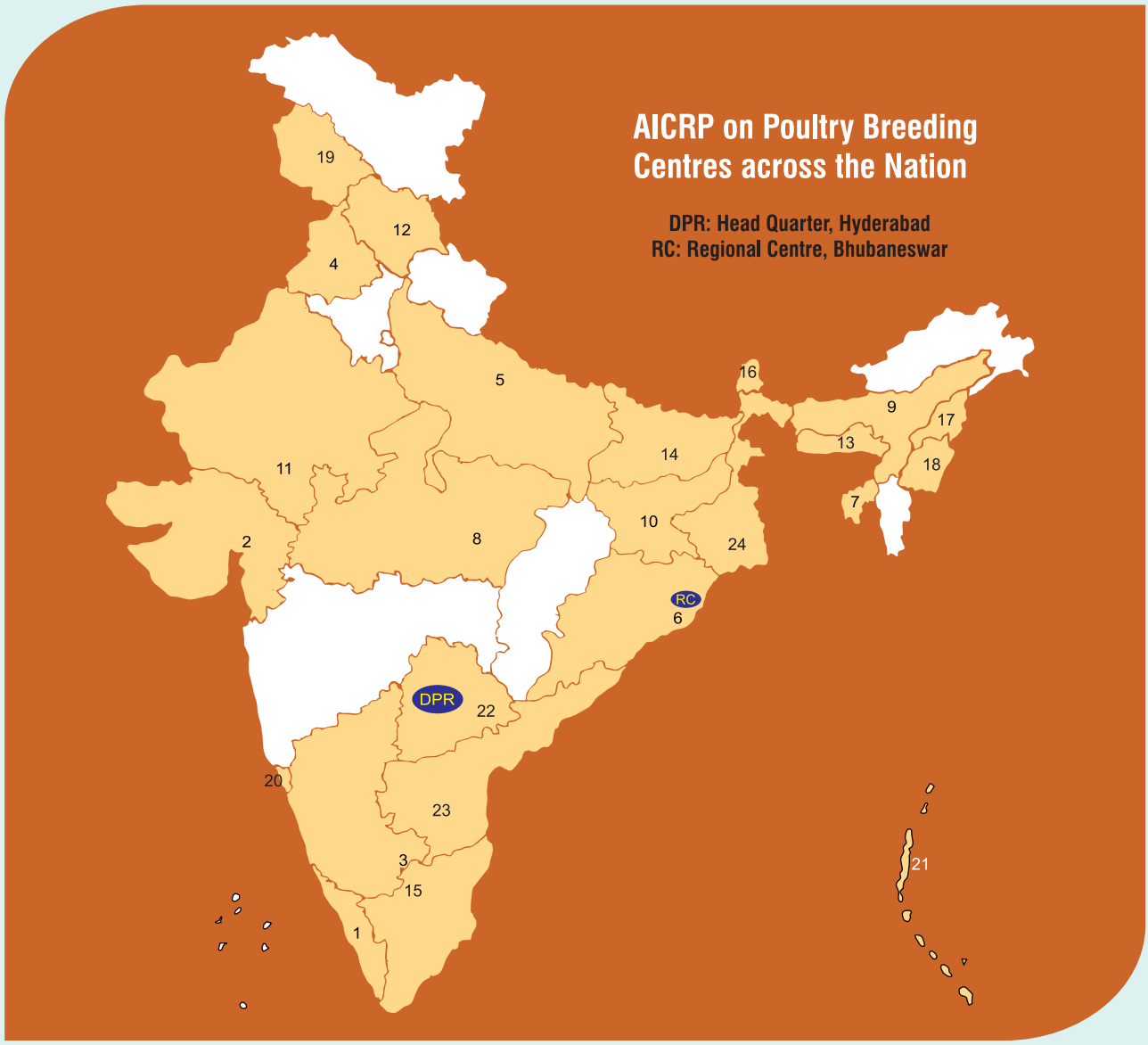
वार्षिक प्रतिवेदन
ANNUAL REPORT
2024

भाकृअनुप - कुक्कुट अनुसंधान निदेशालय

ICAR - Directorate of Poultry Research

Rajendranagar, Hyderabad - 500 030



AICRP Centres

1	KVASU, Mannuthy		13	ICAR-RC for NEHR, Barapani
2	AAU, Anand		14	BASU, Patna
3	KVAFSU,Bengaluru		15	TANUVAS, Hosur
4	GADVASU, Ludhiana		16	ICAR-NOFRI, Sikkim
5	ICAR-CARI, Izatnagar		17	ICAR-RC, Nagaland
6	✻OUAT, Bhubaneswar		18	ICAR-RC, Manipur
7	ICAR-RC, Agartala		19	SKUAST, Srinagar
8	NDVSU, Jabalpur		20	✻ICAR-CCARI, Goa
9	AAU, Guwahati		21	✻ICAR-CIARI, Port Blair
10	BAU, Ranchi		22	PVNRTVU, Warangal
11	MPUAT, Udaipur		23	SVVU, Tirupati
12	CSKHPKVV, Palampur		24	✻WBUAFS, Kolkata

*Closed from September 2024.

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Rajendranagar, Hyderabad - 500 030, Telangana, India.

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Front Cover
Male and female birds of *Nicobari* (dwarf and normal) breed of chicken

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

Inside Back Cover
QR codes of social networking sites of ICAR-DPR, Hyderabad

Back Cover
Adult Ducks

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PREFACE

It is with immense pleasure I put forth the achievements of the Directorate for the year 2024 through this Annual Report. This report comprehensively provides the information on functioning and contribution to different stakeholders of poultry sector.

At the Directorate, continuous improvements have been made to rural, broiler, and layer pure lines, focusing on key economic traits with feedback from farmers. In addition, selected native chicken breeds are being conserved and utilized in the development of new crossbreeds. Ongoing research in poultry genomics is exploring areas such as functional genomics, and gene silencing technologies to enhance poultry production. Transgenic chicken as bioreactor for cost effective production of human therapeutic proteins was developed. The difficulties in poultry rearing are being addressed with development of different IoT solutions to enable smart poultry farm practice. Inclusion of insect larvae in the poultry diet and addressing the antimicrobial resistance using alternative growth promoters will help the poultry industry in promoting the alternative feed ingredient and consumer centric production. Machine learning is being used for the prediction of post-mortem diagnosis in chicken that showcases the use of artificial intelligence in poultry disease management.

The Regional Station of the Directorate endeavours to increase productivity of ducks through scientific research. Kuzi duck crosses developed at the station were evaluated under field conditions by distributing to the tribal farmers. For the White Pekin ducks the feed restriction schedule was standardized and dietary crude protein level was optimized for better production. Thymol was evaluated as an alternative to antibiotics for supporting healthier intestinal architecture.

Funding from several external agencies like DBT, MeitY, IAEA, etc. and from the industry was obtained to address diverse issues faced during the poultry production. The research output was disseminated to the stakeholders through publication in high impact peer reviewed journals, magazines and electronic media.

The Directorate is serving as Hub of ICAR-IVRI and conducting full-fledged programs on post-graduation education and research (MVSc and PhD) in the discipline of Poultry Science. Further, students from IVRI and other Universities with which the Directorate is having MoU are carrying out their research under the scientists of the Directorate.

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. Location specific crosses were developed at the AICRP centres and among which few were evaluated in the field and at Random Sample

Broiler testing facility. Further, the centres supplied the improved germplasm to the farmers.

Due importance was given for transfer of technologies by the Directorate through organization of meetings and training programmes. Under DAPSC, DAPST, and NEH component extensive field activities were undertaken for supporting the poultry farming activities by the under privileged members. Different technologies developed at the institute were showcased by participating in exhibitions, melas, and farmers field programmes. The Directorate distributed 1.2 lakhs germplasm including 8942 parents to various beneficiaries and generated Rs. 164.76 lakhs revenue. The AICRP centres supplied 11.77 lakhs germplasm and generated revenue of Rs. 353.45 lakhs.

