of age. Over the previous seven generations, the response to a 50-week egg mass was 176.82 g on a phenotypic scale and 152.85 g on a genetic scale. The S-20 generation was reproduced by random mating. The fertility was 86.04% and hatchability on total and fertile eggs set was 80.16% and 93.16% respectively.

The PD-3 line was evaluated for growth and production performance up to 40 weeks of age during S-11 generation. The least squares mean for body weight at 4 and 6 weeks were 180.4±1.17 and 353.2±1.5 g, respectively. The corresponding shank length was 45.30±0.12 and 58.64± 0.12 mm, respectively. The juvenile body weight and shank length increased compared to the last generation.

The three generations data were analyzed using REML animal model for juvenile traits. Generation and hatch had significant effect on body weight and shank length. The generation and hatch and their interaction had significant effect on all the parameters. The ASM was 160.9 ±0.53 days in S-11, which reduced in desired direction compared to the previous generation. The least squares mean for body weight at 20 and 40 weeks were 1476±7.21 and 1840±7.57 g, respectively. The egg weight at 40 weeks was 56.89±0.2 g. The part period egg production at 40 weeks of age was 90.34±0.96 eggs, which decreased marginally from previous generation (93 eggs). The heritability estimates for EP 40 was 0.13 from sire & dam components variance. The egg mass at 40 weeks of age was 5342 g, which decreased marginally from the last generation.

During the S-12 generation of PD-6 line the production traits were evaluated up to 40 weeks of age. The ASM, 20-week body weight, 40-week body weight and egg weight at 28, 32, 36 and 40 weeks of age were 178.22±0.08 days, 2396.07±0.84g, 2579.27±0.78g, 49.33±0.01g, 52.85±0.01g, 53.83±0.03 and 55.03±0.02g,

respectively. The egg production at 40 weeks of age was 64.05±020. The S-13 generation was reproduced by pedigree mating. The fertility was 87.94% and hatchability on total and fertile eggs set was 80.14% and 91.13%.

The base generation of RIR was evaluated for growth and production performance up to 40 weeks of age. The ASM was 147.3±2,34 days in base generation. The body weight at 20 and 40 weeks were 1668±22.10 and 1807±33.17 g, respectively. The egg weight at 40 weeks was 54.88±0.57 g. The part period egg production at 40 weeks of age was 92.97±2.46 eggs.

Native chicken populations

Aseel population was regenerated in G-10 generation randomly limiting AI within plumage patterns. A total of 1109 chicks were produced in three hatches. The fertility was 68.78% and hatchability was 90.08 (FES) and 62.0 (TES). The body weight at 4 and 6 weeks of age was 114 and 321 g, respectively. Aseel chicken was evaluated up to 40 weeks of age for growth and production traits in G-10 generation. The ASM was 216 days. The 20 and 40 week body weight of hens was 1285 and 1838 g, respectively. The corresponding body weight in cocks was 1754 and 3063 g respectively. The egg weight was 43.97 g at 40 weeks of age. The part period egg production up to 40 weeks of age was 20.28 eggs, which increased marginally by 2 eggs from the previous generation.

Kadaknath, an indigenous chicken, breed was evaluated for egg production performance up to 72 weeks of age in the G-3 generation. Egg production up to 40, 64 and 72 weeks of age were 81.37±0.99 (391), 165.5±2.74 (74) and 201.4±4.12 (70) eggs, respectively. Egg weights at 40 and 72 weeks of age were 44.49±0.15 (326) and 48.76±0.46 (63) g, respectively. Bodyweight at 72 weeks was 2,550±43.1 (41) and 1,714±33.6 (74) g in males and females, respectively. There was an increase of 12.7 eggs in the annual egg production of Kadaknath as compared to G-2 generation. G-4 generation of Kadaknath was regenerated by pedigreed random matting. A total of 40 sires and 79 dams were utilized in the regeneration. About 1,184 eggs were set and 1,027 good chicks were produced in 3 hatches. Fertility was 96.54%. Hatchability on the total egg set and fertile egg set were 88.18 and 91.34%, respectively. The overall means of body weights at 0 day, 4, 8 and 16 weeks of age were 30.68, 179.7, 456.6 and 1,073 g, respectively. There was an improvement in body weights over the previous generation in body weight at 4 weeks. The average body weight of males and females at 16 weeks of age were 1,251 and 933.7 g, respectively.

Vanashree, evolved from Aseel (PD-4), is being improved for body weight through individual selection in males and for egg production up to 40 weeks of age through independent culling level selection in females. The production performance of *Vanashree* birds during the S-13 generation was evaluated up to 40 weeks of age. Age at sexual maturity, age at 50% production and age at peak production (66.02%) were 176.1±0.88, 187.5, and 210 days, respectively. Hen housed, hen day and SEP egg production up to 40 weeks were 53.8±1.21, 54.18, and 54.66±1.22 eggs, respectively. There was an increase of 4.39, 2.74 and 4.03 eggs in HHEP, HDEP and SEP respectively up to 40 weeks in this generation. Egg weights at 28, 32, 36 and 40 weeks were 45.28±0.22, 46.91±0.20, 47.94±0.25, and 48.22±0.32 g, respectively. Egg weights have increased as compared to the previous generation. Egg mass up to 40 weeks of age was 2594±58.52 g. Egg mass increased by 170 g as compared to the previous generation. The body weight of cocks and hens at 40 weeks was 2829±20.9 and 2003±12.39g, respectively. The shank length of cocks and hens at 40 weeks was 132.1±20.9 and 106.5±0.23 mm, respectively. The liveability observed during 21-40 weeks of

age in hens and cocks was 95.81 and 96.55%, respectively. A total of 50 sires 134 dams contributed progenies to the S-14 generation. A total of 996 good chicks of *Vanashree* in the S-14 generation were hatched in three hatches. The average fertility was 86.01% and the hatchability on fertile and total eggs set was 85.46 and 73.40%, respectively. The growth traits of *Vanashree* were evaluated up to 8 weeks of age. The body weight and shank length of pullets at 20 weeks of age were also recorded. The body weight of females at 20 weeks improved by 26 g while shank length improved marginally. The body weight of males was almost comparable to the previous generation while shank length was higher (1.9 mm) than the previous generation.

Ghagus, an indigenous chicken breed is being conserved and improved for body weight at 8 weeks of age. The S-5 generation of *Ghagus* was evaluated for production traits from 21 to 40 weeks. Age at sexual maturity, hen housed, hen day and survivors' egg production up to 40 weeks of age were almost similar to those recorded in the S-4 generation. Similarly, the egg weights at different ages and 40 weeks egg mass were almost similar to those observed during the previous generation. Higher liveability was observed during 21-40 weeks in hens (96.62%) as compared to the males (93.90%). A total of 49 sires and 137 dams contributed progenies to the S-6 generation. A total of 784 pedigreed chicks were hatched in S-6 generation in two hatches by pedigreed hatching. The average fertility recorded was 85.12% and the hatchability on fertile and total eggs set was 85.38 and 72.68%, respectively. The S-6 generation of *Ghagus* birds was evaluated for growth traits up to 8 weeks of age.

In G-10 generation of *Nicobari* the pedigreed population was produced in two hatches by mating 80 sires with 247 dams resulting in 965 good chicks. The fertility recorded was 85.69%, while hatchability on fertile and total egg set was 93.09 and 79.77%, respectively. The body weight and shank length of G-10 generation pullets at 20 weeks of age was 1137±10.4g (N=303) and 79.49±0.61 mm (N=303), respectively. While those of cockerels were 1437±16.6g (N=139) and 87.09±1.12 mm (N=139), respectively. The body weight of cocks and hens at 40 weeks was 2026±23.38 (N=143) and 1505±13.1 g (N=279), respectively. The shank length of cocks and hens at 40 weeks was 87.65±1.13 (N=143) and 78.74±0.70 mm (N=279), respectively. The production performance of the *Nicobari* breed in the G-10 generation was evaluated up to 40 weeks of age. The ASM in this generation increased by 17.7 days.

Broiler populations

The S-2 generation (random bred) of PB-1 was evaluated for juvenile growth traits. The overall means for body weight at 0 day, 2, 4, 5 and 6 weeks of age were 40.23, 270.9, 788.9, 1,037 and 1,313 g, respectively. Corresponding performance for the hatch-1 were 40.44, 279.3, 795.0, 1,201 and 1,275 g, respectively. The average body weight at 20 weeks in females was 2,747 g. The ASM was 154.01 days and there is a reduction as compared to the previous generation (169.74 days). Egg weights at 28, 32, 36 and 40 weeks of age were 50.38, 54.65, 56.46 and 58.33 g, respectively. Egg production up to 32 and 40 weeks of age was 41.07 and 73.38 eggs. The PB-1 population had undergone random mating (pooled semen) for the last two generations, and the flock was regenerated by pedigree matting by utilising 60 sires and 240 dams to produce S-3 generation. A total of 2,884 good chicks were obtained in two hatches. Fertility was 91.04%. Hatchability on total egg set and fertile eggs set was 81.34 and 89.35%, respectively.

The S-1 generation of PB-2 was reproduced by random mating. Percent fertility, Percent hatchability on total eggs set (HTES) and percent hatchability on fertile eggs set (HFES) respectively were 92.19, 86.28 and 93.59. A total

of 3344 good chicks were obtained. Juvenile body weights at 4 weeks, 5 weeks, 6 weeks and shank length at 5 weeks respectively were 661±1.20g, 980±2.82 g, 1260±4.30 and 79.98±0.30 mm. Adult performance traits i.e ASM, 20 weeks BW, 40 weeks BW, 28 weeks EWT, 32 weeks EWT, 36 weeks EWT, 40 weeks EWT and 40 weeks egg production respectively were 159 days, 2415 g, 3079 g, 48.70 g, 53.96 g 55.89 g 57.30 g and 57.76 eggs.

The S-20 generation of Dwarf gene line was regenerated by random mating. The percent fertility, percent Hatchability on total eggs set (HTES) and hatchability on fertile eggs set (HFES) respectively were 83.15, 69.81 and 83.96. A total of 377 good chicks were obtained. Juvenile traits like 4 weeks BW, 6 weeks BW and 6 weeks shank length respectively were 481±1.42 g, 791±2.81 g and 78.36±0.78 mm. Adult performance traits like ASM, 20 weeks BW, 40 weeks BW, 28 weeks EWT, 32 weeks EWT, 36 weeks EWT, 40 weeks EWT and 40 weeks egg production were 166.94 days, 1782 g. 2408 g, 44.35 g, 47.64 g, 47.13 g, 52.24 g and 46.28 eggs.

The G-21 generation of the control broiler line was evaluated for juvenile growth traits. Average body weight at day old, 2, 4, 5, and 6 weeks of age were 36.79, 189.4, 565.5, 809.6 and 975.3 g, respectively. The shank length and breast angle at 5 weeks of age were 76.53 mm and 73.98^0 respectively. The average body weight in females at 20 weeks was 2,061 g. The ASM was 188.3 days. Egg weights at 28, 32, 36 and 40 weeks of age were 48.59, 53.43, 53.54 and 55.09 g, respectively. Egg production up to 32 and 40 weeks of age was 29.71 and 66.44 eggs. Utilizing 50 sires and 231 dams, regenerated the G-22 generation through pedigreed random mating.

Layer populations

Two elite lines of White Leghorn *viz*. IWH and IWI are under selection for higher egg production up to 64 weeks of age while rest of the lines including IWD, IWF, IWN, IWP, IWK and LC (Layer control) are being maintained through random breeding. The production and growth traits were evaluated up to 64 weeks for IWD, IWF, IWN and IWP lines whereas this data was available up to 52 weeks in IWI and IWK and up to 40 weeks in IWH and LC populations. Egg production up to 40 weeks (EP40) was highest for the selection line IWH (123.22±1.22) and it registered an increase of about 5% over the previous generation mean. The average egg production up to 40 (EP40) and 52 weeks (EP52) for another selection line IWI was 103.81±1.57 and 168.65±2.14 eggs respectively. Egg weight at 40 weeks for IWI and IWH lines was 52.10±0.24 g and 51.37±0.22 g respectively.

The posterior heritability estimates of egg production traits in IWH line were estimated using Bayesian approach. Results revealed that egg production during different phases of laying cycle is a low to medium heritability trait with EP68 (0.076±0.052) showing the lowest and EP36 (0.225±0.056) showing the highest estimate.

A three-way cross (DKH) developed from IWH, Kadaknath and Dahlem Red during 2021-22 was being evaluated for the second time under farm condition. The DKH birds are multicoloured with thin shanks and medium build body conformation. The 20-week body weight of cocks and hen was 1683.54±10.88 and 1196.71±8.96 g, respectively. The ASM was 159.62±0.91 days. There was increase in the ASM in the current generation compared to the first generation. The 40 and 52 weeks egg production was 82.13±1.49 and 142.26±2.54 eggs, respectively. There is slight reduction in egg production compared to previous generation. The egg weights at 28, 40 and 52 weeks was 50.14±0.28, 54.60±0.41 and 57.19±0.40 g, respectively. There is an increase in egg weights in the present generation.

Molecular genetics

A complete, high-quality de novo genome for the female Kadaknath breed has been successfully assembled at the chromosomal level using PacBio Sequel II, Illumina resequencing, and HiC data. The data has been submitted to the SRA archives at NCBI for future reference (SRR22827208, SRR23072454, SRR23072455 SRR23072635 and SRR23072636). A total of 670 scaffolds have been obtained and were appropriately assigned to their respective chromosomes. The assembly contains all the 41 autosomes, W and Z sex chromosome and also complete mitochondrial genome.

To analyze the genetic diversity and population structure of two native duck populations, Kuzi from Odisha and Chemballi from Kerala, eight divergent individuals (four males and four females) were collected from each population for whole genome re-sequencing. The clean reads were aligned against the reference genome (ZJU1.0) from NCBI using the Burrows–Wheeler aligner (BWA) software (version 0.7.17-r1188). The percentage of aligned reads for each sample is >99%. The datasets have been archived with NCBI under the accession number BioProject PRJNA1060887 and PRJNA1060886.

The bLf was characterized from the milk samples collected from Sahiwal and Crossbred cattle. The expression studies in the milk samples using qPCR concluded that the expression of bLf gene was 11.31 folds higher in the Sahiwal cattle population in comparison to crossbred cattle population during mid-lactation stage. The transgene construct for expression of bovine lactoferrin protein in eggs of transgenic chicken was prepared. Similarly, transgene construct for expression of bovine lactoferrin protein in muscle cells of transgenic chicken was developed and expressed in chicken fibroblast and magnum cell culture.

The differentially expressed miRNAs in the right and left ovaries of Kadaknath chickens at the embryonic day 18.5 stage was studied. Differential expression analysis revealed 106 miRNAs exhibiting significant differences in expression. Among them, 42 miRNAs were up regulated, while 64 were down regulated in the right ovary compared to the left ovary. Notably, gga-miR-1560-3p displayed a substantial upregulation, while gga-miR-148a-3p exhibited a significant downregulation. Enrichment analysis of the target genes associated with upregulated miRNAs indicated signalling pathways in driving the degeneration process of the right ovary. A total of 13 LinRNAs that were expressed exclusively to right ovary were identified in chicken.

Nutrition

The current status of CO_2-eq for unit egg mass production (egg production X egg weight) in Andhra Pradesh was assessed during the current year. A total of 10 farms from East Godawari and West Godawari districts of Andhra Pradesh with different farm capacities were selected and data of various inputs utilized by egg layer sector were considered for the calculation of CFP in each farm. The farm size varied from 1 lakh to 5.5 lakh layers and the production period considered for calculation was 52 weeks (20 to 72 weeks of age). The average egg weight and total number of eggs produced in each farm during the production period were considered for the calculation of egg mass (EM). Carbon footprints of all inputs including feed composition, feed intake, water intake, electricity, diesel, coal and manure produced were utilized to calculate the FCP per unit of egg and egg mass in each farm. The value of CO_2-eq / egg produced ranged between 0.281 to 0.316 with a mean value of 0.297±0.0120, similarly, the CFP per kg egg mass ranged between 4.86 to 5.58±0.191 with a mean value of 5.26 kg/kg egg mass. The major contributing factor for the CFP in layers was feed (91%) and the remaining 4 variables represented about 9%.

Though the egg production in both the districts of Andhra Pradesh is as per the standard (300 to 315 egg/year) but the CFP was higher than the global average (3.7 kg/kg egg mass). The higher CO_2-eq could be primarily due to the use of higher concentrations of alternate feed ingredients like rice broken and DDGS as the major substitute for maize and soybean meal in layer diets (30-45%) in the region.

Three experiments were conducted on commercial broiler chicken to explore the benefits of supplementing fibre hydrolyzing enzymes with phytase, microbial protease at graded concentrations and supplementation of different microbial proteases to broiler diets having sub-optimal concentrations of protein (amino acids) to find out the possibility of reducing carbon footprints production and sustaining the broiler production. Fibre hydrolyzing enzyme supplementation significantly improved the commercial broiler performance and simultaneously reduced the calculated carbon footprints per kg broiler meat production. An experiment was conducted to sustain broiler performance and reduce carbon footprints (CFP) by feeding low CP diet (0.75%) supplemented with different sources of microbial proteases. The results suggest the possibility of reducing protein in the diet with microbial protease supplementation without reducing the body weight gain and reducing carbon footprint production.

The efficacy of protease enzyme and a probiotic-cum-prebiotic blend in improving the feeding value of Black soldier fly (*Hermetia illucens*) larva meal (BSFLM) was evaluated in commercial broiler chicken. The BSFLM was evaluated at 0, 7.5 and 15% levels with and without protease enzyme (200g/ton) in the diet of broiler chicks from 0-6 weeks of age. The overall results indicate lack of any beneficial effect of protease supplementation in broiler chicken fed BSFLM at graded levels upto 15%.

BSF larva meal was evaluated in the diet of broiler chicken at 0, 8 and 12% levels with and without a probioticcum prebiotic blend (300g/ton of feed) (PP blend). The blend had probiotic (1.25 billion CFU/g, *B.subtilis, B.pumilis, B.coagulans and B.polymyxa*) and herbal prebiotic (from *Zingiber officinalis* and *Curcuma longa*).The broiler chickens were fed the diets from 0 to 6 weeks of age. The overall results indicated that BSFLM at 8 and 12% depressed performance of broiler chicken and the supplementation of PP blend showed no beneficial effect in chickens fed BSFLM, except for reduction in the serum concentration of glutathione peroxidase and ALP.

Top 12 high residual feed intake (HRFI) and 12 low residual feed intake (LRFI) chickens were selected for genomic analysis using resequencing approach. There was no significant difference between HRFI and LRFI sub-groups in the initial body weights and the final body weights, nor the average daily gain (ADG). There were, however, significant differences in daily feed intake between the groups. Consequently, the difference in mean RFI values and the FCR between HRFI and LRFI chickens were highly significant. In this study, total of 32078790 putative SNPs were obtained from 24 samples. The variants belong to both HRFI and LRFI groups were filtered so as to only include those variants that are present on all the 12 samples of a particular group, along with having a minor allele frequency of greater than equal to 0.01. Total filtered variants were 673204 and 675861 in HRFI and LRFI groups, respectively. The filtered variants unique to LRFI samples, unique to HRFI samples and common to both groups were 410724, 408067 and 265137 respectively. Mitochondria level analysis indicated that 23 SNPs were unique to Low RFI samples, 5 SNPs were unique to high RFI samples and 76 SNPs were common to both the groups. High RFI group had 39,7 and 1507 low, moderate and modifier impact variants. Low RFI group had 2, 42, 14 and 1852 high, low, moderate and modifier impact variations.

Zinc oxide nano particles were biosynthesised using neem leaf extract and characterized for size, shape and other characteristics. The feeding value of this biosynthesised nano zinc was evaluated in comparison with inorganic and organic zinc on performance of commercial broilers. It may be concluded that the supplementation of either nano or organic Zn improved feed conversion efficiency, humoral immune response, antioxidant response and zinc status in comparison with inorganic zinc in commercial broiler chicken.

Using wireless IoT sensor network developed by Centre for Development of Advanced computing (C-DAC), Kolkata an experimental facility for collection of vocalization data of chicken was established at the Directorate. A model was developed for a non-intrusive methodology for continuously monitoring the welfare of birds by harnessing the power of AI and ML techniques. Furthermore, the vocalization signals of male and female one day old chicks were found to be different and these differences was used for identification of the gender.

A study was under taken to determine the feeding value of QPM hybrid in commercial broiler chicken at lower levels of dietary protein and lysine. The maize grains were subjected for evaluation of amino acid content to see the amino acid profile of normal maize and QPM hybrid. It was found that the crude protein, S containing amino acids, Lysine, Tryptophan and Arginine were found to be higher in QPM hybrid compared to normal maize. The feeding experiment was conducted in commercial broiler chicken by feeding QPM hybrid-based diets with reduced levels (2, 4, 6, 8%) of protein and lysine It was concluded that feeding diet with QPM hybrid (VLQPMH 59) at reduced levels of CP and lysine up to 4% maintained the performance and immune parameter in commercial broiler chicken.

Physiology

A study was conducted in White Leghorn layers during the laying period 24-36 weeks of age. The hens were divided in to three groups with equal number of 50 birds in each. From 24 weeks onwards basal feed based on maize and soybean @ 110 g/bird/d was offered to control group (C). The basal feed contained inorganic selenium @ 0.3 ppm which is routinely added at our institute and 0 ppm of organic selenium. Treatment groups were offered basal feed along with 0.3 ppm and 0.6 ppm of organic selenium (selenium enriched yeast) to T1 and T2 groups respectively throughout the course of the experiment. The lower concentration of the dose increased egg production significantly ($P< 0.05$) compared to control and T2 group. The higher concentration of the dose, increased body weight and transport of selenium significantly to muscles and egg. Both the concentrations had beneficial effect on the histo-morphology of the jejunum (portion of digestive tract). When the birds were in the mid phase of the laying period, the higher dose increased egg production more effectively than the lower dose.

The stage X blastodermal cells of Kadaknath were cryopreserved using 10% dimethyl sulphoxide (DMSO) and in the presence of 0.1 or 0.2M raffinose. The percent live cells during pre and post cryopreservation were evaluated. Raffinose had no effect on the percentage of post-thaw live cells. Similarly, antioxidants Tempol (1 and 5 mM), betaine (0.1, 0.2 and 0.4M) and ascorbic acid (25, 50 and 100µM) were evaluated. Tempol had no effect on the percentage of post-thaw live cells. Betaine at 0.2M concentration significantly ($P<0.05$) improved the post-thaw live cells. Ascorbic acid at 25 and 50µM doses had no effect, whereas, at 100µM concentration reduced the percent post-thaw live blastodermal cells.

During this period PGCs of Ankleshwar, Tellicherry, Mewari and Hansli were cryopreserved as part of conservation of native breeds.

Health

Pure line chickens were screened for ALV and 20.6% of the screened birds were found to be positive. A total of 1632 dead birds were necropsied and reasons for mortality were identified. *Escherichia coli* and *Staphylococcus aureus* were isolated and identified in milk samples of cattle and buffalo, rectal swabs of sheep and goat, cloacal swabs of poultry from four different districts. The highest resistance percentage and highest susceptibility percentage of *E. coli* and *S. aureus* isolates from different type of food producing animals for different antibiotics were identified.

Chicken Newcastle disease virus specific egg yolk immunoglobulins (IgY) produced by hyperimmunization with combination ND killed and live vaccination of WL chicken and purified from eggs through PEG precipitation method showed in vitro neutralization of vaccine as well as field ND strain.

Extension

Significant positive impact on attitude of the farmers was observed towards the poultry farming in Bihar due to constant support in terms of input and capacity development. These changes were observed in all the categories (SC, ST, OBC & General) of farmers and it the range of about 35-38%. Income of farmers was increased in tune of 200-380%, weekly egg consumption was increased in the range of 105-135% and monthly chicken consumption increased in the range 60-105% during the study period in different categories of farmers.

REGIONAL STATION, BHUBANESWAR

The regional centre is mandated to work on the improvement and popularization of duck. The centre is also involved in supplying superior ducks germplasm. The fertility and hatchability on fertile egg set in Kuzi ducks improved in S-4 generation in comparison to S-3 generation. The 8th week body weight which is the primary trait of selection was increased by 69 g in S-4 generation. Amongst the crosses both DK and KD produced well and were better than both the parents. The DW and WD crosses were better than White Pekin and all the crosses showed positive heterosis for the egg production up to 40 weeks of age. The Haugh units of egg ranges from 92.78 to 97.20 which indicates good quality of eggs in all the genetic groups. Inter-toxin interaction created more severe morbidity in Pekins, comparable to or higher than group receiving highest doses (6 ng) of AFB1. The Lysine and Methionine administered, *in ovo*, tended to ameliorate duckling's growth and feed efficiency, through improving fitness from 0 to 5 weeks of age. Under a Pilot study as a "Proof-of-concept" the experiment showed that gonadal transplantation at day-old age, can surpass species barrier (intra and interspecies), where it's evident that spermatogenesis progressed naturally, with simultaneous proliferation of transplanted Kadaknath testes and can opens up another vista for biobanking.

In order to study the effect of reduction of dietary protein level in White Pekin starter diet, an experiment was conducted by reducing the level of CP from standard recommended level of 22% to 20% & 18% and the level of lysine and Methionine were maintained through supplementation. It was observed that the CP level can be reduced to 18% without affecting the growth, feed utilization and FCR. An experiment was conducted to find out the effect of replacing wheat with cassava (*Manihot esculenta Crantz, Euphorbiaceae*) in the diet of White Pekin ducks for meat production and concluded that wheat can be replaced with cassava up to 50% level in the diets of white Pekin ducks for meat production. A study was conducted to find out the effect of supplementation of different levels of trace mineral mixture on the performance of White Pekin ducks for meat purpose and concluded that the trace mineral mixture can be supplemented

@ 100 g per 100 kg feed in the diet of White Pekin ducks for meat production. Earthworm production was standardized in brick chambers of dimension (3 ft length X 2 ft width X 2.5 ft depth). On an average, about 2.0 kgs (0.13 kg/cubic ft), 1.8 kg (0.12 kg/cubic ft.) and 1.4 kg (0.09kg/cubic ft) of earthworms were produced during a period of 75-90 days from 1st, 2nd and 3rd treatments, respectively. Proximate composition revealed that the crude protein, ether extract and total ash content of 1st treatment was higher than the 2nd treatment. However, the 1st treatment had lower crude fibre than 2nd treatment.

The *E coli* isolated from the samples collected from Regional station farm and in and around Bhubaneswar were most sensitive to enrofloxacin & ceftriaxone, moderately sensitive to amoxycillin, ciprofloxacin, colistin, neomycin. They were resistant to cephalexin, doxycycline, ofloxacin. Average duckling mortality was 18.9% during this period.

AICRP on Poultry Breeding

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

In the year 2023 Poultry Seed Project was merged with AICRP on Poultry breeding. The Poultry Seed Project (PSP) initiated by ICAR during the XI Five-year Plan. 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 BASU, Patna; ICAR-RC for NEH region, Nagaland centre, Jharnapani; ICAR-RC for NEH region, Gangtok; ICAR-RC for NEH region, Imphal; TANUVAS, Hosur; ICAR-CCARI, Panaji; ICAR-CIARI, Port Blair; SKUAST, Srinagar; PVNRTVU, Warangal; SVVU, Tirupati; ICAR-RC for NEH region, Umiam and WBUAFS, Kolkata. As a coordinating unit the Directorate supplies parent chicks, co-ordinates, and monitors the activities of different centres to aid them to achieve their set targets. The targets set for supplying chicks for mainland and north-eastern centres during the year 2023 were between 0.4 and 1.0 lakhs chicks per annum for different centres and to collect feedback on the performance of the germplasm under backyard farm conditions.

ICAR-DPR is the coordinating unit of the project and is maintaining pedigreed random bred control populations for layers and broilers. These control layer and control broiler populations are supplied to the centres from time to time as per their requirement. During the report period, samples of hatching eggs from these populations were supplied to different centres for estimating the genetic progress.

The Mannuthy centre evaluated the S-34 generation of IWN and IWP strains of White Leghorn. The S6 generation of Tellicherry Native chicken and S1 generation of Mannuthy Red Native chicken were completed. Anand (Gujarat) centre has evaluated native chicken

i.e. "*Ankaleshwar*" and White Leghorn strains (IWN, IWP, IWD, IWK and Control birds) during the year 2023. The Bengaluru centre evaluated S-16 generation of PB-1 and S-29 generation of PB-2 during the report period. Raja II coloured broiler from the centre participated in 57th Random Sample Broiler testing at Central Poultry Performance (CPPTC), Gurugram and stood at 4th (for body weight) and 3rd place (for FCR) among the participated broiler strains.

Ludhiana centre evaluated PB-1 and PB-2 lines and native chicken (*Punjab Brown*). The body weight at 5 weeks of age was 1225 and 1118 g in PB-1 and PB-2 respectively. Bhubaneswar centre evaluated the performance of pure lines CSFL and CSML and native *Hansli* chickens. ICAR-CARI, Izatnagar centre has evaluated the local native chicken along with CSML, CSFL lines and their crosses. Udaipur centre evaluated *Mewari* and *Pratapdhan* populations during the calendar year. AAU, Guwahati centre evaluated the *Kamrupa* variety, Indigenous, *Daothigir*, PB-2 and cross of PB- 2 x Indigenous chicken germplasm. Palampur centre evaluated the native chicken, Dahlem Red, DN cross and *Himsamridhi* during the year 2023. Tripura Centre evaluated the BND cross, *Tripura Black*, and Dahlem Red populations. Jabalpur centre evaluated G-2 and G-3 populations of *Jabalpur colour* and *Kadaknath*. BAU, Ranchi centre evaluated native chicken, Dahlem Red and *Jharsim* birds during the report period.

During the reporting period, under AICRP-PB, a total of 10,40,567 number of chicken germplasm was distributed to 14,113 farmer beneficiaries and the total revenue generated during the year was Rs. 343.65 lakhs.

Technologies transferred

The technologies and varieties developed at the institute were propagated widely throughout the country. A total of 83,478 hatching eggs, 2,32,894 day-old chicks, and 5,662 grown-up birds of *Vanaraja*, *Gramapriya*, *Srinidhi*, *Vanashree*, *Krishibro*, native chickens, etc. were supplied by DPR, to the farmers and different organizations including Government agencies across the country. In addition, 60,203 parent chicks of different varieties were also supplied.

From the AICRP centres, another 10,40,567 numbers of germplasm 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.

ICAR-DPR implemented the Development Action Plan for SC (DAPSC) in Telangana, Tamilnadu, Kerala and West Bengal during the year. Under the plan, on-field training programs were organized and farmer families were trained on different aspects of backyard poultry farming. Input distribution programmes were also organized in these states to enable Backyard Poultry Farming and improve livelihoods and nutritional security of SC families. The Directorate introduced improved chicken varieties and native chickens, with an aim to improve the economic and living standards of tribal farmers under the Scheduled Tribe Component Program. Grownup birds, night shelters, feeders and waterers were distributed to benefit the tribal farmers. To empower tribal farmers through Backyard Poultry Farming in NEH region, training and input distribution was implemented in the three states of NEH region viz. Arunachal Pradesh and Mizoram.

Other activities

During the year, a total of 33 research papers, 6 review papers, 7 popular/technical articles, 5 book chapters were published by the scientists of the institute. In addition, 15 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 the measures required for improvement in research, administration and financial management of the Institute. At the Directorate, the budget utilized during the period was Rs.3000.45 lakhs and at AICRP centers, Rs.1034.42 lakhs, respectively. A total revenue of Rs. 597.01 lakhs (DPR-253.36, AICRP- 343.65) was generated during the year 2023.

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 Network 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. The regional station, Bhubaneshwar was transferred from CARI to DPR during July 2020. Accordingly, the total scientific strength of DPR has increased to 33.

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. 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 north-eastern states including Jammu and Kashmir, Lakshadweep, and Andaman and Nicobar Islands. The Directorate also developed two crosses viz. *Krishibro*, a multi-coloured 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. and bioinformatics 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.

VISION

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

MISSION

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

MANDATE

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

Financial outlay (Rs. lakhs)

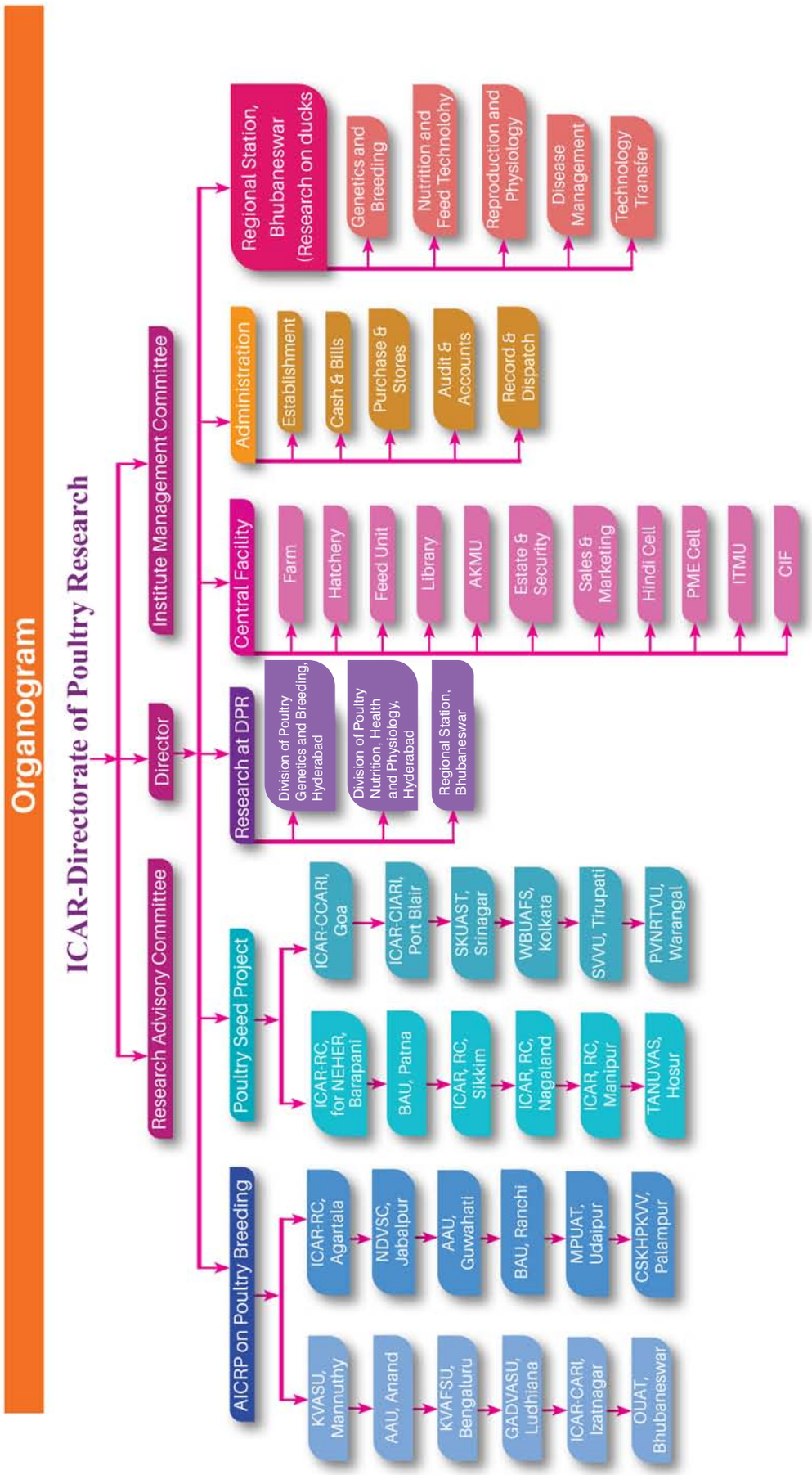
Component	Budget	Expenditure	Receipts
DPR	3000.45	3000.45	253.36
AICRP*	1034.42	1034.42	343.65

*From 01-04-2023 onwards PSP was merged with AICRP on Poultry. Hence only figures of AICRP on Poultry are furnished.

#Above indicated budget, expenditure and receipts figures are calculated proportionately from the allocations/ receipts of the years 2022-2023 and 2023-2024.