I am extremely thankful to Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR for his guidance and encouragement. I express my gratefulness to the Secretary, ICAR and Financial Advisor, ICAR for their support. I am thankful to 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 at the AICRP centres, who have been enduring for the poultry farmers development and welfare.

Date: 30th June 2025

(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 2024 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 2024. The first generation of selection using selection index was evaluated up to 32 weeks of age. PD-3 line was evaluated for production performance during S-11 generation. RIR, was evaluated for growth and production in a random mating. *Aseel* was evaluated for growth and production characters.

PD-1 population was evaluated for juvenile traits in the first generation (SI-1) population selected based on the selection index for both 6-week body weight and shank length. The fertility and hatchability were 79.45% and 85.89% (FES) and 68.24% (TES), respectively. The primary traits both body weight and shank length at 6 weeks of age increased from the base generation. In PD-2 line the S-20 generation was reproduced by random mating. The fertility percentage was 75.77 and hatchability on total and fertile eggs were 64.66 and 85.34. The juvenile traits evaluated up to 6 weeks of age were reported.

A total of 1335 chicks were produced and evaluated for juvenile traits in S-11 generation. The fertility was 63.92% and hatchability on FES was 71.31 and on TES was 45.58%, respectively. The growth and production performance up to 32 weeks of age during S-11 generation was reported. RIR, a new female line was evaluated for growth and production performance up to 32 weeks of age was reported. The S-13 generation of PD-6 line was reproduced by pedigree mating. The fertility was 78.05% and hatchability on total and fertile eggs set was 65.39% and 83.76% respectively. The body weight and shank length at 6 weeks of age were 925.58 g and 90.12mm. Recording of production traits has been completed up to 32weeks of age.

Native chicken populations

The production performance of *Vanashree* birds during the S-14 generation was evaluated up to 40 weeks of age. Age at sexual maturity, age at 50% production and age at peak production (63.74%) were 162.7±1.14, 190.7 and 196.0 days, respectively. The 40 weeks body weight and shank length have increased in cocks in this generation. The S-15 generation was hatched in four hatches. The average fertility was 70.21% and the hatchability on FES and TES was 83.32

and 58.50%, respectively. There was significant improvement in the body weight of S-15 generation birds as 6 weeks and 8 weeks' body weight improved by 104 and 109.0g. There was 4.92 mm improvement in 6 weeks' shank length.

Ghagus, an indigenous chicken breed is being conserved and improved for body weight at 8 weeks of age. The S-6R batch of Ghagus was evaluated for growth and production traits up to 8 weeks of age. Body weight at 0 day, 4 and 8 weeks of age was 34.54±0.12, 243.2±3.65, and 579.0±7.24g, respectively. The shank length at 8 weeks of age was 75.52±0.42 mm. Liveability observed during 0 to 8 weeks of age was 85.21%.

The G-11 generation of *Nicobari*, an indigenous breed of chicken was produced by pedigreed random mating and evaluated for juvenile growth traits. The G-11 generation was evaluated up to 4 weeks of age. Body weight at day old and 4 weeks of age was 34.87±0.14 and 251.7 g respectively. There was an improvement of 58.2g in the 4th week body weight compared to the previous generation. The G-11R generation birds were evaluated for growth traits up to 20 weeks of age. Body weight at 0-day, 4, 6, 8 weeks was 33.3±0.15, 144.1±1.86, 223.3±3.44 and 315.4±5.2g, respectively. Shank length at 6 and 8 weeks of age was 47.71±0.35 and 55.08±0.46 mm, respectively. A study on the effect of dwarf character naturally segregating in the *Nicobari* breed of chicken on various growth, production and reproduction traits and the nature of its inheritance was carried and results reported.

The G-4 generation of *Kadaknath* breed was evaluated for egg production performance up to 72 weeks of age. Egg production up to 40, 64, and 72 weeks was recorded as 72.04±1.25 (n=268), 144.02±2.95 (n=100), and 165.86±3.27 (n=95) eggs, respectively. The G-5 generation of *Kadaknath* was regenerated through pedigreed random mating and was subsequently evaluated for growth traits up to 16 weeks of age.

The *Aseel* population was regenerated in G-10 generation randomly, restricting AI with in plumage patterns. The fertility was 75.12 % and hatchability was 89.82 (FES) and 67.48 (TES). The birds were evaluated up to 32 weeks of age for growth and production traits. The part period egg production up to 32 weeks of age was 15.54±0.76 eggs with an egg weight of 41.45±0.33 g.

Broiler populations

The juvenile performance of the S-3 generation (first pedigree) in PB-1 was evaluated. The overall least squares mean for body weight at 0 days, and at 2, 4, 5, and 6 weeks of age were 40.67g, 270.7g, 871.4g, 1,121g, and 1,419g, respectively, highlighting the growth potential of this genotype. The S-3 generation (random bred, repeat regeneration) of PB-1 was evaluated for juvenile growth traits. The overall mean body weights at 0 days, and at 2, 4, 5, and 6 weeks of age were 41.06g, 234.8g, 581.8g, 833.9g, and 1,070g, respectively. For the hatch-1 chicks, the corresponding body weights were 41.27g, 288.1g, 699.9g, 1,041g, and 1,223g. The Control Broiler population was regenerated (G-22R) and evaluated for juvenile growth traits. At 5 weeks of age, the average body weight was 454.9g (n=97) for males and 415.4g (n=109) for females. The growth performance was comparatively lower than in previous generations. At 20 weeks of age, the average body weight was 2,319±28.14g (n=118) in females and 2,825±46.69g (n=101)

in males. The average shank length at 20 weeks was 112.1±0.50 mm (n=118) in females and 132.3±0.67 mm (n=101) in males. PB-2 (S-2 generation) was reproduced by random mating. Percent fertility, Percent hatchability on total eggs set (HTES) and percent hatchability on fertile eggs set (HFES) respectively were 80.03, 66.19 and 82.70. Juvenile body weights at 4WK, 5WK and 6WK and shank length at 5WK respectively were 667±1.10g, 943±2.62g, 1103±3.20g and 76.63±0.35 mm. Adult performance traits were recorded up to 36WK of age. As compared to last generation these traits were more or less similar.

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 egg production, egg weight and body weight traits in the later phases of the laying cycle were recorded for IWI, IWH, IWK and LC populations. The average egg production up to 64 weeks (EP64) in IWH and IWI lines was 241.31±2.67 and 217.76±3.74 eggs respectively. The egg weight at 64 weeks in gm (EW64) was maximum for IWK (54.10±0.32) followed by LC (53.77±0.45), IWH (52.86±0.34) and IWI (52.53±0.34). In IWD, IWF, IWN and IWP populations, the average egg production up to 72 weeks (EP72) was recorded as 239.02±4.08, 232.54±4.72, 285.29±3.09 and 262.63±5.19 respectively. IWH (S-10), IWI (S-10), IWK (G-1), LC (S-18), IWD (G-5) and IWF (G-5) lines were regenerated using parent stock whereas IWN and IWP lines were regenerated using hatching eggs from AICRP Mannuthy centre. The genetic parameters were estimated for the important economic traits in IWI line using Bayesian inference. The S-21 generation of Dwarf were regenerated by random mating.

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 body weight at 64 and 72 weeks in females was 1694.71±25.16 and 1759.96±29.13g, respectively. The respective egg weights were 55.40±0.43 and 57.91±0.50g. The 64 and 72-week egg production was 196.97±2.78 and 223.91 eggs, respectively.