Staff position (as on December 31, 2023)

Cadre	Head Quarter, Hyderabad		RS. Bhubaneswar		Total	
	Sanctioned	In Position	Sanctioned	In position	Sanctioned	In position
RMP	01	01	-	-	01	01
HoDS	02	02	-	-	02	02
HoRC	00	00	01	01	01	01
Scientists	21	19	09	09	30	28
Technical	16	11	02	01	18	12
Admin.	22	07	01	01	23	08
Skilled Support	14	12	05	02	19	14
Total	76	52	18	14	94	66


Organogram
ICAR-Directorate of Poultry Research
Director
Research Advisory Committee
Institute Management Committee
AICRP on Poultry Breeding
KVASU, Mannuthy
AAU, Anand
KVAFSU, Bengaluru
GADVASU, Ludhiana
ICAR-CARI, Izatnagar
OUAT, Bhubaneswar
ICAR-RC, Agartala
NDVSC, Jabalpur
AAU, Guwahati
BAU, Ranchi
MPUAT, Udaipur
CSKHPKVV, Palampur
Poultry Seed Project
ICAR-RC, for NEHER, Barapani
BAU, Patna
ICAR, RC, Sikkim
ICAR, RC, Nagaland
ICAR, RC, Manipur
TANUVAS, Hosur
ICAR-CCARI, Goa
ICAR-CIARI, Port Blair
SKUAST, Srinagar
WBUAFS, Kolkata
SVVU, Tirupati
PVNRTVU, Warangal
Research at DPR
Division of Poultry Genetics and Breeding, Hyderabad
Division of Poultry Nutrition, Health and Physiology, Hyderabad
Regional Station, Bhubaneswar
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
Regional Station, Bhubaneswar (Research on ducks
Genetics and Breeding
Nutrition and Feed Technology
Reproduction and Physiology
Disease Management
Technology Transfer

Genetic improvement of rural parent lines and development promising chicken varieties suitable for free range poultry farming

The pure line populations of PD-1, PD-2, PD-3, RIR and Aseel were evaluated for important economic traits during the year 2023. PD-1 line was regenerated utilizing the selection index in S-1 generation.PD-2 line was evaluated in S-19 generation. PD-3 line was evaluated for growth and production performance during S-11 generation. RIR, a new female line was procured from Indbro research farms Pvt Ltd., Hyderabad was evaluated for production performance. Aseel was evaluated for growth and production traits

PD-1 line

PD-1 population was regenerated in a pedigree mating with selection index as selection criterion in S-1 generation using 50 sires and 250 dams. The S-1 generation was evaluated for growth and production traits in the year 2023.The fertility and hatchability was 79.06% and 89.91% (TES) and 71.15% (TES) in the base generation. The least squares mean for body weight and shank length at 6 weeks of age was 696.8±11.56 g and 78,64 ± 1,5 mm, respectively.

The selected population of PD-1 (367 hens) was evaluated for production traits. The LSMs for 20 and 40 week body weight was 2212±10.03 and 2997±17.22 g, respectively. The ASM was 173.1±0.79 days. The 40 week egg production was 55.24 ±1.12 eggs with 59.76 ± 0.19 g egg weight. The body weight and egg production increased significantly in the S-1 generation.

PD-2 line

PD-2 line is the female parent Vanaraja. Egg mass up to 52 weeks is the selection criterion. During the S-19 generation, the production traits were assessed up to 52 weeks of age. The means with standard deviations for ASM, body weight, egg weight, egg production, and egg mass up to 52 weeks of age (Table 1). Over the previous seven generations, the response to 50-week egg mass was 176.82 g on a phenotypic scale and 152.85 g on a genetic scale.

Table 1: Least square means production traits in PD-2 line (S-19) and Rural control

Traits	PD-2	Rural control
Age at Sexual Maturity (d)	166.04±0.0	185.32
Body weight at (g) 20wks	2540±1.23	2365.36
40wks	2602±1.05	2522.88
52wks	2842±1.02	2770.29
Egg weight at (g) 28wks	50.18±0.01	47.29
32wks	50.97±0.01	49.36
36wks	52.55±0.02	51.23
40wks	53.48±0.02	52.18
52wks	55.86±0.02	53.45

Traits	PD-2	Rural control
Egg Production(no.)		
40wks	80.87±0.99	68.28
52wks	132.40±1.02	113.42
Egg Mass (g) 52wks	7435.86±5.19	6037.59

The S-20 generation was reproduced by random mating. The fertility was 86.04% and hatchability on total and fertile eggs set was 80.16% and 93.16%. Total number chicks produced were 1836.

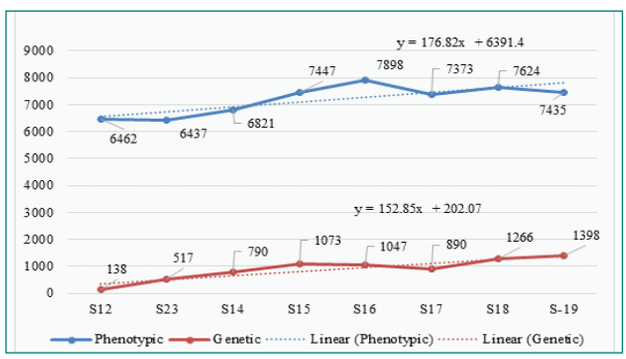


Fig.1 Selection response for Egg Mass up to 52 weeks of age in PD-2 line

PD-3 line

Juvenile performance

The population was evaluated for growth performance up to 60 weeks of age during S-11 generation. The least squares mean for body weight at 4 and 6 weeks were 180.4±1.17 and 353.2±1.5 g, respectively. The corresponding shank length was 45.30±0.12 and 58.64 ± 0.12 mm, respectively. The juvenile body weight and shank length increased compared to the last generation.

The three generations data were analyzed using REML animal model for juvenile traits. Generation and hatch had significant (P≤0.05) effect on body weight and shank length. The LSMs for body weight and shank length are presented in Table 2.

Table 2: Least squares means of body weight traits of PD-3 chicken

Particulars	Body weight, g		Shank length, mm	
	4 wks	6 wks	4 wks	6 wks
Overall	179.49 ± 0.52 (8643)	321.31 ± 0.83 (10,036)	45.12 ± 0.05 (8643)	56.65 ± 0.06 (10,036)
Gen	**	**	**	**
9	196.69 ± 0.75^{c} (3968)	329.90 ± 1.31^{b} (4046)	46.49 ±0.77^{c} (3968)	57.29 ± 0.10^{b} (4046)
10	157.55 ± 0.89^{a} (3002)	278.67 ± 1.55^{a} (3002)	43.32 ±0.91^{a} (3 002)	53.85 ± 0.12^{a} (3002)
11	180.37 ± 1.17^{b} (1673)	353.21 ± 1.50^{c} (2988)	45.30 ±0.12^{b} (1673)	58.64 ± 0.12^{c} (2988)

Particulars	Body weight, g		Shank length, mm	
	4 wks	6 wks	4 wks	6 wks
Hatch	**	**	**	**
1	187.94±1.03^{a} (1999)	361.22 ± 1.61^{d} (2607)	45.30 ± 0.11^{c} (1999)	60.13 ± 0.12^{d} (2607)
2	192.29 ± 1.21^{b} (1630)	330.31 ± 1.77^{d} (2377)	45.81 ± 0.12^{e} (1630)	57.25 ± 0.13^{c} (2377)
3	163.63 ± 1.13^{c} (1645)	289.65 ± 1.96^{b} (1661)	43.85 ± 0.12^{a} (1645)	54.07 ± 0.15^{b} (1661)
4	177.25 ± 0.96^{d} (2478)	317.12 ± 1.67^{c} (2483)	44.80 ± 0.98^{b} (2478)	55.10 ± 0.13^{b} (2483)
5	191.31 ± 1.53^{e} (891)	282.08 ± 2.64^{a} (908)	46.66 ± 0.16^{d} (891)	54.06 ± 0.20^{a} (908)

Production performance

The selected population was evaluated for growth and production performance up to 40 weeks of age during S-11 generation and the data were analyzed using REML animal model with generation and hatch as fixed effects. The results are presented in Tables 3-5. The generation and hatch and their interaction had significant effect on all the parameters. The ASM was 160.9±0.53 days in S-11, which reduced in desired direction compared to the previous generation. The least squares mean for body weight at 20 and 40 weeks were 1476 ±7.21 and 1840 ±7.57 g, respectively. The egg weight at 40 weeks was 56.89±0.2 g. The part period egg production at 40 weeks of age was 90.34 ± 0.96 eggs, which decreased marginally from previous generation (93 eggs). The heritability estimates for EP 40 was 0.13 from sire & dam components variance. The egg mass at 40 weeks of age was 5342 g, which decreased marginally from the last generation.

Table 3: Least square means for adult body weights in PD-3

Particulars	body weight at			
	16wks	20wks	40wks	ASM
Overall LSM	1244.92 ± 4.68 (2190)	1543.45 ± 3.83 (2014)	1821.61 ± 6.28 (1325)	154.18 ± 0.28 (2002)
Generation	-	**	**	**
9	-	1540.35 ± 6.82^{b} (685)	-	154.03 ± 0.50^{b} (685)
10	-	1615.02 ± 5.48^{c} (843)	1803.26 ± 7.57 (843)	147.63 ± 0.40^{a} (838)

Particulars	body weight at			
	16wks	20wks	40wks	ASM
11	1244.92 ± 4.68 (2190)	1475.75 ± 7.21[a] (486)	1839.97 ± **10.01** (482)	160.93 ± 0.53[c] (479)
Hatch	**	**	**	**
1	1400.83 ± 9.36[c] (542)	1547.15 ±7.49[b] (474)	1773.67 ± 12.44[a] (334)	152.86 ± 0.54[a] (475)
2	1269.21 ± 8.66[b] (634)	1520.68 ± 6.80[b] (627)	1830.17 ± 12.57[b] (337)	157.38 ± 0.50[c] (625)
3	1020.38 ± 9.48[a] (529)	1561.07 ± 8.26[b] (425)	1838.36 ± 12.51[b] (336)	156.21 ± 0.61[b] (418)
4	1289.27 ± 9.90[b] (485)	1547.96 ± 8.22[ab] (412)	1844.25 ± 12.69[b] (318)	151.27 ± 0.60[a] (408)
5	-	1534.00 ± 18.24[a] (76)	-	151.18 ± 1.33[a] (76)

Table 4: Least squares mean for egg weight and egg production in PD-3

Particulars	Egg weight, g			Egg production, no
	24 wks	28 wks	40 wks	40 wks
Overall LSM	47.28 ± 0.26 (320)	52.02 ± 0.10 (1970)	55.43 ± **0.10** (1984)	95.52 ± 0.51 (2011)
Generation	-	**	**	**
9	-	53.09 ± 0.17[c] (685)	55.71 ± 0.18[b] (685)	99.32 ± 0.91[c] (685)
10	-	50.07 ± 0.13[a] (838)	53.61 ± 0.15[a] (838)	95.94 ± 0.73[b] (838)
11	47.28 ± 0.26 (320)	52.63 ± 0.19[b] (447)	56.89 ± 0.20[c] (461)	90.34 ± 0.96[a] (488)
Hatch	**	**	**	**
1	47.96 ± 0.49[b] (86)	52.44 ± 0.19[b] (459)	54.07 ± 0.20[a] (468)	99.51 ± 0.99[b] (476)

Particulars	Egg weight, g			Egg production, no
	24 wks	28 wks	40 wks	40 wks
2	48.06 ± 0.52^{b} (78)	52.66 ± 0.18^{bc} (607)	55.10 ± 0.18^{b} (621)	95.04 ± 0.90^{ab} (626)
3	47.33 ± 0.61^{b} (56)	51.45 ± 0.20^{a} (423)	55.58 ± 0.22^{bc} (421)	94.66 ± 1.10^{a} (423)
4	45.77 ± 0.46^{a} (100)	51.12 ± 0.20^{a} (405)	56.26 ± 0.22^{c} (398)	92.61 ± 1.09^{a} (410)
5	-	53.25 ± 0.45^{c} (76)	57.54 ± 0.49^{d} (76)	96.28 ± 2.42^{ab} (76)

Table 5: Egg production at 40 weeks of age

Items^{+}	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
σ^2_a	58.54 ± 17.29	58.57± 20.45	76.97 ± 27.87	58.87 ± 20.04	58.55 ± 20.90	75.34 ± 28.92
σ^2_m	-	0.001± 9.34	2.13 ± 13.10	-	0.001± 11.60	2.30± 15.60
σ_{am}	-	-	-12.79± 16.63	-	-	-13.16 ±17.26
σ^2_c	-	-	-	0.01± 10.30	0.002± 12.78	1.88 ± 12.52
σ^2_e	399.90 ± 18.45	399.87± 18.53	392.18± 21.19	399.92 ±18.52	399.87± 18.73	391.93± 21.19
σ^2_p	458.43 ± 14.96	458.44± 14.96	458.49 ± 14.99	458.85± 15.01	458.44± 15.01	458.29± 14.98
h^2	0.13 ±0.04	0.13± 0.04	0.17 ± 0.06	0.13 ± 0.04	0.128 ± 0.045	0.16 ± 0.06
m^2	-	0.00± 0.02	0.01± 0.03	-	0.00 ± 0.03	0.01± 0.03
r_{am}	-	-	-1.000	-	-	-1.000
c^2	-	-	-	0.00± 0.022	0.00± 0.03	0.00 ± 0.03
h^2_T	0.13	0.13	0.13	0.13	0.13	0.12
AIC	14291.938 (best)	14293.938	14295.026	14293.94	14295.938	14296.996

The genetic and phenotypic response for egg mass and egg production are presented in Fig 2 and 3, respectively. The genetic and phenotypic response for EM 40 was 32.46 and 222 g and for EP40 was 0.75 and 3.09 eggs per generation, respectively over last 11 generations.

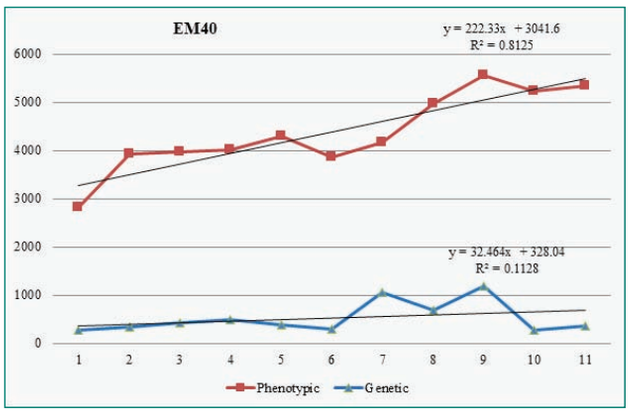


Fig 2. Selection response for egg mass at 40 weeks of age in PD-3 line

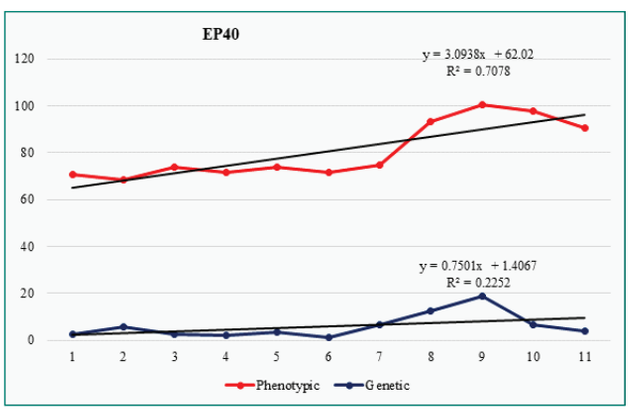


Fig 3. Correlated response for egg production at 40 weeks of age in PD-3 line

PD-6 line

The PD-6 line is developed from coloured random bred control population. This line is used as male for production of *Gramapriya* variety. The selection criteria is shank length at 6 weeks age. During the S-12 generation the production traits were evaluated upto 40 weeks of age. The means with slandered error for ASM, 20-week body weight, 40-week body weight and egg weight at 28, 32, 36 and 40 weeks of age were 178.22±0.08 days, 2396.07±0.84g, 2579.27±0.78 g, 49.33±0.01 g, 52.85±0.01 g, 53.83±0.03 and 55.03±0.02 g, respectively. The egg production at 40weeks of age was 64.05±020.

The S-13 generation was reproduced by pedigree mating. The fertility was 87.94% and hatchability on total and fertile eggs set was 80.14% and 91.13%.

Rhode Island Red

The base generation of RIR was evaluated for growth and production performance up to 40 weeks of age. The ASM was 147.3 ±2,34 days in base generation. The body weight at 20 and 40 weeks were 1668 ± 22.10 and1807± 33.17 g, respectively. The egg weight at 40 weeks was 54.88±0.57 g. The part period egg production at 40 weeks of age was 92.97±2.46 eggs.

Genetic improvement and evaluation of native chicken breeds

Vanashree

Vanashree, evolved from Aseel (PD-4), is being improved for body weight through individual selection in males and for egg production up to 40 weeks of age through independent culling level selection in females. The production performance of *Vanashree* birds during the S-13 generation was evaluated up to 40 weeks of age. Age at sexual maturity, age at 50% production and age at peak production (66.02%) were 176.1±0.88, 187.5, and 210 days, respectively. Hen housed, hen day and SEP egg production up to 40 weeks were 53.8±1.21, 54.18, and 54.66±1.22 eggs, respectively. There was an increase of 4.39, 2.74 and 4.03 eggs in HHEP, HDEP and SEP respectively up to 40 weeks in this generation. Egg weights at 28, 32, 36 and 40 weeks were 45.28±0.22, 46.91±0.20, 47.94±0.25, and 48.22±0.32 g, respectively. Egg weights have increased as compared to the previous generation. Egg mass up to 40 weeks of age was 2594±58.52 g. Egg mass increased by 170 g as compared to the previous generation. The body weight of cocks and hens at 40 weeks was

2829±20.9 and 2003±12.39g, respectively. The shank length of cocks and hens at 40 weeks was 132.1±20.9 and 106.5±0.23 mm, respectively. The liveability observed during 21-40 weeks of age in hens and cocks was 95.81 and 96.55%, respectively.

Selection records

A total of 50 cocks having the highest body weight at 6 weeks of age were selected through individual selection and 150 hens having the highest body weight at 6 weeks and egg production up to 40 weeks of age were selected through independent culling level selection and mated in 1:3 ratio to produce the S-14 generation. The selection differential and selection intensity for 6 weeks bodyweight was 30.62g and 0.45σ, respectively. The selection differential and selection intensity for egg production up to 40 weeks of age was 2.26 Nos and 0.11σ, respectively. A total of 50 sires 134 dams contributed progenies to the S-14 generation. Therefore, the effective population size was 144.4 and rate of inbreeding was 0.00343.

Regeneration of S-14 generation

A total of 996 good chicks of *Vanashree* in the S-14 generation were hatched in three hatches. The average fertility recorded was 86.01% and the hatchability on fertile and total eggs set was 85.46 and 73.40%, respectively. Fertility improved by 1.52% as compared to the previous generation.

Growth traits

The growth traits of Vanashree were evaluated up to 8 weeks of age. The least-square means and heritability estimates of juvenile growth traits of *Vanashree* in the S-14 generation are presented in Table 6. Heritability estimates of juvenile growth traits on sire component of variance were high (except for 0 day body weight), indicating ample additive genetic variance in the *Vanashree* population for these traits. There was a high genetic correlation between body weight and shank length (0.96±0.04) measured at 6 weeks of age There was an improvement of 5.9 g in 6 weeks body weight and 0.86 mm in 6 weeks shank length as compared to the previous generation.

The body weight and shank length of pullets at 20 weeks of age were 1621±7.38g (N=326) and 107.1±0.23 mm (N=326), respectively while those of cockerels were 2144±18.7g (N=105) and 134.1±0.50 mm (N=105), respectively. The body weight of females at 20 weeks improved by 26 g while shank length improved marginally. The body weight of males was almost comparable to the previous generation while shank length was higher (1.9 mm) than the previous generation. The liveability of chicks averaged over three hatches during 0-8 weeks of age was 96.29% and during 9-20 weeks of age was 96.98%. Liveability during 0-8 weeks and 9-20 weeks improved by 1.08 and 1.17%, respectively as compared to the previous generation (95.21 and 95.81%).

Table 6: Juvenile growth traits of *Vanashree* (S-14)

Traits	N	Mean±S.E.	h^2 (Sire)
Body weight (g)			
0 day	997	34.71±0.10	0.17±0.19
4 wks	967	201.0±1.14	0.44±0.14
6 wks	874	388.5±1.85	0.38±0.13
8 wks	872	605.0±3.24	0.36±0.12
Shank length (mm)			
6 wks	874	65.57±0.14	0.37±0.13

Ghagus

Ghagus, an indigenous chicken breed is being conserved and improved for body weight at 8 weeks of age. The S-5 generation of *Ghagus* was evaluated for production traits from 21 to 40 weeks (Table 7). Age at sexual maturity, hen housed, hen day and survivors' egg production up to 40 weeks of age were almost similar to those recorded in the S-4 generation. Similarly, the egg weights at different ages and 40 weeks egg mass were almost similar to those observed during the previous generation. Higher liveability was observed during 21-40 weeks in hens (96.62%) as compared to the males (93.90%).

Table 7: Production traits of *Ghagus* breed (S-5)

Traits	N	Mean±S.E.
ASM (d)	290	160.9±0.83
Age at 50% production (d)	-	171.5
Age at peak production (d)	-	180.0 (66.7%)
Egg production 40 wks (Nos.)		
Survivors' EP	280	50.70±1.19
HHEP	290	50.15±1.18
HDEP	-	50.9051.89
Egg mass 40 wks (g)	280	2316±54.3
Egg weight (g)		
28 wks	202	43.87±0.27
32 wks	187	45.56±0.28
36 wks	136	46.36±0.29
40 wks	134	46.52±0.38

HHEP: Hen housed egg production, HDEP: Hen day egg production, figure in parenthesis is production percentage.

Selection records

After evaluating the production performance up to 40 weeks of age, a total of 50 sires and 150 hens having the highest 8 week's body weight were selected and mated to produce the S-6 generation through pedigree mating in a 1:3 ratio. The selection differential and selection intensity for body weight at 8 weeks of age were 59.6 g and 0.48σ, respectively. The selection differential and selection intensity for shank length at 8 weeks of age were 2.52 mm and 0.37σ, respectively. A total of 49 sires and 137 dams contributed progenies to the S-6 generation. Therefore, the effective population size was 144.74 and the rate of inbreeding was 0.00353.

Regeneration of S-6 generation

A total of 784 pedigreed chicks were hatched in S-6 generation in two hatches by pedigreed hatching. The average fertility recorded was 85.12% and the hatchability on fertile and total eggs set was 85.38 and 72.68%, respectively.

Growth traits

The S-6 generation of *Ghagus*birdswas evaluated for growth traits upto8weeksofage. Body weights at day old, 4 and 8 weeks of age were recorded while the shank length was recorded at 8 weeks of age (Table 8). Body weight at 8 weeks of age improved by 72.3g and shank length at 8 weeks of age improved by 3.1mm when compared to the previous generation. Heritability estimates of juvenile growth traits were moderate to high on sire+dam component of variance. Liveability during 0-8 and 9-20 weeks of age was 95.66 and 97.00%, respectively.

Table 8: Juvenile growth traits of *Ghagus* (S-6)

S.No.	Age	N	Mean±S.E	h^2
Body weight (g)				
1	0-day	774	34.54±0.12	0.48±0.27 (Sire)
2	4 wks	748	220.5±1.66	0.36±0.09 (S+D)
3	8 wks	729	693.6±4.37	0.31±0.08 (S+D)
Shank length (mm)				
4	8 wks	729	81.87±0.24	0.25±0.08 (S+D)

Maintenance and evaluation of the *Nicobari* breed

Nicobari, an important indigenous breed of chicken is being evaluated and conserved as a purebred random mating population at the Institute.

Regeneration of G-10 generation

The pedigreed population of *Nicobari* with a total of 965 good chicks was produced in two hatches in G-10 generation by mating 80 sires with 247 dams in a 1:3 ratio. A total of 76 sires and 153 dams contributed progenies to the G-10 generation with an effective population size of 203.1 and a rate of inbreeding of 0.0025. The fertility recorded was 85.69%, while hatchability on fertile and total egg set was 93.09 and 79.77%, respectively.

Growth traits

The G-10 generation of the *Nicobari* breed was evaluated on a straight run basis for growth traits at 4 weeks intervals up to 20 weeks of age (Table 9). The body weight and shank length of pullets at 20 weeks of age was 1137±10.4g (N=303) and 79.49±0.61 mm (N=303), respectively while those of cockerels were 1437±16.6g (N=139) and 87.09±1.12 mm (N=139), respectively. The body weight of cocks and hens at 40 weeks was 2026±23.38 (N=143) and 1505±13.1g (N=279), respectively. The shank length of cocks and hens at 40 weeks was 87.65±1.13 (N=143) and 78.74±0.70 mm (N=279), respectively. Liveability during 0-8 and 9-20 weeks of age was 86.38, and 94.37%, respectively.

Table 9: Growth performance of *Nicobari* birds (G-10)

S.No.	Traits	N	Mean±S.E
Body weight (g)			
1	0 day	965	32.65±**0.09**
2	4 wks	952	193.5±**1.45**
3	8 wks	474	499.3±**6.03**
4	12 wks	662	929.3±**8.40**
5	16 wks	231	1081 ±15.8
Shank length (mm)			
1	8 wks	471	66.09±**0.43**
2	12 wks	662	82.53±0.49
3	16 wks	223	88.09±0.95

Production performance

The production performance of the *Nicobari* breed in the G-10 generation was evaluated up to 40 weeks of age (Table 10). The ASM in this generation increased by 17.7 days. Therefore, the survivors' hen-housed and hen-day egg production up to 40 weeks of age have reduced. However, there was improvement in the egg weights recorded at 28, 32, 36 and 40 weeks of age. The egg mass recorded up to 40 weeks of age has also reduced in this generation. The reduction in egg production and egg mass might

be due to increased ASM and a higher number of observations recorded in this generation. The liveability observed during 21-40 weeks of age in hens and cocks was 93.12 and 98.89%, respectively.

Table 10: Production performance of Nicobari breed (G-10)

Traits	N	Mean±S.E.
ASM (d)	276	179.2±**1.01**
Age at 50% production (d)	-	197.5
Age at peak production (d)	-	214 (67.32%)
Egg production 40 wks (Nos.)		
Survivors' EP	270	57.56±1.26
HHEP	216	56.72±1.27
HDEP	-	56.58
Egg mass 40 wks (g)	270	2895±63.5
Egg weight (g)		
28 wks	218	42.47±0.19
32 wks	245	46.01±0.22
36 wks	228	47.17±0.21
40 wks	183	50.29±0.28

HHEP: Hen housed egg production, HDEP: Hen day egg production, figure in parenthesis is production percentage.

Performance of Kadaknath (G-3)

Production performance

Kadaknath, an indigenous chicken, breed was evaluated for egg production performance up to 72 weeks of age in the G-3 generation (Table 11). Egg production up to 40, 64 and 72 weeks of age were 81.37±0.99 (391),165.5±2.74 (74) and 201.4±4.12 (70) eggs, respectively. Egg weights at 40 and 72 weeks of age were 44.49±0.15 (326) and 48.76±0.46 (63) g, respectively. Bodyweight at 72 weeks was 2,550±43.1 (41) and 1,714±33.6 (74) g in males and females, respectively. There was an increase of 12.7 eggs in the annual egg production of Kadaknath as compared to G-2 generation.

Table 11: Production performance of Kadaknath (G-3)

Traits	G-3
Egg Production (Nos)	
40 wks	81.37± 0.99 (391)
64 wks	165.5±2.74 (74)
72 wks	201.4±4.12 (70)
Egg weight at (g)	
40 wks	44.49± 0.15 (326)
72 wks	48.76± 0.46 (63)

Regeneration of the Kadaknath (G-4 Gen.)

G-4 generation of Kadaknath was regenerated by pedigreed random matting. A total of 40 sires and 79 dams, which were negative for ALV, were utilized in the regeneration. About 1,184 eggs were set and 1,027 good chicks were produced in 3 hatches. Fertility was 96.54%. Hatchability on the total egg set and fertile egg set was 88.18 and 91.34 %, respectively. There was an increase in fertility and hatchability (TES) parameters as compared to the last generation.

Table 12: Incubation and hatching performance in Kadaknath (G-4)

Hatch No	No of eggs set	No of eggs transferred	Fertility (%)	Hatchability (%)		Total No of good chicks
				TES	FES	
1	368	350	95.11	85.60	90.00	308
2	471	461	97.88	91.72	93.71	427
3	345	332	96.23	86.09	89.46	292
Overall	**1184**	**1143**	**96.54**	**88.18**	**91.34**	**1027**

Performance of growth traits in Kadaknath (G-4)

The overall means of body weights at 0 day, 4, 8 and 16 weeks of age were 30.68, 179.7, 456.6 and 1,073g, respectively. There was an improvement in body weights over the previous generation in body weight at 4 weeks (BW4: 13.2 g). The average body weight of males and females at 16 weeks of age were 1,251 and 933.7 g, respectively.

Table 13: Growth performance of Kadaknath (G-4)

Traits	Means (G-4)
Body weight at (g)	
0 day	30.68 ±0.08 (1027)
4 wks	179.7±1.21 (1010)
8 wks	456.6 ±3.52 (1001)
16 wks	1,073±7.67 (964)
16 wks: Male	1,251±9.585 (424)
16 wks: Female	933.7±6.97 (540)

A total of about 287 adult female birds were housed for performance evaluation. Body weight at 20 weeks of age was 1716 g in males and 1,240 g in females. There is an improvement in body weights at 20 weeks as compared to the previous generation (M: 101 g and F: 38 g)

Table 14: Adult Body Weight in Kadaknath (G-4)

Traits	G-4
Body weight at (g)	
20 wks: Male	1,716±19.24 (155)
20 wks: Female	1,240±7.62 (287)
Shank Length at (mm) 20 wks	
Male	117.81±0.76 (99)
Female	98.37±0.31 (287)

Aseel

The population was regenerated in G-10 generation randomly limiting AI with in plumage patterns. A total of 1109 chicks were produced in three hatches. The fertility was 68.78 % and hatchability was 90.08 (FES) and 62.0 (TES). The body weight at 4 and 6 weeks of age was 114 and 321 g, respectively.

Aseel chicken was evaluated up to 40 weeks of age for growth and production traits in G-10 generation. The ASM was 216 days. The 20 and 40 week body weight of hens was 1285 and 1838 g, respectively. The corresponding body weight in cocks was 1754 and 3063 g respectively. The egg weight was 43.97 g at 40 weeks of age. The

part period egg production up to 40 weeks of age was 20.28 eggs, which increased marginally by 2 eggs from the previous generation.

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

Performance of Juvenile Traits in S-2 Generation of PB-1

During the period under the report, the S-2 generation (random bred) of PB-1 was evaluated for juvenile growth traits. The overall means for body weight at 0 day, 2, 4, 5 and 6 weeks of age were 40.23, 270.9, 788.9, 1,037 and 1,313g, respectively. Corresponding performance for the hatch-1 were 40.44, 279.3, 795.0, 1,201 and 1,275 g, respectively which revealed the growth potential of this genotype.

Table 15: Performance of Juvenile traits in PB-1

Traits/ Generation	S-2
Body weight (g)	
0 day	40.23±0.09 (1960)
4 wks	788.9±3.9 (993)
5 wks	1034±4.5 (1846)
6 wks	1313±10.1 (412)
Breast angle (^{0}) 5wks	73.63±0.28 (315)
Shank length (mm) 5 wks	84.21±0.16 (1085)

Egg production performance of PB-1 (S-2)

About 470 adult females of PB-1 were housed and egg production was evaluated. The average body weight at 20 weeks in females was 2,747 g. The ASM was 154.01 days and there is a reduction as compared to the previous generation (169.74 days). Egg weights at 28, 32, 36 and 40 weeks of age were 50.38, 54.65, 56.46 and 58.33 g, respectively. Egg production up to 32 and 40 weeks of age was 41.07 and 73.38 eggs.

Table 16: Production Performance of PB-1

Traits	S-2
Body weight at 20 wks	
Male	3,489±36.54 (124)
Female	2,747±13.51 (470)
Body weight at 40 wks	
Male	4,352±45.345 (95)
Female	3,288±22.13 (377)
ASM, days	154.01±1.13 (401)
Egg weight, g	
28 wks	50.38±0.28 (304)
32 wks	54.65±0.26 (288)
36 wks	56.46±0.29 (284)
40 wks	58.33±0.29 (284)
Egg Production (Nos)	
28 wks	25.73±0.71 (343)
32 wks	41.07±0.94 (332)
40 wks	73.385±1.35 (318)

Regeneration of the PB-1 flock

The PB-1 population had undergone random mating (pooled semen) for the last two generations, and the flock was regenerated by pedigree matting by utilising 60 sires and 240 dams to produce S-3 generation. A total of 2,884 good chicks were obtained in two hatches. Fertility was 91.04%. Hatchability on total egg set and fertile eggs set was 81.34 and 89.35%, respectively.

Table 17: Incubation and hatching performance of PB-1 population (S-3)

Hatches	No of eggs set	No of eggs transferred	Fertility (%)	Hatchability (%)		Total No of good chicks
				TES	FES	
Hatch-1	1904	1720	90.34	82.30	91.10	1538
Hatch-2	1725	1584	91.83	80.29	87.44	1346
Overall	3629	3304	91.04	81.34	89.35	2884

Genetic improvement of coloured synthetic broiler female line

A) Coloured Synthetic Broiler Female line (PB-2)

S-1 generation of PB-2 was reproduced by random mating. Percent fertility, Percent hatchability on total eggs set (HTES) and percent hatchability on fertile eggs set (HFES) respectively were 92.19, 86.28 and 93.59. A total of 3344 good chicks were obtained. Juvenile body weights at 4WK. 5WK and 6WK and Shank length at 5WK respectively were 661±1.20 g, 980±2.82 g, 1260±4.30 and 79.98±0.30 m.m. Adult performance traits i.e ASM, 20WK BW, 40WK BW 28WK EWT, 32WK EWT, 36WK EWT 40WK EWT and 40WK egg production respectively were 159 days, 2415 g, 3079 g, 48.70 g, 53.96 g 55.89 g 57.30 g and 57.76 eggs. Regeneration of S-2 population is in progress by pedigree mating.

Table 18: Performance of Juvenile Traits of PB-2 (S-1)

Trait	Mean ±S.E
4WK BW(g)	661±1.20
5WK BW(g)	980±2.82
6WK BW(g)	1260±4.30
5WK Shank length(m.m.)	79.98±0.30

Table 19: Adult performance Traits of PB-2 (S-1)

Trait	Mean±S.E
ASM (days)	159±2.32
20WK BW (g)	2415±25.29
40WK BW (g)	3079±30.31
28WK EWT (g)	48.70±0.82
32WK EWT (g)	53.96±0.81
36WK EWT (g)	55.89±0.72
40 WK EWT (g)	57.76±0.90
40WK EP (no)	57.76±1.28

Pedigreed random bred broiler control line (CB)

Performance of Juvenile traits (G-21) in CB

During the period under the report, the G-21 generation of the control broiler line was evaluated for juvenile growth traits. Average body weight at day old, 2, 4, 5, and 6 weeks of age were 36.79, 189.4, 565.5, 809.6 and 975.3 g, respectively. The shank length and breast angle at 5 weeks of age were 76.53 mm and 73.98^0 respectively.

Table 20: Performance of Juvenile traits in CB (G-21)

Traits/ Generation	G-21
Body weight (g)	
0 day	36.79±0.09 (885)
4 wks	565.5±7.9 (111)
5 wks	809.6±4.09 (865)
6 wks	975.3±9.01 (253)
Breast angle (^{0}) 5wks	73.98±0.59 (111)
Shank length (mm) 5 wks	76.53±0.22 (503)

Table 21: Production Performance of CB

Traits	G-21
Body weight at 20 wks	
Male	2,633±21.43 (248)
Female	2,060±15.18 (283)
Body weight at 40 wks	
Male	4,189±32.08 (163)
Female	2,975±21.49 (261)
ASM, days	188.30±1.27 (248)
Egg weight, g	
28 wks	48.59±0.39 (185)
32 wks	53.43±0.30 (205)
36 wks	53.54±0.26 (217)
40 wks	55.09±0.27 (215)
Egg Production (Nos)	
32 wks	29.71±0.74 (216)
40 wks	66.44±1.28 (225)

Production Performance of CB in G-21

About 280 adult females were housed and egg production was evaluated. The average body weight in females at 20 weeks was 2,061 g. The ASM was 188.3 days. Egg weights at 28, 32, 36 and 40 weeks of age were 48.59, 53.43, 53.54 and 55.09 g, respectively. Egg production up to 32 and 40 weeks of age was 29.71 and 66.44 eggs.

Regeneration of the CB flock (G-22)

The CB flock had undergone random regeneration (pooled semen) during the last two generations. Utilizing 50 sires and 231 dams, regenerated the G-22 generation through pedigreed random matingand a total of 1050 eggs were set for hatching.

Improvement and Maintenance of elite layer germplasm

Presently, two elite lines of White Leghorn *viz.* IWH and IWI are under selection for higher egg production up to 64 weeks of age while rest of the lines including IWD, IWF, IWN, IWP, IWK and LC (Layer control) are being maintained through random breeding. During the report period, production and growth traits were evaluated up to 64 weeks for IWD, IWF, IWN and IWP lines whereas this data was available up to 52 weeks in IWI and IWK and up to 40 weeks in IWH and LC populations. Egg production up to 40 weeks (EP40) was highest for the selection line IWH (123.22±1.22) and it registered an increase of about 5% over the previous generation mean. The average egg production up to 40 (EP40) and 52 weeks (EP52) for another selection line IWI was 103.81±1.57 and 168.65±2.14 eggs respectively. Egg weight at 40 weeks for IWI and IWH lines

was 52.10±0.24 g and 51.37±0.22 g respectively. The normalized means for egg production traits and growth traits have been presented in Tables 20-21 and normalized means for egg quality traits at 40 weeks of age in different layer populations are available in Table 24.

Since small sample size is a major limitation in poultry breeding programmes, Bayesian approach for genetic parameter estimation can be helpful as it is not based on the assumption of a large population. Further, it combines prior information related to the trait along with the likelihood to result in a posterior distribution and hence, improves the accuracy of the estimates. During the report period, posterior heritability estimates of egg production traits in IWH line were also estimated using Bayesian approach. Results revealed that egg production during different phases of laying cycle is a low to medium heritability trait with EP68 (0.076±0.052) showing the lowest and EP36 (0.225±0.056) showing the highest estimate. The details of posterior heritability estimates of egg production traits along with Highest Probable Density interval (HPDI) in IWH line are presented in Table 22.

Table 22: Normalized means (Mean±S.E.) for production traits in layer lines

Traits	IWD (G-4)	IWF (G-4)	IWN (G-2)	IWP (G-2)	IWI (S-9)	IWH (S-9)	IWK (S-0)	LC (S-17)
EP40	101.88±1.63	103.66±1.31	111.02±1.19	99.39±2.27	103.81±1.57	123.22±1.22	91.77±1.46	119.85±1.33
EP52	170.51±2.20	167.70±2.05	179.58±1.82	162.28±3.80	168.65±2.14	-	152.44±1.94	-
EP64	222.59±3.10	223.26±2.84	250.20±2.41	235.73±4.14	-	-	-	-
EW40	50.60±0.30	49.19±0.29	49.03±0.33	51.39±0.79	52.10±0.24	51.37±0.22	52.82±0.23	51.41±0.22
EW52	53.08±0.30	52.54±0.32	52.74±0.34	53.73±0.99	-	-	-	-
EW64	56.06±0.39	54.43±0.41	54.83±0.41	57.07±0.59	-	-	-	-

Table 23: Normalized means (Mean±S.E.) for growth traits in layer lines

Traits	IWD (G-4)	IWF (G-4)	IWN (G-2)	IWP (G-2)	IWI (S-9)	IWH (S-9)	IWK (S-0)	LC (S-17)
BW1	336.03±1.26	328.46±1.17	358.49±1.36	366.60±1.62	357.95±0.21	352.84±0.13	213.59±1.48	35.34±0.21
BW8	429.41±8.85	500.74±4.28	478.85±5.95	430.48±7.35	428.61±5.28	-	423.10±6.19	-
BW20	1224.83±9.99	1249.51±10.11	1312.75±10.33	1296.87±24.89	1000.75±9.35	1115.78±8.59	984.49±7.64	1126.76±7.03
BW40	1402.54±12.78	1430.50±12.81	1559.99±19.35	1554.90±23.90	1384.01±12.98	1500.56±11.50	1393.37±11.88	1500.56±11.50
BW52	1473.24±13.47	1487.95±14.13	1557.54±18.73	1549.20±28.63	1467.77±15.33	-	1459.99±12.29	-
BW64	1596.55±16.15	1577.53±13.98	1751.21±22.48	1704.74±30.96	-	-	-	-

Table 24: Normalized means (Mean±S.E.) for egg quality traits at 40 weeks in layer lines

Traits	IWD (G-4)	IWF (G-4)	IWN (G-2)	IWP (G-2)	IWI (S-9)	IWH (S-9)	IWK (S-0)	LC (S-17)
Egg length	54.76±0.36	54.37±0.47	55.84±0.38	55.02±0.58	54.77±0.39	54.47±0.48	54.80±0.58	54.18±0.44
Egg width	41.03±0.29	40.76±0.23	41.06±0.18	41.72±0.36	41.82±0.27	42.13±0.36	41.77±0.21	42.62±0.57
Yolk width	37.72±2.59	41.29±0.26	41.18±0.38	40.98±0.46	39.41±1.86	40.85±0.34	39.49±0.32	40.41±0.38
Yolk height	19.06±0.23	18.31±0.23	17.83±0.28	19.64±0.25	19.68±0.12	19.95±0.18	19.98±0.21	19.62±0.23
Albumen length	83.24±2.08	78.21±4.13	83.21±1.69	83.83±1.33	80.55±2.09	85.69±1.37	86.91±1.68	82.32±2.06
Albumen width	66.34±1.93	62.72±1.11	63.58±2.01	67.65±1.22	64.02±1.04	66.76±1.27	67.74±1.37	63.99±1.83
Albumen height	5.97±0.44	6.32±0.47	8.73±0.39	8.54±0.46	8.36±0.26	7.00±0.19	5.18±0.30	6.73±0.42
Haugh unit	76.00±3.56	77.75±4.27	93.80±2.07	92.2±3.01	92.70±1.27	84.90±1.25	70.63±2.67	82.00±3.03
Albumen wt.	20.69±0.56	19.99±0.84	22.45±0.44	23.37±0.81	23.36±0.97	23.08±0.67	23.28±0.79	22.56±0.87
Yolk wt.	15.40±0.28	14.74±0.36	15.07±0.29	15.70±0.39	14.66±0.25	14.98±0.41	14.36±0.22	14.87±0.32
Shell wt.	4.91±0.14	4.59±0.07	4.64±0.07	4.69±0.12	-	-	-	-

Table 25: Posterior heritability estimates of egg production traits in IWH line estimated using Bayesian approach

Trait	Posterior h^2 ± S.D.	Highest Posterior Density interval
EP24	0.202±0.05	0.11-0.31
EP28	0.184±0.051	0.089-0.285
EP32	0.198±0.056	0.093-0.31
EP36	0.225±0.056	0.12-0.34
EP40	0.206±0.055	0.104-0.316
EP44	0.144±0.05	0.058-0.24
EP48	0.168±0.069	0.042-0.305
EP52	0.150±0.066	0.038-0.282
EP56	0.158±0.064	0.0513-0.299
EP60	0.116±0.066	0.003-0.24
EP64	0.090±0.056	0.003-0.196
EP68	0.076±0.052	0.0001-0.174
EP72	0.103±0.063	0.0001-0.217

Dwarf gene line:

S-20 generation of Dwarf were regenerated by random mating The percent fertility, Percent Hatchability on total eggs set(HTES) and hatchability on fertile eggs set (HFES) respectively were 83.15, 69.81and 83.96. A total of 377 good chicks were obtained in 4 hatches. Juvenile traits like 4WK BW, 6WK BW and 6WK Shank length respectively dwarf were 481±1.42 g, 791±2.81 g and 78.36±0.78 mm. Adult performance traits like ASM, 20WK BW, 40WK BW, 28WK EWT, 32WK EWT, 36WK EWT, 40WK EWT and 40WK egg production in Dwarf were 166.94 days, 1782 g. 2408 g, 44.35 g, 47.64 g, 47.13g, 52.24 g and 46.28 eggs as compared to last generation the values in were similar.

Table 26: Juvenile Performance of Dwarf Gene line (S-20)

Trait	Mean ±S.E
4WK BW(g)	481±1.42
6WK BW(g)	791±2.81
6WK Shank length(m.m.)	78.36±0.78

Table 27: Adult Performance of Dwarf gene line (S-20)

Trait	Mean±S.E
ASM(days)	166.94±1.90
20WK BW (g)	1782±20.21
40WK BW(g)	2408±25.22
28WK EWT (g)	44.35±0.72
32WK EWT (g)	47.64±0.77
36WK EWT (g)	48.13±0.82
40WK EWT (g)	52.24±0.86
40WK EP (no)	46.28±1.10

Development of coloured egg type germ plasm for enhanced egg production in rural and backyard system

A three way cross (DKH) developed from IWH, Kadaknath and Dahlem Red during 2021-22 was being evaluated for the second time under farm condition. The DKH birds are multicoloured with thin shanks and medium build body conformation. The 20 week body weight of cocks and hen was 1683.54±10.88 and 1196.71±8.96 g, respectively. The ASM was 159.62±0.91 days. There was increase in the ASM in the current generation compared to the first generation. The 40 and 52 weeks egg production was 82.13±1.49 and 142.26±2.54 eggs, respectively. There is slight reduction in egg production compared to previous generation. The egg weights at 28, 40 and 52 weeks was 50.14±0.28, 54.60±0.41 and 57.19±0.40 g, respectively. There is an increase in egg weights in the present generation.

Fig.4 DKH multicoloured birds

MOLECULAR BIOLOGY

Genome assembly of native Kadaknath chicken

A complete, high-quality de novo genome for the female Kadaknath breed has been successfully assembled at the chromosomal level using PacBio Sequel II, Illumina resequencing, and HiC data. All pertinent data has been submitted to the SRA archives at NCBI for future reference (SRR22827208, SRR23072454, SRR23072455 SRR23072635 and SRR23072636). A total of 670 scaffolds have been obtained and were appropriately assigned to their respective chromosomes. The assembly contains all the 41 autosomes, w and z sex chromosome and also complete mitochondrial genome. The de nova chromosomal assembly has been submitted to the NCBI with the accession number JBAGCV000000000.

Native Duck Genomic Characterization

In order to analyze the genetic diversity and population structure of two native duck populations, Kuzi from Odisha and Chemballi from Kerala, eight divergent individuals (four males and four females) were collected from each population for whole genome re-sequencing.Clean reads were acquired from raw reads following the quality control (QC) process to remove unstable reads (Illumina library construction adapters, low-quality bases etc.). A combined sum of 382.52 Gb (201.63 Gb for Chemballi and 181.89 Gb for Kuzi) of raw base reads was acquired from eight individual of each duck population. Following the completion of quality control measures, each sample yielded clean data reads (333.66 Gb) ranging from 18.66 to 26.63 Gb. The sequencing quality was exceptional, with a Q30 ranges from 94-96% for raw reads while for cleaned reads the Q30 is >98%. The clean reads were aligned against the reference genome (ZJU1.0) from NCBI using the Burrows–Wheeler aligner (BWA) software (version 0.7.17-r1188). The % of aligned reads for each sample is >99%. The datasets have been archived with NCBI under the accession number BioProject PRJNA1060887 and PRJNA1060886

Characterization and expression of bLf gene in Indigenous and crossbred cattle:

The bLf was characterized from the milk samples collected from Sahiwal and Crossbred cattle fof Livestock Farm Complex (LFC), PVNRTVU Hyderabad. Total RNA was extracted from milk somatic cells, cDNA synthesized and PCR amplified using specific primers. The PCR product was cloned and then sequenced. The PCR product and the sequence showed a complete ORF of bLf gene comprising of 2127 bp. The qPCR reaction was set to investigate the bLf gene expression in Sahiwal and Crossbred cattle during mid lactation stage with the help of GAPDH as an internal control. The expression studies in the milk samples using qPCR concluded that the expression of bLf gene was 11.31 folds higher in the Sahiwal cattle population in comparison to crossbred cattle population during mid-lactation stage

Development of transgene construct for expression of bovine lactoferrin protein in eggs of transgenic chicken

The transgene construct was prepared by cloning four DNA fragments viz. (i) Chicken histone gene (ii) Chicken ovalbumin as active promoter,

(iii) bovine lactoferrin complete coding sequence, (iv) chicken ovalbumin poly A tail. The construct cloned in pUC57-ampicillin vector and transformed in *E. coli* for multiplication.

Development of transgene construct for expression of bovine lactoferrin protein in muscle cells of transgenic chicken

The transgene construct was prepared by cloning four DNA fragments viz. (i) Chicken histone gene (ii) Chicken growth hormone receptor (GHR) s active promoter, (iii) bovine lactoferrin complete coding sequence, (iv) chicken growth hormone receptor (GHR) poly A tail. The construct cloned in pUC57-ampicillin vector and transformed in *E. coli* for multiplication.

In vitro expression of bLf in Chicken fibroblast cell culture:

The plasmid construct consisting of bovine lactoferrin alpha ORF with growth hormone receptor promoter was transfected into chicken fibroblast cell culture using gene pulsar. Immediately after transfection, the cells were allowed to grow in DMEM medium for three days. The fibroblast cell lysate was prepared and the lactoferrin protein was purified through column chromatography. The purified 80kDa protein and crude protein was detected by SDS-PAGE.

In vitro expression of bLf in Chicken magnum cell culture:

The plasmid construct consisting of lactoferrin ORF with ovalbumin promoter was transfected into magnum cell culture. The cells were allowed to grow in DMEM medium with optimized hormone concentrations. The magnum cell lysate was prepared and the lactoferrin protein was purified through column chromatography. The SDS-PAGE analysis of cell lysate and purified protein showed 80 kDabLfprotein

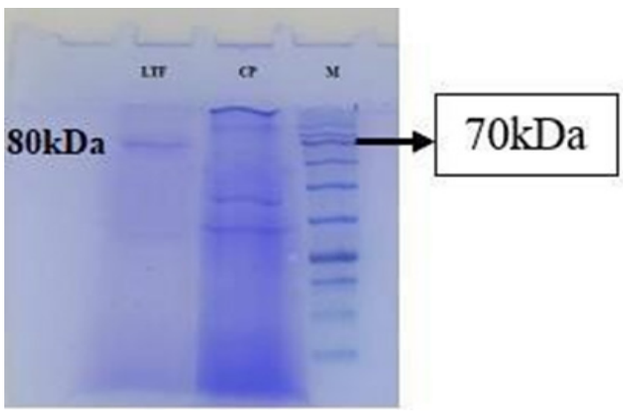


Fig 1. SDS-PAGE detection of recombinanat bovine Lactoferrin protein

LTF**:** 80 kDa lactoferrin protein; CP: Crude protein; M: Prestained protein ladder)

Development of transgenic chicken as bioreactor for easy and cost-effective production of human therapeutic proteins-tissue plasminogen activator (htPA) and erythropoietin (hERP)

The necessary approvals from Institute Animal ethics committee (IAEC), Institute Biosafety Committee (IBSC), Review Committee on Genetic Manipulation (RCGM) have been obtained. The transgene construct for htPA and hERP was developed for expression of htPA and hERP in the egg. The gene construct for htPA and hERP was transformed into the DH5α (E. coli) cells. The voltage for electroporation of the gene constructs into the magnum cell culture has been standardized in the present study from the previously reported voltage of 120 to 100 V/CM which increased the survivability of the magnum cells after transfection. The positive plasmids of the hERP and htPA constructs were transfected into magnum cell culture using a gene pulsator. Protein isolation was carried out from the cell

lysate of control and treated magnum cells that were freeze thawed and sonicated and extraction of the protein was carried out. The desired proteins of hERP and htPA were isolated by column chromatography and identified by SDS PAGE. For in vivo study, positive plasmids were also isolated and linearized using the restriction enzymes.

Genome wide profiling of long intergenic non-coding RNAs, miRNAs and mRNAs during the asymmetric ovarian development of Chicken

The differentially expressed miRNAs in the right and left ovaries of Kadaknath chickens at the embryonic day 18.5 stage. The results of the differential expression analysis revealed that 106 miRNAs exhibited significant differences in expression. Among them, 42 miRNAs were upregulated, while 64 were downregulated in the right ovary compared to the left ovary. Notably, gga-miR-1560-3p displayed a substantial upregulation, while gga-miR-148a-3p exhibited a significant downregulation. Furthermore, the enrichment analysis of the target genes associated with upregulated miRNAs shed light on their role in regulating critical pathway such as oocyte meiosis,wnt signaling pathway, notch signaling pathway, and MAPK signaling pathways, all of which play a pivotal role in driving the degeneration process of the right ovary. A total of 13 LinRNAs that were expressed exclusively to right ovary were identified in chicken.

Maintenance and Regeneration of the transgenic chicken producing human interferon alpha 2b

Regeneration of the transgenic birds has been carried out and at present a total of 56 birds are available.

Exploration of Genomic architecture of the Indian native ducks using whole genome sequencing and transcriptome analysis

The genome of Kuzi and Chemballi duck revealed a total of 16571316 high quality SNPs in both the duck populations were identified.

Primordial germ cell (PGC) conservation for various registered breeds of poultry (CRP on Agrobiodiversity)

The object of the project is to conserve indigenous chicken breeds of our country by cryopreserving the primordial germ cells (PGC). During this period PGCs of Ankleshwar, Tellicherry, Mewari and Hansli were cryopreserved for posterity and conservation.

NUTRITION

Life Cycle Analysis for carbon footprint reduction through dietary modulations in broiler meat production (NICRA)

The current status of CO2-eq for unit egg mass production (egg production X egg weight) in Andhra Pradesh was assessed during the current year. East Godawari and West Godawari districts of Andhra Pradesh are one of the main egg-producing pockets in our country with more than 5 crore egg-laying birds. Assessment of CFP per unit egg production based on the inputs provided in the region would represent the majority of the poultry sector in the country, where the climate variables are quite different with high temperature and humidity in the majority of months in a year. A total of 10 farms with different farm capacities were selected and data of various inputs utilized by egg layer sector were considered for the calculation of CFP in each farm. The farm size varied from 1 lakh to 5.5 lakh layers and the production period considered for calculation was 52 weeks (20 to 72 weeks of age). The average egg weight and total number of eggs produced in each farm during the production period were considered for the calculation of egg mass (EM). Carbon footprints of all inputs including feed composition, feed intake, water intake, electricity, diesel, coal and manure produced were utilized to calculate the FCP per unit of egg and egg mass in each farm. The value of CO2-eq / egg produced ranged between 0.281 to 0.316 with a mean value of 0.297±0.0120, similarly, the CFP per kg egg mass ranged between 4.86 to 5.58±0.191 with a mean value of 5.26kg/kg egg mass. The major contributing factor for the CFP in layers was feed (91%) and the remaining 4 variables represented about 9%. Though the egg production in both the districts of Andhra Pradesh is as per the standard (300 to 315egg/year) but the CFP was higher than the global average (3.7 kg/kg egg mass). The higher CO2-eq could be primarily due to the use of higher concentrations of alternate feed ingredients like rice broken and DDGS as the major substitute for maize and soybean meal in layer diets (30-45%) in the region.

Three experiments were conducted on commercial broiler chicken to explore the benefits of supplementing fibre hydrolyzing enzymes with phytase (experiment 1), microbial protease at graded concentrations (experiment 2) and supplementation of different microbial proteases to broiler diets having sub-optimal concentrations of protein (amino acids) to find out the possibility of reducing carbon footprints production and sustaining the broiler production

An experiment was conducted on commercial broiler male chicken to explore the benefits of supplementing fibre hydrolyzing enzymes in combination with phytase (cocktail enzymes) in diets containing sub-optimal concentrations of energy (ME) and supplemental phosphorus. A control diet with standard concentrations of all nutrients was prepared. Four basal diets with 100kcal less ME/kg diet with reduced concentrations of supplemental phosphorus (0.10, 0.125, 0.15 and 0.2% less supplemental phosphorus in NC1, NC2, NC3 and NC4, respectively). The NC diets were fed as such and the NC were also fed with supplemental concentrations of phytase (500, 1000, 1500 and 2000 FYT/kg diet, respectively). Each diet was fed to 15 replicates of 22 broiler male chicks in each pen. The results indicated progressive reduction in broiler performance with reduction in ME & NPP. Enzyme supplementation significantly improved the broiler performance and simultaneously reduced the calculated carbon footprints per kg broiler meat production (Fig.1).

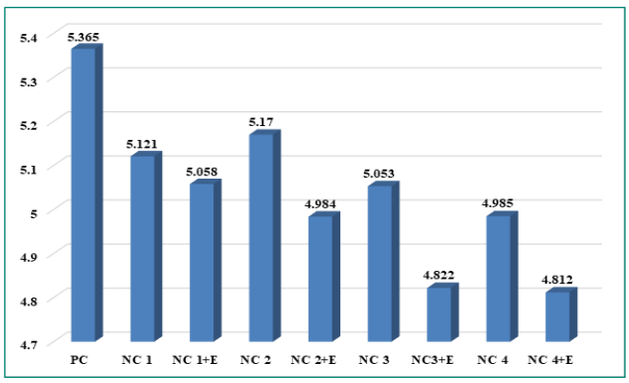


Fig. 1. Cocktail enzyme supplementation to low density diets reduced the CFP for broiler meat production

The second experiment (experiment 2) was conducted to study the effect of reducing dietary protein (amino acids) @ 0.75% and supplementation of the low CP diets with graded concentrations of microbial protease (0, 50, 100, 200, and 400 g/kg) on performance and carbon footprints (CFP) in broiler meat production. Reduction in dietary CP significantly reduced the broiler performance at the end of the study (42d of age). Though supplementation of protease improved the body weight gain and feed efficiency, the CFP was reduced in low CP diets compared to those fed the standard protein control diet. The CFP in groups fed 200 g/kg protease was lower than those fed the low protein NC diet without supplemental protease (Fig.2).

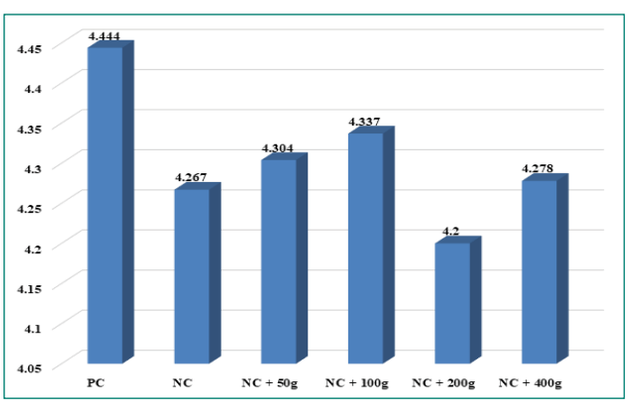


Fig. 2. Supplementation of microbial protease (g/kg) reduced the CFP in broiler meat production

The third experiment was conducted to sustain broiler performance and reduce carbon footprints (CFP) by feeding low CP diet (0.75%) supplemented with different sources of microbial proteases. A practical maize-soybean meal-based diet with the recommended levels of nutrients was prepared and fed as positive control (PC). Another set of diets with lower levels of CP (0.75%) compared to the PC was prepared (NC). The NC diet was supplemented with 5 different sources of microbial protease and the NC diet was fed to study the possible benefits of supplementing different proteases over the NC diet-fed broilers. Supplementation of 3 proteases to the low CP NC diet improved the BWG similar to those fed the CD besides reducing the carbon footprints lower than those fed CD (Figure 3). The results thus suggest the possibility of reducing protein in the diet with microbial protease supplementation without reducing the body weight gain and reducing carbon footprint production.

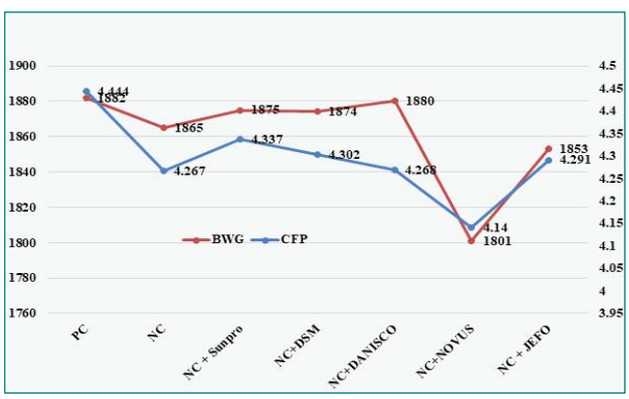


Fig. 3. Different microbial proteases supplementation to low CP diets sustained broiler performance and reduced CFP production

Evaluation of Insect larva meal as a novel protein source in chicken diet

The Black soldier fly (*Hermetiaillucens*) larva meal (BSFLM) has been evaluated as a novel protein source in the diet of chickens for the past

2 years. During the current year, the efficacy of protease enzyme and a probiotic-cum-prebiotic blend in improving the feeding value of BSFLM was evaluated in commercial broiler chicken.

The BSFLM was evaluated at 0, 7.5 and 15% levels with and without protease enzyme (200g/ton) in a 3x2 factorial design on *iso- caloric* and *iso-nitrogenous* basis in the diet of broiler chicksfrom 0-6 weeks of age. During the 1st week of age, BSFLM inclusion in diet significantly (P<0.01) increased body weight gain (BWG) at 7.5 and 15% levels (Table 1). However, from 2nd week onwards, no effect on BWG was observed with BSFLM in diet. On the other hand, the feed intake was significantly (P<0.01) higher and the feed conversion efficiency was poor at the highest level of 15% BSFLM in comparison to both control and 7.5% BSFLM throughout the experiment. BSFLM showed no effect on ND titres and slaughter parameters, except for spleen weight, which decreased at the 15% BSFLM (Table 2). Furthermore, the serum concentration of SGPT and glutathione peroxidase increased and glutathione reductase decreased at the highest level of BSFLM (15%). Protease enzyme showed no effect on the performance and carcass variables, except for bursa weight and SGPT concentration, which increased and decreased, respectively with protease supplementation.

Table 1. Effect of dietary supplementation of protease on performance of broiler chicken fed BSF larva meal at graded levels

BSFLM, % in diet	Protease, 200 g/ton	Body wt. gain, g		Feed intake, g		FCR	
		0-1wk	0-6wks	0-1wk	0-6wks	0-1wk	0-6wks
0.0		123.7^{b}	2482	139.6^{c}	3907^{b}	1.13^{b}	1.57^{b}
7.5		134.7^{a}	2497	152.2^{b}	3965^{b}	1.13^{b}	1.59^{b}
15.0		133.8^{a}	2470	158.7^{a}	4118^{a}	1.19^{a}	1.67^{a}
P		0.0001	0.646	0.0001	0.0001	0.001	0.0001
N		24	24	24	24	24	24
SEM		1.696	20.999	1.580	35.920	0.011	0.007
	-	131.1	2474	149.9	3971	1.14	1.61
	+	130.3	2491	150.4	4022	1.16	1.61
	P	0.694	0.486	0.765	0.230	0.334	0.245
	N	36	36	36	36	36	36
	SEM	1.385	17.146	1.29	29.329	0.009	0.006

Table 2. Effect of dietary supplementation of protease on slaughter (g/kg) and serum biochemical variables in broiler chicken fed BSF larva meal at graded levels

BSFLM, % in diet	Protease, 200g/ton	RTC	Breast	Liver	Abd. fat	Spleen	Bursa	GPX, units/ml	SGPT, IU/ltr
0.0		719.9	271.6	16.2	7.7	1.13[a]	1.61	306.3[b]	1.52[b]
7.5		718.7	267.6	16.3	14.9	1.13[a]	1.89	300.0[b]	2.53[a]
15.0		717.0	270.5	15.6	11.5	0.92[b]	2.01	425.2[a]	2.90[a]
P		0.945	0.709	0.331	0.095	0.012	0.112	0.001	0.001
n		24	24	24	24	24	24	20	20
SEM		6.220	3.519	0.362	2.287	0.055	0.136	24.370	0.241
	-	719.2	269.9	16.2	10.6	1.01	1.69[b]	356.8	2.78[a]
	+	717.9	269.9	15.9	12.2	1.11	1.99[a]	330.8	1.86[b]
	P	0.863	0.986	0.513	0.543	0.107	0.068	0.360	0.002
	N	36	36	36	36	36	36	30	30
	SEM	5.078	2.873	0.296	1.867	0.045	0.111	19.898	0.197

Significant interaction was observed between BSFLM level in diet and protease supplementation on feed intake. The increase in feed intake at 15% BSFLM was much more conspicuous with protease supplementation. The overall results indicate lack of any beneficial effect of protease supplementation in broiler chicken fed BSFLM at graded levels upto 15%.

BSF larva meal from another source was evaluated in the diet of broiler chicken at 0, 8 and 12% levels with and without a probioticcum prebiotic blend (300 g/ton of feed) (PP blend) employing 3x2 factorial design. The blend had probiotic (1.25 billion CFU/g, *B.subtilis, B.pumilis, B.coagulans and B.polymyxa*)and herbal prebiotic (from *Zingiber officinalis* and *Curcuma longa*).The broiler chickens were fed the diets from 0 to 6 weeks of age. The BWG was higher and feed conversion efficiency was better at 8% BSFLM during the initial 2 weeks than at 0 and 12% levels (Table 3). However, from 3rd week onwards, BWG and feed conversion efficiency decreased with each incremental level of BSFLM. The feed intake decreased at the highest level of 12% BSFLM during the last two weeks of life (5 and 6 weeks). The PP blend showed no effect on performance variables. The bursa weight increased at the highest level of BSFLM, whereas the serum glutathione peroxidase decreased with the supplementation of PP blend (Table 4).

Other variables like ready to cook yields, organ weights, serum ND titres and concentration of SGOT, SGPT and glutathione reductase were not affected. Significant interaction was observed between BSFLM level and the PP blend supplementation, which indicated that increase in serum ALP concentration with BSFLM level in diet could be countered by the supplementation of PP blend. The overall results indicated that BSFLM at 8 and 12% depressed performance of broiler chicken and the supplementation of PP blend showed no beneficial effect in chickens fed BSFLM, except for reduction in the serum concentration of glutathione peroxidase and ALP.

Table 3. Effect of dietary supplementation of probiotic cum prebiotic blend on the performance of broiler chicken fed BSF larva meal at graded levels

BSFLM, % in diet	Probiotic + prebiotic, 300g/ton	Body wt. gain, g			Feed intake, g		FCR	
		0-1wk	0-3wks	0-6wks	0-3wks	0-6wks	0-1wks	0-6wks
0		134.9^{b}	909.8^{a}	2516^{a}	1140	3803^{a}	1.037^{b}	1.512^{c}
8		141.1^{a}	881.1^{b}	2391^{b}	1123	3716^{ab}	1.022^{b}	1.554^{b}
12		135.0^{b}	843.6^{c}	2302^{c}	1106	3706.2^{b}	1.091^{a}	1.610^{a}
P		0.021	0.0001	0.001	0.093	0.070	0.017	0.0001
N		24	24	24	24	24	24	24
SEM		1.758	7.966	16.74	10.884	32.130	0.018	0.009
	-	137.2	878.3	2397	1126	3748.5	1.066	1.565
	+	136.7	878.1	2409	1119	3735.0	1.034	1.552
	P	0.820	0.978	0.552	0.552	0.717	0.126	0.200
	N	36	36	36	36	36	36	36
	SEM	1.435	6.504	13.668	8.887	26.234	0.014	0.007

Table 4. Effect of dietary supplementation of probiotic cum prebiotic blend on slaughter variables (g/kg), serum titres and glutathione peroxidase concentration of broiler chicken fed BSF larva meal at graded levels

BSFLM, % in diet	Probiotic + prebiotic, 300 g/ton	RTC	Breast	Liver	Abd fat	Bursa	Giblets	ND titres, log2	GPX, units/ml
0		709.6	261.7	18.4	9.99	1.24^{b}	38.8	6.05	157.8
8		717.3	264.2	18.3	10.96	1.45^{ab}	38.6	5.85	168.4
12		717.3	259.6	18.8	11.05	1.65^{a}	39.6	5.85	149.1
P		0.874	0.728	0.845	0.529	0.033	0.675	0.582	0.415
N		20	20	20	20	20	20	20	20
SEM		12.064	4.070	0.679	0.730	0.106	0.844	0.156	10.241
	-	709.1	257.4^{b}	18.4	10.57	1.34^{b}	39.2	5.93	185.8^{a}
	+	720.4	266.3^{a}	18.6	10.76	1.55^{a}	38.9	5.90	131.1^{b}
	P	0.421	0.065	0.856	0.823	0.088	0.762	0.854	0.0001
	N	30	30	30	30	30	30	30	30
	SEM	9.850	3.323	0.555	0.596	0.087	0.689	0.127	8.361

Identification and characterization of residual feed intake specific SNPs and candidate genes in coloured broiler

Top 12 high residual feed intake (HRFI) and 12 low residual feed intake (LRFI) chickens were selected for genomic analysis using resequencing approach. Detail comparative performance of PB1 chickens used for sequencing is presented in Table 5.

Table 5. Performance of PB1 chickens used for sequencing (n=12 per group)

Measurement	LRFI	HRFI	p-Value
RFI (g/d)	-24.61±4.19 (-68.93 to –16.16)	24.13±1.36 (35.75 to 18.89)	<0.001
Actual FI (g/d)	146±4.78	190±4.72	<0.001
Initial BW (g)	1478±56.8	1448±47.5	0.731
Final BW (g)	3658±126	3539±117	0.530
ADG (g)	44.5±2.76	42.7±2.01	0.619
FCR	3.398±0.187	4.540±0.159	<0.001
Actual FI as % of Predicted FI	85.71±2.08 (64.64 to 91.31)	114.6±0.83 (121.7 to 110.46)	<0.001

The significance of difference between LRFI and HRFI birds was determined using Student's t-test. There was no significant difference between HRFI and LRFI sub-groups in the initial body weights and the final body weights, nor the average daily gain (ADG). There were, however, significant differences in daily feed intake between the groups. Consequently, the difference in mean RFI values and the FCR between HRFI and LRFI chickens were highly significant.

Genomic DNA was isolated from whole blood samples collected from 12 HRFI and 12 LRFI chickens using the DNeasy blood kit (QIAGEN) as per manufacturers instruction. Pure DNA is eluted in water and stored at -20 until further use. The concentration of DNA was determined using a qubit fluorometer and the quality will be assessed based on tapestation analysis. The Kapa Hyperplus kit was used to perform library preparation as per Manufacturers instructions. The expected library size was checked by running a tapestation. A library was considered a pass if it resulted in a right peak at the expected size and yielded enough for sequencing. The libraries were normalized, pooled and sequenced using NovaSeq X plus. We used 10B flow cell, 300 cycle kit to generate ~ 12-13 Gb Gb data per sample with 150bp read length. Base composition by position, sequence length and mean read quality score of the sequenced reads were checked using FastQC and MultiQC. Demultiplexed and trimmed FASTQ files, along with the reference genome (GCF_016699485.2_bGalGal1.mat.broiler. GRCg7b), were uploaded onto the Illumina BaseSpace Cloud Platform for the process of Alignment and Variant Calling. The DRAGEN Germline application (version 4.2.4), an Illumina Software Tool, was used to carry out read quality check, mark duplicated reads, Alignment of the reads to the reference

genome, followed by sorting and finally Variant Calling. The VCF files produced as part of the variant calling process were annotated with the publicly available software tool, VEP (version 110). The variants belonging to both the groups were filtered so as to only include those variants that are present on all the 12 samples of a particular group, along with having a Minor Allele Frequency of greater than equal to 0.01 (this allows variants with insignificant MAFs, such as 0 or NA, to be filtered out). A publicly available software, PLINK (version 1.9) was used to carry out the filtration process.

In this study, total of 32078790 putative SNPs were obtained from 24 samples. The variants belong to both HRFI and LRFI groups were filtered so as to only include those variants that are present on all the 12 samples of a particular group, along with having a minor allele frequency of greater than equal to 0.01. Total filtered variants were 673204 and 675861 in HRFI and LRFI groups, respectively. The filtered variants unique to LRFI samples, unique to HRFI samples and common to both groups were 410724, 408067 and 265137 respectively.

The classification of a variant based on its location in genome that impacts the gene structure aids in understanding the consequence that might be caused due to its presence has been presented in following Variant consequence type abundance plots (Fig 4 and 5). Intron variants are the most abundant types followed by Upstream and downstream variants in both the groups.

SNPs were further classified according to the impact on their respective regions of the genome in the following way: High impact mutations as those affecting splice site, start and stop codons; moderate impact as non-synonymous variations; low impact as synonymous variations; and as modifier impact as variations in non coding region (upstream, downstream, intergenic and untranslated regions (UTR) but transcribed regions). Modifier variants were most predominant followed by low impact variations in both the groups.

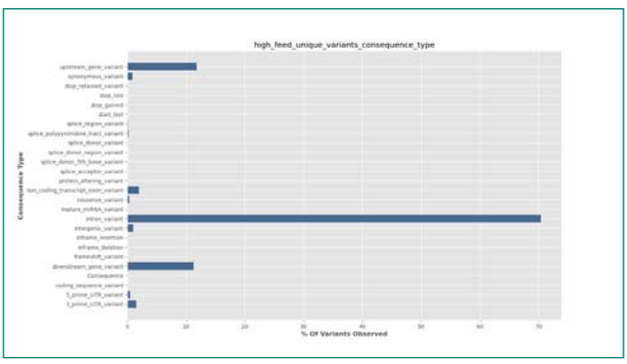


Fig. 4.