Molecular genetics

A high-quality haplotype resolved De-novo chromosomal genome assembly of black native female chicken of India has been assembled. The final gene predicted in the hybrid genome assembly is 25990. Selection sweeps and CNVs in native chicken Daothigir and Kashmir Favorolla were studied and reported. The differentially expressed miRNAs having role in different pathways in the right and left ovaries of *Kadaknath* chickens at the embryonic day 18.5 stage were identified. Transgenic chicken expressing human tissue plasminogen (htPA) and human erythropoietin (hERP) was developed. Long-term culture of PGCs were maintained up to 70 days under two different conditions both with and without a feeder cell layer and protocols for both methods were standardized. Six transgenic birds producing bovine lactoferrin protein in egg were successfully produced using the sperm-mediated gene transfer (SMGT) method.

Nutrition

The effects of low protein diet and nutraceuticals on carbon footprint reduction in commercial broiler chicken for meat production was evaluated. The reduced crude protein with Gelatin diets reduced carbon footprint bt 158 g /kg meat which works out to be 7.534 lakh tons of CFP reduction per year in India. Butyric acid plus phytase or xylanase can significantly reduce carbon footprint primarily through improvement in feed efficiency.

The efficacy of protease enzyme and a probiotic-cum-prebiotic blend in improving the feeding value of BSF larva meal was evaluated in commercial broiler chicken. The BSFLM was evaluated at 0, 7.5 and 15% levels with and without protease enzyme (200g/ton). The results indicated 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 probiotic cum prebiotic blend (300g/ton of feed). BSFLM at 8 and 12% depressed performance of broiler chicken and the supplementation of probiotic cum prebiotic blend showed no beneficial effect in chickens fed BSFLM.

A feeding trial was conducted for identification and characterization of residual feed intake specific SNPs and candidate genes in coloured broiler. Birds were grouped based on the residual feed intake and further parameters were studied. A total of 410724 SNP variants were unique to low RFI samples, 408067 SNP variants unique to high RFI samples and 265137 SNP variants common to both groups were identified. Majority of variants were in intron region (about 70%), upstream (about 11%) and downstream (about 11%). Mitochondria level analysis also indicated SNP variants unique to RFI groups. Low RFI had 2 SNPs with high impact classification, 14 with moderate, 42 with low impact and 1852 with modifier classification. High RFI group had 39 SNPs of low impact, 7 of moderate and 1507 with modifier impact classification.

The effect of different alternatives to antibiotic growth promoters on growth and feed efficiency, pathogen shedding, antibiobic resistance profile of gut E. coli isolates, and evaluation of resistome profile in caecal microbiome using metagenomic shotgun sequencing was done. The results indicated that alternatives to antibiotic growth promoters had exerted comparable performance to that of the antibiotic growth promoter.

Substitution of conventional maize with bio-fortified Pro-A (HQPM5) maize in the diet has improved the meat quality, skin pigmentation, mineralisation of bone and stability of meat during storage.

Two different IoT sensor prototypes were developed for layer farm and broiler farm. To control environmental temperature in poultry house, a prototype for automatic sprinkler system was developed. The sensor node requirements for environmental monitoring and the coverage area per sensor node were determined. A new desktop version was developed for improving the speed of the gender detection using vocalization of one day old chicks.

Physiology

Different physiological parameters were estimated in White Leghorn birds during early (EP)and mid laying period (MP). The treatment group birds

were supplemented with yeast selenium @ 0.3 and 0.6 ppm along with basal feed. Selenium supplementation increased villi height, hormone levels and gene expression in the jejunum and magnum tissues. The effect of supplementing moringa leaf powder and earthworm was studied till 24 weeks of age and found that the average egg production was numerically higher in group fed with leaf powder, earthworm and broken rice. The trial has to be terminated due to mortality of all the birds. During this period PGCs of Aravali and Daothigir were cryopreserved as part of conservation of native breeds.

Health

Major diseases recorded during the period under report were septicemia, enteritis, egg-peritonitis, Newcastle disease, laryngotracheitis and aspergillosis. The overall ALV positive percentage was 14.49%. A database of chicken farm was created especially from existing post-mortem (PM) reports for the years 2018 to 2023 and data on environmental variables were collected for the respective years. The shape of dataset is 24223 rows and 16 columns. Two different models of Random forest classifier, a ML-based algorithm and a basic Artificial Intelligence (AI) algorithm-based model of Neural Networks for the data were built with PM diagnosis as the target variable. Comparison of these two models showed that Random Forest Classifier has better accuracy in predicting PM diagnostic condition. It was observed that the environment variables of temperature followed by relative humidity are having greater feature importance in predicting the PM diagnosis.

Surveillance of AMR in target microorganisms isolated from different species were done in few villages of Nalgonda district. Analysis revealed that Escherichia coli isolates are resistant to ampicillin and cefoxitin and susceptible to chloramphenicol. The AST pattern depicts that Staphylococcus species are resistant to penicillin and cefoxitin and susceptible to chloramphenicol, gentamicin and co-trimoxazole. The incidences and prevalence of Marek's disease from suspected MD outbreaks in different geographical regions were determined by collecting samples and identification by molecular method by PCR. Overall incidence/prevalence of MD in suspected outbreaks is 33.5%.

Extension

ICAR-DPR germplasm reached to 31.5% of districts and 75 Krishi Vignana Kendra in the country. There was significant correlation between budget expenditure and performance of DPR in terms of output indicators. In the past ten years (2010-20), a total of 38.71 million chicken were supplied to 3.73 lakh stakeholders of the country. Majority of the germplasm (75.12%) was taken by individual farmers and remaining by firms/organizations. A total of 430 research articles and 962 other articles were published during 1992-2017 from the institute. There were 180 publications based on DPR germplasms published by different organizations in India. Average Annual Growth Rate (AAGR) and Compounded Annual Growth Rate (CAGR) of revenue receipt during the period were 16.75 and 13.92%, respectively.

The rural poultry production system in different regions of the country was studied to assess the rural poultry value chain prevalent in different regions in the country and to evaluate the poultry production economics and viability. The cost of

the production per bird was estimated Rs. 326 (Rs 308 variable cost and Rs 18 fixed cost) and return per bird was estimated Rs 771.5 and Net return per bird was found Rs. 445.5.

Regional Station, Bhubaneswar

The Kuzi ducks (S4 generation) was evaluated upto 72 weeks of age. In addition, two-way crosses (Kuzi X Khaki Campbell (DK) and Khaki Campbell X Kuzi (KD)) were evaluated under farm and field conditions. The DK cross was found to produce more egg than the KD cross in the field. *In ovo* injection of mycotoxin (AFB1) in duck embryos correlates with worsening growth depression and mortality, while combined effect of AFB1 and OTA act more extensively than either toxin alone. Lysine and Methionine supplementation in ducks could not completely prevent OTA-induced mortality, however, it effectively minimized morbidity and improved growth performance. Nano-selenium (Se) and a nano-composite (Cm: Nano-Se+ Nano-Iron in a composite form) were supplemented in feed of White Pekin ducklings over a period of 8 weeks. It was observed that nano-selenium enhanced survival and nano-composite provided an optimal balance of superior growth and no mortality. Chemballi ducks were maintained and conserved at the station. The feed restriction schedule for White Pekin ducks was standardized and dietary crude protein level was optimized. Inclusion of 2 % earthworm in the diet of White Pekin ducks by replacing fish meal improved body weight gain, better feed conversion ratio and reduction in price (Rs) of feed for kg body weight gain. A study had concluded that wheat can be replaced by broken rice at 50% level in the diets of White Pekin ducks up to eight weeks of age for meat production. It was also found that wheat can be replaced by broken rice at 50% level in the diets of Khaki Campbell ducks up to eight weeks of age. During the growing phase (9-20 weeks) wheat can be replaced by broken rice at 50% level in the diets of Khaki Campbell ducks. A new product "Duck Meat Popcorn" was developed with an aim to popularize the duck meat as ready to eat snack. To encourage commercial duck farming attempts were made to rear ducks in cages like chickens. The age at first egg, egg production upto 40 weeks of age and egg weight at 32 and 40 weeks of age were higher in cage rearing. Thymol was identified as a beneficial alternative to antibiotics, supporting healthier intestinal architecture and efficient nutrient absorption in ducks. The regional station participated in different exhibitions and transferred information and technologies to the stakeholders.