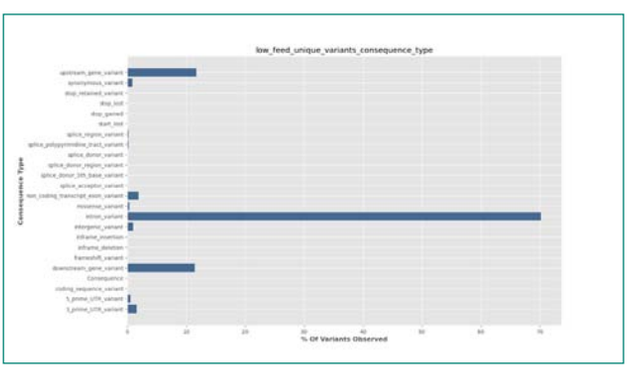


Fig. 5.

Annotation of the variants across both the groups made it possible to obtain information about the genes that these variants are occurring in. Post filtration high RFI variants involved 19571 genes whereas low feed (post filtration) variants involved 19664 genes. Genes unique to low RFI samples were 2702 and genes unique to high RFI samples were 2609.

Mitochondria level analysis indicated that 23 SNPs were unique to Low RFI samples, 5 SNPs were unique to high RFI samples and 76 SNPs were common to both the groups. High RFI group had 39, 7 and 1507 low, moderate and

modifier impact variants respectively. Low RFI group had 2, 42, 14 and 1852 high, low, moderate and modifier impact variations, respectively.

The following Circos plots (Figure 6) shows a graphical representation of distribution of the variants across each chromosome in low RFI group. First layer depict relative size of each chromosome, second layer depicts distribution of SNPs across each chromosome and the third layer describes the spread of high impact variants across chromosomes.

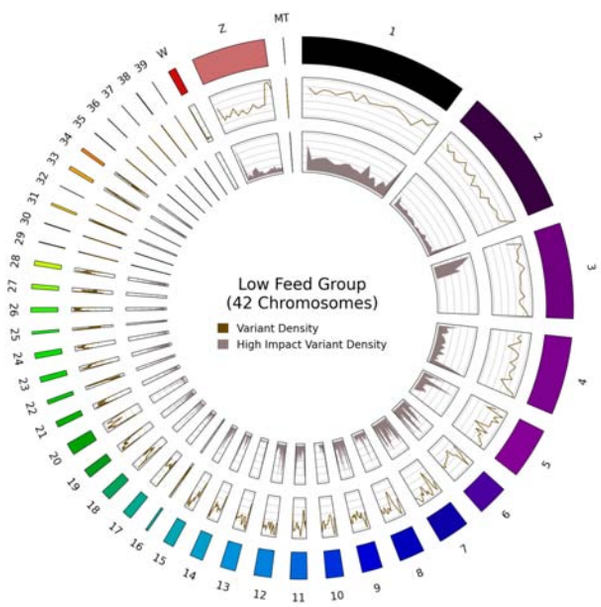


Fig. 6.

Biosynthesis of different nano mineral particles using plant extracts and evaluation of their potential as feed supplement in poultry

To replace inorganic minerals which has low bioavailability and the excretion of which leads to environmental pollution, the Directorate initiated research to biosynthesise different mineral nanoparticles using plant extracts and explore their feeding value for poultry. During this period, Zinc oxide nanoparticles biosynthesised using plant extracts was evaluated in the diet of commercial broilers.

Zinc oxide nano particles were biosynthesised using neem leaf extract and characterized for size, shape and other characteristics. The feeding value of this biosynthesised nano zinc was evaluated in comparison with inorganic and organic zinc on performance of commercial broilers. A total of 210, one-day old male broiler chicks (Vencobb) were randomly assigned to six groups (35 chicks/group) having 7 replicates with 5 chicks per replicate. The treatment groups were fed either 40mg or 80 mg of Zn from any of the three sources of Zn i.e. inorganic, organic or nano Zn. Zinc sulphate and Zn proteinate were used as inorganic and organic sources of zinc respectively. All birds were kept under the same managerial conditions. Results indicated that there was no significant difference in cumulative body weight gain and feed intake among the groups. However, significantly better FCR was observed in nano Zn and organic Zn fed groups as compared to inorganic Zn fed groups. Plasma Zn, tibia Zn and meat Zn contents were significantly higher in nano Zn and organic Zn fed groups as compared to inorganic Zn fed birds **(Figure 7).** The nano Zn and organic Zn groups had higher serum super oxide dismutase (SOD) activity, glutathione peroxidase (GPx) activity and lower malondialdehyde (MDA) content as compared with inorganic Zn fed group (**Table 6)**. Humoral immune response was better in nano Zn and organic Zn groups as indicated by the higher levels of antibody titres observed in these groups as compared to inorganic Zn fed groups **(Figure 8).** Most of the carcass characteristics and relative weights of different organs were comparable among the groups. From the study,

it may be concluded that the supplementation of either nano or organic Zn improved feed conversion efficiency, humoral immune response, antioxidant response and zinc status in comparison with inorganic zinc in commercial broiler chicken.

The project was initiated at the Directorate with an aim to develop real time poultry environment monitoring using IoT sensors to reduce environmental stress on poultry birds and also to study the vocalization of poultry and correlate it with bird health, stress and gender.

Table 6. Effect of inorganic, nano and organic zinc supplementation on serum super oxide dismutase and glutathione peroxidase activities and malondialdehyde (MDA) content in commercial broilers

Treatment	SOD	GPx	MDA
	U/ml	(nmol/ min/ml)	(µmol/L)
InorgZn40	105.56^{c}	129.5^{c}	3.45^{a}
InorgZn80	113.86^{c}	132.5^{c}	3.32^{a}
NanoZn40	132.5^{ab}	149.7^{ab}	2.95^{b}
NanoZn80	141.6^{a}	162.2^{a}	2.55^{c}
OrgZn40	125.65^{ab}	145.5^{ab}	3.05^{b}
OrgZn80	135.8^{a}	156.8^{a}	2.72^{c}
SEM	5.1	5.56	0.21
N	7	7	7
P value	0.03	0.045	0.02

^{a,b,c} Means with different superscripts in a column differ significantly.

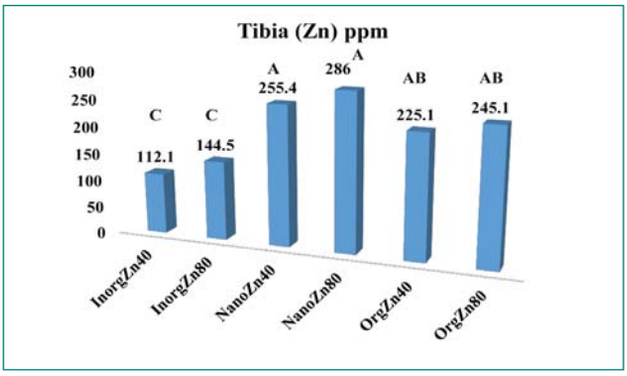


Fig. 7. Effect of nano, inorganic and organic zinc supplementation on tibia zinc levels in commercial broilers

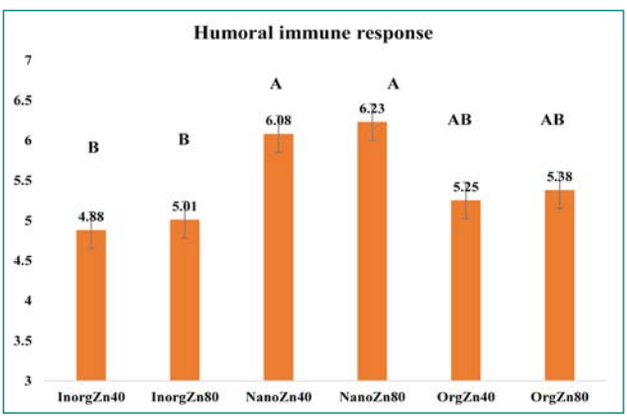


Fig. 8. Effect of nano, inorganic and organic zinc supplementation on humoral Immune response (Antibody titres against Newcastle disease vaccine, Log 2 values) in commercial broilers

The wireless IoT sensor network developed by Centre for Development of Advanced computing (C-DAC), Kolkata with inputs from the Directorate for real time monitoring of the important poultry environmental parameters like temperature, relative humidity, dust, and gaseous emissions (ammonia, CO_2) are deployed at five locations including one commercial layer farm and one commercial broiler farm and are being tested for speed, accuracy, reliability.

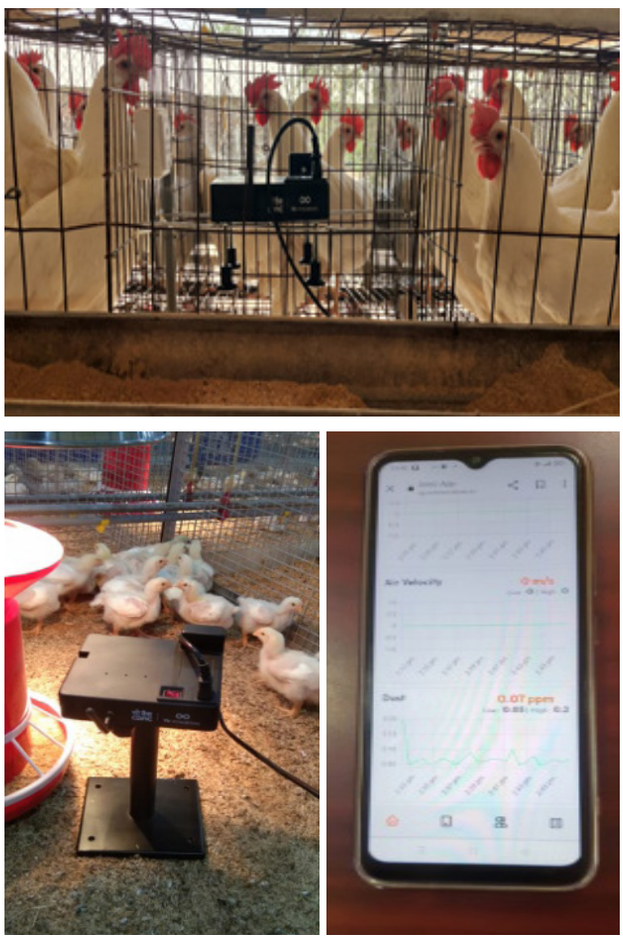


Fig. 9. Real time environmental monitoring of farm using fabricated wireless sensor node Experiments were also conducted for detection of stress through vocalization analysis in White Leghorn birds

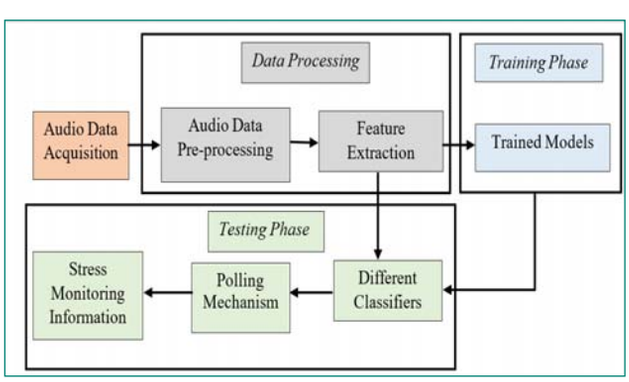


Fig. 9. Block diagram of system used for developing model for stress detection through vocalization analysis in White Leghorn chicken

Vocalization frequency, intensity, pattern is an indicator of behaviour changes of birds and provide valuable clues regarding performance, health and other stress conditions. In this project, an Experimental facility for collection of vocalization data of chicken is established at the Directorate. For stress detection in White Leghorn birds through vocalization analysis, vocalization data were collected during normal condition and also during stress condition (using external stimuli like opening umbrella, colored balloons, heat, handling birds, changing birds, difference in light intensity, movement of birds, flies, squirrels etc.). The data recording was done using 16-channel Audio Mixer, dynamic microphones, computer, speaker, headphone and specially developed data recording software at the Directorate. The recording format used was 16-bit, 44.1 kHz, mono Windows PCM wav format. A total of 12.5 hours of White Leghorn birds' vocalization data collected (Seven hours of normal and 5.5 hours of stress) and the data was analysed at CDAC, Kolkata for developing a model for stress detection using AI-ML tools. The dataset was partitioned into training (80%) and evaluation (20%) sets for the ML-based system for building and evaluating the model. Spectral features such as pitch, intensity, and frequency modulation were extracted from the audio recordings for normal **(Figure 10)** and stressed birds **(Figure 11).**

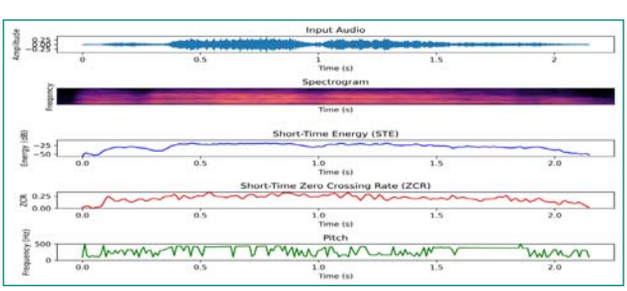


Fig. 10. Birds vocalization in normal condition

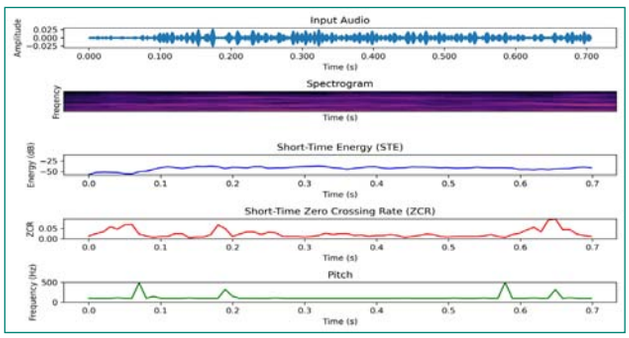


Fig. 11. Birds vocalization in stress condition

Additionally, higher-level features like Mel-frequency Cepstral Coefficients (MFCCs), Chroma Feature, Mel Spectrogram were also extracted for temporal and spectral characteristics of stress-related vocalizations. Moreover, a hybrid feature set was introduced, merging MFCC, Chroma STFT, and Mel-spectrogram, which significantly improved the stress detection accuracy. The developed model introduces a non-intrusive methodology for continuously monitoring the welfare of these birds by harnessing the power of AI and ML techniques.

Gender determination in chicks is crucial in poultry production, but current methods like vent sexing and feather sexing have limitations. Vent sexing relies on expertise and is stressful, while feather sexing is easier but most strains (breeds) of chickens do not have these feather sexing characteristics and not all chicks can be feather sexed. Moreover, these techniques cannot be automated. Therefore, the project team initiated a pilot study to develop an automated and non-invasive method for gender determination using vocalization analysis of one day old chicks by utilizing artificial intelligence and machine learning tools.

To collect the chicks' vocalization data, a specially designed box was developed fitted with a light source, wired microphone, and wireless recorder **(Figure 12).** The box is made in such a way that external sound was minimized to nearly zero. Our collaborators, CDAC, Kolkata, has developed a mobile app for chicks' sound recording. For chicks data collection - both a hand held audio recorder and *Mobile App* is being used. Using these recorded audio data, a POC system is developed to identify the gender from the chicks audio. The collected audio data was analysed at audio processing laboratory of CDAC, Kolkata.

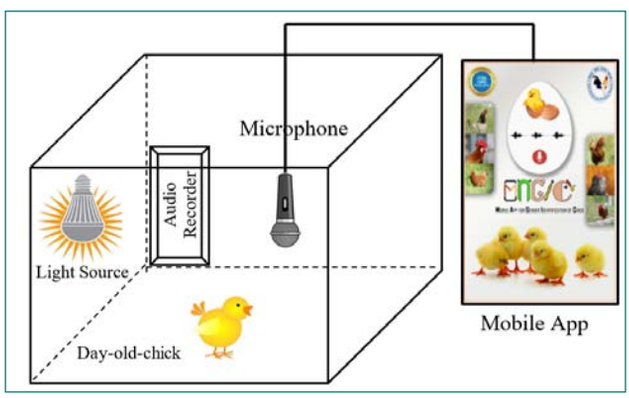


Fig. 12. Schematic diagram of specially designed box for recording of vocalization of one day old chick

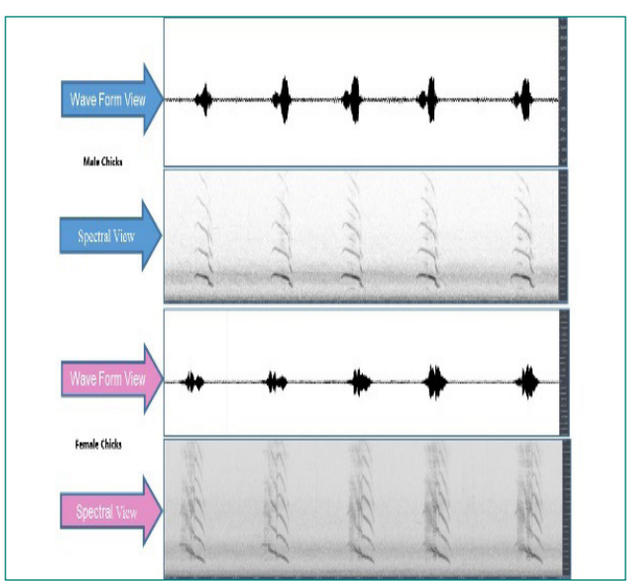


Fig. 13. Vocalization signals of male and female one day old chicks

The vocalization signals of male and female one day old chicks **(Figure 13)** are different and these difference was used for identification of the gender. The project team collected one day old chick vocalization data of Cornish (CN), Gramapriya (GP), Vanaraja (VR), and White Leghorn (WL)) for the study. The project team also extracted important features like spectral features Melspectrogram, Mel-Frequency Cepstral Coefficients (MFCCs) Chroma Feature and Hybrid features for the analysis from the collected audio data. Different classifiers like Support Vector Machines (SVM), Multi-Layer Perceptron (MLP), Logistic Regression (LR), Decision Tree (DT), Random Forest (RF), Gradient Boosting Machines (GBM), Gaussian Naive Bayes (GNB), K-Nearest Neighbors (KNN), X Gradient Boost (XGB), AdaBoost (ADB), Light GBM (LGB) were used for the analysis.

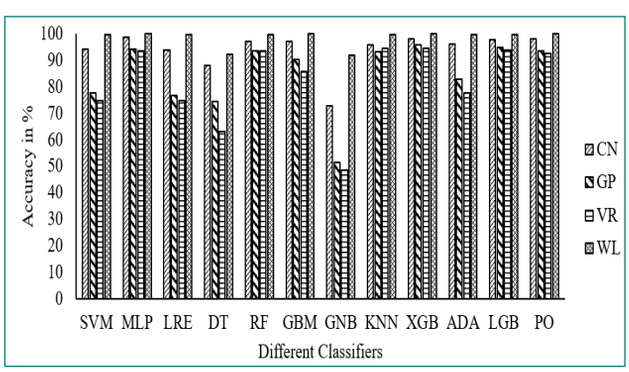


Fig. 14. Performance analysis of different classifiers in identifying gender among four varieties/breeds. CN-Cornish, Gramapriya parent line, VR-Vanaraja parent line, WL-White Leghorn

Performance analysis of different classifiers in identifying gender among four varieties/breeds is given in (Figure 14). Till now 1651 chicks of different varieties/breed vocalization data were collected and the data is being processed to determine gender. Project team has also developed the baseline system for identification of Male and Female chicks from the recorded chicks' voice (Fig). Cornish (CN) and White Leghorn (WL) varieties/breeds achieved exceptionally high accuracy scores across all classifiers. However, Gramapriya (GP) and Vanaraja (VR) varieties showed slightly lower accuracy scores compared to Cornish and White Leghorn varieties/breeds.

Evaluation of QPM hybrid (VLQPMH 59) based-diets with reduced levels of Protein and Lysine on performance in commercial broiler chicken

The study was under taken to determine the feeding value of QPM hybrid in commercial broiler chicken at lower levels of dietary protein and lysine. The maize grains were subjected for evaluation of amino acid content to see the amino acid profile of normal maize and QPM hybrid. It was found that the crude protein, S containing amino acids, Lysine, Tryptophan and Arginine were found to be higher in QPM hybrid compared to normal maize (Table 7). The feeding experiment was conducted in commercial broiler chicken by feeding QPM hybrid based diets with reduced levels (2, 4, 6, 8%) of protein and lysine (Figure 15). A total of 240 chicks (day old) were randomly distributed to 6 treatments with 9 replicates having 5 chicks in each replicate. The feeding trial was conducted up to 6 weeks of age and daily feed intake was recorded and weekly body weight gain was measured throughout the experiment. It has been observed that the feeding of QPM based diets with reduced levels of protein and lysine did not affect the feed intakein commercial broiler chicken. However, during third week among the groups fed Diet 5 and during sixth week among the groups fed Diet

5 and 6 the feed intake was marginally higher compared to those groups fed other experimental diets (Figure 16). Similarly, the body weight gain, slaughter parameters (Figure 17) and feed conversion ratio (Figure 18) were also did not vary among the various dietary groups. The cell mediated immune (CMI) response also did not differ significantly among the different groups in the present experiment (Figure 19). However, CMI was marginally improved among the birds fed QPM based diets compared to those fed normal maize based diets. It is concluded that feeding diet with QPM hybrid (VLQPMH 59) at reduced levels of CP and lysine up to 4% maintained the performance and immune parameter in commercial broiler chicken.

Table 7. Amino acids profile of QPM hybrid and maize grains

Parameters (%)	Maize	QPM (VLQPMH 59)
Crude protein	8.74	9.01
Methionine	0.17	0.18
Cysteine	0.21	0.24
Methionine + Cysteine	0.38	0.42
Lysine	0.25	0.36
Threonine	0.22	0.25
Tryptophan	0.05	0.07
Arginine	0.32	0.39
Isoleucine	0.24	0.29
Leucine	1.06	0.80
Valine	0.37	0.36
Histidine	0.26	0.32
Phenylalanine	0.47	0.39

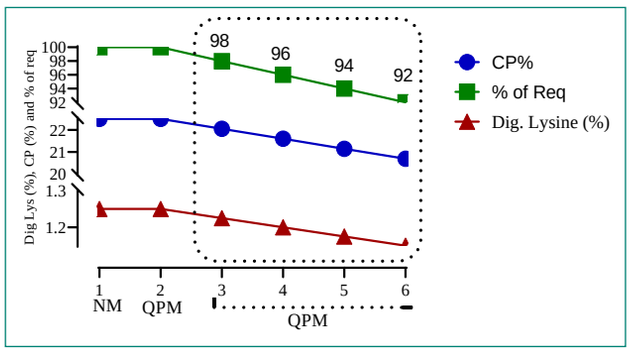


Fig. 15. Experimental diets with normal maize (Diet 1; NM) and QPM (Diet 2) with 100% requirement and QPM with lowered levels of CP and Lysine (Diet 3, 4, 5 and 6).

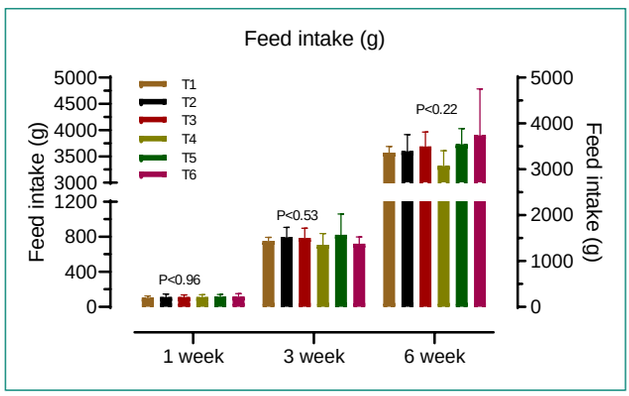


Fig. 16. Effect of feeding QPM hybrid with reduced levels of dietary CP and lysine on feed intake in commercial broiler chicken

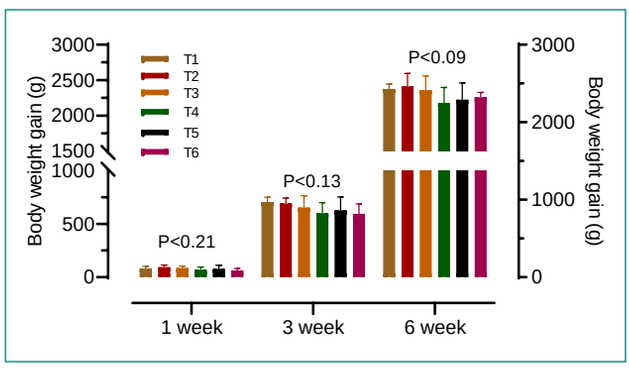


Fig. 17. Effect of feeding QPM hybrid with reduced levels of dietary CP and lysine on body weight gain in commercial broiler chicken

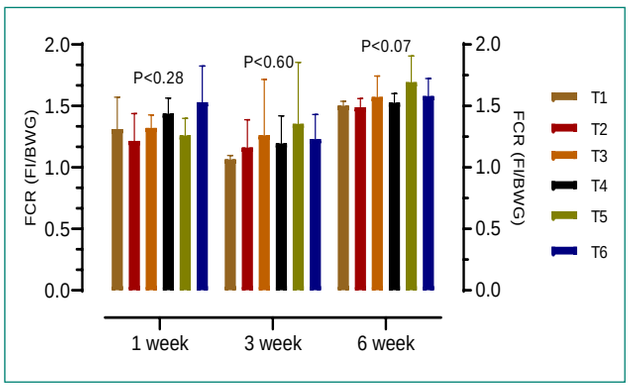


Fig. 18. Effect of feeding QPM hybrid with reduced levels of dietary CP and lysine on feed conversion ratio in commercial broiler chicken

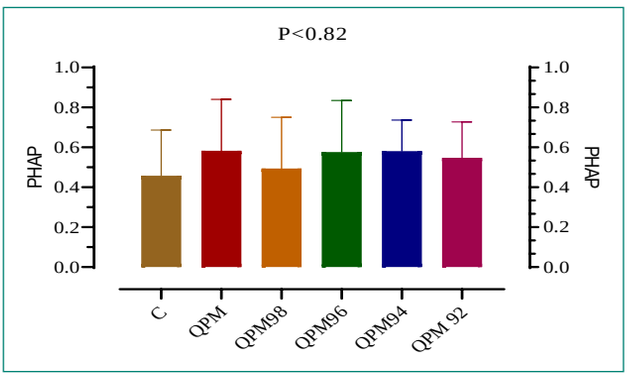


Fig. 19. Effect of feeding QPM hybrid with reduced levels of dietary CP and lysine on cell mediated immune response in commercial broiler chicken

PHYSIOLOGY

Relation between different physiological parameters and production performance in white leghorn layers

The study is being conducted in White Leghorn layers for the laying period from 24-36 weeks of age. This tenure was again divided in to two groups i e 24-28 weeks (Early laying period) and 32-36 weeks (Mid laying period). The hens were divided in to three groups with equal number of 50 birds in each. From 24 weeks onwards basal feed based on maize and soybean @ 110g/bird/d was offered to control group (C). The basal feed contained inorganic selenium @ 0.3ppm which is routinely added at our institute and 0ppm of organic selenium. Treatment groups were offered basal feed along with 0.3ppm and 0.6 ppm of organic selenium (selenium enriched yeast) to T1 and T2 groups respectively throughout the course of the experiment. Blood samples have been collected. Plasma has been extracted and stored for the estimation of hormones, melatonin, ghrelin, estradiol and progesterone. Birds (6 nos.) from each group were sacrificed at 26 and 34 weeks of age. The tissues Jejunum and Magnum were collected for gene expression studies on hormone receptors and amino acid transporters.

The lower concentration of the dose increased egg production significantly ($P< 0.05$) compared to control and T2 group. The higher concentration of the dose, increases body weight and transport of selenium significantly to muscles and egg. Both the concentrations had beneficial effect on the histo-morphology of the jejunum (portion of digestive tract). When the birds were in the mid phase of the laying period, the higher dose increased egg production more effectively than the lower dose. RNA has been extracted from the tissues and has been converted to c DNA for downstream experiments. Experiments are in progress.

Table 1. Body weight (g) of WLH hens

Weeks

	25	27	29	32	34	36
C	1342.1^{a}±14	1346.7^{a}±13	1356^{a}±13	1404.6^{a}±15.4	1414.4^{a}±13.2	1417.4a±12
T1	1342.1^{a}±14	1354.3^{a}±15	1374.69^{a}±13.7	1427.4^{a}±16.8	1434^{a}±12.4	1475.2a±15.2
T2	1334.6^{a}±12	1360.7^{a}±13	1424.22^{b}±12.30	1449.0^{a}±14	1478^{b}±12	1517.2b±10.5

Values are represented as Mean ± SE. Values with different super scripts in a column are significantly different at least at $P<0.05$. C-Control, T1 and T2-Treatment

C-CONTROL, T1, T2-TREATMENT

25-29 weeks - 3 5birds 32-26 weeks - 25birds

Table 2. Egg production (%) of WLH

Weeks

	24	26	28	32	34	36
C	54.4*±0.5	65.1±0.7	82.1±1.0	76.5±0.3	68.84±1.2	64.06±0.9
T1	51±0.5	67.4±0.8	86.08*±0.6	79.8*±0.4	77.85**±1.1	72.1**±1.05
T2	51±0.5	67.8±0.3	84.78±0.5	76.69±0.3	79.71**±1.03	76.6±**1.04

C-CONTROL, T1, T2-TREATMENT

24-28 weeks - 35 birds 32-2 6 weeks-25 birds

Poultry rearing with moringa and other feed base – an Integrated Farming System

Commercial Gramapriya chicks have been taken and are being reared. The birds were taken for the feeding trial in the Moringa farm. There will three treatment groups besides one control group. Each group will be having 20 birds and will have two replicates each. For the control group, feed and water will be made available all the time and treatment group (T1) will be offered 65g feed and earthworm 4g per bird per day, the treatment group (T2) will be offered 65g of feed along with 4g earthworm and 7g moringa dry leaves powder per bird per day and the treatment group (T3) will be offered 65g of feed, 4g earthworms, 7g moringa dry leaves powder and 30g broken rice per bird per day. Body weight and egg production will be recorded when the birds attain the age of 20 weeks.

Cryopreservation of blastodermal cells and production of chicken chimera

Effect of addition of raffinose and antioxidants during cryopreservation of Kadaknath blastodermal cells.

The stage X blastodermal cells of Kadaknath were cryopreserved using 10% dimethyl sulphoxide (DMSO) in 0.25ml plastic straws. The blastodermal cells were stained before and after cryopreservation procedure by 0.4% trypan blue and live cell percentage calculated. The blastodermal cells were cryopreserved in the presence of 0.1 or 0.2M raffinose. The percent live cells during pre and post cryopreservation were evaluated. Both the concentrations evaluated had no effect on the percentage of post-thaw live cells compared to control. In another experiment antioxidants Tempol (1 and 5 mM), betaine (0.1, 0.2 and 0.4M) and ascorbic acid (25, 50 and 100µM) were evaluated during blastodermal cell cryopreservation. Tempol had no effect on the percentage of post-thaw live cells. Betaine at 0.2M concentration significantly ($P<0.05$) improved the post-thaw live cells. Ascorbic acid at 25 and 50µM doses had no effect, whereas, at 100µM concentration significantly ($P<0.05$) reduced the percent post-thaw live blastodermal cells. In conclusion, betaine at 0.2M concentration may be used during blastodermal cell cryopreservation to improve the post-thaw live cells.

HEALTH

Disease monitoring, surveillance and control in chicken populations of DPR

The mortality pattern and causes of mortality: Major diseases recorded during the period under report were septicemia, egg-peritonitis and Newcastle disease. NDV was isolated from suspect samples and identified as genotype 13 by sequence analysis.

Screening of pure line chicken lines for ALV: A total of 3744 vaginal/cloacal swabs collected from 11 pureline populations were screened for ALV by Ag ELISA. The overall ALV positive percentage was 20.6%.

Prevalence of *Escherichia coli* infection, detection of virulence and antimicrobial resistance genes: A total of 1632 dead birds were necropsied, out of which 115 (7.04%) cases were having lesions suggestive of colibacillosis. The chicken carcasses which exhibited gross lesions of Airsacculitis, Pericarditis, Perihepatitis, Peritonitis and Oophoritis were scored as score-1 (mild); score-2 (moderate) and score-3 (severe) and results are presented in the Table 1.

Table 1: Detail gross pathology score of Colibacillosis chickens

Age group	Gross lesion	Score-1	Score-2	Score-3	Total birds	1	2	3	Total score	Final score
Chicks	Airsacculitis	6	15	9	30	6	30	27	63	2.1
	Pericarditis	7	5	5	17	7	10	15	32	1.9
	Perihepatitis	0	3	1	4	0	6	3	9	2.3
Growers	Airsacculitis	8	7	8	23	8	14	24	46	2.0
	Pericarditis	6	7	12	25	6	14	36	56	2.2
	Perihepatitis	3	6	5	14	3	12	15	30	2.1
	Peritonitis	1	4	0	5	1	8	0	9	1.8
	Oophoritis	1	2	0	3	1	4	0	5	1.67
Adults	Airsacculitis	9	6	3	18	9	12	9	30	1.66
	Pericarditis	2	10	16	28	2	20	48	70	2.5
	Perihepatitis	8	3	6	17	8	6	18	32	1.9
	Peritonitis	7	31	33	32	7	62	99	168	2.36
	Oophoritis	12	20	25	57	12	40	75	127	2.23
	Salpingitis	1	11	18	30	1	22	54	77	2.6

Out of 115 cases of septicemia, E coli was isolated from 74 cases (64.90%). E coli infection was confirmed by cultural and molecular tests. Virulence genes (iroN, ompT, hlyF, iss and iutA) were detected by multiplex PCR. Out of 70 *E. coli* isolates 50 (71.42%) isolates harboured iroN gene, 50 (71.42%) isolates carried ompT gene, 50 (71.42%) isolates harboured hlyF gene, 54 (77.14%) isolates harboured iss genes and 60 (85.71%) isolates harboured iutA gene. Three antimicrobial resistance genes (blaTEM, tetA, strA strB) were determined by PCR. Out of 74 *E coli* strains tested 40%, 85.71% and 41.42% isolates were positive for blaTEM, tetA and strA strB genes. Antimicrobial sensitivity testing of 74 isolates of *E coli* isolates against 16 antibiotics revealed high percentage of resistance to some antibiotics. *E coli* serotypes detected were O2, O7, O20, O109, O114, and O118.

Indian Network for Fisheries and Animal Antimicrobial Resistance

A. Isolation and Identification of *Escherichia coli* isolates

Milk samples of cattle and buffalo, rectal swabs of sheep and goat, cloacal swabs of poultry for three different quarters among four different districts were collected and subjected to isolation of *Escherichia coli* based on metallic sheen colour (Figure 1) on Eosin Methylene Blue Agar (EMB Agar) and biochemical identification using grams staining and IMViC tests. Molecular characterization of *Escherichia coli* was confirmed by using Pentaplex PCR for presence of *lac*Y, *lac*Z, *uid*A, *cyd*A, *pho*A genes. Isolation percentage of *Escherichia coli* from different animals in each quarter and overall percentage is shown in Table 2.

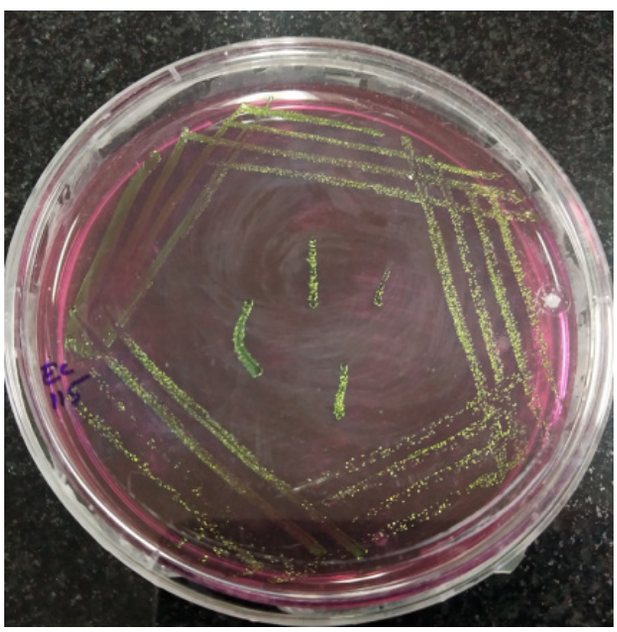


Figure 1: Metallic sheen colonies on EMB agar

Table 2: Isolation percentage of *Escherichia coli*

Type of Animal (Sample type)	*Escherichia coli (%)*			
	Quarter 1	Quarter 2	Quarter 3	TOTAL
Cattle (milk)	65.0	62.5	50.0	59.2
Buffalo (milk)	67.5	60.0	55.0	60.8
Sheep (rectal)	100.0	100.0	95.0	98.3
Goat (rectal)	100.0	90.0	100.0	96.7
Poultry (cloacal)	96.7	96.7	93.3	95.6

Phenotypic detection of antibiotic susceptibility among *Escherichia coli* isolates

Antibiotic sensitivity test (ABST) by disk diffusion was done for various antibiotic classes belonging to Penicillins (Ampicillin), Aminoglycosides (Amikacin), Quinolones (Nalidixicacid,Enrofloxacin),Folate-Pathway Inhibitors(Trimethoprim/Sulfamethoxazole), Phenicols (Chloramphenicol), Tetracyclines (Tetracycline), Cephems (Ceftazidime. Cefoxitin, Ceftriaxone, Cefotaxime, Cefpodoxime) and Monobactams (Aztreonam). For poultry *E. coli* isolates Colistin was also tested using MIC by broth dilution. Among the antibiotics tested, the highest resistance percentage and highest susceptibility percentage of *E. coli* isolates in different type of food producing animals is shown in Table 3. The MIC was <2.0 depicting that colistin resistance were not there.

Table 3: Highest antibiotic resistance and susceptible percentage of *E. coli*

Animal	Resistant (%)	Susceptible (%)
Cattle (milk)	Ampicillin (94.4%)	Amikacin (97.2%)
Buffalo (milk)	Ampicillin (74%)	Amikacin and Chloramphenicol (94.5%)
Sheep (rectal)	Ampicillin (93.2%)	Amikacin (88.1%)
Goat (rectal)	Ampicillin (50%)	Chloramphenicol (100%)
Poultry (cloacal)	Ampicillin (89.5%)	Cefoxitin (76.7%)

Genotypic detection of Extended Spectrum Beta-lactamases (ESBL) and AmpC betalactamase (ACBL) production among *Escherichia coli* isolates: Screening of resistant samples for genotypic detection of ESBL and ACBL (AmpC betalactamase) was done by PCR and could detect TEM (Figure 2) and AmpC genes.

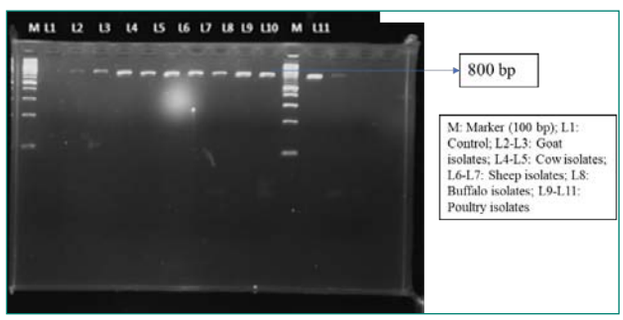


Figure 2: Genotypic detection of ESBL enzyme TEM in *E.coli* isolates of food production animals

B. Isolation and Identification of *Staphylococcus aureus* isolates

Milk samples of cattle and buffalo, sheep and goat rectal swabs and poultry cloacal swabs for three different quarters among four different districts were collected and subjected to isolation of *Staphylococcus* spp. based on jet black colonies (Figure 3) on Baird Parker Agar (BPA) and biochemical identification using grams staining, coagulase and catalase tests. *Staphylococcus aureus* isolates obtained were gram positive cocci in clusters and catalase and coagulase positive. Molecular characterization of *Staphylococcus* was confirmed by PCR based detection of thermonuclease (*nuc)* gene (Figure 4). Isolation percentage of *Staphylococcus aureus* from different animals in each quarter and overall percentage is shown in Table 4.

Table 4: Isolation percentage of *Staphylococcus aureus*

Type of Animal (Sample type)	*Staphylococcus aureus (%)*			
	Q1	Q2	Q3	TOTAL
Cattle (milk)	100.0	92.5	97.5	96.7
Buffalo (milk)	90.0	95.0	95.0	93.3
Sheep (rectal)	75.0	80.0	100.0	85.0
Goat (rectal)	95.0	80.0	100.0	91.7
Poultry (cloacal)	96.7	96.7	100.0	97.8

Phenotypic detection of antibiotic susceptibility among *Staphylococcus aureus* isolates

Antibiotic sensitivity test (ABST) was done for various antibiotic classes belonging to Penicillin-G (Penicillins), Quinolones (Enrofloxacin), Gentamicin (Aminoglycosides), Folate-Pathway Inhibitors (Trimethoprim/ Sulfamethoxazole), Phenicols (Chloramphenicol), Tetracyclines (Tetracycline), Cephems (Cefoxitin), Erythromycin (Macrolides) and Monobactams (Aztreonam). Among the antibiotics tested, the highest resistance percentage and highest susceptibility percentage of *E. coli* isolates in different type of food producing animals is shown in Table 5.

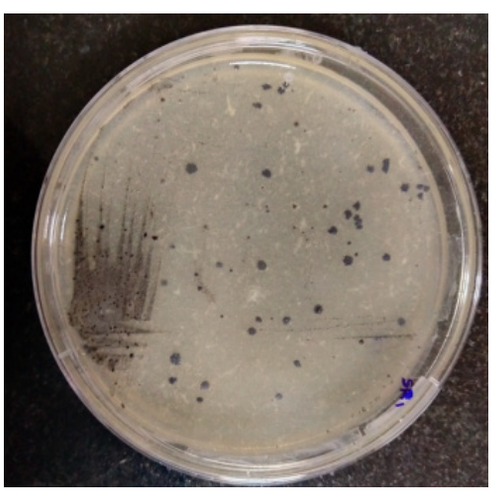


Figure 3: Jet black colonies on BPA

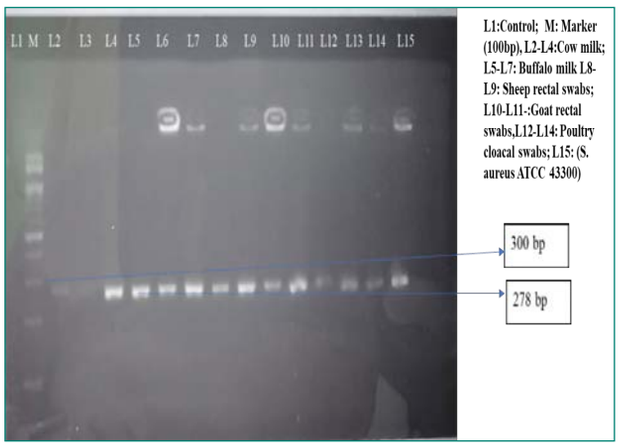


Figure 4: Molecular detection of thermonuclease (*nuc*) gene for identification of *S.aureus*

Table 5: Highest antibiotic resistance and susceptible percentage of *S. aureus*

Animal	Resistant (%)	Susceptible (%)
Cattle (milk)	Penicillin-G (100%)	Chloramphenicol (75.9%)
Buffalo (milk)	Penicillin-G (100%)	Chloramphenicol (78.6%)
Sheep (rectal)	Penicillin-G and Erythromycin (100%)	Chloramphenicol (56.9%)
Goat (rectal)	Penicillin-G and Erythromycin (100%)	Chloramphenicol (70.9%)
Poultry (cloacal)	Penicillin-G (98.9%)	Cefoxitin (48.9%)

Project Title: Prediction of health status in poultry using machine learning models

Creation of database

Creation of health database utilizing secondary data of health, management and production available at chicken farm and health section of ICAR-DPR farm is initiated. Health management data creation with vaccination, postmortem details for 2020, 2021, 2022. Month wise live

bird strength of pure line farms maintained at DPR farm is recorded for 2018-2019, 2019-2020, 2020-2021.

Understanding the disease tolerance/ resistance in Indian native chicken breeds to Newcastle disease and novel control strategies

Purification and characterization of Newcastle disease virus (NDV) specific chicken egg yolk immunoglobulins (IgY) as potential therapeutic and prophylactic use

Chicken Newcastle disease virus specific egg yolk immunoglobulins (IgY) produced by hyperimmunization with combination ND killed and live vaccination of WL chicken and purified from eggs through PEG precipitation method showed in vitro neutralization of vaccine as well as field ND strain. White Leghorn layers were hyperimmunized (n=10) for ND by using combination of both killed and live NDV vaccine by following standard protocol. Eggs from these birds were collected once the HI titre of serum reached 2^{12}. Chicken IgY was extracted and purified from eggs of hyperimmunized birds by following PEG 6000 precipitation method. Total harvest of chicken IgY was 35mg of protein per ml of egg yolk and 70mg from one egg. The hemagglutination inhibition (HI) titer of the preparation was 2^{11-12}. SDS-PAGE characterization of the IgY preparation showed distinct 70 and 20kDa bands representing heavy and light chain of IgY respectively. In vitro neutralization assays with LaSota NDV and velogenic NDV field strain showed good neutralization with titers in the range of 10-12. Good *in vitro* and *in ovo* neutralization of ND virus shows its potential to be used as prophylactics and / or therapeutics during ND outbreak in poultry flocks.

EXTENSION

Assessment of ICAR-DPR germplasms in the field condition and their impact on food security and livelihood

During the period (April, 2020-December, 2023) 10.93 lakh germplasm supplied from ICAR-DPR hatchery to different parts of the country. Majority of the germplasm was supplied in the form of Day Old Chicks (59.6%) followed by fertile eggs (27.5%), parent lines (11.1%) and grownup birds (1.8%). A total of 3898 stakeholders were benefited during the period. The Vanaraja variety was the highest number of supplied birds (41.8%) followed by Gramapriya (27.1%), Srinidhi (8.6%), Kadaknath (7.9%) and rest other birds. During the same period 38.4 lakh germplasm was supplied to 47.9 thousand beneficiaries from AICRP and PSP centers in different parts of the country.

Significant positive impact on attitude of the farmers was observed towards the poultry farming in Bihar due to constant support in terms of input and capacity development. Thischanges was observed in all the categories (SC, ST and OBC &General) of farmers and it the range of about 35-38%. Major factors were responsible for attitude changes were production performance of improved varieties birds and importance of poultry was seen during natural disaster. Attitudinal change lead to increased number of new poultry farmers in the study area by 43.5% as well as there was significant change observed in adoption rate of different poultry production technologies. There is negative correlation with age of farmers, and positive correlation with education, landholding and size of livestock holding with adoption of technology. Income of farmers was increased in tune of 200-380%, weekly egg consumption was increased in the range of 105-135% and monthly chicken consumption was increased in the range 60-105% during the study period in different categories of farmers.

REGIONAL STATION, BHUBANESWAR

Research Achievements

Genetics and Breeding

Maintenance of Kuzi duck and evaluation of its crossbreds

During the year, S-4 generation of Kuzi was hatched and data collected up to 40 weeks of age. The S-3 generation's egg production and egg weight data were also analysed. The egg production from 20-40 week and up to 40 weeks of age in S-3 generation were 87.51±3.48 and 92.51± 3.50 eggs, respectively. Number of female kept for evaluation was 320. The egg weight recorded at 40 weeks of age was 68.84±0.66 g. In S4 generation total ducklings kept at farm was 800 in numbers and the fertility % was 74.05% (S3=71.70%) and hatchability % on total egg set and fertile egg set basis were 64.42 and 86.99%, respectively. The fertility and hatchability on fertile egg set improved over last generation. The stock is being maintained as a non pedigreed selected line using 250 female and 50 males in each generation. The juvenile body weights at different weeks of age in both the hatches are presented in Table 1. The 8th week body weight which is the primary trait of selection was increased by 69 g in current generation. The Shank, bill and keel length at 8 weeks of age in straight run birds were 71.17±0.13, 64.97±0.13 and 116.76±0.23 mm, respectively. Most of the birds were multi-colour and dominant shank and bill colour was pink and brown, respectively. The eviscerated carcass yield % in male and female at 10 weeks of age was 67.31±0.59 and 68.68±0.53%, respectively. The growing period body weights in male and female are presented in Fig.1. The 20 week body weight in female was 1459±9.30 g. Age at different duck day production % and age at first egg of the flock are depicted in Fig. 2 and it was observed that compared to last generation the flock takes more days to reached the production level except age at first egg of the flock. The egg production up to 40 weeks of age was 90.94±2.02 eggs and reduced by 2 eggs compared to last generation. The egg weight at 40 weeks of age was 71.28±0.46 g and increased by 2 g compared to last generation. Number of females kept for the egg production record was 347 numbers. The egg quality parameters measured at 40 weeks of age are presented in Table 2. The mortality % from 0-8, 8-16, 16-20 and 20-40 weeks of age was 2.50, 0.42 and 2.29%, respectively. Flock photographs of Kuzi having different plumage colour pattern are given in figure 3-7.

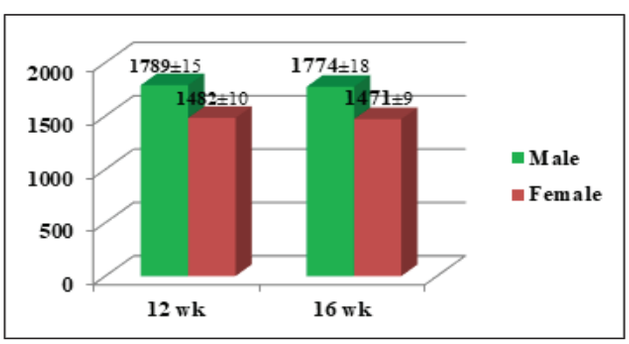


Fig.1. Growing period body weight (g) in S4 in Kuzi

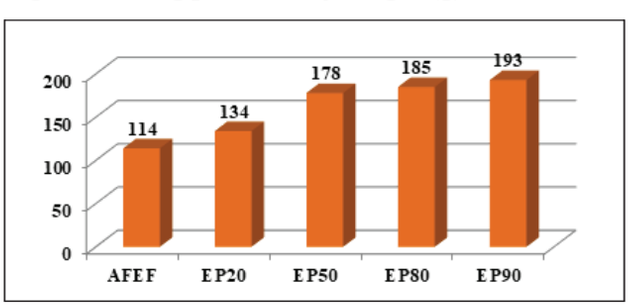


Fig. 2. Duck day egg production at different ages in Kuzi

The egg number, egg quality and egg weight at different weeks of age recorded in purebred Kuzi (D), Khaki Campbell (K) and White Pekin (W) and crosses of Kuzi with Khaki Campbell

(DK and KD) and Kuzi with White Pekin (DW and WD) were analysed. The comparative duck day egg productions at different period in different genetic groups are presented in Table 3. Significant difference between the genetic groups was found for the egg production number during different period. Among the purebred Kuzi and Khaki Campbell produce more eggs though numerically Kuzi produce more eggs. Amongst the crosses both DK and KD produced well and better than both the parents. DW and WD also produced better than White Pekin and all the crosses showed positive heterosis for the egg production up to 40 weeks of age. The heterosis % for egg production up to 40 weeks of age in DK, KD, DW and WD were 13.13, 16.89, 2.80 and 0.67%, respectively. DK and KD out performed both the parents in respect to egg production up to 40 weeks of age. The egg weights in different genetic groups at different weeks of age are presented in Table 4 and the egg weight differ significantly between the genetic groups irrespective the age of measurement. Amongst the purebred White Pekin showed higher Egg weight followed by Kuzi and Khaki Campbell. Amongst the crosses the crosses having White Pekin as one parent showed higher egg weight than DK and KD. KD recorded higher egg weight than DK at 40 weeks of age. At 40 week of age egg weight except DK all other showed negative heterosis, however all the crosses recorded higher egg weight than one parent irrespective the age of measurement. The egg quality recorded at 40 weeks of age revealed significant difference between genetic groups for the traits like egg weight, shape index, albumen index, content % (albumen, yolk, shell), shell thickness and Haugh unit. A Haugh unit ranges from 92.78 to 97.20 which indicate the good quality of the eggs in all the genetic groups. Mortality from 16 to 40 weeks of age ranges from 0 to 2.70% in different genetic groups. The results revealed that for egg production DK and KD crosses are to be preferred and for dual purpose birds DW and WD crosses were performing well. If purebreds is to be propagated then both Kuzi and Khaki is the breed of choice however, the egg weight in Khaki Campbell is lower than the Kuzi. The photographs of different genetic groups during laying period are given from figure 8-13. During the period from the project bird ducklings were also supplied to the farmers for duck farming.

Table 1. Juvenile body weights in S4 generation of Kuzi.

Traits	Values (N=768)
Day old BW (g)	42±0.15
1 wk BW (g)	111±0.85
2 wk BW (g)	279±1.63
4 wk BW (g)	670±2.89
5 wk BW (g)	943±4.68
6 wk BW (g)	1160±4.67
7 wk BW (g)	1338±4.89
8 wk BW (g)	1418±5.60

In first column BW=Body weight, wk=week; in second column N=number of observation.

Table 2. Egg quality in Kuzi ducks at 40 weeks of age.

Parameters	Values
Egg weight (g)	73.57±0.61
Shape index	75.13±0.41
Albumen index	0.1345±0.0028
Yolk index	0.43±0.006
Yolk colour	1.25±0.07
Shell thickness without membrane (mm)	0.3971±0.0041
Haugh unit	88.39±0.61
Albumen %	58.30±0.31
Yolk %	31.64±0.27
Shell %	10.07±0.12

Table 3. Egg production in different genetic groups in different periods

Genetic groups	EP16-20	EP20-40	EP40
Kuzi (D) (N=45)	32.04±2.90^{ab}	73.67±1.40^{b}	105.71±1.40^{ab}
Khaki Campbell (K) (N=42)	16.71±2.28^{c}	76.86±1.79^{ab}	93.57±1.79^{bc}
White Pekin (W) (N=46)	2.67±1.52^{d}	55.80±1.31^{d}	58.47±1.31^{d}
DK (N=67)	31.92±5.49^{ab}	80.80±2.12^{a}	112.72±7.09^{ab}
KD (N=37)	41.47±4.23^{a}	75.00±1.15^{ab}	116.47±4.04^{a}
DW (N=77)	20.26±1.83^{c}	64.13±1.84^{c}	84.39±3.23^{c}
WD (N=78)	23.42±4.38^{bc}	59.22±2.84^{cd}	82.64±6.82^{c}

Average showing even one common superscript did not differ significantly ($p<0.05$).

EP16-40=Duck day egg production from 16-20 weeks of age. EP20-40= duck day egg production from 20-40 weeks of age and EP40= Duck day egg production upto 40 weeks of age. N=Number of females

Table 4. Egg weight (g) at different weeks of age in different genetic groups.

Genetic groups	EW20	EW30	EW40
Kuzi (D)	53.87±0.82b	64.40±0.52b	69.00±0.33^{c}
Khaki Campbell (K)	47.34±0.70^{d}	62.37±0.46^{c}	65.20±0.56e
White Pekin (W)	59.33±1.93^{a}	69.22±0.47^{a}	73.38±0.35^{a}
DK	50.89±0.65^{c}	63.82±0.46^{bc}	66.58±0.35^{de}
KD	51.07±0.77^{c}	63.09±0.70^{bc}	68.21±0.42^{c}
DW	55.68±0.73^{b}	68.16±0.45^{a}	71.00±0.38^{b}
WD	54.63±0.70^{b}	68.29±0.55^{a}	70.44±0.36^{b}

Average showing even one common superscript did not differ significantly ($p<0.05$).

Fig. 3. Kuzi multi colour

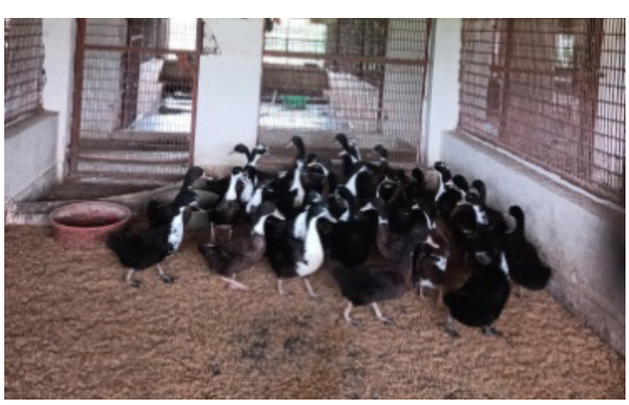


Fig. 4. Kuzi White brest black

Fig. 5. Kuzi multicolour

Fig. 9. KD

Fig. 6. Fawn and brown colour

Fig. 10. DW

Fig. 7. Kuzi male

Fig. 11. WD

Fig. 8. DK

Fig. 12. Khaki

Fig. 13. White Pekin

Breeding for Development of Mycotoxin Tolerant Meat Type ducks

Under this project, the Experimental Pekin embryos were exposed to micro-quantities of AFB1 (***In Ovo***) to sensitize them and their performances (Fitness, growth, productivity etc.) were recorded and analyzed for experimental purposes.Among the parallel stock (un-exposed to any toxins), Selective breeding for improvement in Juvenile body weight (BW6) is being followed, which Selective breeding for Mycotoxin-tolerance could not be operated during the year 2023. As a routine, Productivity-profiling of ducklings [for both AFB1 exposed versus No-toxin exposed] for growth, production, histopathology (outsourced) were undertaken and are being reported here.

(A) Mycotoxin-threshold and toxin-toxin interaction impacting neonatal Growth of Pekins accessed via In Ovo injected Aflatoxin B1 and Ochratoxin, with or without ameliorants.

Studies were taken up to explore impacts of Aflatoxin-B1 (AFB1) and Ochratoxin-A (OTA) on Pekin embryos, individually and in interaction modes. Mycotoxins injected *in ovo*, (inoculated on D23 of Incubation), with groups (N per group=90 eggs) receiving varying doses of AFB1 (1 to 6 ng/egg) and OTA (50 ng/egg) individually or with combinations of AFB1, where amelioration (lysine + Methionine at fixed doses) were offered, *in ovo*, to select duckling groups to study patterns of hatchability, survival and Neo-natal growth.

Under the Results realized, the following prominent findings were generated:

a) A linear decrease in hatchability was seen with increasing AFB1 doses, *in ovo*, from 1ng/egg, with the highest growth retardation visible at 6ng/egg.

b) As expected, the OTA+AFB1 group showed the harshest impact on fitness of Pekins.

c) Hatchability dropped significantly (15 to 32% drops) over the treatments.

d) Weekly neonatal growth varied across groups, with OTA individually or in combination, negatively affecting growth up to 4th week of age.

e) Post-natal mortalities ranged from 14% to 36% over 4-week period in AFB1 and OTA interaction groups.

f) Growth depression and stressed-survival were consistently associated with OTA injected groups. Administering the combo of 2 prominent essential amino acids, i.e. lysine and methionine at fixed doses (@10 mg/egg each), *in ovo*, could not significantly reduce mortalities, as accounted from AFB1+OTA combinations, but showed compensated growth in the recipient embryos up 3rd week at par with controls/sham controls.

g) It was concluded that Inter-toxin interaction created more severe morbidity in Pekins, comparable to or higher than group receiving highest doses (6 ng) of AFB1.

h) As a trend, the Lysine and methionine administered, *in ovo*, tended to ameliorate duckling's growth and feed efficiency, through improving fitness from 0 to 5 weeks of age.

(B) Prenatal Aflatoxin tolerance of Pekin embryos, with or without amelioration through *In Ovo* injections

Under these, experiment was conducted with 450 fertile-eggs of Pekins for *in-ovo* intervention on D23 to determine the prenatal Aflatoxin (AFB1) tolerance in Pekin ducks. Purified AFB1 was used at 3 experimental dilutions, namely @ 2.0, 4.0 and 6.0 ng per egg, to be delivered, *in-ovo*, in sterile normal-saline solution (NSS at pH 7.0) following standard procedures. A simultaneous treatment comprising of purified lysine and L-methionine in-combination (L+M) @10 mg each, was delivered along with AFB1 at above 3 doses, besides a sham-control.

The Results realized from above showed that:

i) Despite exposure to AFB1, Pekins- embryos hatched out at reasonable percentages (fertile-eggs basis) ranging from 50 to 82% correlating well to their *in-ovo* delivered AFB1 levels. Necropsy of dead-in-shell embryos, showed up typical inflammatory hepatotoxic-lesions, associated with usual AFB1 pathology, starting with 2 ng/egg levels. Neonatal growth measured up significantly higher for group that received Lysine and Methionine (L+M), besides AFB1 exposure. The mortality levels (till 5 weeks) varied from 28 to 51% for all treatments that received in-ovo AFB1 at varied doses.

j) The L+M combination showed up significantly better growth and tolerance compared to only-AFB1 exposed birds, which were devoid of any ameliorants.

k) The growth peak (till 5th-week) still was significantly-lower (~l1%) in the group receiving AFB1 (@ 2 ng/egg) along with L+M supplementation, compared to controls (1750 g at 5 Wks). The weekly weight gains remained lower than control, for all AFB1-groups,

l) The L+M groups retained their significant-superiority over only-AFB1 groups, indicating a hepato-protective effect from this amino acid combination.

m) The Study concluded that despite pre-natal AFB1-exposures, amino-acid combo (lysine and methionine) offered distinct ameliorative effects in juvenile-growth of pekins, evidenced from higher growth through 2-5 weeks period, in all AFB1-recipients.

n) Pekin-embryos could withstand *in ovo* AFB1-exposure, up to 8 ng/egg and still hatch, despite significant toxico-pathologies evident in neonatal growth, till 5 Wks age.

Based on the above results it was concluded that, it was possible to realize production and propagation of Pekin ducks, by a minimal perinatal exposure of Aflatoxn-B1, through *In-ovo* injection at D23 of embryonic cycle, which despite embryonic toxicity, could growth up till routine brooding ages (6 weeks of age). The Pekin ducklings could overcome the *in-ovo* dosages of AFB1 @ 6 ng/egg, which remained as a threshold level of AFB1 injection on the Pekin

embryos, beyond which significant lethal effects could be seen in Pekins. Lastly, the interaction of Ochratoxin and Aflatoxin, under in-ovo exposure, turned out to be more devastating on the fitness and post-hatch survival of pekin ducklings, despite administration of Ameliorants (Lysine, methionine etc), which offered limited protection to the survivor ducklings, both in perinatal fitness and neo-natal growth.

(C) Pilot studied on Inter-species Gonadal Transplantation of Kadaknath in Khaki Campbell ducks, as a means of Genome conservation.

Under a Pilot study approved by competent authority, an experiment was conducted to explore a "**Proof-of-concept**" that surgical transplantation of chicken gonadal tissues (male part) is feasible and successful as in this cases using a native chicken breed: Kadaknath, performed at neonatal stages of recipients (Khaki Campbell as well as Pekin ducks).

Results of the experiment showed that gonadal transplantation at day-old age, can surpass species barrier (intra and interspecies), where it's evident that spermatogenesis progressed naturally, with simultaneous proliferation of transplanted Kadaknath testes, in a convincing manner, with fidelity.

The results of the experiment opens up another vista for biobanking of such other valued poultry including ornithologically imp species.

These inspiring results call for further skill evolution, whereby reproductive lives of functional gonads of valued chicken breeds can be enhanced indefinitely, including that of other avian species. The results of the experiment has been documented as a distinct technology, vide a publication made in journal of Genes, special issue: *Genes*, 14: 1094. https://doi.org/10.3390/genes14051094.

Fig. 14. Duck (Khaki Champbell) as a surrogate hosting Kadaknath gonads tissue grafts

Fig. 15. Dead recipient Duck (Khaki Champbell) abdominal cavity showing donor gonadal tissue positioned just above the endogenous gonad

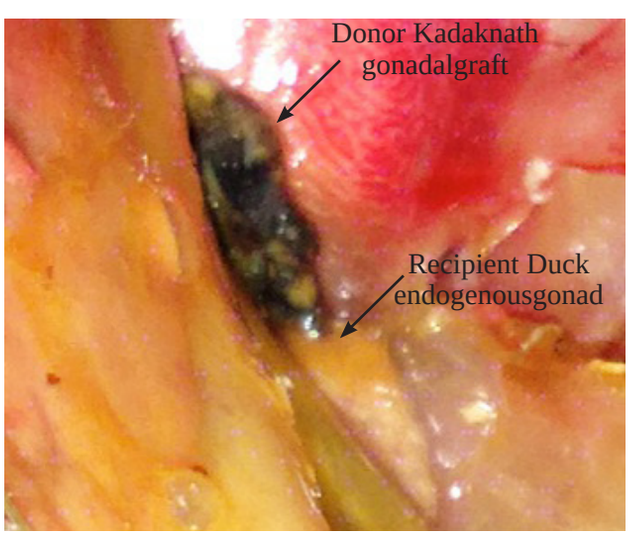


Fig.16. Gonad graft

Maintenance and Evaluation of Chemballi Ducks

The egg production and egg quality data of S0 (parental generation) in Chamballi duck was recorded. The average age at first egg of the flock: 117.16 ± 2.37 days; age at 50% duck housed egg production: 139.00 ± 1.82 days; and duck day egg production up to 72 weeks: 173.45 eggs were recorded. The average egg weight was 66.96±1.15g (60 week) and at 72 week 68.72± 2.29 g. Random mating was followed to generate the S1 generation. A total of 747 number of S1 generation ducklings were hatched. The growth parameters of S1 generation were recorded. The mean body weight of day old ducklings was 40.89 ± 0.16 g. Selection was applied on 8th week body weight. Improvement in growth parameters of S1 generation over S0 generation were as follows: Improvement in day old body weight +2.92 gram (40.89 g in S_1 vs 37.97 g in S_0); in 12th week body weight male ducks +12.04 gram (1706.32 g in S_1 vs 1694.28 g in S_0); 16th week body weight (male) + 37.43 gram (1698.57 g in S_1vs 1661.14 g in S_0); 20th week male body weight gain + 24.77 g (1654.44 ±10.97 S_1 vs 1679.21±15.70 S_0). The carcass quality parameters were studied and the eviscerated carcass yield was 68.73±0.21 % of live weight in male and 67.16±0.11 % in female. Breast portion was the highest cut-up part measuring 28.23±0.27 % and 27.14±0.22 % followed by the back measuring 27.16±0.31 % and 26.29±0.51% of eviscerated carcass weight in male and female, respectively.

Nutrition

Standardization of Feed Restriction Schedule and Optimization of Dietary Crude Protein Level for White Pekin Ducks.

An experiment was conducted to reduce the level of dietary protein in white Pekin ducks during starter stage (0-6 weeks) through supplementation of synthetic amino acids like L-Lysine and DL-Methionine. For this experiment 198 day old white Pekin were randomly divided into three groups having six replicates with eleven ducklings in each replicate. Three experimental diets namely CP-18, CP-20 and CP-22 were prepared containing 18%, 20% and 22% crude protein (CP), respectively. Care was taken to balance the level of L-Lysine and DL-Methionine in CP-20 and CP-18 groups with their respective level in CP-22 groups. All the diets were iso-caloric having 2900 k cal ME per kg diet. The birds were fed *ad libitum* twice daily up to six weeks. The feed offered and residue left were recorded daily to calculate average daily feed intake. Clean drinking water was provided round the clock. The ducklings were reared in deep litter system with paddy husk as the litter materials and raised under standard managemental practices. Blood samples were collected on sixth week from one bird from each replicate to determine the different blood biological in different treatment groups. On sixth week one male bird from each replicate were sacrificed to study the carcass characteristics. At the end of feed trial after 6th week, a metabolism trial was conducted to determine the metabolizability of different nutrients in different treatment groups.

The body weight at 6th week of age was 1999.68 ± 10.31, 1975.46 ± 22.40 and 2037.59 ± 47.02 and the FCR was 2.51 ± 0.09, 2.48 ± 0.04 and 2.50.06 in CP-18, CP-20 and CP-22, respectively. No significant differences between the groups were observed. On carcass study at 6th weeks of age, the eviscerated weight percentage was 70.66±0.33, 68.41±0.60 and 69.59±0.88 in CP-18, CP-20

and CP-22, respectively without showing any significant differences between the groups. No significant differences between the groups were observed with respect to Blood, Feather, Head, Offals, Giblet and eviscerated weight percentage. Similarly, when the cut-up parts were expressed as percentage of eviscerated weight no significant differences between the groups were observed in Leg, Neck, Breast and wing percentages. The metabolizability of different nutrients was studied. However, no significant differences between the groups were observed with respect to DM, OM, CP, CF and EE metabolizability. On study of various parameters like total protein, albumin, urea, creatinine, calcium, phosphorus, total cholesterol and triglyceride levels in serum, no significant differences between the groups were observed. From this experiment it can be concluded that the level of protein can be reduced safely from 22% to 18% of White Pekin starter diet without affecting growth, FCR and nutrient utilization by balancing the level of Lysine and Methionine through their supplementation.

Production and utilization of earthworm based feed in White Pekin ducks

An earthworm unit was constructed with Blue metal sheet roof. In this unit, Nine chambers (3 ft length X 2 ft width X 2.5 ft depth) were constructed with bricks plastered with cement and sand mixture. In the first treatment, three brick chambers (brick pit) were filled with matured cow dung (15 days old) and biomass (green grass and dried leaves matured for 15 days) in alternate layers of 8 inch depth each in three layers. In 2nd and 3rd treatments 3 brick chambers (brick pit) each were filled with mixture (50:50) of matured cow dung and duck litter and mixture of (25:75) matured cow dung and duck litter, respectively. Each brick chamber was inoculated with 500 grams of earthworm (*Eisenia foetida*) culture. From the 1st brick chamber about 2.0 kgs of earthworm was produced during a period of 75-90 days i.e. 0.13 kg per cubic ft From the 2nd chamber about 1.8 kgs of earthworm was produced during a period of 75-90 days i.e. 0.12 kg per cubic ft From the 3rd chamber about 1.4 kgs of earthworm was produced during a period of 75-90 days i.e. 0.09 kg per cubic ft. Earthworms were killed in warm water and dried in hot air oven at temp of 70-80 ^{0}C till a moisture level of below 10 % and stored for proximate composition and further use in feed formulation.

Table 5. Proximate Composition (%) of Earthworm Meal (N=6) with biomass cow dung

Attributes	Composition
Dry matter	95.05±0.21
Crude Protein	56.75±0.72
Ether extract	6.04±0.15
Crude Fibre	3.93±0.03
Total ash	15.74±0.15
Nitrogen free extract	17.54±0.48

Table 6. Proximate Composition (%) of Earthworm Meal (N=6) With biomass mixture of cow dung and duck litter (50:50)

Attributes	Composition
Dry matter	95.72±0.26
Crude Protein	54.05±0.19
Ether extract	5.55±0.05
Crude Fibre	4.16±0.05
Total ash	14.41±0.11
Nitrogen free extract	21.84±0.24

Evaluation of broken rice or tuber crops based feed mixture supplement in White Pekin ducks in semi-intensive rearing system

An experiment was conducted to find out the effect of replacing wheat with cassava (*Manihot esculenta Crantz, Euphorbiaceae*) in the diet of White Pekin ducks for meat production. White Pekin ducks (240, day old) were divided into three treatment groups with four replicates in each group and each replicate had 20 ducklings. Three experimental diets without (Cassava-0) and with cassava, replacing 25 (Cassava-25) and 50 (Cassava-50), percent wheat were prepared. The above three diets were offered randomly to the above three groups for 8 weeks; and the data recorded were daily feed intake and weekly body weight. Carcass characteristics parameters were studied on four ducks from each group (one duck from each replicate), following standard procedures. All the three experimental diets were isonitrogenous (22.04-22.25% CP) and isocaloric (2866.25-2888.95 kcal ME/kg). There was no significant difference ($P>0.05$) in the 8th week body weight (2290.39-2338.83 g) among the groups. The daily feed intake in Cassava-50 group (127.59g) was similar ($P>0.05$) to Cassava-0 group (126.69g) and Cassava-25 (136.04g) group. The cumulative feed intake during 0-8 week in Cassava-50 group (5548.01 kg) was similar ($P>0.05$) to Cassava-0 group (5573.61 kg); but significantly lower ($P<0.05$) than the Cassava-25 group (5689.30 kg). Although, there was significant difference ($P<0.05$) in the feed conversion ratio values between Cassava-25 group (2.54) and Cassava-50 group (2.42); but both were comparable with Cassava-0 group (2.49). The body weight (2517.00-2563.25, g) and eviscerated weight (62.43-63.22, %) was similar ($P>0.05$) among the groups. There was no significant difference ($P>0.05$) in different body parts as percentage of eviscerated weight *viz.* neck (9.95-11.47), legs (22.35-22.76), breast (24.32-26.46), back (23.82-24.78) and wings (15.04-15.39). It can be concluded that wheat can be replaced with cassava up to 50% level in the diets of white Pekin ducks for meat production.