AICRP on Poultry Breeding

The AICRP is being operated at twenty centres of AICRP on Poultry Breeding *viz*. KVASU, Mannuthy; KU, Anand; KVAFSU, Bengaluru; GADVASU, Ludhiana; ICAR-CARI, Izatnagar; ICAR-RC for NEH region, Agartala; NDVSU, Jabalpur; AAU, Guwahati; BAU, Ranchi; MPUAT, Udaipur, CSKHPKVV, Palampur; 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; Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Srinagar; PVNR Telangana Veterinary University

(PVNRTVU), Warangal; Sri Venkateswara Veterinary University (SVVU), Tirupati and ICAR - Research Complex for NEH Region, Umiam, Meghalaya.

GBPUAT, Pantnagar was added as a non-funded centre of AICRP-PB from 26 August 2024. Four centres including OUAT, Bhubaneswar; ICAR-CCARI, Goa; ICAR-CIARI, Port Blair and WBUAFS, Kolkata were discontinued with effect from 30th September, 2024. 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 and ICAR-CARI, Izatnagar have been mandated to maintain four elite broiler lines (PB-1, PB-2, CSML and CSFL).

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 institute also supplies parent chicks to the different centres and 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 2024 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 2024, under AICRP-PB, a total of 11,77,284 number of chicken germplasm was distributed to 16,635 farmer beneficiaries and the total revenue generated during the year was Rs. 353.45 lakhs.

Technologies transferred

The technologies and varieties developed at the institute were propagated widely throughout the country. A total of 33,463 hatching eggs, 69,411 day-old chicks, and 8,694 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, 8,942 parent chicks of different varieties were also supplied.

From the AICRP centres, another 11,77,284 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 Karnataka 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 (DAPST).

The program was implemented in Telangana and Andhra Pradesh. 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 48 research papers, 6 review papers, 19 popular/technical articles, 8 book chapters were published by the scientists of the institute. In addition, 33 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.3684.86 lakhs and at AICRP centers, Rs.1354.73 lakhs, respectively. A total revenue of Rs.578.64 lakhs (DPR-225.19, AICRP- 353.45) was generated during the year 2024.

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 main 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 totaling to 12. From the year 2023-24 the Poultry Seed Project was merged with the AICRP on Poultry Breeding. 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

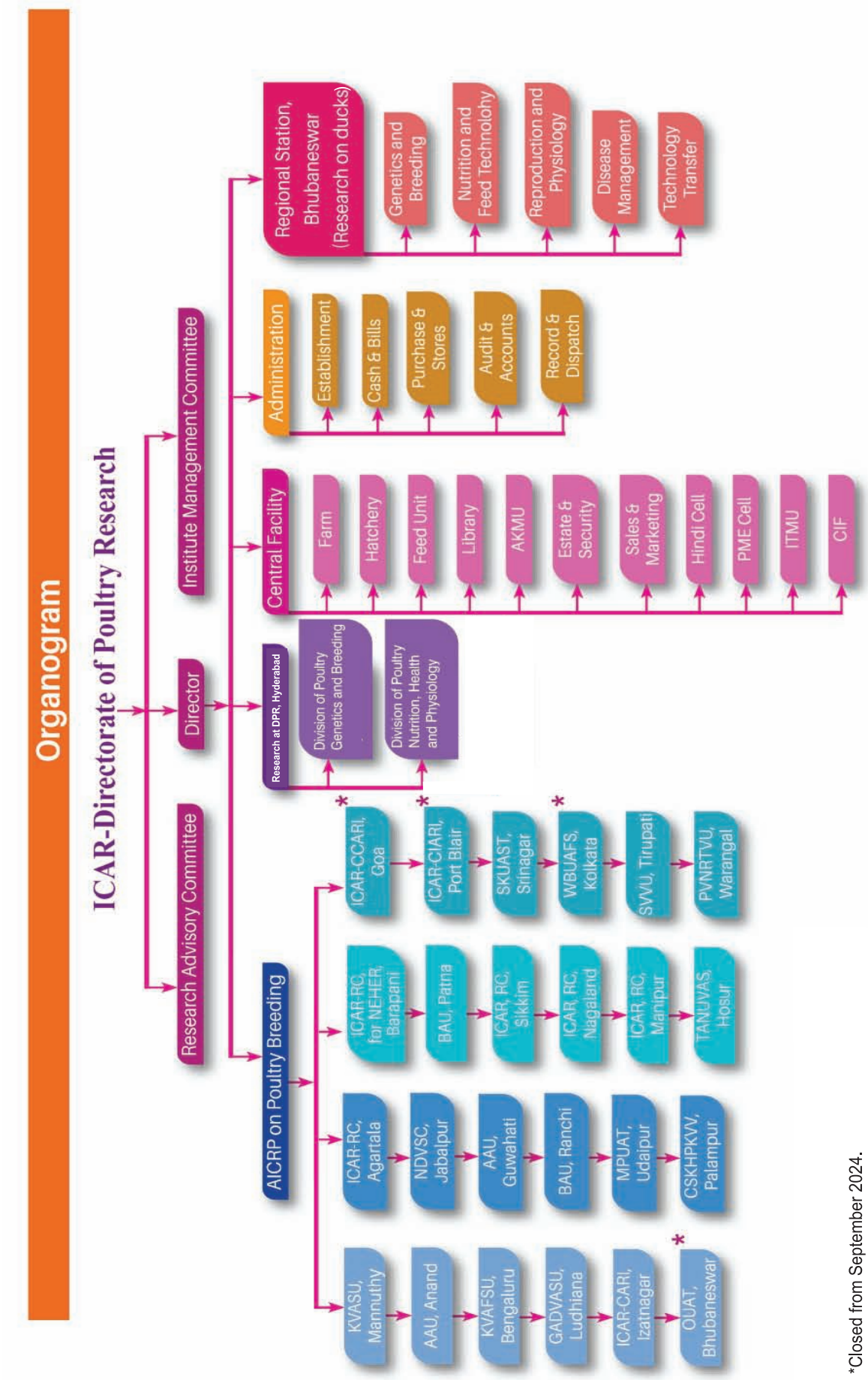
Financial outlay (Rs. lakhs)

Component	Budget	Expenditure	Receipts
DPR	3684.86	3684.86	225.19
AICRP*	1354.73	1354.73	353.45

*Above indicated budget, expenditure and receipts figures are calculated proportionately from the allocations/ receipts of the years 2023-2024 and 2024-2025.

Staff position (as on December 31, 2024)

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
HoRS	00	00	01	01	01	01
Scientific	21	19	09	09	30	28
Technical	16	09	02	01	18	10
Administrative	23	11	-	01	23	12
Skilled Support Staff	14	12	05	02	19	14
Total	**77**	**54**	**17**	**14**	**94**	**68**


Organogram
ICAR-Directorate of Poultry Research
Director
Research Advisory Committee
Institute Management Committee
Administration
Establishment
Cash & Bills
Purchase & Stores
Audit & Accounts
Record & Dispatch
Central Facility
Farm
Hatchery
Feed Unit
Library
AKMU
Estate & Security
Sales & Marketing
Hindi Cell
PME Cell
ITMU
CIF
Regional Station, Bhubaneswar (Research on ducks)
Genetics and Breeding
Nutrition and Feed Technolohy
Reproduction and Physiology
Disease Management
Technology Transfer
Research at DPR, Hyderabad
Division of Poultry Genetics and Breeding
Division of Poultry Nutrition, Health and Physiology
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
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
*
*
*
*Closed from September 2024.

2. RESEARCH ACHIEVEMENTS

GENETICS AND BREEDING

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

The pure line populations of PD-1, PD-3, RIR and Aseel were evaluated for important economic traits during the year 2024. The first generation of selection using selection index was evaluated up to 32 weeks of age. PD-3 line was evaluated for production performance during S-11 generation. RIR, was evaluated for growth and production in a random mating. Aseel was evaluated for growth and production characters.

PD-1 line

PD-1 population was evaluated for juvenile traits in the first generation (SI-1) population selected based on the selection index for both 6-week body weight and shank length. The fertility and hatchability were 79.45% and 85.89% (FES) and 68.24% (TES), respectively. The body weight and shank length at 4 and 6 weeks of age were 363.1±2.40 and 715.9±4.51 g and 61.87± 0.17 and 80.42±0.22 mm, respectively (Table 1). The primary traits both body weight and shank length at 6 weeks of age increased significantly from the base generation due to the heterosis in the first generation of selection using selection index. The 20-week body weight was 2182±4.94 g which was higher than the base generation. The ASM was 173.3 ±0.38 days. The egg weight at 28 and 32 weeks of age was 52.05 ±0.14 and 55.52 ±0.13 g, respectively. The part period egg production up to 28 and 32 weeks of age was 13.92 ±0.27 and 31.53 ±0.32 eggs, respectively.

Table 1. Body weight and shank length in PD-1 line

Trait	Body weight, g		Shank length, mm		n
	Mean±SE	h^2	Mean±SE	h^2	
Day old	39.72±0.11	0.26±0.11			905
BW 2	157.6±0.95	0.22±0.10			905
BW 4	363.1±2.40	0.27±0.09	61.86±0.17	0.23±0.07	905
BW 6	715.9±4.50	0.28±0.13	80.41±0.22	0.29±0.08	905

Improvement and Evaluation of PD-2 and PD-6 lines for Rural Poultry Production

PD-2 line

PD-2 line is developed from coloured random bred control population. This line is used as female for production of Vanaraja chicks. The selection criteria is egg mass to 52 weeks. The S-20 generation wat was reproduced by random mating. The fertility percentage was 75.77 and hatchability on total and fertile eggs were 64.66 and 85.34. The juvenile traits were evaluated up to 6 weeks of age. Total number chicks produced were 1153. Among the juvenile traits, the body weight at 2, 4 and 6 weeks of age and shank length at 6 weeks of age was evaluated. The means with standard error for body weight at 2, 4 and 6 weeks of age 156.41±0.06, 361.26±0.05 and 69065±4.98g, respectively and shank length at 6 weeks of age was 78.493±0.001. Recording of production traits has been completed up to 32 weeks of age.

PD-3 line

Juvenile performance

A total of 1335 chicks produced from 40 sires and 200 dams were evaluated for juvenile traits in S-11 generation. The fertility was 63.92% and hatchability on fertile egg set (FES) was 71.31 and on total egg set (TES) was 45.58%, respectively. The hatchability declined as the regeneration was delayed beyond 80 weeks of age. The body weight at 4 and 6 weeks of age was 163.96±0.01 and 285.88±0.02 g, respectively (Table 2). The corresponding shank length was 44.06±0.001 and 54.79±0.001 mm, respectively.

Table 2. Body weights at different weeks in PD-3 (S-11)

Parameter	Body weight (g)		Shank length (mm)	
	PD-3 (n=1209)	DRC (n=231)	PD-3 (n=1209)	DRC (n=231)
0 day	37.83±0.12	35.74±0.38		
BW 2	80.31±0.50	79.97±1.12		
BW 4	168.1±1.35	156.7±2.64	44.73±0.15	44.76±0.33
BW 6	309.2±2.40	282.7±4.54	57.46±0.19	56.26±0.38

Production performance (S-11)

The selected population was evaluated for growth and production performance up to 32 weeks of age during S-11 generation. The ASM was 153.5 ±0.66 days, which reduced in desired direction compared to the previous generation. The least squares mean for body weight at 20 weeks was 1500 ± 8.19 g in hens. The part period egg production up to 28 and 32 weeks of age was 34.67±*0.60 and* 58.96±*0.67 eggs, respectively*. The egg weight at 28 weeks was 51.84±0.16 g.

Rhode Island Red

RIR, a new female line was evaluated for growth and production performance up to 32 weeks of age. The fertility was 75.12 and hatchability on FES was 89.82 and TES was 67.48. The day-old body weight was 35.75±0.22 g. The body weight and shank length at 6 weeks of age was 269.2±3.6 g and 55.19±0.32 mm, respectively (Table 3). The part period egg production at 28 and 32 weeks of age was 27.86±0.96 and 51.23±1.2 eggs. The corresponding egg weight was 52.03±0.27 and 53.91±0.29 g, respectively.

Table 3. Body weights and shank length at different weeks in RIR

	Body weight, g		Shank length, mm	
0 day	35.74±0.22			
BW 2	78.78±0.78			
BW 4	140.0±1.98		42.89±0.26	
BW 6	269.2±3.67		55.19±0.32	
	Male	Female	Male	Female
BW12	900.3±20.72	806.2±14.68	91.20±0.88	86.41±0.71
BW16	1537±24.69	1260±17.57	112.6±0.77	100.1±0.62

PD-6 line

The PD-6 line is developed from coloured random bred control population. This line is used as male line for production of *Gramapriya* variety. The selection criteria is shank length at 6 weeks age. The S-13 generation was reproduced by pedigree mating. The fertility was 78.05% and hatchability on total and fertile eggs set was 65.39% and 83.76% respectively. Total number chicks produced were 1013. The body weight at 2 and 4 weeks of age was 191.82 and 591 g. The body weight and shank length at 6 weeks of age were 925.58 g and 90.12mm. Recording of production traits has been completed up to 32weeks of age. The phenotypic response to 6 weeks shank length was 1.97 mm over last 7 generations (Fig.1). Recording of production traits has been completed up to 32 weeks of age.

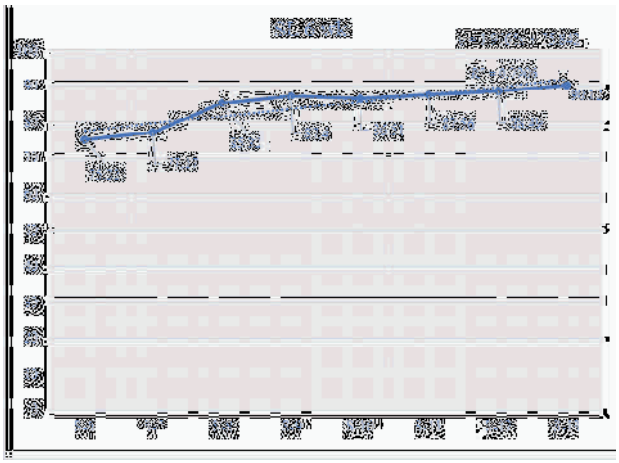


Fig. 1. Phenotypic response for shank length in PD-6 line

Genetic improvement and evaluation of native chicken breeds

Vanashree

Vanashree, strain evolved from Aseel (PD-4) was 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-14 generation was evaluated up to 40 weeks of age. Age at sexual maturity, age at 50% production and age at peak production (63.74%) were 162.7±1.14**,** 190.7 and 196.0 days, respectively. Hen housed, hen day and survivors'' (SEP) egg production up to 40 weeks were 50.89±1.26, 53.23 and 53.28±1.33, eggs, respectively. There was a slight reduction in HHEP, HDEP and SEP up to 40 weeks in this generation. Egg weights at 28, 32, 36 and 40 weeks were 44.16±0.26, 47.31±0.41, 47.98±0.20, and 47.84±0.42 g, respectively. Egg mass up to 40 weeks of age was 2549±63.13g. The body weight of cocks and hens at 40 weeks of age was 2930±30.1 and 1955±13.6g, respectively. The shank length of cocks and hens at 40 weeks was 135.0±0.71 and 108.4±0.24 mm, respectively. The 40 weeks body weight and shank length have increased in cocks in this generation. The liveability observed during 21-40 weeks of age in hens and cocks was 88.38 and 75.13%, respectively.