Effect of Supplementation of Different Levels of Trace Mineral Mixture on the Performance of White Pekin Ducks for Meat Purpose

A study was conducted to find out the effect of supplementation of different levels of trace mineral mixture on the performance of White Pekin ducks for meat purpose. White Pekin ducks (180; day old) were divided into three groups; with each group of four replicates; and each replicate had 15 ducklings. Three experimental feeds were prepared by supplementing a starter feed (22.15% CP, 2810 ME Kcal/ kg) with trace mineral mixture (TMM) containing (Mn 11 g; Zn-10 g; Cu-2g; Fe-11 g; Se-0.15 g; I-0.25 g; Co-0.125 g; Cr-40 mg per 100kg feed) @ of 100g (TMM-100), 200g (TMM-200) and 300g (TMM-300) per 100 kg diet. The three experimental feeds were offered randomly to the above three groups for a period of eight weeks. Data were recorded for daily feed intake, weekly body weight and feed conversion ratio. The carcass characteristics parameters were studied on four ducks from each group (one duck from each replicate) following standard procedures. The day old body weights of the ducklings (51.67-53.27) were similar among the groups. The mean body weigh at 6th week in TM-100 group (1821.02g) was similar to TM-200 (1833.27g) and TM-300 groups (1719.92). The mean body weight at 7th week (1969.40-1995.00, g) and 8th week (2155.02-2176.17, g) were similar among the groups. The body weight gain during 4-6 weeks (673.60-736.44, g) was higher than 6-8 weeks (334.17-435.10, g). The daily feed intake at 6th week of age (158.44-162.59, g) was similar

among the groups. The daily feed intake at 7th week of age in TM-100 group (168.62 g) was similar to TM-300 group (163.81 g) but higher than the TM-200 group (161.64 g). However, the daily feed intake at 8th week of age in TM-100 group (156.62 g) was similar to both TM-200 group (154.77 g) and TM-300 group (160.31g). The cumulative feed intake up to 6 weeks and 8 weeks in TM-100 group (4.55 and 6.83, kg) was similar to TM-200 group (4.61 and 6.83) and both were higher than the TM-300 group (4.33 and 6.60). The feed conversion ratio up to 6 weeks (2.58-2.60) and 8 weeks (3.14-3.25) were similar among the groups. At 8 weeks, the eviscerated weight percentage (68.98-70.27) was similar among the groups. There were no significant differences in various body parts as percentage of eviscerated weight *i.e.* legs (19.89-20.51), breast (27.99-29.11) and wings (15.57-17.08) among the groups. However, the back as percentage of eviscerated weight in TM-100 group (23.11) was similar to TMC-200 group (24.23), but lower than TM-300 group (24.69). It can be concluded that trace mineral mixture can be supplemented @ 100 g per 100 kg feed in the diet of White Pekin ducks up to 8 weeks of age for better meat production.

PHYSIOLOGY AND REPRODUCTION

Maintenance and multiplication of Khaki Campbell ducks with a focus on cage house rearing and improving fertility to augment germplasm supply to meet the farmers demand.

A total of 450 numbers of day old ducklings (collected from experimental hatchery of regional station) were brooded in six chambers of equal size and design with standard brooding practice. Duckling mash (CP: 20% and ME: 2900 kcl) ad.lib with sufficient clean drinking water were offered and brooding temperature was maintained as per the requirement. Dry sand was used as the litter material throughout the experimental period. The growth performance and mortality rate recorded up to 4wks of age is presented in Table 6.

Table 7. The growth performance and mortality rate up to 4 weeks

Age	B.wt (g)	Mortality (%) upto
Day old	40.61±0.23	
2nd wk	156.57±1.38	0.005 (02 nos)
4th wk	579.13±3.20	0.007 (03 nos)

After 15 days of brooding under light, the ducklings were allowed to move freely in the chamber when guards were removed. The sand used as litter was made upside down from time to time to keep the litter dry and free from damping. After one month of age, the growing ducks were allowed to remain in the run-space during day time where the water channel was filled with water for swimming as their physiological need. The duck growing mash (CP:16% and ME: 2500 kcl) were offered up to 16 wk of age. Male and female ducks were identified at 14-16th wk of age.

Table 8. The performances recorded in male and female ducks

Age		B.wt (g)	Mortality (%) upto
6th wk		813.14 ± 3.66	0.009 (04 nos)
8th wk		986.82 ± 4.46	
12th wk		1199.65 ± 5.51	
16th wk	Female	1228.74 ± 5.93	0.009 (04 nos)
	Male	1388.07 ± 9.96	
20th wk	Female	1344.39 ± 5.69	
	Male	1512.89 ± 11.47	

Expt 2. Measurement of body parts of Khaki Campbell ducks at 20 weeks of age under intensive management:

Table 9. Body measurements of Khaki Campbell ducks at 20 weeks of age.

Parameters	Khaki Campbell Male (n=50)		Khaki Campbell Female (n=100)	
	Mean	± SE	Mean	± SE
B wt (g)	1488.90	12.95	1396.59	7.90
Bill length (mm)	66.35	0.28	61.34	0.27
shank (mm)	68.19	0.28	64.32	0.22
Keel (mm)	119.74	0.51	111.74	0.46
Neck (cm)	22.12	0.20	19.00	0.23
Head (cm)	7.44	0.10	7.28	0.05
Body Len (cm)	41.92	0.27	38.92	0.23
Body Girth (cm)	33.78	0.20	31.91	0.12

HEALTH

Investigating the role of GRAS Compounds as alternatives of antimicrobial in ducks

Various samples (aprrox 50) from RS farms and outside farms were processed and screened for presence of any bacteria and culture sensitivity. Out of 50 samples, 30 samples were positive for E. coli. They were most sensitive to enrofloxacin & ceftriaxone, moderately sensitive to amoxycillin, ciprofloxacin, colistin, neomycin. They were resistant to cephalexin, doxycycline, ofloxacin.

Table 10. Sensitivity of different antibiotics

Antibiotics	Sensitive samples (Nos.)/total samples (Nos.)	Moderately sensitive samples (Nos.)/ total samples (Nos.)	Mild sensitive samples (Nos.)/ total samples (Nos.)	Resistant samples (Nos.)/ total samples (Nos.)
Enrofloxacin	28/30	1/30	-	1/30
Ceftriaxone	27/30	2/30	-	1/30
Ciprofloxacin	22/30	1/30	2/30	5/30
Colistin	20/30	2/30	2/30	6/30
Amoxycillin	2/30	4/30	12/30	12/30
Neomycin	14/30	1/30	2/30	13/30
ofloaxin	12/30	2/30	1/30	15/30
Doxycycline	-	-	8/30	22/30
Cephalexin	-	-	10/30	20/30

Surveillance and monitoring of duck diseases and their biosecurity measures

A total of 1256 ducks were reported to be died this year. (Jan 2023 to Dec 2023). The average mortality of duck revealed to be 4.77% (previously 0.99% during corresponding period). Month wise highest mortality % was in Aug, 2023 (394, 20.59%) and minimum mortality % reported in Dec, 2023 (35, 0.82%). Highest cause of mortality was found due to nephritis (596, 48.61%), followed by Hepatitis & nephritis (342, 27.9%), hepatitis (111, 9.05%), inaniation (80, 6.53%), omphalitis (21, 1.71%), gout (20, 1.63%), egg bound condition (13, 1.06%), drowning (14, 1.14%), cannibalism (5, 0.41%), huddling (5, 1.14%), aspergillosis (4, 0.33%), cardiomegaly (2, 0.16%), perocarditis Egg (1, 0.08%) and peritonitis (1, 0.08%) etc. Age wise highest mortality found in duckling (1082) followed adult (157) and least in grower (17). Breed wise highest mortality was observed in White Pekin (964) followed by Khaki Campbell (157), Desi/ Pati (85), Chambelli (59) and Muscovy (1), respectively. Average duckling mortality was 18.9% during this period. Proper health care and prophylactic measures was provided to different breeds of duck.

POST HARVEST TECHNOLOGY

Formulation of Duck Meat Based Products

A new product "Duck Meat Pickle" was developed with an aim to preserve the duck meat food delicacy in room temperature for long time. The boneless duck meat was cut into small pieces and mixed with condiments and spices mixture. It was dry-roasted in a pan over medium flame for complete removal of water. Then the meat was dropped into medium heated oil and fried till it turns to golden colour. Again spices powder, salt, vinegar and lemon juice were added and kept overnight. In sour and sweet version, tamarind extract and jaggery were added. The pickle, so developed was subjected to organoleptic evaluation by the expert sensory panel and adjudged "Good" (6 out of 8 in score chart) rating of acceptance by sensory panel.

Fig. 17. Duck meat pickle

EXTENSION

Inter-institutional Collaborative project:

Increasing productivity and sustaining the rice based production System through Farmer FIRST approach.

During 2023 a total of 60 units of backyard poultry were added to the previously continuing farmers. The farmers imparted training on basic management of backyard poultry production. Critical inputs like day old chicks (Vanaraja from CPDO, Bhubaneswar), chick mash for brooding period and medicine (Vimeral liquid and Tetracycline powder; required during early period of life to check mortality) were supplied. Lassota vaccination (Naso-occular route) was done during first week of brooding. Birds were released to surroundings after 20 days of age with close monitoring against predation. No

supplementary feed were offered to birds after they were adopted for scavenging from outside. Data w.r.t. growth, mortality and initiation of egg laying were recorded.

Farmers training conducted in village Gopinathpur (Farmers FIRST programme) and one successful women farmer with her backyard poultry unit.

TRANSFER OF TECHNOLOGY (TOT)

The Transfer of Technology Unit of the Directorate is engaged in propagation of technologies developed at the institute to different stakeholders of the sector. The propagation of the improved rural chicken varieties across the country is the main objective of the Unit.

The institute popularized the technologies through participation in exhibitions, Kisan Melas, Farmer's days, etc. across the country. The scientists delivered TV and Radiotalks on various aspects of poultry farming. Brochures, pamphlets and bulletins on different chicken varieties were prepared for distribution to the farmers. The details of the activities are as follows.

Germ plasm distribution during 2023

S.No.	Particulars	Number
A	**Hatching Eggs**	
	Krishibro	668
	Vanaraja	25246
	Gramapriya	15566
	Srinidhi	17373
	Aseel	316
	Vanashree	770
	Ghagus	1229
	Kadaknath	4976
	Layer	1653
	Layer Control	1470
	Broiler Control	210
	Nicobari	1182
	Janpriya	10
	Embryonated eggs	12809
	Total	**83478**
B	**Day Old Chicks**	
	Krishibro	11734
	Vanaraja	88058
	Gramapriya	21032
	Srinidhi	61987
	Aseel	5984
	Vanashree	9791
	Ghagus	10945
	Kadaknath	18597
	Layer	790
	Nicobari	3582
	Janpriya	394
	Total	**232894**
C	**Parents**	
	Krishibro	177
	Vanaraja	36665
	Gramapriya	19167
	Srinidhi	4194
	Total	**60203**
D	**Grownup Birds supplied in TSP, SCSP and at DPR**	**5662**
	Net Total	**382237**
	Supply to DPR pure line & comm Farm	37477
	Total Feed supply in Kg	415
E	**Revenue Generated (In Rupees)**	
1	Germplasm Supply (Hatchery)	12342624
2	TOT Supply (Sales)	9161342
3	Refunds	245536
	Total Revenue Generated	**21258430**

Germplasm supply and revenue generation:

A total of 40,068 duck germplasm was supplied to farmers, Govt and Private organization during January to December, 2023. During this period **a revenue of Rs 18,55,213/-** was generated through sale of farm produce.

Germplasm supply from Regional Station, ICAR-DPR, Bhubaneswar during the year 2023

Variety of Duck	Kuzi	Khaki	White Pekin	Cham-beli	Cross Breed	Total
Number	7,801	16,368	8,782	4,661	2,456	40,068

Development Action Plan for Scheduled Caste (DAPSC)

The DAPSc programme aimed at improving the livelihood and nutritional security of SC families through enhanced egg and meat production. During this year DAPSC programme was implemented in Telangana, West Bengal and six AICRP centres (Bangalore, Jabalpur, Anand, Ludhiana, Kerala, Palampur) and 4 PSP centres (Warangal, Tirupati, Hosur and Patna). Overall 11 training programmes were conducted on backyard poultry benefiting 438 farmers. Eleven awareness camps were also organised for 340 farmers. During this period, a total of 21167 chicks, 720 no of feeder/ drinker, 392 doses of medicines, 900kg feed, 400kg minerals, were distributed among the farmer families to enable them to start back yard poultry farming. Three animal health camps were also organised benefitting 400 livestock farmers. Input distribution programme at Nakkalpalle village, Mancherial district. The Directorate is implementing DAPSC programme in different villages of Kotapally mandal of Mancherial district. On 17th January 2023 Scientists from the Directorate with help from Animal Husbandry department of Telangana organized a training program on rearing poultry birds under backyard farming at Nakkalpalle village. Earlier, sixty SC families were identified for the implementation of the scheme and were distributed temporary night shelter for rearing of chicken. During the training practical tips on feeding and health care management of birds were provided. Importance of regular consumption of animal protein especially chicken egg and meat to improve nutritional status and immunity of the people was explained to the beneficiaries. After the training, the beneficiary families were provided with different inputs including 1138 grown up birds, 300 kg feed, 60 feeders and drinkers under the scheme. Dr. M. Shanmugam, Dr. S. Jayakumar, Senior Scientists and Mr. D. Pratap, ACTO, from the Directorate participated in the programme. The programme was also attended by Dr. Pavan Kumar, VAS, AH Department, Telangana, elected representatives and officials of the Nakkalpalle panchayat. Input distribution at Parpalli village ICAR-Directorate of Poultry Research, Hyderabad organised an on field training programme and also distributed backyard chicken variety to SC families of Parpalli village, Mancherial district on 18th August, 2023. After conducting training to selected 143 SC beneficiaries, 981 chicks, 450 kg chicken feed, feeders and drinkers were distributed to 143 farmers to establish small back yard poultry units as a subsidiary income provider. Dr. A. Kannan, Principal Scientist, Dr. M. Shanmugam, and Dr. S. Jayakumar, Senior Scientists, from the Directorate participated in the programme. The programme was also attended by elected representatives and officials of the Parpalli panchayat.

TSP programme:

Under TSP programme two awareness cum training programme was conducted at Garabanda and Alami village in Phulbani block of Kandhamala district of Odisha on 23rd and 24th November, 2023. About 100 tribal farmers from different villages were participated and imparted training on backyard duck farming. A total of 25 selected tribal farmers were supplied with 20 ducklings each of crossbred ducks along with starter feed. The programme was attended by Head, RS, ICAR-DPR, CDVO of Kandhamala, Sarpanch of Garabanda and other official of district Animal Husbandry Department.

Distribution of grower birds to SC families at Nakkalpalle village

NEH Component

Mizoram

Under the NEH component in Mizoram state, the activities were carried out in Lawngtlai, Mamit and Aizawl Districts in 10 different villages namely Bungtlang South, Thingkah, AOC vengReiek, Ailawng, Lengte, Nghalchawm,Muthi, Nausel and Phunchawng. Initially, the meeting with Local NGO's, Village Council Members in the proposed area were undertaken and described about the importance of rearing backyard chicken in their respective villages. Conducted training at 6 locations of the selected villages for educating the tribal farmers to learn about the backyard poultry management. A total of 3700 Vanaraja chicks were distributed to the 132 farmers of different villages.

Input Distributuion to the tribal farmers

System of Rearing backyard poultry in Reiekvillage of MamitDist of Mizoram

Arunachal Pradesh

A training programme on Scientific rearing of backyard poultry for the tribal women of Arunachal Pradeshwas conducted with176 tribal farmers. After training is over,each participant was provided with 10 number ofVanaraja chicks, 10 kg concentrate poultry feed with some basic veterinary medicines. Further, a field trial on backyard poultry farming was carried out in Lish Village under Dirang circle of Arunachal Pradesh. The institute supported with feeder, drinker, poultry feed and medicines.Established FLD unit on poultry farming in KVK, West Kameng, Dirang to conduct capacity building programmes for benefitting the tribal farmers. Under the NEH

component in Arunachal Pradesh, a total of 140 tribal farmers received 1400 Vanaraja chicks with 1.4 tons ofpoultry feed, 25 electric brooders with some basic veterinary medicines in order to strengthen the backyard poultry production system in Arunachala Pradesh.

Farmers benefited getting chicks, feed & medicines

Allowing birds under FLD for free ranging

Cage layers

FLD unit established under KVK, West Kameng

Input distribution at Mankapur village

The TSP programme aimed to improve the livelihood and nutritional security of tribal families through backyard duck rearing to enhance duck egg and meat production. Crossbred ducklings along with feed were distributed at different tribals village of Kandhamals district and before distribution awareness/training programme on various aspects of backyard duck farming was conducted.

Awareness programme and inputs distribution at Garabanda village in Tudipju Gram panchyat of Phulbani block

On 23 November, 2023 Regional station, ICAR-DPR, Bhubaneswar imparted training cum awareness programme on backyard duck farming to 50 number of tribal farmers (mostly female) at Garbanda village of Phulbani block (Gram panchyat Tudipaju). Chief District Veterinary officer, of Kandhamala Dr. S. K. Patel explained about the benefit from duck farming to the farmers. Head of the Regional Station Dr. S.K.Bhanja explained about the importance of duck farming and benefits out of the back yard

duck farming as well as their management. Dr. S. K. Sahoo, principal scientist of RS, ICAR-DPR, Bhubaneswar informed in details about the feed and feeding programme f ducks. Dr M K Padhi elaborated about the breed and variety of duck and the care to be taken during the brooding of ducklings and health care. Reading materials about duck on local language, a writing pad and a pen was also distributed to all the farmers attended. The programme was also graced Mrs. Kausalya Kanhar, Sarpanch of the Tudipaju panchayat, SDVO, Phulbani, Deputy Director (veterinary health), Phulbani, VAS, MVU, Phulbani. The livestock inspector and Prani mitra of the locality also present in the awareness programme and helps in smooth conduct of the programme. The farmers are enthusiastic to rear duck as it will be introduced in their areas first time. After the awareness programme the interested and selected 25 tribal beneficiary were registered and each beneficiary was given inputs of 20 ducklings (3-4 weeks old age) and 20 kg of starter feed from the hand of CDVO, Kandhamala, Sarpanch of the panchayat, and Head of RS, ICAR-DPR, Bhubaneswar, Principal scientists of Rs, ICAR-DPR, SDVO and Deputy director of the district veterinary official. So a total of 500 grown up ducklings and 500 kg of duck starter feed were distributed to the tribal farmers.

Training programme at Garabanda village

Input distribution at Garabanda village

Awareness cum sensitization programme on back yard duck farming at Alami village of Phulbani Block (Alami Gram panchyat).

On 24th November, 2023 Regional station, ICAR-DPR, Bhubaneswar conducted an awareness cum sensitization programme on backyard duck farming Alami village of Phulbani block. A total of 50 farmers were registered for the training programme and the farmers (all tribal) were informed about the positive aspects of duck farming, their rearing, feeding management as well as health cover and importance of duct meat and egg. Farmers also interacted with the experts about their question and doubt in respect of duck rearing. They were also provided reading materials in Odia about backyard duck farming. The programme was attended by Head, RS, ICAR-DPR, Dr S K Bhanja, Dr S.K.Sahoo, Principal scientist, Deputy Director (veterinary health), Phulbani, Dr Dora, VAS, MVU, Phulbani, Dr Sangram Keshari Sahoo. Livestock inspector and Pranimitra of the veterinary department help in successful conduct of the awareness programme. Dr M K Padhi In-charge of TSP cell of RS, ICAR-DPR coordinated the training programme. The helps of CDVO, Kandhamala and his staffs to conduct the programme are of praise worthy.

Training programme at Alami village

TRAININGS ATTENDED

S.No.	Particulars of training	Official(s)	Duration	Organiser/Venue
1	Training on "Biosecurity and Biosafety: Policies, Diagnostics, Phytosanitary Treatments and Issues"	Dr. S.P. Yadav,	September 4-14, 2023	DBT-NBPGR, New Delhi (online)
2	Data Science and Machine Learning with R	Dr. Jayakumar S	21st October to 17st November 2023	Decode life, India
3	Molecular Phylogenetics from Basic to Advance Applications	Dr. Jayakumar S	7th to 8th October, 2023	Quaxon Bio and IT solutions, India
4	Biological Sciences for Sustainable Future" organized by the School of Biotechnology and Bioinformatics	Dr. Jayakumar S	15th – 16th December 2023	D Y Patil Deemed to be University, Navi Mumbai

TRAININGS ORGANISED

S.No.	Particulars of training	Official(s)	Duration	Organiser/Venue
1	Training -cum-awareness programme about backyard duck rearing	Dr. C.K. Beura Principal Scientist	20 December, 2023	KVK, Block-Ullunda, Dist: Sonepur, Odisha
2	Training -cum-awareness programme about backyard duck rearing	Dr. C.K. Beura Principal Scientist	21 December, 2023	Village- Singari, G.P.- Janmura, Block- Sonepur, Dist: Sonepur, Odisha
3	Training -cum-awareness programme about backyard duck rearing	Dr. C.K. Beura Principal Scientist	19 January, 2023	Village-Sansmura, Dist: Sonepur, Odisha
4	Certified Livestock Advisor Programme on Poultry-Module II	Dr. Vijay Kumar Senior Scientist	7-21 Feb, 2023	ICAR-DPR and MANAGE, Hyderabad

S.No.	Particulars of training	Official(s)	Duration	Organiser/Venue
5	Refresher training programme on poultry management for established Agripreneurs under AC&ABC Scheme	Dr. Vijay Kumar Senior Scientist	21-23 June, 2023	ICAR-DPR and MANAGE, Hyderabad
6	Advanced Research Methodology in Data Analytics	Dr. C.K. Beura Principal Scientist	22-28 June, 2023	Digvijai Nath Post Graduate College, Gorakhpur, UP

PROGRAMS ATTENDED

Programs	Officials(s)	Duration	Organiser/Venue
Cera Regional workshop cum Awareness Program	J. Srinivas Rao, ACTO	5thDecember 2023	TNAU, Coimbatore
Hindi Workshop	Dr. R.K. Mahapatra, Principal Scientist Dr. S.P. Yadav, Principal Scientist J. Srinivas Rao, ACTO	7th July, 2023	NRCMeat, Hyderabad.
Technical Hindi Workshop	Dr. R.K. Mahapatra, Principal Scientist Dr. S.P. Yadav, Principal Scientist J. Srinivas Rao, ACTO	24th August, 2023	IIOR, Hyderabad.
OL Conference	J. Srinivas Rao, ACTO	14-15 September, 2023	CSM Stadium, Balewadi, Dept. of OL, Govt. of India, Pune

Dr. S.K. Bhanja was nominated for International training on Cage-free training program organised by Animal Science University, Gadjah Mada, during 16th to 19th Oct 2023 at Universitas Gadjah Mada, Yogykarta, Indonesia.

Dr. S. K. Bhanja was elected as "Councilor" of THE WORLD'S POULTRY SCIENCE ASSOCIATION (INDIA BRANCH) for the period 2023-27.

Dr. S.K. Bhanja was nominated as expert for finalization of Terms and condition for procurement of LIT and Desi type birds at Fisheries and ARD Department of Government of Odisha, Bhubaneswar and attended the meeting on 12th October, 2023.

Dr. S.K. Bhanja was nominated as Academic Council member of ICAR-IARI–NRRI hub and attended the orientation programme of newly admitted Bsc (Ag) and Msc (Ag) students at ICAR-NRRI, Cuttack on 28th November, 2023.

Dr. S.K. Bhanja was nominated as Subject Expert for the interview of project fellow under DST project entitled "Assessment of production and welfare during heat stress in indigenous Chicken Population of Odisha" on 31st August, 2023.

Dr. S.K. Bhanja was nominated as Member of Northern Region Committee for Recognition of Poultry Establishments as compartments free from Avian Influenza constituted by DAHD, MFAHD, Got. of India, New Delhi visited M/S Venky (India) Ltd Pune, Maharashtra and M/s. Ovo Farm (P) Limited, Balangir, Odisha.

Dr. Jayakumar S was awarded with member of National Academy of veterinary sciences, New Delhi.

Dr. Jayakumar S was awarded with Veterinary Scientist Award – 2023 by Dr. B. Vasantharaj David foundation, Chennai.

Dr. S.K. Mishra, Awarded with Fellowship of National Academy of Veterinary Sciences (June-23)

Dr. S.K. Mishra, Awarded with Fellowship of Indian Poultry Science Association (September-23)

Dr. S.S. Dande were awarded the best keynote speaker award for the for keynote talk on "Can Antimicrobial Resistane (AMR) in poultry sector be reduced: Way forward" in the 7th International Hybrid Conference on Veterinary and Livestock during 24-25, November, 2023.

Naveen, T. Haunshi, S. *et al.*, were conferred with Prof. P.K. Pani Research Award in the field of Poultry Genetics and Breeding by Indian Poultry Science Association for the year 2023 held during 13-15 September 2023 at SKAUST-Kashmir, Srinagar, Jammu and Kashmir.

Dr. Santosh Haunshi, Pr. Scientist of this institute was nominated as the principal member of the Animal Husbandry and Equipment Sectional Committee, FAD 32, B.I.S., New Delhi

All the scientists of ICAR-DPR were awarded with Certificate of Excellence in Reviewing, ICAR Reviewer Recognition. The Indian Journal of Animal Sciences. Directorate of Knowledge Management in Agriculture, ICAR, New Delhi

Best Oral Presentation

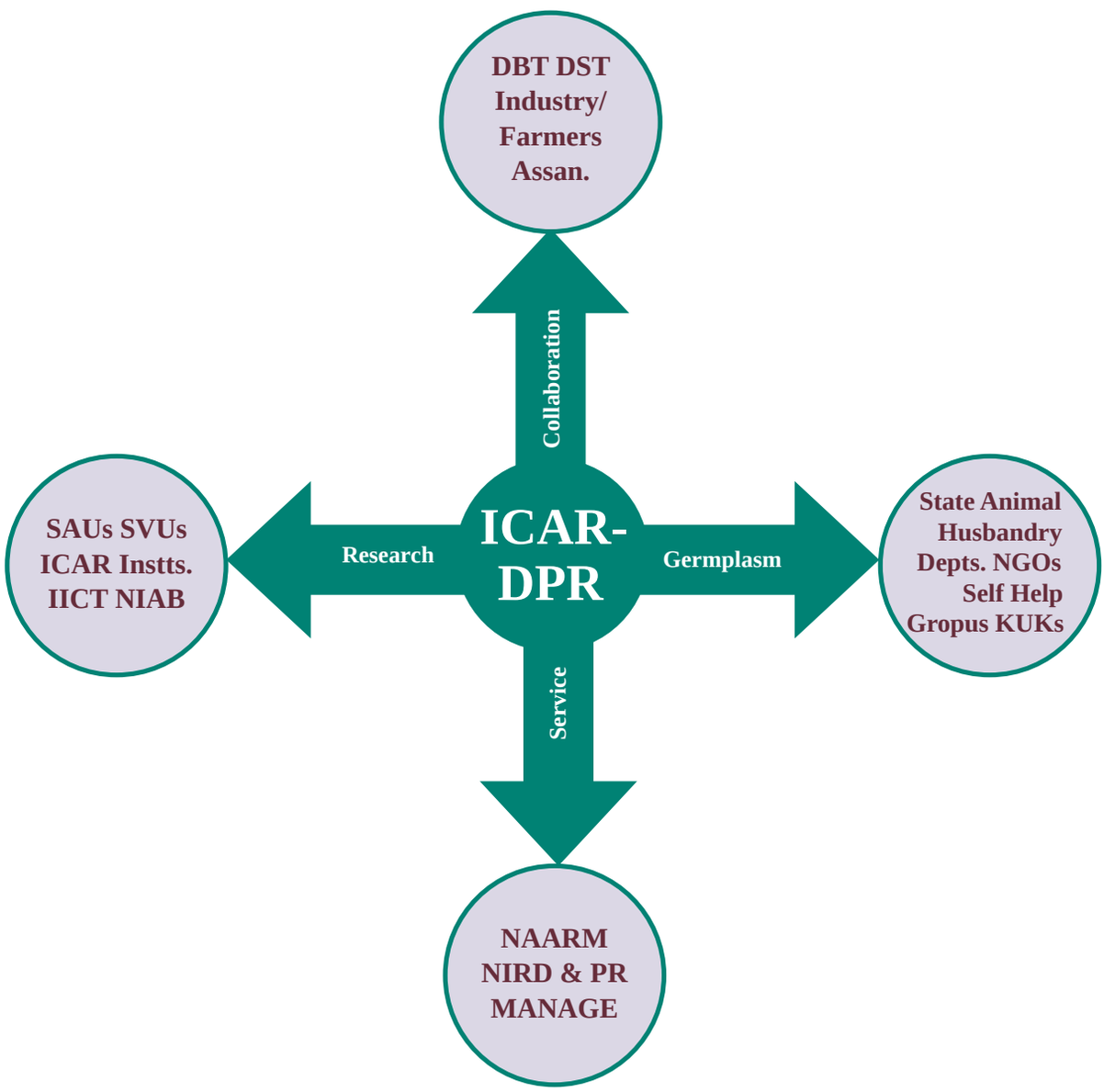
Dr. S.S. Dande and M.R. Reddy were awarded the 'Best Oral presentation award (First)-2023' for the abstract entitled "AMR pattern of *Escherichia coli* isolates in poultry maintained under different farming conditions" held at CVSC, GB Pant UAT, Pantnagar, Uttarakhand during 22-24 February, 2023.

Dr. Rajalaxmi Behera, M.K Padhi, D. Kumar, A Sahu, P.K. Naik, B.K. Swain and C.K Beura were awarded 'Second Best Oral Presentation Award-2023' for the presentation on "Evaluation of Kuttanad ducks for growth and mortality traits under climatic conditions of Odisha" during the National Livestock Conference- ABHYUDAYA: Futuristic Approach to Viable Animal Production vis-à-vis Climate and Calamity Challenges and the 29th Annual Convention of Indian Society of Animal Production & Management (ISAPM)-2023 held from 18-20 January, 2023 at C.V.Sc. & A.H., OUAT, Bhubaneswar.

Dr. S.S. Paul, SV Rama Rao, RN Chatterjee, MVLN Raju, AK Mahato, B Prakash, SP Yadav, A Kannan, GN Reddy, V Kumar and PSP Kumar were awarded the Best oral presentation award-2023 for the presentation on "Dietary supplementation of an encapsulated essential oil blend as an alternative to antimicrobial growth promoter improves performance, immunity, population density of beneficial microbes and suppresses pathogens in broiler chickens" at the Proceedings of Animal Nutrition Association biennial conference ANACON 2023, DUVASU, Mathura, Feb 16-18, 2023.

6. LINKAGES AND COLLABORATIONS

The Directorate has entered into collaborations with outstanding research and academic institutions of national and international repute in the field of poultry health, nutrition, breeding and biotechnology. The Directorate is a leading institution in the field of poultry research in the country and is equipped with the state of the art facilities, which are being used by the students of institutions like PVNRTVU, Hyderabad; PJTSAU, Hyderabad; KVAFSU, Bengaluru; NIAB, Hyderabad etc. for carrying out their research work. The scientists of this Directorate have guided many PG and PhD students as Co-chairmen/members of their advisory committees. Two major network programs of ICAR (AICRP on Poultry Breeding and Poultry Seed Project) have been implemented at 24 centres located across the country. The institute has a special linkage with State Animal Husbandry Departments, NGOs and KVKs by involving them in dissemination of technologies like supplying improved poultry germplasm developed at this Institute. The institute conducted training programmes in collaboration with other Institutes like MANAGE and Directorate of Extension, Govt. of India. Besides, participants/students from neighboring institutions like NAARM, PVNRTVU, PJTSAU, MANAGE, NIRD&PR etc. visited the institute to have practical exposure to the applied aspects of poultry farming and the ongoing research activities.



Collaboratiopn of ICAR-DPR with different agencies

7. ALL INDIA COORDINATED RESEARCH PROJECT ON POULTRY BREEDING

All India Coordinated Research Project (AICRP) on Poultry Breeding is one of the umbrella projects on poultry initiated to produce superior stocks of layers and broilers and to encourage self-reliance in poultry production. Accordingly, the project has evolved with time in order to meet the changing demands and at present, it is focused on rural poultry development as a tool for nutritional and livelihood security in rural and tribal areas of the country. The main objectives of the project include: development of location-specific chicken varieties; conservation, improvement, characterization and utilization of native chickens, elite layer and broiler germplasm and development of package of practices for village poultry and entrepreneurships in rural, tribal and backyard areas. Presently, there are twelve centres of AICRP on Poultry Breeding *viz*. KVASU, Mannuthy; AAU, Anand; KVAFSU, Bengaluru; GADVASU, Ludhiana; OUAT, Bhubaneswar; ICAR-CARI, Izatnagar; ICAR-RC for NEH region, Agartala; NDVSU, Jabalpur; AAU, Guwahati; BAU, Ranchi; MPUAT, Udaipur and CSKHPKVV, Palampur. Although all the centres have to work on rural and location-specific varieties, few centres have been mandated to maintain certain pure lines as well. KVASU, Mannuthy and AAU, Anand centres are maintaining two elite layer pure lines (IWN and IWP). Similarly, KVAFSU, Bengaluru, GADVASU, Ludhiana, OUAT, Bhubaneswar and ICAR-CARI, Izatnagar have been mandated to maintain four elite broiler lines (PB-1, PB-2, CSML and CSFL).

ICAR-DPR, Hyderabad is the coordinating unit of the project and is maintaining pedigreed random bred control populations for layers and broilers. These control layer and control broiler populations are supplied to the centres from time to time as per their requirement. During the report period, samples of hatching eggs from these populations were supplied to different centres for estimating the genetic progress.

In 2023, Poultry Seed Project was merged with AICRP on Poultry breeding. Poultry Seed Project was initiated during XI Five year plan in order to increase the availability of rural chicken germplasm in remote areas of the country. The main objectives of this project include: local production of improved chicken germplasm (fertile eggs, day old chicks and grownup chicks) and supply to various stakeholders 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. Presently, the project is being operated at 12 centres across the country. These centres are located at: Bihar Animal Sciences University (BASU), Patna; ICAR - Research Complex for NEH Region, Jharnapani, Nagaland; ICAR - Research Complex for NEH Region, Gangtok, Sikkim; ICAR - Research Complex for NEH Region, Imphal, Manipur; Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Hosur; ICAR-Central Coastal Agricultural Research Institute (CCARI), Panaji, Goa; ICAR-Central Island Agricultural Research Institute (CIARI), Port Blair; Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Srinagar; PVNR Telangana Veterinary University (PVNRTVU), Warangal; Sri Venkateswara Veterinary University (SVVU), Tirupati; ICAR - Research Complex for NEH Region, Umiam, Meghalaya and West Bengal University of Animal and Fishery Sciences (WBUAFS), Kolkata. ICAR-DPR acts as a coordinating unit and supplies parent chicks to the different centres. The institute coordinates and monitors the activities

of the centres, thus enabling them to achieve their set targets. The targets set for supplying chicks for mainland and north-eastern centres during the year 2023 were between 0.5 and 1.0 lakh chicks per annum and to collect feedback on the performance of the germplasm under backyard farm conditions.

During 2023, under AICRP-PB, a total of 10,40,567 number of chicken germplasm was distributed to 14,113 farmer beneficiaries and the total revenue generated during the year was Rs. 343.65 lakhs.

The centre-wise performance during the calendar year 2023 is detailed below and the details of germplasm supply, number of farmer beneficiaries and revenue generated is presented in Table 1.

KVASU, Mannuthy: The Mannuthy centre evaluated the S-34 generation of IWN and IWP strains of White Leghorn. The S6 generation of Tellicherry Native chicken and S1 generation of Mannuthy Red Native chicken were completed and the analysis of data under progress. During the year 2023, the centre distributed 1,08,000 germplasm to 840 needy farmers and generated revenue of Rs. 20 lakhs.

AAU, Anand: Anand (Gujarat) centre has evaluated native chicken i.e. "*Ankaleshwar*" and White Leghorn strains (IWN, IWP, IWD, IWK and Control birds) during the year 2023. The egg production up to 40 weeks of age was 84.92 eggs in S_4 generation of *Ankaleshwar* chicken, which was higher (83.30) as compared to S_3 generation. Egg production up to 72 weeks of age was 305.98 and 302.31 eggs in IWN and IWP strains (S_3 Gen.) respectively. Egg production up to 64 weeks of age was 228.31 and 218.69 eggs in IWD and IWK strains (S_{10} Gen.), respectively. The centre has supplied a total of 47,030 chicken germplasm to 627 farmers during the year 2023. Also, the centre generated a revenue of Rs. 28.15 Lakhs during the calendar year.

KVAFSU, Bengaluru: The centre evaluated S-16 generation of PB-1 and S-29 generation of PB-2 during the report period. The average 5th week body weight (g) in PB-1 males, PB-2 and Control population was 1303.34 ±5.63 g (1157), 1283.12±6.50 g (893) and 987.59 ± 6.40 g respectively. Raja II coloured broiler from the centre participated in 57th Random Sample Broiler testing at Central Poultry Performance (CPPTC), Gurugram and stood at 4th (for body weight) and 3rd place (for FCR) among the participated broiler strains. During 2023, 1,47,142 number of germplasm including day old chicks and hatching eggs were supplied to 296 farmer beneficiaries and total revenue of Rs. 39,33,215/- was generated.