Selection records: A total of 35 cocks having the highest body weight at 6 weeks of age and that survived up to 68-74 weeks of age were used for artificial insemination. Similarly, 176 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. Males and females were mated in 1:5 ratio to produce the pedigreed population of S-15 generation. The selection differential and selection intensity for 6 weeks body weight was 22.54g and 0.39σ, respectively. The selection differential and selection intensity for egg production up to 40 weeks of age was 4.98 Nos and 0.22σ, respectively. A total of 35 sires and 120 dams contributed progeny to the S-15 generation. Therefore, the effective population size was 108.4 and rate of inbreeding was 0.0046.

Regeneration (S-15): A total of 1022 good chicks of *Vanashree* strain in the S-15 generation were hatched in four hatches. The average fertility recorded was 70.21% and the hatchability on fertile and total eggs set was 83.32 and 58.50%, respectively. There was reduction in fertility and hatchability due to regeneration of the flock at old age (68-74 weeks of age) of parents.

Evaluation of growth traits: The growth traits of Vanashree strain were evaluated up to 8 weeks of age. Body weight at 0-day, 4, 6 and 8 weeks of age was 36.25±0.12, 245.7±1.79, 492.5±4.55 and 714.3±4.00g, respectively. Shank length at 6 and 8 weeks of age was 70.49±0.29 and 82.50±0.23 mm respectively. There was significant improvement in the body weight of S-15 generation birds as 6 weeks and 8 weeks' body weight improved by 104 and 109.0g, respectively. Similarly, there was 4.92 mm improvement in 6 weeks' shank length in this generation. Better liveability (96.08%) was observed during 0-8 weeks of age.

Ghagus

Ghagus, an indigenous chicken breed was improved for body weight at 8 weeks of age. The S-6 generation of *Ghagus* could not be evaluated further for production traits from 21 to 40 weeks of age as all birds of S-6 generation succumbed at 20-22 weeks of age due to respiratory infection/ disease outbreak in the farm. Therefore, the repeat batch of S-6 generation (S-6R) of Ghagus was produced with a limited number of birds of S-5 generation (Parents). In S-6R generation, a total of 845 good chicks were produced in 3 hatches with fertility of 88.88% and hatchability of 90.33% on fertile eggs set and 80.28% on total eggs set by random mating using pooled semen of 19 males and 52 females. A few hatching eggs of Ghagus breed were also procured from Warangal centre of AICRP on Poultry Breeding for hatching of Ghagus chicks. The S-6R batch of Ghagus was evaluated for growth and production traits up to 8 weeks of age during the reporting period. Body weight at 0 day, 4 and 8 weeks of age was 34.54±0.12, 243.2±3.65, and 579.0±7.24g, respectively. The shank length at 8 weeks of age was 75.52±0.42 mm. Liveability observed during 0 to 8 weeks of age was 85.21%.

Nicobari

Regeneration (G-11): The G-11 generation of *Nicobari*, an indigenous breed of chicken was produced by pedigreed random mating and evaluated for juvenile growth traits. A total of 557 good chicks were hatched with fertility of 86.73% and hatchability of 93.09 and 80.74% on fertile and total eggs set basis, respectively. Fertility and hatchability were almost similar to the previous generation. The G-11 generation was evaluated up to 4 weeks of age. Body weight at day old and 4 weeks of age was 34.87±0.14 and 251.7 g respectively. There was an improvement of 58.2g in the 4th week body weight compared to the previous generation. Excellent liveability of 96.4% was recorded during 0 to 8 weeks of age.

Further evaluation of the G-11 generation of *Nicobari* breed could not be done as all the G-11 generation birds succumbed due to the respiratory disease outbreak in the farm. Therefore, the repeat (G-11R) generation of *Nicobari* was produced by random mating using pooled semen. A total of 573 good chicks were hatched with fertility of 79.60% and hatchability of 85.94 and 68.41% on fertile and total eggs set basis, respectively. The reduced fertility and hatchability were due to advanced age of parents (76 to 80 weeks of G-10 generation birds). The G-11R generation birds were evaluated for growth traits up to 20 weeks of age. Body weight at 0-day, 4, 6, 8 weeks was 33.3±0.15, 144.1±1.86, 223.3±3.44 and 315.4±5.2g, respectively. Shank length at 6 and 8 weeks of age was 47.71±0.35 and 55.08±0.46 mm, respectively. Body weight of male and female birds at 16 weeks of age was 1147±23.9 and 847.3±14.8g, respectively. Shank length of male and female birds at 16 weeks of age was 93.7±1.23 and 79.1±0.87mm, respectively. Body weight of male and female birds at 20 weeks of age was 1510±23.8 and 1358±28.9g, respectively. Shank length of male and female birds at 20 weeks of age was 99.6±1.00 and 94.31±1.08mm, respectively. Liveability during 0-8, 9-20 and 0-20 weeks of age was 84.82, 86.42 and 72.43%, respectively.

Dwarfism in *Nicobari* breed and its effect on traits of economic importance

A study was carried out to investigate the effect of dwarf character naturally segregating

in the *Nicobari* breed of chicken on various growth, production and reproduction traits and to determine the nature of its inheritance. The dwarf character did not affect the body weight for up to 4 weeks. However, it significantly affected the growth traits from 8 weeks onwards. There was a significant reduction in the body weights at different ages in male (5.5 to 9.0%) and female (9.0 to 16%) birds. The reduction in shank length was much higher in both male and female dwarf (22 to 27%) birds. The average age at first egg was higher (3.08%) in dwarf hens when compared to their normal counterparts with a non-significant reduction (5.63%) in 40 weeks egg production record. Egg weights at 32 (2.23%) and 40 (2.64%) weeks were also lesser in dwarf hens. The egg quality study revealed that shape index and shell thickness were better in dwarf hens. The eggs of dwarf hens were darker and red with less hue as compared to the eggs of normal hens. However, there was no effect on internal egg quality traits. Fertility and hatchability were lower in dwarf dams mated with dwarf sires than in normal ones, cross and reciprocal cross. The results of the breeding experiment and sequencing of the transmembrane protein 263 ruled out the possibility of sex-linked (dw) and autosomal dwarfism (adw), respectively as the genetic cause of dwarfism in the *Nicobari* breed. Therefore, dwarfism observed in the *Nicobari* breed appears novel, and its effect on growth traits was unique.

Normal male and female *Nicobari* birds

Dwarf male and female *Nicobari* birds

Fully grown dwarf (left) and Normal (right) *Nicobari* cocks

Kadaknath

Production performance: The G-4 generation of *Kadaknath* breed was evaluated for egg production performance up to 72 weeks in the G-4 generation. The age at sexual maturity (ASM) was 174.91±1.12 days (n=280). Body weight at 40 weeks was 2,429±27.4g (n=121) in males and 1,608±15.6g (n=260) in females, while at 64 weeks, it was 2,674±56.7g (n=37) in males and 1,756±29.4g (n=97) in females.

Egg production up to 40, 64, and 72 weeks was recorded as 72.04±1.25 (n=268), 144.02±2.95 (n=100), and 165.86±3.27 (n=95) eggs, respectively. Egg weights at 28 and 40 weeks of age were 40.79±0.21g (n=227) and 44.98±0.22g (n=233), respectively.

Regeneration (G-5): The G-5 generation of *Kadaknath* was regenerated through pedigreed random mating using 38 sires and 112 dams, which were tested negative for ALV. A total of 1,418 eggs were set, resulting in 1,114 healthy chicks from two hatches. The fertility and hatchability performance of *Kadaknath* breed is presented in Table 4.

Growth performance (G-5): The G-5 generation of *Kadaknath* was evaluated for growth traits up to 16 weeks of age. The findings of growth performance of *Kadaknath* are presented in Table 5.

Table 4. Incubation and hatching performance in *Kadaknath* (G-5)

Hatch No.	No. of eggs set	No. of eggs transferred	Fertility (%)	Hatchability (%)		No. of good chicks
				TES	FES	
1	607	573	94.40	77.10	81.68	461
2	811	767	94.57	83.35	88.14	653
Overall	**1418**	**1340**	**94.50**	**80.68**	**85.37**	**1114**

Table 5. Growth performance of *Kadaknath* (G-5)

Traits	N	Mean±SE
Body weight, g		
0 day	1114	32.42±0.09
4 wks	513	107.6±1.45
8 wks	679	375.1±4.67
12 wks	406	709.8±9.20
16 wks	643	1,067±9.62
16 wks: Male	258	1248±13.12
16 wks: Female	385	945.1±9.25
Shank Length, mm		
16 wks: Male	57	123.3±0.88
16 wks: Female	102	100.6±0.54

Aseel

The Aseel population was regenerated in G-10 generation randomly, restricting AI with in plumage patterns. A total of 514 chicks were produced in two hatches. The fertility was 75.12% and hatchability was 89.82 (FES) and 67.48 (TES). The fertility and hatchability on FES were maintained over the generations.

Aseel chicken was evaluated up to 32 weeks of age for growth and production traits in G-10 generation. The ASM was 191.1±1.09 days. The body weight and shank length at 6 weeks of age was 228.6±6.3 g and 53.58 ±0.63 mm in males and 189.93±2.98 g and 49.34±0.36 mm in females, respectively (Table 6). The part period egg production up to 32 weeks of age was 15.54±0.76 eggs with an egg weight of 41.45±0.33 g.

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

Performance of Juvenile traits in PB-1 (S-3)

The juvenile performance of the S-3 generation (first pedigree) in PB-1 was evaluated. The overall least squares mean for body weight at 0 days, and at 2, 4, 5, and 6 weeks of age were 40.67g, 270.7g, 871.4g, 1,121g, and 1,419g, respectively (Table 7), highlighting the growth potential of this genotype. Unfortunately, during the grower stage, all the chicks succumbed to a respiratory infection.

Table 6. Body weights and shank length at different weeks in Aseel

	Body weight, g		Shank length, mm	
	Male	Female	Male	Female
BW 0	31.55±0.31	30.91±0.16		
BW 2	70.43±0.81	62.30±0.77		
BW 4	136.1±4.18	112.6±1.8	42.85±0.50	39.38±0.50
BW 6	228.6±6.3	189.93±2.98	53.58±0.63	49.34±0.36
BW 12	771.0±23.0	650.37	87.58±1.20	80.62±0.64
BW 16	1339±28.4	1127±15.0	111.29±1.02	101.32±0.69
BW 20	1928±31.4	1349±19.32	124.7±1.56	108.37±0.45

Table 7. Performance of Juvenile traits in PB-1 (S-3)

Particulars	Means±SE
Body weight (g) at	
0 day	40.67±0.07 (2887)
2 wks	270.7±0.09 (1882)
4 wks	871.4±3.03 (1491)
5 wks	1,121±4.14 (1476)
6 wks	1,419±10.68 (421)
Breast angle (^{0}) at 5wks	78.74±0.17 (579)
Shank length (mm) at 5 wks	86.57±0.13 (1449)

Regeneration of the PB-1 flock

To revive the PB-1 population, regeneration was carried out using the available sires (58) and dams (334) through random mating (pooled semen). The parents were over 74 weeks of age. A total of 1,377 healthy chicks were obtained across three hatches. Overall fertility was recorded at 78.95%, while hatchability rates for total eggs set and fertile eggs set were 71.43% and 90.47%, respectively (Table 8). The fertility parameters were relatively low, likely due to the advanced age of the parents (72–76 weeks)

Performance of Juvenile Traits in S-3R generation of PB-1

The S-3 generation (random bred, repeat regeneration) of PB-1 was evaluated for juvenile growth traits. The overall mean body weights at 0 days, and at 2, 4, 5, and 6 weeks of age were 41.06g, 234.8g, 581.8g, 833.9g, and 1,070g, respectively (Table 9). For the hatch-1 chicks, the corresponding body weights were 41.27g, 288.1g, 699.9g, 1,041g, and 1,223g, highlighting the growth potential of this genotype. At 5 weeks of age, the average body weight for hatch-1 males was 1,111±10.0g (n=258), while for females, it was 971.6±8.64g (n=252). The growth performance of later hatches was comparatively lower.

Table 8. Incubation and hatching performance of PB-1 population (S-3R)

Hatches	No of eggs set	No of eggs transferred	Fertility (%)	Hatchability (%)		Total No of good chicks
				TES	FES	
Hatch-1	713	601	84.29	77.14	91.51	546
Hatch-2	672	511	76.04	68.75	90.41	446
Hatch-3	582	441	75.77	67.53	89.12	385
Overall	**1967**	**1553**	**78.95**	**71.43**	**90.47**	**1377**

Table 9. Performance of Juvenile traits in PB-1

Traits/ Generation	S-3R
Body weight (g)	
0 day	41.06±0.11 (1377)
2 wks	234.8±1.72 (1326)
4 wks	580.8±4.8 (1272)
5 wks	833.9±7.33 (1249)
6 wks	1070±22.4 (465)
Breast angle (^{0}) 5 wks	73.21±0.16 (1158)
Shank length (mm) 5 wks	77.83±0.26 (1157)

Adult body weights of PB-1 (S-3R)

About 470 adult PB-1 females were housed for egg production evaluation. The average body weight at 20 weeks was 2,596±15.59g (n=471) in females and 3,104±62.84g (n=143) in males

Pedigreed random bred broiler control line (CB)

Performance of juvenile traits in CB (G-22)

In the G-22 generation, a total of 791 healthy chicks were obtained through pedigreed random mating, with an average body weight of 38.61g at hatch. Unfortunately, all chicks were lost due to a respiratory infection outbreak.

Regeneration of the CB flock (G-22R)

To revive the Control Broiler population, regeneration was carried out using the available sires (71) and dams (217) through random mating with pooled semen. The parent birds were over 72 weeks old. A total of 457 healthy chicks were obtained from two hatches. Overall fertility was recorded at 59.16%, with hatchability rates of 51.50% for total eggs set and 87.05% for fertile eggs set (Table 10). The lower fertility parameters were likely due to the advanced age of the parent birds (72–76 weeks).

Table 10. Incubation and hatching performance of CB (G-22R)

Hatches	No of eggs set	No of eggs transferred	Fertility (%)	Hatchability (%)		Total No of good chicks
				TES	FES	
Hatch-1	438	290	66.21	57.31	86.55	246
Hatch-2	463	243	52.48	46.00	87.65	211
Overall	**901**	**533**	**59.16**	**51.50**	**87.05**	**457**

Performance of Juvenile Traits in CB (G-22R)

The G-22 generation (random bred, repeat regeneration) of CB was evaluated for juvenile growth traits. The overall mean body weights at 0 days, and at 2, 4, 5, and 6 weeks of age were 39.46g, 103.3g, 274.8g, 415.4g, and 593.6g, respectively (Table 11). At 5 weeks of age, the average body weight was 454.9g (n=97) for males and 415.4g (n=109) for females. The growth performance was comparatively lower than in previous generations.