GADVASU, Ludhiana: Ludhiana centre evaluated PB-1 and PB-2 lines and native chicken (*Punjab Brown*). The body weight at 5 weeks of age was 1225 and 1118 g in PB-1 and PB-2 respectively. The average egg production up to 40 weeks of age in PB-1 and PB-2 was 62 and 71 eggs, respectively. The body weight in *Punjab Brown* at 4, 8, 16, 20 and 40 weeks of age was 340, 658, 1452, 2110 and 2765 g, respectively and the average egg production up to 36 weeks was 58 eggs. During 2023, a total of 69,917 germplasm was supplied to 419 farmers and Rs. 18.50 lakhs was generated as revenue.

OUAT, Bhubaneswar: OUAT, Bhubaneswar centre evaluated the performance of pure lines CSFL and CSML and native *Hansli* chickens. The 5th week body weight on combined sex basis for CSFL was 1005.14 g with FCR value of 1.97. For CSML, the 5th week body weight on combined sex basis was 1102.29 g with FCR

value of 1.93. G-1 generation of the native *Hansli* chicken breed was evaluated for production traits and the 52 week egg production (no/hen) was 34.36 while in the G-2 generation, 40 week egg production (no/hen) was recorded as 19.17 eggs. A total of 14,035 germplasm was supplied to 462 beneficiaries and revenue to the tune of Rs. 1.69 lakhs was generated during the calendar year.

ICAR-CARI, Izatnagar: During the report period, ICAR-CARI, Izatnagar centre has evaluated the local native chicken along with CSML, CSFL lines and their crosses. The germplasm supply was 35,180 and Rs. 24,60,761 was generated as revenue. As a result, a total of 31 farmers were benefitted.

MPUAT, Udaipur: Udaipur centre evaluated *Mewari* and *Pratapdhan* populations during the calendar year. The body weight at 20 and 40 weeks of age in females was recorded as 2019 g and 1680 g in *Pratapdhan* and *Mewari* respectively. The annual egg production (up to 72 weeks of age) in *Mewari* and *Pratapdhan* was 101.13 and 162.49 respectively. A total of 36,122 improved chicken germplasm was distributed to 412 farmers during the calendar year. The revenue for the period was Rs 11.38 lakh from the distribution of germplasm.

AAU, Guwahati: AAU, Guwahati centre evaluated the *Kamrupa* variety, Indigenous, *Daothigir*, PB-2 and cross of PB- 2 x Indigenous chicken germplasm. Body weight at 20 weeks of age in *Kamrupa*, indigenous and *Daothigir* was reported as 1568.59 ± 5.30 g, 1349.81 ± 3.56 g and 1204.42 ± 4.21 g respectively while at 40 weeks, it was 2488.51 ± 6.24 g, 1787.32 ± 4.43 g and 1857.28 ± 3.24 g respectively. Similarly, egg production up to 72 weeks was 162.81, 116.57 and 122.33 eggs for *Kamrupa*, indigenous and *Daothigir* birds respectively. During the year 2023 (Jan-Dec), a total revenue of Rs. 11,15,855.00 was generated through supply of 39,544 numbers of improved germplasm to 191 farmers.

CSKHPKVV, Palampur: Palampur centre evaluated the native chicken, Dahlem Red, DN cross and *Himsamridhi* during the year 2023. At 40 weeks of age, HDEP for native germplasm was 51.37 eggs while HDEP up to 40 and 52 weeks for Dahlem Red population was 82.48 and 140.56 eggs respectively. HDEP up to 40 weeks and 52 weeks for Dahlem Red x Native (DN) birds was 61.07 and 101.49 eggs respectively. For *Himsamridhi* (DND), a location-specific variety, HDEP up to 40 and 52 weeks was 74.17 and 121.62 eggs respectively under farm conditions and showed improvement in comparison to the previous evaluation. A total of 39,360 chicks were supplied to 456 farmers of Himachal hill region. The centre realized receipts of Rs 18.40 lakhs on account of sale of various poultry products.

ICAR-RC NEH, Tripura: Tripura Centre evaluated the BND cross, *Tripura Black*, and Dahlem Red populations. In E-7 evaluation of BND cross, the 40 weeks egg production was 64.38 and 54.12 eggs under farm and field conditions, respectively. The body weight recorded in E-7 at 20 and 40 weeks of age slightly increased in comparison to previous (E-6) evaluation under farm. A total of 24,386 poultry germplasm were supplied among 559 farmers and total revenue of Rs. 13,42,329 was generated.

NDVSU, Jabalpur: During the year 2023, Jabalpur centre evaluated G-2 and G-3 populations of *Jabalpur colour* and *Kadaknath*. For G-2, Hen day egg production up to 72 weeks of age was 248.6 eggs in *Jabalpur colour and* 181 eggs in *Kadaknath* respectively. *Narmadanidhi* (commercial dual type colour chicks, 75% *Jabalpur colour* and 25% *Kadaknath*) laid 109 eggs up to 52 weeks of age with avg. egg weight

of 49.0 g in farm conditions. During the year 2023, 28,567 chicken germplasm was distributed to 674 farmers with revenue receipts of Rs. 9.71 lakhs.

BAU, Ranchi: BAU, Ranchi centre evaluated native chicken, Dahlem Red and *Jharsim* birds during the report period. The fertility ranged from 89.19 to 97.28 in native and *Jharsim* respectively and it also improved in pure line and crosses. The centre supplied 19,346 (15485 hatching eggs and 3861 six-eight weeks) amongst 147 farmers, NGOs, KVKs and other agencies. The centre generated receipt of Rs. 2,74,900/- during the calendar year 2023.

BASU, Patna: In the year 2023, a total of 55,998 *Vanaraja* eggs were produced and 52,190 commercial chicks were distributed among the needy farmers in Bihar and nearby farmers of other states like Uttar Pradesh and Jharkhand. Average body weight of the *Vanaraja* birds was recorded as 3495.08±78.33 g, 3684.67±29.39 g and 3708.44±41.22 g at 32nd, 36th and 40th week age respectively for males while it was recorded as 2489.39±29.66 g, 2539.22±36.72 g and 2549.42±47.65 g at 32, 36 and 40th weeks of age respectively in females. During the report period, a total of 2,062 farmers were benefitted through this centre and revenue receipts of Rs. 11,66,632/- were generated.

ICAR-RC NEH, Nagaland: The parent stock of *Vanaraja* and *Srinidhi* variety of chicken were reared during the reporting year and a total of 1,56,584 eggs were produced. From these eggs, 95,489 chicks were produced and 92,336 chicks were supplied to 1,296 farmers. The revenue generated during the period was Rs. 38,19,560/-.

ICAR-RC NEH, Sikkim: Under the Project, Sikkim centre has produced and distributed a total of 66,889 nos. of *Vanaraja* day old chicks (DOC) to the farmers in Sikkim during the year 2023. Out of this, 52,112 numbers of DOCs were distributed under tribal sub-plan while 14,777 nos. were distributed in cash. A total of 2,104 farmers belonging to 456 villages were benefitted during this period. Total revenue of Rs. 20,71,702/- (Rupees Twenty Lakh Seventy-One Thousand Seven Hundred and Two only) was realized by the centre during the reporting period.

ICAR-RC NEH, Manipur: *Vanaraja* and *Srinidhi* germplasm supplied by the centre during the calendar year (Jan 2023 to December, 2023) was 20,997 under PSP. 215 farmers from different districts of Manipur were benefited under this project and the revenue generated during the reporting period was Rs 10,41,940.00.

TANUVAS, Hosur: The College of Poultry Production and Management (TANUVAS), Hosur distributed 54,678 germplasm of *Vanaraja* and *Gramapriya* chicken amongst 976 beneficiaries during the year 2023, which included 50,038 and 4,640 germplasm of *Gramapriya* and *Vanaraja* respectively. A sum of Rs. 14,32,689/- had been generated as revenue from the sale of germplasm during the year 2023.

ICAR-CCARI, Goa: *Grampriya*, *Srinidhi*, local and pure breed *Kadaknath* were reared in ICAR-CCARI, Goa and KVK poultry farm during the reporting year. During the calendar year 2023, 23,053 germplasm (including fertile eggs) was supplied to 543 farmers, generating a revenue of Rs 4,52,100.

ICAR-CIARI, Port Blair: ICAR-CIARI, Port Blair is maintaining *Srinidhi* and the native *Nicobari* germplasm. A total of 1003 numbers of germplasm was supplied to 50 beneficiaries during the reporting period and the revenue receipt was Rs. 2.05 lakhs.

SKUAST, Srinagar: In the year 2023, SKUAST, Srinagar centre distributed a total of 30,021 chicks and 1,154 adult *Vanaraja* birds among 985 farmer beneficiaries, resulting in a revenue of Rs.10,08,295/-

ICAR-RC for NEHR, Barapani: At ICAR-RC for NEHR, Umiam centre, 19,454 chicks of *Vanaraja* and *Srinidhi* were produced and distributed amongst 373 beneficiaries in 2023. A sum of Rs.13,50,182/- was generated as revenue during the report period.

PVNRTVU, Warangal: At PVNRTVU Warangal centre, 5th batch of *Gramapriya* parent stock and 3rd batch of *Aseel* commercials were housed during the reporting period. The centre supplied around 48,660 germplasm including both day old chicks and fertile eggs to 103 farmers and generated revenue to the tune of Rs.15.13 lakhs.

SVVU, Tirupati: During the year 2023, a total of 21,503 *Vanaraja* germplasm was supplied to the 292 farmers and a revenue of Rs.3,97,147 was generated during the report period.

Table 1: Germplasm distributed, farmers benefitted and revenue generation under AICRP on Poultry Breeding during 2023

Centre	Germplasm (No.)	Farmers (No.)	Revenue (Rs. in lakhs)
KVASU, Mannuthy	1,08,000	840	20.00
AAU, Anand	47,030	627	28.15
KVAFSU, Bengaluru	1,47,142	296	39.33
GADVASU, Ludhiana	69,917	419	18.50
OUAT, Bhubaneswar	14,035	462	1.69
ICAR-CARI, Izatnagar	35,180	31	24.61
MPUAT, Udaipur	36,122	412	11.38
AAU, Guwahati	39,544	191	11.16
CSKHPKVV, Palampur	39,360	456	18.40
ICAR-RC NEH, Agartala	24,386	559	13.42
NDVSU, Jabalpur	28,567	674	9.71
BAU, Ranchi	19,346	147	2.75
BASU, Patna	52,190	2,062	11.66
ICAR-RC, Jharnapani, Nagaland	92,336	1,296	38.19
ICAR-RC, Gangtok, Sikkim	66,889	2,104	20.71
ICAR-RC, Imphal, Manipur	20,997	215	10.42
TANUVAS, Hosur	54,678	976	14.32
ICAR-CCARI, Goa	23,053	543	4.52
ICAR-CIARI, Port Blair	1,003	50	2.05
SKUAST, Srinagar	31,175	985	10.08
ICAR-RC for NEHR, Umiam	19,454	373	13.50
PVNRTVU, Warangal	48,660	103	15.13
SVVU, Tirupati	21,503	292	3.97
Total	**10,40,567**	**14,113**	**343.65**

8. PUBLICATIONS

I. Headquarters, Hyderabad

Research papers (Work done at ICAR-DPR)

International Journals

Anand Laxmi, N., Raja Ravindra K. S., Jayakumar S., Ramakrishna, M. and Shanmugam, M. 2023. Differential Level of Hormones Amino Acids Expression of Amino Acid Transporters and Hormone Receptors during Early and Mid Laying Period and their Modulation by Organic Selenium in Vanaraja Chickens. *Acta Scientific Veterinary Sciences*, 5.7:119-132.

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Prakash B., Rama Rao, S.V., Raju, M.V.L.N., Hossain, F., Khulbe, R.K., Vignesh, M., Paul, S.S., Kannan, A., Phani Kumar, S. and Rakshit, S. 2023. Effect of feeding low phytate maize on performance, bone-breaking strength, and intestinal phosphorus transporters in slow-growing chickens during starter phase. *Journal of Applied Poultry Research*. doi: https://doi.org/10.1016/j.japr.2023.100364.

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Raju, M.V.L.N., Rama Rao, S.V., Paul, S.S., Prakash, B., Reddy, M.R., Kannan, A., Shanmugam, M. and Santosh Phani Kumar, P. 2023. Source variation in nutrient profile and the effects of black soldier fly **(***Hermetiaillucens*) larva meal inclusion in diet at graded levels on broiler chicken. *International Journal of Tropical*

Insect Science, https://doi.org/10.1007/s42690-023-01139-8.

Rama Rao S.V., Raju, M.V.L.N., Paul, S.S., Nagalakshmi, D., Srilatha, T., Prakash, B. and Phani Kumar, S. 2023. Effect of coated sodium butyrate in diet on performance, gut microbiota, ileal digestibility, serum nutrient fractions, immune responses and bone mineral variables in broiler chicken fed antibiotic-free diet. *Animal Production Science*, 63(15): 1515–1524. doi:10.1071/AN22294

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Rajkumar, U., Prince, LLL., Haunshi, S., Jayakumar, S., Raja Ravindra, K S., Niranjan, M., Reddy, B L N. and Chatterjee, R N. 2023. Does selection index application for highly heritable traits need revisiting – A comprehensive study with bodyweight and shank length in Vanaraja male line chicken. *Indian Journal of Animal Sciences* 93 (10): 1021–1025. https://doi.org/10.56093/ijans.v93i10.135284.

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Sreeteja, T., Sreenivas, D., Sridevi, B. Prasad R.M.V. and Rajkumar, U. 2023. Inheritance of growth and production traits in Gramapriya male line chicken. *Indian Journal of Animal Sciences*, 93(5):455–459.https://doi.org/10.56093/ijans.v93i5.130344..

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Lead papers/ Invited Papers

Basu, J., Roy, R. Pal, M., Kannan A., Ghosh, T.K., Ray H., Ghosh A., Rama Rao, S.V. and Chatterjee R.N. 2023. Gender detection of day-old chicks from vocalization data: An experimental study. 2023 IEEE 20th India Council International Conference (INDICON). Hyderabad, India, 2023. doi: 10.1109/INDICON59947.2023.10440685. Pp, 1428-1432.

Basu, J., Roy, R. Pal, M., Ghosh, T.K., Ray H., Ghosh A., Kannan A., Rama Rao S.V. and Chatterjee R.N. 2023. MAGIC: Mobile App for Gender Identification of Chick from Vocalization Data Analysis. In proceedings of International Conference on Systems and Technologies for Smart Agriculture (ICSTA-2023). Springer publishers, Kolkata. 19-20 December 2023. Pp, 217-227.

Basu, J., Roy,R. Pal, M., Ghosh,T.K. , Ray H., Ghosh A., Kannan A., Rama Rao S. V.and Chatterjee R. N.2023. *Deciphering Distress: Stress Detection in White Leghorn Birds through Vocalization Analysis.* In proceedings of International Conference on Systems and Technologies for Smart Agriculture (ICSTA-2023). Springer publishers, Kolkata. 19-20 December 2023. Pp, 383-393.

Ghosh, T.K. , Biswas, A., Doloi, D., Saha,S,, Ray H., Ghosh A., Singh O. K., Kannan A., Rama Rao S. V.and Chatterjee R. N.2023. Weight Dynamics Analysis: A Novel Approach for Timely Growth Observation of Poultry at Commercial Open-Shed Broiler Farms. In proceedings of International Conference on Systems and Technologies for Smart Agriculture (ICSTA-2023). Springer publishers, Kolkata. 19-20 December 2023. Pp, 508-518.

Paul, S.S. and Rama Rao. S.V. 2023. Nutrigenomic approaches to improve animal production. In ANACON 2023, Mathura February 16-18, 2023, Pp. 20-23.

Research Abstracts presented in Symposia/ Conferences

Anand Laxmi, N. 2023. Comparative Study of Some Endocrine and Molecular Parameters Between Two Indigenous Breeds of India and Effect of Selenium supplementation on Egg production during Early and Mid

Laying period. For 3rd International Webinar on Food Science and Nutrition, Dubai; Webinar hosted by Scientex Conferences on Nov. 23-24 2023.p-38.

Dande, S.S. and Reddy, M.R. 2023. Abstract for oral presentation at 39th Annual convention of ISVM and National conference on "Advancements in research and innovations in mitigation of diseases of livestock, companion, wild animals and poultry" for abstract entitled "AMR pattern of Escherichia coli isolates in poultry maintained under different farming conditions" held at CVSC., Pantnagar during Feb 24-25, 2023 and awarded Best Oral presentation award (First)p?

Kannan, A., Ravikumar M. Paul S. S. Prakash, B., Rama Rao, S.V. Raju M. V. L. N., Katyaayini, S. Santosh P. and Shiva T.2023. Evaluation of biosynthesized zinc oxide nanoparticles on production performance and blood biochemical profile in commercial broilers. In Proceedings of XII Biennial Animal Nutrition Conference, Mathura, India. 16-18 February 2023. p.54.

Kannan, A., Hena Ray, Ghosh T.K., Ghosh, A., Rama Rao S.V., Katyaayini S. and Bhanja S.K. 2023. Real-time multi sensor monitoring of environmental conditions of poultry farm using IOT sensors. National Livestock Conference and 29th Annual Convention of Indian Society of Animal Production & Management (ISAPM) -2023, College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar-3. 18-20 January 2023. p.423.

Mahapatra, R.K., P.K. Pankaj, S.K. Bhanja, B. Prakash, M. Shanmugam, N. Anand Laxmi and Yadav, S.P. 2023. Poultry litter compost with paddy straw. XXXVIII Annual Conference on "Innovative Poultry Production Strategies for Nutritional, Scio-economic and Environmental security". Faculty of Vety. Sci. and Ani. Husbandry, SKUAST, Srinagar, 13-15 September 2023. p 45-46.

Mahapatra, R.K., P.K. Pankaj, S.K. Bhanja, B. Prakash, M. Shanmugam, N. Anand Laxmi and Yadav, S.P. 2023. Vermicomposting with poultry litter – Wealth out of Waste. XXXVIII Annual Conference on "Innovative Poultry Production Strategies for Nutritional, Scio-economic and Environmental security". Faculty of Vety. Sci. and Ani. Husbandry, SKUAST, Srinagar, 13-15 September 2023. p 46.

Book Chapters

Chatterjee R.N. and Rajkumar, U. 2023. Innovations in Poultry production systems for sustainable productivity and food security. In: Bonday M T., Khan, A A., Adil, S.and Sheik, I U. (eds). *Poultry Production Current Insights*. Pp. 5-12.

Technical/Popular articles

Chatterjee, R.N. and Paul, S.S. 2023. Poultry products: Options for improving nutritional values. *Agriculture today*, April 23

Chatterjee, R.N., Kour, A. and Rajkumar, U. 2023. Rural Poultry Revolution: Rejuvenating Indian Backyards. *Agriculture World*, July 2023. Pp. 33.

Kumar, V. and Rao, J. S. Year? Gawon men uchch aaya srot: ghar angan kukuut palan. 2023 *MANAGE-Ankur*, 2(4): 35-36.

Kumar, V., Kour, A. and Rajkumar, U. 2023. High Income source in village: Backyard poultry. *AgriTech Today*, December, 2023. Pp. 68-70.

S.P. Yadav, S.S. Paul, Jayakumar S, R.N. Chatterjee, Kumar D, Behera R, Padhi M.K and Ajay Kumar Mahato submitted duck whole genome sequence data and obtained the following Accession numbers (SRA) from NCBI;

Genomic data (Kuzi and Chemballi duck)

SRR27476302, SRR27476301, SRR27476300, SRR27476299, SRR27476298, SRR27476297, SRR27476296, SRR27476295, SRR27476670, SRR27476669, SRR27476668, SRR27476667, SRR27476666, SRR27476665, SRR27476664, SRR27476663,

Transcriptome data (Kadaknath)

SRR24519273, SRR24519272, SRR24519271, SRR24519270, SRR24519269, SRR24519268, SRR24519267, SRR24519266, SRR24519265, SRR24519264, SRR24519263, SRR24519262, SRR24519263, SRR24519260, SRR24519259

Research Paper (Collaborative work done at other Institutes)

Kanaka, K. K., Nidhi Sukhija, H. N. Basavaprabhu, Nibedita Nayak, Amiya Ranjan Sahu, R. N. Chatterjee, T. K. Bhattacharya, and Jayakumar Sivalinga M. 2023. Computer-aided design and evaluation of a multi-epitope vaccine for egg allergy. *Indian journal of Poultry Science*, 58(2): 145- 154.

Kanaka, K.K., Nidhi Sukhija, Jayakumar Sivalingam, Rangasai Chandra Goli, Pallavi Rathi, KomalJaglan, and Chethan Raj. 2023. Deep Learning in Neural Networks and their Application in Genomics. *Acta Scientific Veterinary Sciences,*5.7:

Komal Jaglan, Utsav Surati, Nidhi Sukhija, Mohan M, Jayakumar S, Archana Verma and Saket K Niranjan.2023. A novel and cost-effective genotyping approach using next generation sequencing. *Cattle Practice*,31.

Kumar, A., Dige, M., Niranjan, S.K., Ahlawat, S., Arora, R., Kour, A., Vijh, R.K. 2023. Whole genome resequencing revealed genomic variants and functional pathways related to adaptation in Indian yak populations. Animal Biotechnology, 1-11. https://doi.org/10.1080/10495398.2023.2282723

Kumar, R., Singh, B.P, Basunathe, V.K. and Kumar, V. 2023. Production Performance of Goat at Farm Level and Marketing Practices Followed by Unorganized Goat Farmers. *Indian Research Journal of Extension Education*, 23(5): 36-40. https://doi.org/10.54986/irjee/2023/dec_spl/36-40

Mishra, A. K., Kumar, V., Gururaj, K., Sharma, N. and Gangwar, C. 2023. Occurrence of Abortions in Goats Reared under Different Farming Systems. *Indian Journal of Animal Research*, doi:10.18805/IJAR.B-5088.

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Surati, U., Mohan, M., Kour, A., Koul, Y., Patel, G., Anmol, Niranjan, S.K. 2023. Identification of deleterious SNPs in bovine HPRT gene by in silico approach. Indian

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II. Regional station, Bhubaneswar

Research papers

International Journals

Naim, A., Mishra, S.K., Sahoo, A. and Nath, I.M. 2023. Male Gonads Transplantation from Kadaknath Chicken to Chicken and Duck Surrogates. *Genes*, 14:1094. https://doi.org/10.3390/genes14051094.

Kumar, D., Panda, S.K., Jena, G.R., Sethy, K., Mishra, S.K., Swain, B.K., Naik, P. K., Beura, C.K. and Behera, R.2023. Alternations of fertility parameters by graded dose of inorganic arsenic in adult male White Pekin ducks. *Biological Trace Element Research*, 201(11): 5358-5367. https://doi.org/10.1007/s12011-023-03580-9.

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Das, P.P., Patra, R. C., Panda, S.K., Sahoo, R., Jena, G.R. and D. Kumar. 2023. Effect of aflatoxin on haematology, gross and histopathology of internal organs in white pekin ducks and its amelioration by dietary incorporation of bentonite clay. *Indian Journal of Animal Sciences*, 93(5):442–448, https://doi.org/10.56093/ijans.v93i5.13378.

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Padhi, M.K., Giri, S.C., and Sahoo, S.K. 2023. Comparative performance of Kuzi Ducks (*Anas platyrhynchos*) and its crosses with Khaki Campbell with respect to growth, phenotypic parameters and carcass quality. *Indian Journal of Animal Sciences*, 93(5):523–527. https://doi.org/10.56093/ijans.v93i5.130396

Padhi, M.K., Sahoo, S.K., Sastry, K.V.H., Bais, R.K.S. and Giri, S.C. 2023. Evaluation of ducks and Vanaraja chickens under backyard rearing systems in Nabarangpur district of Odisha. *Indian Journal Poultry Science*, 58(2):173-177.

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Behera, R., Padhi, M.K., Kumar, D.; Sahu, A., Naik, P.K., Swain, B.K. and Beura, C.K. 2023. Evaluation of Kuttanad ducks for growth and mortality traits under climatic conditions of Odisha. In: National Livestock Conference- ABHYUDAYA: 29th Annual Convention of Indian Society of Animal Production & Management (ISAPM)-2023 held from 18-20 January, 2023 at C.V.Sc. & A.H., OUAT.

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Kumar, R., Jena, G.R., Kumar D., Mishra, S.K., Panda, S.K., Naik, P.K., Swain, B.K and Beura, C.K. 2023. In ovo effect of Ocharatoxin A and its amelioration with L-Tryptophan in White Pekin ducks. Proceedings, VII World Waterfowl Conference held at Jakarta, Indonesia, held during: Sept 20 – 23, 2023.

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LIST OF PROJECTS (2023)

DPR, Hyderabad

A. List of institute funded research projects

S.No.	Project Title	PI	Name of Co-PIs	Duration
1.	Genetic improvement of rural parent lines and development of promising chicken varieties suitable for free range poultry farming (Project No. ANSCDPRSIL202000200072)	Dr. U. Rajkumar	Dr. M.Niranjan Dr. S.Haunshi Dr. L.L.L.Prince Dr. M.R.Reddy Dr. Vijay Kumar Dr. B.Prakash Dr. S. Jayakumar Dr. Aneet Kour (from July, 2023	2020-25
2.	Improvement and Evaluation of PD-2 and PD-6 lines for Rural Poultry Production (Project No. ANSCDPRSIL202000300073)	Dr. M. Niranjan	Dr. U. Rajkumar Dr. K.S. Rajaravindra Dr. T.R. Kannaki	2020-25
3.	Genetic improvement and evaluation of native chicken breeds (Project No. ANSCDPRSIL202000400074)	Dr. S. Haunshi	Dr. U. Rajkumar Dr. L.L.L. Prince Dr. T.R. Kannaki Dr. Suresh Devatkal (NRCM)	2020-25
4.	Improvement and maintenance of elite layer germplasm (Project No. ANSCDPRSIL202000500075)	Dr. K.S. Rajaravindra (up to June 2023) Dr. Aneet Kour (from July, 2023)	Dr. R.N. Chatterjee Dr. K.S. Rajaravindra (from July, 2023) Dr. M.Niranjan Dr. U.Rajkumar Dr. S.Haunshi Dr. L.L.L.Prince	2020-25
5.	Development of coloured egg type germ plasm for enhanced egg production in rural and backyard system (Project No. ANSCDPRSIL202300500099)	Dr. K.S. Rajaravindra	Dr. R.N. Chatterjee Dr. U. Rajkumar Dr. Aneet Kour Dr. M. Niranjan Dr. S. Haunshi Dr. L.L.L. Prince	2023-26
6.	Genetic improvement of synthetic coloured broiler male line (PB-1) and maintenance of Broiler Control population (Project No. ANSCDPRSIL202000600076)	Dr. L. Leslie Leo Prince	Dr. K.S.Rajaravindra Dr. U.Rajkumar Dr. B.L.N.Reddy Dr. M.Niranjan	2020-25

S.No.	Project Title	PI	Name of Co-PIs	Duration
7.	Genetic improvement of the coloured broiler female line (PB-2) (Project No. -ANSCDPRSIL201900100068)	Dr. B.L.N. Reddy	Dr. U. Rajkumar Dr. L.L.L. Prince	2019-24
8.	Generation of whole genome assembly of native Kadaknath chicken and its annotation (Project No. ANSCDPRSIL202000100071)	Dr. S.P. Yadav	Dr. S.S. Paul Dr. R.N. Chatterjee Dr. S. Jaya Kumar	2020-24
9.	Genomic Characterization and Identification of Selection Sweeps and CNVs in Native Chicken and Duck (Project No. ANSCDPRSIL202200100091)	Dr. S.P. Yadav	Dr Jayakumar Dr S. S. Paul Dr. R.N. Chatterjee Dr. Rajalaxmi Behera	2022-25
10.	Exploration of Genomic architecture of the Indian native ducks using whole genome sequencing and transcriptome analysis (Project No. ANSCDPRSIL202100200086)	Dr. S. Jayakumar	Dr. R.N. Chatterjee Dr. C.K. Beura Dr. S.K. Mishra Dr. M.K. Padhi Dr. S.C. Giri Dr. S.P. Yadav Dr. D.C. Mishra-IASRI, New Delhi	2021-25
11.	Genome wide profiling of long intergenic non-coding RNAs, miRNAs and mRNAs during the asymmetric ovarian development of Chicken (Project No. ANSCDPRSIL202100100085)	Dr. S. Jayakumar	Dr U Rajkumar Dr M. Shanmugam Dr T. K. Bhattacharya Dr. S.P. Yadav	2021-24
12.	Regeneration and maintenance of the transgenic chicken producing human interferon alpha 2b (Project No. ANSCDPRSIL202300200096)	Dr. S. Jayakumar	Dr. M.R. Reddy Dr. K.S. Raja Ravindra	2023-25
13.	Regeneration and maintenance of CRISPR/Cas9 edited Kadaknath and Nicobari chicken for Prolactin and Inhibin genes (Project No. ANSCDPRSIL202300600100)	Dr. K.S. Rajaravindra	Dr. S. Jayakumar Dr. Aneet Kour	2023-25

S.No.	Project Title	PI	Name of Co-PIs	Duration
14.	Identification and characterization of residual feed intake specific SNPs and candidate genes in coloured broiler (Project No. ANSCDPRSIL202100300087)	Dr. S.S. Paul	Dr. U Rajkumar Dr. L L L Prince Dr. SV Rama Rao Dr. S Jayakumar Dr. MVLN Raju Dr. A Kannan Dr. SP Yadav Dr. B Prakash	2021-24
15.	Disease Monitoring, Surveillance and Control in Chicken Populations of DPR (Project No. ANSCDPRSIL202001100081)	Dr. M.R. Reddy	Dr. D. Suchitra Sena Dr. T.R. Kannaki Dr. S.K. Bhanja	2020-24
16.	Prediction of health status in poultry using Machine Learning models (Project No. ANSCDPRSIL202300300097)	Dr. D. Suchitra Sena	Dr. M.R. Reddy Dr. S.K. Bhanja	2023-26
17.	Relationship between different physiological parameters and production performance in White Leghorn layers (Project No. ANSCDPRSIL202200400094)	Dr. N. Anand Laxmi	Dr. R.K. Mahapatra Dr. M. Shanmugam	2022-25
18.	Poultry rearing with moringa and other feed base - an Integrated Farming System (Project No. ANSCDPRSIL202001200082)	Dr. R.K. Mahapatra	Dr. B. Prakash Dr. S.K. Bhanja Dr. M.R. Reddy	2020-24
19.	Cryopreservation of blastodermal cells and production of chicken chimera (Project No. ANSCDPRSIL202100400088)	Dr. M. Shanmugam	Dr. N. Anand Laxmi	2021-24
20.	Assessment of ICAR-DPR germplasms in the field condition and their impact on food security and livelihood (Project No. ANSCDPRSIL202001300083)	Dr. Vijay Kumar	Dr. S.K. Bhanja Dr. M. Niranjan Dr. S.V. Rama Rao	2020-24

B. List of externally funded research projects

S.No.	Project Title	PI	Name of Co-PIs	Project Duration
1	Life cycle Analysis for Carbon footprint reduction through dietary modulations in broiler meat production (NICRA-CGP)	Dr. S.V. Rama Rao	Dr. M.V.L.N. Raju Dr. S.S. Paul Dr. B. Prakash Dr. Vijay Kumar Dr. M. Shanmugam Dr. T.R. Kannaki	2021-24
2	Effect of dietary supplementation of bio-fortified maize (QPM) on performance of chickens (ICAR-consortia research program)	Dr. B. Prakash	Dr. S.V. Rama Rao Dr. M.V.L.N. Raju	2018-24
3	INFAAR (Indian Network of Fisheries and Animal Antimicrobial Resistance) (Net work project)	Dr. D. Suchitra Sena	Dr. M.R. Reddy Dr. S.K. Bhanja Dr. T.R. Kannaki	2020-24
4	Enrichment of egg and meat by producing bovine Lactoferrin through development of transgenic chicken (DBT)	Dr. KS Rajaravindra	Dr. Nirmalya Ganguli, NIAB	2022-25
5	IoT Solution for Smart Poultry Farm practice (MeitY (Ministry of Electronics and Information Technology))	Dr. A. Kannan	Dr S V Ramarao Dr T R Kannaki Dr S K Bhanja	2022-24
6	Development of transgenic chicken as bioreactor for easy and cost effective production of human therapeutic proteins - tissue plasminogen activator (htPA) and erythropoietin (hERP)- NASF Project	Dr. S Jayakumar	Dr. S.P. Yadav Dr. Nirmalya Ganguli, NIAB	2022-25
7	Consortium Research Platform (CRP) on Agro- biodiversity (ICAR- NBAGR)	Dr. Shanmugam M	Dr Jayakumar S	2021-25

C. List of Institute funded research projects completed during 2023

S.No.	Project Title	PI	Name of Co-PIs	Project Duration
1	Evaluation of Insect larva meal as a novel protein source in chicken diet (Project No. ANSCDPRSIL202000700077)	Dr. MVLN Raju	Dr. S.V. Rama rao Dr. S.S. Paul Dr. B. Prakash Dr. A. Kannan Dr. M. Shanmugam Dr. M.R. Reddy	2020-23
2	Biosynthesis of different nano mineral particles using plant extracts and evaluation of their potential as feed supplement in poultry (Project No. ANSCDPRSIL202000800078)	Dr. A. Kannan	Dr. S.S. Paul Dr. M. Shanmugam Dr. D. Rajendran (NIANP) Dr. M. Muthkumar (NRCM) Dr. R. Venkateshwarlu (IIMR)	2020-23
3	Understanding the disease tolerance/resistance in Indian native chicken breeds to Newcastle disease and novel control strategies (Project No. ANSCDPRSIL201900300070)	Dr. T.R. Kannaki	Dr. M.R. Reddy Dr. S. Haunshi Dr. S.P. Yadav	2019-23

DPR Regional Station, Bhubaneswar

D. List of institute funded research projects

S.No.	Project Title	PI	Co-PIs	Duration
1	Maintenance of Kuzi duck and evaluation of its crossbreds (Project No. ANSCDPRSIL202200200092_B)	Dr. M.K. Padhi	Dr S.C Giri	2022-24
2	Breeding for development of mycotoxin tolerant meat type ducks (Project No. ANSCDPRSIL202100500089_B)	Dr. S. K. Mishra	Dr. C.K. Beura Dr. P.K. Naik Dr. B.K. Swain Dr. D. Kumar Dr. Rajalaxmi Behera	2021-25
3	Maintenance and Conservation of Kuttanad ducks (Project No. ANSCDPRSIL202200300093_B)	Dr. Rajalaxmi Behera	Dr. M.K. Padhi	2022-24
4	Formulation and evaluation of duck meat based products (Project No. ANSCDPRSIL202300800102_B)	Dr. C.K. Beura	Dr. B.K. Swain Dr. P.K. Naik Dr. S.K. Mishra Dr. D. Kumar	2023-24

S.No.	Project Title	PI	Co-PIs	Duration
5	Production and utilization of earthworm based feed in White Pekin ducks (Project No. ANSCDPRSIL202100600090_B)	Dr. B.K. Swain	Dr. P. K. Naik Dr. S.K. Sahoo Dr. S.K. Mishra Dr. D. Kumar Dr. C.K. Beura	2021-24
6	Evaluation of broken rice and maize based feed in Khaki Campbell ducks under intensive rearing system (Project No. ANSCDPRSIL202300400098_B)	Dr. P.K. Naik	Dr. B. K. Swain Dr. S. K. Sahoo Dr. C K. Beura Dr. S. K. Mishra Dr. S K. Bhanja Dr. D. Kumar Dr. R. Behera	2023-26
7	Standardization of Feed restriction schedule and optimization of dietary crude protein level in White Pekin ducks (Project No. ANSCDPRSIL202300700101_B)	Dr. S.K. Sahoo	Dr. M. K. Padhi Dr. S.C. Giri Dr. S. K. Bhanja Dr. B. K. Swain Dr. P. K. Naik	2023-25
8	Maintenance and multiplication of Khaki Campbell ducks with a focus on cage house rearing and improving fertility to augment germplasm supply to meet the farmers demand (Project No. ANSCDPRSIL202300100095_B)	Dr. S.C. Giri	Dr. M.K. Padhi Dr. S. K. Sahoo Dr. B.K. Swain Dr. D. Kumar	2023-26
9	Investigating the role of GRAS Compounds as alternatives to antimicrobial in ducks (Project No. ANSCDPRSIL202300900103_B)	Dr. D. Kumar	Dr. S. K. Mishra Dr. S K. Bhanja Dr. C K. Beura Dr. B.K. Swain Dr. P.K. Naik Dr. R. Behera	2023-26
10	Monitoring of duck diseases and their biosecurity measures	Dr. D. Kumar	Dr. S.K. Mishra Dr. S.C. Giri	2023-28
Inter-Institutional Collaborative Projects				
1	Increasing productivity and sustaining the rice based production system through Farmer FIRST approach. (Lead centre: ICAR-NRRI, Cuttack)	Dr Biswajit Mondal (ICAR-NRRI	Dr. S.C. Giri	2019-24

E. List of Institute funded research projects completed during 2023

S.No.	Project Title	PI	Name of Co-PIs	Project Duration
Institute funded projects				
1	Meat quality determination of RC duck breeds	Dr. C.K. Beura	Dr. B.K. Swain Dr. P.K. Naik Dr. S.K. Mishra Dr. D. Kumar	2021-23
2	Nutrient requirements of White Pekin ducks	Dr. S.K. Sahoo	Dr. B.K. Swain Dr. P.K. Naik Dr. S.C. Giri	2020-23
3	Evaluation of Broken Rice or Tuber Crops Based Feed Mixture Supplement in White Pekin Ducks in Semi-Intensive Rearing System	Dr. P.K. Naik	Dr. B.K. Swain Dr. S.K. Sahoo Dr. S.K. Mishra Dr. D. Kumar Dr. C.K. Beura	2018-23
4	Duck Rearing management practices in farm condition for optimum productivity under changing climatic condition.	Dr. S.C. Giri	Dr. M.K. Padhi Dr. S.K. Sahoo	2020-23
Inter-Institutional Collaborative Projects				
1	Diversified rice based farming system for livelihood improvement of small and marginal farmers: (Lead center: ICAR-NRRI, Cuttack)	Dr. A. Poonam (ICAR-NRRI)	Dr. S.C. Giri	2016-23

Institute Technology Management Unit at ICAR-DPR is managed by Institute Technology Management Committee (ITMC). ITMC is the highest body which takes important decisions for the intellectual property management at DPR viz., filing of patents, Trademarks, approval of the technology for commercialization, pricing of the technologies ready for commercialization etc. ITMC is chaired by the Director.

ITMC Meetings Conducted

ITMC meetings were conducted on 16th March, 2023, 17th May, 2023 and 30th May, 2023 for assessment of Products/Technology for Certification, to examine Patent applications for their novelty and commercial applicability and to review Trademarks application and evaluation of technologies developed at this Directorate for commercialization. .

Patent Filed and Granted

One Patent applications for the technology invented at ICAR-DPR were filed with Indian Patent office with following details.

Table 1. Details of Patent applications filed during 2023

S.No.	Title of patent	Date of filing	Application number	Inventor
1	A Feeder Tray	30th June 2023	E-137/7093/2023/CHE	Dr Sunil Chandra Giri

Trademark Filed

One Word Trademark **"VERMIPOUL"** for the technology developed at ICAR-DPR was filed with Indian Trademark office on 5th September

Contract Research

The facilities of the Directorate were extended for the benefit of poultry industry through the contract research mode of ICAR. ICAR-DPR entered in following agreements during the year.

Table 2. List of MoUs entered in Contract Research mode during 2023

S.No.	Organization with whom MOU signed	Title of the Project	Date of Agreement	Date of completion	Project PI	Total cost in Rs.
1	Heka Pharma Pvt Ltd	Isolation and molecular genotyping of Newcastle disease virus from poultry	3.1.2023	3.1.2024	Dr.MR. Reddy	11,70,000
2	Shree Ram India Gums Limited	Evaluation of Guar Protein Concentrate as replacement of soybean in chicken	12.12.2023	12.12.2024	Dr.SS Paul	11,79,528

Quinquennial Review meeting

The 1st meeting was held on 28th and 29th July 2023 at ICAR-DPR, Hyderabad. The chairman and all the members participated in the meeting. The QRT visited the laboratories, experimental farm, hatchery, and other facilities of ICAR-DPR. The QRT reviewed the work done under different research projects at the head quarter i.e. breeding, molecular genetics, nutrition, health and physiology., The overall progress under AICRP on Poultry Breeding and Poultry Seed Project and action taken on the previous QRT recommendations were also reviwed. The QRT held discussion with scientific, administrative, technical and supporting staff of the Directorate. The programme of visits to AICRP and PSP centres was finalized.

Quinquennial Review meeting

Institutional Animal Ethics Committee

The IAEC meetings of ICAR-DPR were conducted on 2 March 2023 and 15 December 2023 for the approval of experimental protocols of the research projects. The IAEC nominees of CCSEA, Dr Jayant Hole, Dr Shiva Prakash, Dr Ramesh Bhumaiyya and Dr Satyabrata Bhanja attended both the meetings. The annual inspection of the facility was conducted on 27 December 2023.

The IAEC meeting (15 December 2023) is in progress

Internal Complaints Committee

Internal Complaints Committee meetings was held on 14 March 2023, 30 June 2023, 25 September 2023 and 22 December 2023 respectively.

Institute Joint Staff Council

Seventh and eighth Meetings of 11th Institute Joint Staff Council (IJSC) were held on 16 March 2023 and 01 June 2023 respectively. First Meeting of 12th IJSC held on 20 September 2023.

Institute Management Committee

42 Institute Management Committee meeting was held at this Directorate on 29 September 2023.

Institute Research Committee

Annual IRC Meeting of DPR Main Institute, Hyderabad

The annual meeting of the Institute Research Committee (IRC) for the year 2022-23 convened on 14-15and 21June 2023, at the Directorate. Chaired by Dr. R.N. Chatterjee, Director, the session evaluated the projects (2022-23) undertaken by ICAR-DPR Main Institute, Hyderabad. Dr. L. Leslie Leo Prince, In-charge of the PME Cell and Member Secretary of IRC, extended a warm welcome to Dr. R.N. Chatterjee,

Director and Chairman of IRC, experts Dr. R.P. Sharma, Former Director of ICAR-DPR, and Dr. S. T. Viroji Rao, Former Registrar of PVNRTVU, Hyderabad. The progress of the institute's research projects underwent thorough assessment, leading to constructive recommendations. New project proposals were presented by the PIs, and the IRC duly approved them. Dr. R.N. Chatterjee, Chairman of IRC, commended and congratulated all scientists for their commendable work, excellent presentations, and engaging discussions during the IRC meeting.

Annual IRC Meeting of DPR RS, Bhubaneswar

The annual meeting of the Institute Research Committee (IRC) for the year 2022-23 took place on 10-11July 2023, at the DPR Regional Station, Bhubaneswar, chaired by Dr. R.N. Chatterjee, Director. The meeting involved the evaluation of the progress of projects (2022-23) at ICAR-DPR RS, Bhubaneswar. Dr. S. K. Bhanja, Head of the Regional Station, extended a warm welcome to the Director and Chairman of IRC, along with other members attending the Annual IRC meeting. The progress of the institute's research projects underwent thorough assessment, leading to constructive recommendations. New project proposals were presented by the PIs, and the IRC duly approved them. Dr. R.N. Chatterjee, Director & Chairman, IRC offered his concluding remarks of the IRC 2023 where he encouraged the scientists to focus on increasing the visibility of the institute.

Women's' Grievances Committee

Women's Grievance Committee meetings has been held on 14 March 2023, 30 June 2023, 25 September 2023 and 22 December 2023 respectively.

12. PARTICIPATION OF SCIENTISTS IN SEMINARS, CONFERENCES, WORKSHOPS, ETC.

S. No.	Particulars of Seminars/ conferences/workshops	Official(s)	Schedule	Venue/ Organised by
1	XII Biennial Conference of Animal Nutrition Association (ANACON-2023)	Dr. S.S. Paul, HoD, PNHP Dr. B. Prakash, Pr. Scientist	16-18 February 2023	DUVASU, Mathura
2	39th Annual Convention of ISVM	Dr. D. Suchitra Sena, Pr. Scientist	22-24 February 2023	Uttarakhand
3	Virtual Review Meeting of All India Coordinated Research Project (AICRP) on Poultry Breeding and Poultry Seed Project (PSP)	Dr. L.L.L. Prince Pr. Scientist	14 March 2023	ICAR-DPR, Hyderabad
4	1st Meeting of Animal Husbandry and Equipment Sectional Committee, FAD 32	Dr. Santosh Haunshi, Pr. Scientist	3 April 2023	Online
5	Technical Seminar	Dr. M.V.L.N. Raju Pr. Scientist	3 April 2023	Chalimeda Feeds, Karimnagar (under Consultancy project)
6	World Intellectual Property Day	Dr. R.K. Mahapatra, Pr. Scientist Dr. S.P. Yadav, Pr. Scientist	26 April 2023	ICAR-DPR, Hyderabad
7	Stake Holders Meet on "Black Soldier Fly (BSF) Farming - As an accelerator for Sustainable Development Goals" (Moderator)	Dr. M.V.L.N. Raju Pr. Scientist	20 June 2023	PJTSAU, Hyderabad
8	VIP Poultry Symposium 2023	Dr. U. Rajkumar, HoD, PGB Dr. M.V.L.N. Raju, Pr. Scientist	28 June 2023	Hyderabad
9	Town Official Language Implementation Committees (TOLIC) Hindi Workshop	Dr. R.K. Mahapatra, Pr. Scientist Dr. S.P. Yadav, Pr. Scientist Shri. J. Srinivas Rao A.C.T.O.	7 July 2023	NRC on Meat, Hyderabad
10	25th Meeting of FAD 05 of Bureau of Indian Standards	Dr. M.V.L.N. Raju, Pr. Scientist	20 July 2023	BIS, New Delhi

S. No.	Particulars of Seminars/ conferences/workshops	Official(s)	Schedule	Venue/ Organised by
11	2nd Meeting of Animal Husbandry and Equipment Sectional Committee, FAD 32,	Dr. Santosh Haunshi, Pr. Scientist	31 July 2023	Bureau of Indian Standards, HQ, ManakBhavan, New Delhi
12	Hindi Technical Workshop	Dr. S.P. Yadav Pr. Scientist	24 August 2023	ICAR-IIOR, Hyderabad
13	Indo-US Workshop on Systems-based integrated approaches for enhancing the sustainability of the poultry sector in India and the USA ICAR-National Meat Research Institute (NMRI),	Dr. M. Niranjan Pr. Scientist Dr. Santosh Haunshi, Pr. Scientist	5 September 2023	ICAR-National Meat Research Institute (NMRI), Chengicherla, Hyderabad
14	XXXVIII Indian Poultry Science Association Conference and National Symposium (IPSACON-2023)	Dr. Santosh Haunshi, Pr. Scientist Dr. R.K. Mahapatra, Pr. Scientist	13-15 September 2023	SKUAST-Kashmir, Srinagar, Jammu and Kashmir
15	Town Official Language Implementation Committees (TOLIC-2) Hindi workshop	All the staff of the institute	4 October 2023	ICAR-DPR, Hyderabad
16	XVI Agricultural Science Congress & EXPO	Dr. R.N. Chatterjee, Director Dr. S.S. Paul, HoD, PNHP Dr. S. K. Sahoo, Pr. Scientist Dr. S. C. Giri, Pr. Scientist Dr. Vijay Kumar, Sr. Scientist	10-13 October 2023	Kochi, Kerala
17	XVII Annual Convention of Indian Society of Animal Genetics and Breeding (ISAGB) Conference 2023	Dr. R.N. Chatterjee, Director Dr. U. Rajkumar, HoD, PGB Dr. S. Jayakumar, Sr. Scientist	16-17 November 2023	ICAR-NBAGR, Karnal
18	J Gate CeRA Nodal officer workshop	Dr. S.P. Yadav Pr. Scientist	5 December 2023	TNAU, Coimbatore
19	3rd Meeting of Animal Husbandry and Equipment Sectional Committee, FAD 32,	Dr. Santosh Haunshi, Pr. Scientist	15 December 2023	Online

S. No.	Particulars of Seminars/ conferences/workshops	Official(s)	Schedule	Venue/ Organised by
20	IEEE 20th India Council International Conference (INDICON-2023)	Dr. A. Kannan, Pr. Scientist	14-17 December 2023	Organised by IEEE India Council and National institute of Technology, Warangal at CMR Institute of Technology, Hyderabad, India
21	International Conference on Systems and Technologies for Smart Agriculture (ICSTA-2023)	Dr. R.N. Chatterjee, Director Dr. A.Kannan, Pr. Scientist	19-20 December 2023	Organized by CDAC, Kolkata, Agri EnIcs programme and Ministry of Electronics and IT (MeitY) at Biswa Bangla Convention Centre, Kolkata

Regional station, Bhubaneshwar

S. No.	Particulars of Conference / Seminar / Workshop	Official (s)	Schedule	Venue / Organised by
1.	29th Annual Convention of Indian Society of Animal Production and Management (ISAPAM-2023)	Dr. M.K. Padhi, Pr. Scientist Dr. Rajalaxmi B., Pr. Scientist	18-20 January 2023	OUAT, Bhubaneswar
2.	XII Biennial Conference of Animal Nutrition Association (ANACON-2023)	Dr. P.K. Naik, Pr. Scientist	16-18 February 2023	DUVASU, Mathura
3.	XXXVIII Annual Conference of IPSACON 2023	Dr. C.K. Beura, Pr. Scientist Dr. B.K. Swain, Pr. Scientist Dr. M.K. Padhi, Pr. Scientist Dr. S.K.Mishra, Pr. Scientist	13 to 15 September 2023	SKUAT, KASHMIR
4.	Workshop on “Promoting Animal Welfare for entrepreneurship & employability” on	Dr. S.K. Mishra	4 October 2023	OUAT, Bhubaneswar
5.	XVI ASC & EXPO	Dr. S.K. Sahoo, Pr. Scientist Dr. S.C. Giri, Pr. Scientist	10-13 October 2023	Kochi, Kerala

13. PERSONNEL

ICAR-DPR, Head Quarters-Hyderabad

Research & Management Position:

Dr. R.N. Chatterjee, Director

Head of the Department

Dr. S.S. Paul, HoD, PNHP

Dr. U. Rajkumar, HoD, PGB

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. Anand Laxmi, Pr. Scientist
5. Dr. M.R. Reddy, Pr. Scientist
6. Dr. M. Niranjan, Pr. Scientist
7. Dr. R.K. Mahapatra, Pr. Scientist.
8. Dr. D. Suchitra Sena, Pr. Scientist
9. Dr. Santosh Haunshi, Pr. Scientist
10. Dr. L.L.L. Prince, Pr. Scientist
11. Dr. S.P. Yadav, Pr. Scientist
12. Dr. A. Kannan, Pr. Scientist
13. Dr. B. Prakash, Pr. Scientist
14. Dr. M. Shanmugam, Sr. Scientist
15. Dr. T.R. Kannaki, Sr.Scientist
16. Dr. K.S. Rajaravindra, Sr. Scientist
17. Dr. S. Jayakumar, Sr. Scientist
18. Dr. Vijay Kumar, Sr. Scientist
19. Dr. Aneet Kour, Scientist

TECHNICAL:

1. Dr. S.K. Bhanja, C.T.O. (Farm Manager)
2. Sri. V.V. Rao, C.T.O. (Computer Astt.)
3. Sri. D. Pratap. A.C.T.O. (Field/Farm)
4. Sri. J. Srinivasa Rao, A.C.T.O. (Hindi Translator)
5. Dr. Diwakar Singh Rana, Sr. T.O (Field/Farm)
6. Sri. G. Rajeshwar Goud, Tech. Officer (Field/Farm)
7. Sri. G. Madhukar, Tech. Officer (IT)
8. Sri. Md. Maqbul, Tech. Officer (Driver)
9. Sri. Md. Yousufuddin, Sr. Tech. Astt (Driver)
10. Sri. P. Santosh Phani Kumar, Tech. Asst. (Field/Farm)
11. Sri. D. Ashok Kumar, Technician- (Field/Farm)

ADMINISTRATIVE:

1. Sri. S. Bala Kamesh, F. & A.O.
2. Smt. T.R. Vijaya Lakshmi, A.A.O.
3. Smt. M. Kamala, A.A.O.
4. Sri. T.V. Ramadas, P,S.
5. Sri. Rajesh Parashar, Asst.
6. Sri. L.V.B. Prasad, Asst.
7. Smt. N. Siva Dharani, L.D.C.
8. Sri. R. Ganesh, L.D.C.

SUPPORTING:

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

Head ICAR-DPR, Regional Station, Bhubaneswar

Dr. Subrat Kumar Bhanja

SCIENTIFIC:

1. Dr. C.K. Buera, Principal Scientist
2. Dr. S.K. Sahoo, Principal Scientist
3. Dr. S.K. Mishra, Principal Scientist
4. Dr. M.K. Padhi, Principal Scientist
5. Dr. P.K. Naik, Principal Scientist
6. Dr. B.K. Swain, Principal Scientist
7. Dr. S.C. Giri, Principal Scientist
8. Dr. Dhirendra Kumar, Sr. Scientist
9. Dr. Rajalaxmi Behera, Scientist

TECHNICAL:

1. Sri. A.K. Jha, Sr. Technical Officer

ADMINISTRATIVE :

1. Sri Sukul Hansda, Assistant

SUPPORTING:

1. Sri Birendra Kumar Behra
2. Sri. Haresh Chandra Sahoo

PROMOTIONS:

Dr. Raja Laxmi Behera, Scientist, RS-Bhubaneswar, Promoted to Grade Pay of Rs. 6000-00 to Rs.7000-00 in the post of Scientist (Sr. scale) w.e.f 01.07.2019.

Dr. Dhirendra Kumar, Scientist (Sr. scale), RS-Bhubaneswar, Promoted to Grade Pay of Rs.8000-00 to Rs.9000-00 in the post of Sr. Scientist w.e.f 07.01.2021.

Dr. Vijay Kumar, Sr. Scientist Promoted to Grade Pay of Rs.8000-00 to Rs.9000-00 in the post of Sr. Scientist w.e.f 15.12.2021.

Sri. Ashutosh Kumar Jha Promoted to Technical Officer (Level-7) to Sr. Technical Officer (Level-10) w.e.f 15.12.2021.

Dr. Subrat Kumar Bhanja, Principal Scientist has joined as HoD, ICAR-DPR, RC Bhubaneswar in the F.N. of 16th June, 2023.

Dr. S.S. Paul, Principal Scientist has Joined as HoD, Poultry Nutrition Health Physiology in AN of 15th June, 2023 at ICAR DPR, Hyderabad.

Dr. U Rajkumar, Principal Scientist has Joined as HoD, Poultry Genetics and Breeding in AN of 15th June, 2023 at ICAR DPR, Hyderabad.

NEW JOINING:

Dr. Aneet Kour, Scientist has joined at ICAR DPR, Hyderabad on 31th March, 2023.

Sri. T.V. Ramadas has joined ICAR DPR, Hyderabad on Promotion as Private Secretary on 1st December, 2023.

RETIREMENT:

Smt. Minakshi Dange, C.T.O has retired on superannuation on 30th September, 2023.

RESIGNATION:

Smt. N. Siva Dharani, L.D.C has selected as Assistant in ADA, Ministry of Defence, Bengaluru and relieved on 25th September, 2023.

HEAVENLY ABODE:

Sri. A.K. Nanda, Sr. Technical Officer has left to heavenly abode on 3rd August, 2023 while in service at ICAR-DPR, RS-Bhubaneswar.

Experimental Hatcheries

During the period April, 2020-December, 2023 10.93 lakh germplasm was supplied from to different stakeholders of the country. Majority of the germplasm was supplied in the form of day-old Chicks (59.6%) followed by fertile eggs (27.5%), parent lines (11.1%) and grownup birds (1.8%). A total of 3898 stakeholders were benefited during the period. The Vanaraja variety was the highest number of supplied birds (41.8%) followed by Gramapriya (27.1%), Srinidhi (8.6%), Kadaknath (7.9%) and rest other birds. During the same period 38.4 lakh germplasm was supplied to 47.9 thousand beneficiaries from AICRP and PSP centers in different parts of the country.

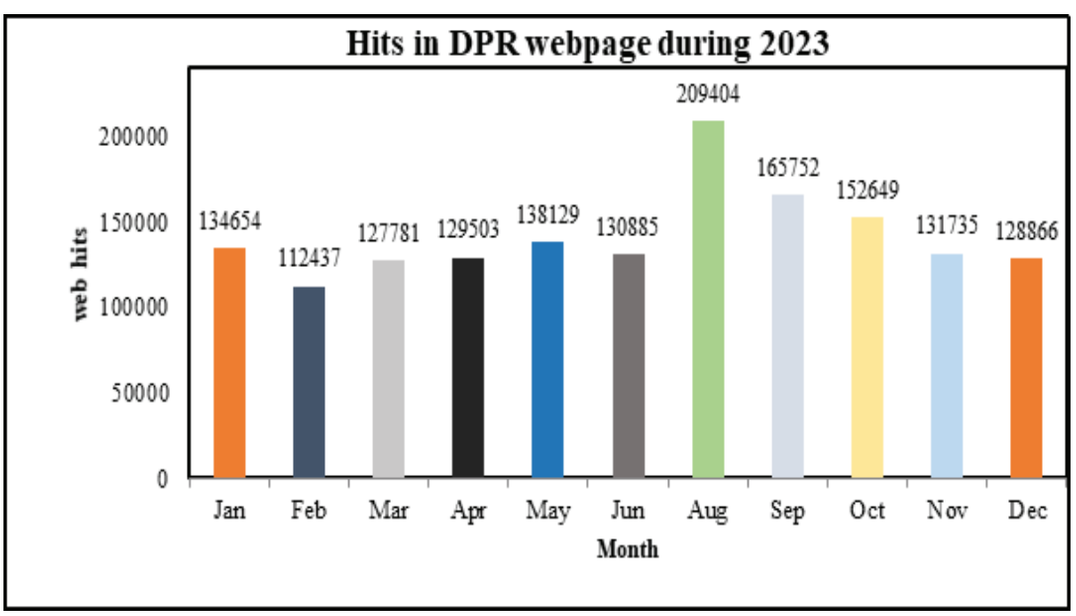
Experimental Farm

The experimental poultry farm, being the focus point of research for the Directorate is located inside the campus and is divided in to two units such as Pure Line and Commercial farm unit. The Pure line farm is again located in the farthest point of the Directorate campus which is having a dip vat before taking entry in to it. All the elite pure line germ plasm is reared and is being bred to illicit maximum genetic gain from the pure lines maintained. In the Commercial Farm, only exploitation of Parent birds is done for commercial gains and for the germplasm supply to cater the needs of the farmers from across the Country.

The monthly average livestock reared in Pure Line and Commercial Farm were 24,334 (twenty four thousand three hundred and thirty four) birds only. In the farm a total of 18,51,176 (Eighteen lakh fifty one thousand and one hundred seventy six) eggs were produced during the year, out of which 5,79,596 (five lakh seventy nine thousand five hundred and ninety six only) nos. were hatching eggs and the remaining ones were table eggs.

Feed Compounding Unit

The Feed Compounding Unit, one of the important central facilities at the institute, suppliedcompounded feed for the various purelines, commercial stocks and experimental birds of the Directorate. Furthermore, feedin small quantities was also supplied to the farmers, who purchased chicks from DPR hatchery, and several beneficiaries under TSP and SCSP programs at the distribution points in Telangana state.The raw materials, like maize, soybean meal, DORB, stone grit, vitamins, minerals, additives etc. were procured and balanced dietswere compounded



for chick, grower and adult breeding stocks of layer, broiler and rural type of birds. The Unit has sophisticated a feed plant (2 systems of 0.5 ton capacity/hour with bucket elevators and horizontal mixers) and a go-down having 2500 sft area that can accommodate stocks for about 2 months. During the year, a total quantity of 925.5 MT of feed was compounded and supplied.

Agricultural Knowledge Management Unit

Internet Connectivity under NKN

The Internet connectivity provided by the National Knowledge Network (NKN) guarantees a reliable Internet leased line with a speed of 100Mbps. This connection is fortified by a robust firewall, reinforcing security measures to protect against potential threats. Moreover, there is a backup connectivity arrangement in place through the BSNL fibre line, ensuring continuity in case of any unforeseen disruptions. This substantial bandwidth has been efficiently employed by the staff for hosting and participating in numerous online meetings and webinars.

DPR Webpage

The official website of the directorate (http://www.pdonpoultry.org) underwent consistent updates, ensuring that it remained current and informative. For the year 2023, the website received 16.99 lakh hits. This translates to an impressive average of 4,655 visits per day, reflecting the site's relevance and popularity among its audience. The DPR webpage includes a Payment Gateway link for the convenient booking and purchase of chicken germplasm. Additionally, brochures showcasing the various varieties of DPR and AICRP-PB are accessible on the site.

ICAR-DPR Mobile App

The ICAR-DPR Mobile App, accessible in English on Android, is consistently updated to provide information about the institute, chicken germplasm, AICPR on Poultry Breeding, germplasm availability, and other relevant details. In the year 2023 alone, the app recorded 149 downloads, contributing to a total of 4,149 downloads since its launch. Impressively, the app has garnered an average rating of 4.5 out of 5, based on feedback from 35 users.

YouTube Channel

The ICAR-DPR Poultry YouTube channel, available at https://www.youtube.com/@IcarPoultry, presents DPR profiles along with a variety of informative videos and webinars. In 2023, the channel saw a total of 24,251 views across its diverse content. Since its launch, the channel has gained 4,470 subscribers and accumulated 196,970 views on different informative videos.

Social Media accounts

The Facebook page (https://www.facebook.com/ICAR.DPR.Hyderabad) and Twitter (X) handle (https://twitter.com/IcarPoultry) were actively managed to share important info with farmers and poultry entrepreneurs. We regularly posted updates, relevant news, and useful insights on both platforms to better connect with the farming and poultry communities. Since the beginning, the Facebook page has 1,020 followers, and the Twitter handle has 213 followers, showing a growing and engaged audience.

Visit of Deputy Director General (AS) at Regional Station:

Honorable Deputy Director General, Animal Science, Indian Council of Agricultural Research Dr J.K. Jena visited Regional station, ICAR-Directorate of Poultry Research, Bhubaneswar on 25th August, 2023. Dr S K Bhanja, Head, RS, ICAR-DPR presented the salient achievements and the areas/requirements which need the support of DDG (AS) for upliftment of the center. DDG (AS) advised to import of duck germplasms like Khaki Campbell and White Pekin, formulate a project under National Livestock Mission that would aid to the infrastructural development, organization of National Consultancy Meetings with eminent personnel from duckery sectors and Preparation of Brochure on Duck Production and ICAR-DPR, RS, Bhubaneswar at a glance to upgrade visibility of the center.

Inauguration of Demonstration unit and Duck Shed at Regional Station:

Newly constructed two duck sheds – Duck Grower House and one Demonstration Unit was inaugurated by Dr. J.K. Jena, Honourable DDG (AS) in presence of Director, ICAR-DPR, Hyderabad, Head, Scientists, Technical and Administrative staffs of the Regional Station of ICAR-DPR, Bhubaneswar on 27th October, 2023.

Conduct of IRC meeting at Regional Station:

The annual Institute Research Council meeting-2023 for Regional Station was held at ICAR-DPR Regional Station, Bhubaneswar during 10th -11th July, 2023 under the chairmanship of Director, ICAR-DPR, Hyderabad. The progress of ten ongoing and six new projects were presented.

ICAR-DPR celebrated International Day of Yoga-2023

The Directorate celebrated the 9th International Day of Yoga on 21st June, 2023 with a lot of enthusiasm and zeal. The staff members participated in the yoga session conducted by Dr. A. Debnath, MBBS, Authorised Medical Attendant of ICAR DPR Clinic. He narrated the group about the various benefits of yoga both for the body and mind. He taught Asanas and Pranayamas which were practised by the

participants. Director, Dr. R.N. Chatterjee participated in the yoga session and encouraged the staff to practice yoga for healthier life. The programme was coordinated by Dr K.S. Rajaravindra, Senior Scientist and Shri. G. Rajeswar Goud, Tech. Officer of this Directorate.

Celebration of International Yoga Day at Regional Station:

The International Yoga Day was celebrated in the campus of Regional Station, ICAR-DPR, Bhubaneswar on 21st June, 2023 at 6.00 AM in the morning. On this occasion, Sri Surendra Nath Tripathy, a renowned Yoga Guru was invited to apprise the staffs about different aspects of Yoga with demonstrations.

Celebration of Hindi Pakhwada at Regional Station:

Hindi Pakhwada was organized at the Regional Station, ICAR-DPR, Bhubaneswar from 14-9-2023 to 28-9-2023. During this period Hindi Day Celebration, Hindi Translation Competition, Hindi Word Writing, debate competition and Hindi poetry recitation competition was organized. The closing cum prize distribution ceremony was organized on 29-9-2023.

Quinquennial Review Team Meeting at Regional Station:

The Quinquennial Review Team Meeting for the period April, 2017 to March, 2022 was held at Regional Station, ICAR-DPR, Bhubaneswar during **22nd - 23rd** September, 2023. In absence of Dr K.M.L. Pathak, Chairman QRT, Dr C.S. Prasad, Member of QRT lead the session. The meeting started with formal welcome of the esteemed members of QRT team by Director, ICAR-DPR - Dr. R.N Chatterjee, by offering bouquet as token of love. Dr. R.N Chatterjee also briefed the esteemed members about the status of the regional station and fetched the attention of the QRT members about the cutting down of the allotted fund to the institute even after transfer of the regional station form ICAR- CARI, Bareilly, Uttar Pradesh. After the brief opening remark of the Director, the QRT members had a formal visit to the institute duck farms, hatchery

unit, post-mortem room, azolla production unit, earthworm production unit and feed processing unit. Then Dr S K Bhanja, Head, Regional Station presented the completed and onging projects. The QRT teams interacted with the scientists and suggest few things for qualitative improvement in the projects. The QRT team also visited the farmers house who were rearing ducks by procuring ducklings from this centre.

Pledge in Vigilance week observation:

On the occasion of observation of Vigilance week from 30th Oct. to 5th Nov., 2023 a pledge was taken by all the staff members of Regional Station, ICAR-DPR, Bhubaneswar on 30th Oct. 2023

Pledge in Rastriya Ekta Divas observation:

On 31st Oct. 2023 a pledge was taken by all the staff members of Regional Station, ICAR-DPR, Bhubaneswar for observation of Rastriya Ekta Divas.

Report on Swachata Pakhwada at Regional Station:

On 26th December, 2023 a cleanness drive inside the campus was organized in which all the scientists, technical and supporting staffs took part. The Swachata Pakhwada closing ceremony was organized on 1st Jaunary, 2024 (as 31st December, 2023 was a holiday). In this programme plantations were done on the road side of the Regional Station. Some photographs related to the programme is presented below.

Participation in SCSP program

Dr. S.K. Mishra along with Dr. Dhirendra Kumar and Dr. S.K. Bhanja participated in a Duckery training for farmers of paikapalli, brahmanipalli & Parvatipur villages: of sonepur district on Dt: 20-21 Dec, 2023, which was covered by the Odia daily Samvad on 22nd Dec 2023.

Library

The Directorateis having a small and well equipped resource full collection of books in library, which is very much useful to the readers like scientific, technical, administrative staff of the institute. Besides this the other users from veterinary universities and poultry industry people for their resource material available at institute library.

The library has been subscribing two foreign journals and Indian journals/magazines and having approximately about eight hundred reference books on different aspects of poultry science and livestock as well other general subject books. Institute also utilizing of Cera consortia services. The library also subscribe daily newspapers in Hindi, Telugu and English for our regular readers. We also digitalized all our publications (such as annual reports, newsletters, un-priced books). The facilities of this library is being utilizing by the institute scientist, scholars and students and faculty members of neighbor veterinary college as well from other parts of India.

Hindi Implementation

The Directorate conducted four quarterly meetings of Official Language Implementation Committee on 23th March, 2023, 22-06-2023, 29-08-2023 and 14th December, 2023, in which different issues related to effective implementation of Hindi Language in office were discussed. The Directorate also conducted three Virtual Hindi workshops, i.e. on 23th March, 2023, 23th June, 2023 and 6th November, 2023 for employees to upgrade their Hindi language skills as official language, and one technical Hindi workshop conducted on 04th October, 2023 for TOLIC-2 member offices. These Hindi learning workshops are very much informative and useful to the staff for their routine works.

The Directorate also celebrated Hindi Fortnight celebrations during 1-15 September, 2023 and Hindi Day on 14th September, 2023, during these celebrations different literary competitions were conducted for the staff members. Dr. R.P. Sharma, former Director, DPR, Hyderabad was the Chief guest on this occasion, he heightened the importance of Hindi language and its vast usage in all parts of India. The Dr. R.N. Chatterjee, Director, ICAR-DPR presented cash awards and certificates to all winners and wishes them.

TOLIC-2 A technical Hindi workshop was conducted at ICAR-Directorate of Poultry Research, Hyderabad on 4th October, 2023. Officers from various Central Government Agency participated in the workshop.

Institute Management Council:

42nd IMC was held at this Directorate on 29/09/2023.

Institute Joint Staff Council:

7th and 8th Meeting of 11th IJSC was held on 16th March, 2023 and 1st June, 2023 respectively.

1st Meeting of 12th IJSC held on 20th September, 2023.

Women Grievances Committee:

Women's Grievance Committee meetings was held on 14th March, 2023, 30th June, 2023, 25th September, 2023 and 22nd December, 2023.

ICAR-Directorate of Poultry Research, celebrated 36th Foundation Day

ICAR-Directorate of Poultry Research celebrated its 36th Institute Foundation Day on 1st March, 2023. Shri. Adhar Sinha, IAS, Special Chief Secretary, Animal Husbandry, Dairy Development and Fisheries, Government of Telangana graced the function as Chief Guest. Dr. R.K. Mathur, Director, ICAR-IIOR acted as the Guest of Honour. The dignitaries visited the farm complex, hatchery, Moringa Poultry integrated farming unit, Vermicompost unit, IoT research facility and Biotech facility. Dr. R.N. Chatterjee, Director,ICAR-DPR welcomed the guests and briefed the importance of Poultry in the Indian agriculture scenario. Dr. U. Rajkumar, Principal Scientist presented a glimpse of the achievements of the Directorate. The Chief guest appreciated the contribution of DPR in the form of improved varieties and other technologies in the field of nutrition, health and biotechnology. He emphasised that Integrated farming with moringa and vermicomposting should be taken up in a big way to benefit the poultry farmers. The Guest of honour recalled the various collaborations between DPR and IIOR over the years. He also suggested for utilization of different unconventional oil seed cakes for poultry feeding to ease pressure on soya bean meal. Dr. K. Anitha, Head, NBPGR-RS, University Officers of PVNRTVU, Hyderabad and staff of the directorate participated in the program. Twenty eight officers from 10 African Countries undergoing International Training at National Institute for MSME, Hyderabad were taken for an exposure visit of the Directorate and interacted with the Director. Dr. B. Prakash, Organizing Secretary proposed the vote of thanks.

ICAR-DPR Celebrated National Science Day

ICAR-Directorate of Poultry Research celebrates National Science Day- 2023 ICAR-Directorate of Poultry Research, Hyderabad celebrated National

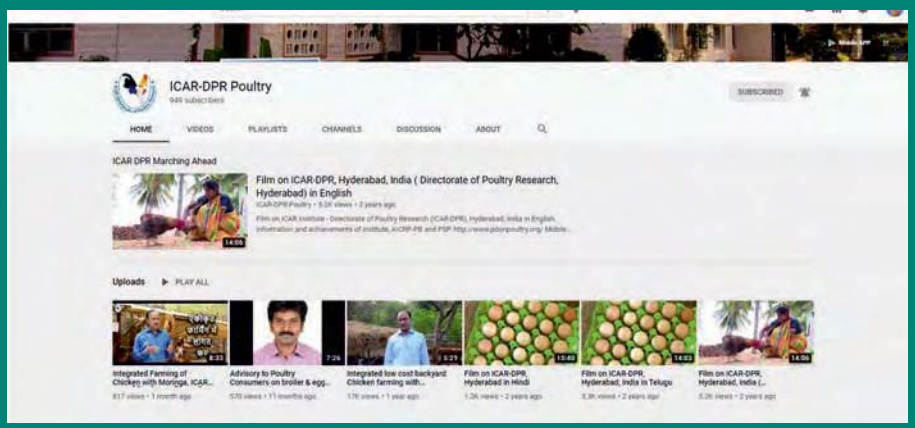
Science Day on 28th February 2023 with the theme of "Global Science for Global Wellbeing'. Dr C V Raman's contribution to science and his life was remembered in the event. Dr. V.K.Singh, Director, ICAR-CRIDA, Hyderabad graced the Science Day celebration as chief guest. In his address, he emphasized the role of agricultural science and technologies in the development of well-being of mankind. Dr. R.N. Chatterjee, Director, ICAR-DPR, briefed about the Directorate's salient achievements and the role of science and technologies in the development of the poultry sector. An exhibition to showcase new technologies, chicken varieties developed by the institute and information on chicken and eggs was organized and about 250 school children from different schools in Hyderabad visited. School children also exhibited models on different scientific themes related to global warming, climatic change, wellness and organic farming, etc. Dr.B.Prakesh, Principal Scientist presented a vote of thanks. Staff of this directorate and school students participated in the event.

DPR

DPR-App

Face Book

Twitter



YouTube

भाकृअनुप – कुक्कुट अनुसंधान निदेशालय

ICAR - Directorate of Poultry Research

Rajendranagar, Hyderabad - 500 030