Table 11. Performance of Juvenile traits in CB

Traits/ Generation	G-22R
Body weight (g)	
0 day	39.46±0.18 (457)
2 wks	103.3±1.55 (371)
4 wks	274.8±5.95 (270)
5 wks	415.4±8.96 (255)
6 wks	593.6±15.03 (184)
Breast angle (^{0}) 5 wks	73.25±0.36 (154)
Shank length (mm) 5 wks	61.34±0.36 (253)

Adult body weights of CB (G-22R)

About 120 adult CB females were housed for egg production evaluation. At 20 weeks of age, the average body weight was 2,319±28.14g (n=118) in females and 2,825±46.69g (n=101) in males. The average shank length at 20 weeks was 112.1±0.50 mm (n=118) in females and 132.3±0.67 mm (n=101) in males.

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

Coloured Synthetic Broiler Female line (PB-2)

S-2 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 80.03, 66.19 and 82.70. A total of 1688 good chicks were obtained. Juvenile body weights at 4WK. 5WK and 6WK and Shank length at 5WK respectively were 667±1.10g, 943±2.62g, 1103±3.20g and 76.63±0.35m.m. Adult performance traits were recorded up to 36WK of age i.e ASM, 20WK BW, 28WK EWT, 32WK EWT, 36WK EWT and 36WK egg production respectively were 175days, 2168g, 50.28g, 53.70g 54.75g and 46.62 eggs (Table 13). As compared to last generation these traits were more or less similar.

Table 12. Performance of Juvenile Traits of PB-2 (S-2)

Trait	Mean ±S.E
4 WK BW (g)	667±1.10
5 WK BW (g)	943±2.62
6 WK BW (g)	1103±3.20
5 WK Shank length (mm)	76.63±0.35

Table 13. Adult performance Traits of PB-2 (S-2)

Trait	Mean±S.E
ASM (days)	175±2.12
20 WK BW (g)	2168±22.13
28 WK EWT (g)	50.28±0.71
32 WK EWT (g)	53.70±0.75
36 WK EWT (g)	54.75±0.72
36 WK EP (no)	46.62±1.32

Dwarf Gene Line

S-21 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 87.23, 78.49and 89.98. A total of 583good chicks were obtained in 4 hatches. Juvenile traits like 4WK BW, 6WK BW and 6WK Shank length respectively dwarf were 365±1.43g, 666±2.60g and 73.32±0.78 mm (Table 14). Adult performance traits like ASM, 20WK BW, 40WK BW, 28WK EWT, 32WK EWT, 36WK EWT, 40WK EWT and 40WK egg production in Dwarf were 148 days, 1488g. 2309g, 47.40g, 47.55g, 48.10g, 49.12g and 45.23eggs as compared to last generation the values in were similar (Table 15).

Table 14. Juvenile Performance of Dwarf Gene line (S-21)

Trait	Mean ±S.E
4 WK BW (g)	365±1.43
6 WK BW (g)	666±2.60
6 WK Shank length (m.m.)	73.32±0.78

Table 15. Adult Performance of Dwarf gene line (S-21)

Trait	Mean±S.E
ASM (days)	148±1.20
20 WK BW (g)	1488±18.11
40 WK BW (g)	2309±22.26
28 WK EWT (g)	47.40±0.60
32 WK EWT (g)	47.55±0.73
36 WK EWT (g)	48.10±0.71
40 WK EWT (g)	49.12±0.76
40 WK EP (no)	45.23±1.13

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, egg production, egg weight and body weight traits in the later phases of the laying cycle were recorded for IWI, IWH, IWK and LC populations (Table 16). The average egg production up to 64 weeks (EP64) in IWH and IWI lines was 241.31±2.67 and 217.76±3.74 eggs respectively. The egg weight at 64 weeks in g (EW64) was maximum for IWK (54.10±0.32) followed by LC (53.77±0.45), IWH (52.86±0.34) and IWI (52.53±0.34). In IWD, IWF, IWN and IWP populations, the average egg production up to 72 weeks (EP72) was recorded as 239.02±4.08, 232.54±4.72, 285.29±3.09 and 262.63±5.19 respectively.

Also, IWH (S-10), IWI (S-10), IWK (G-1), LC (S-18), IWD (G-5) and IWF (G-5) lines were regenerated using parent stock during the report period whereas IWN and IWP lines were regenerated using hatching eggs procured from AICRP Mannuthy centre.

Table 16. Normalized means (Mean±S.E.) for traits in the later phase of the laying cycle in White Leghorn lines

Traits	IWH (S-9)	IWI (S-9)	IWK (S-0)	LC (S-17)
EP52	188.45±1.57	168.65±2.14	152.44±1.94	148.93±2.19
EP64	241.31±2.67	217.76±3.74	194.46±3.36	183.95±3.22
EP72	257.52±2.94	245.75±4.48	211.47±4.19	198.69±3.78
EW52	53.49±0.24	54.71±0.25	55.99±0.29	55.21±0.33
EW64	52.86±0.34	52.53±0.34	54.10±0.32	53.77±0.45
EW72	52.44±0.46	54.34±0.38	55.62±0.36	54.67±0.44
BW52	1511.30±12.39	1467.77±15.33	1459.99±12.29	-
BW64	1554.95±13.80	1433.48±16.67	1413.61±13.08	1578.32±15.77
BW72	1586.00±19.26	1507.36±16.27	1493.47±15.56	1641.09±19.49

During the report period, genetic parameters were also estimated for the important economic traits in IWI line using Bayesian inference. The study utilized the recent four generations' data of IWI strain from the years 2018-19 to 2023-24 and the total dataset comprised of 2,993 birds spanning four generations (G1: 2018-19, G2: 2020-21; G3: 2021-22; G4:2023-24) and five hatches out of which 1,353 female chicks were considered for the analysis. Genetic parameters were estimated for the recorded traits including: egg production traits *viz*., egg production up to 24 (EP24), 32 (EP32), 40 (EP40), 52 (EP52), 64 (EP64) and 72 (EP72) weeks of age; reproductive trait *viz.*, age at sexual maturity (ASM); egg weight traits *viz*., egg weight at 28 (EW28), 40 (EW40) and 52 (EW52) weeks of age and body weight traits *viz.*, birth weight (BW0), body weight at 4 (BW4), 8 (BW8), 16 (BW16), 20 (BW20), 40 (BW40) and 52 (BW52) weeks of age.

The normalized data for all the traits was used for genetic parameter estimation including generation (N = 4) and hatch (N = 5) as non-genetic factors. Genetic analysis was carried out by fitting six different BLUP Animal models with different random effect definitions (including maternal genetic and maternal permanent environmental effect) utilizing Gibbs sampling algorithm. The best fitted model for each trait and the corresponding genetic values have been presented in Table 17.

Egg production traits starting from 40 to 72 weeks *viz*., EP40 (0.08±0.05), EP52 (0.02±0.02), EP64 (0.03±0.02) and EP72 (0.03±0.03) were the ones exhibiting very low additive heritability ($h^2_{additive}$) whereas the early egg production traits like EP24 (0.28±0.14) and EP32 (0.22±0.09) showed medium estimate. ASM was found to be highly heritable (0.46±0.16) with a significant maternal genetic influence in trait regulation.

All the egg weight traits were highly heritable with EW28, EW40 and EW52 showing estimates as 0.38±0.13, 0.37±0.12 and 0.35±0.15, respectively.

BW0 showed very high additive genetic h^2 estimate (0.63±0.07) and BW16, BW20 and BW40 were also highly heritable. On the other hand, BW4, BW8 and BW52 were found to exhibit medium heritability estimate.

As far as the maternal heritability (h^2_{mat}) estimates were concerned, ASM (0.12±0.05), EW52 (0.12±0.06) and BW20 (0.10±0.05) traits had a significant maternal genetic effect regulating the variance partitioning for the traits. Traits like EP24, EP32, EP40, EW28, BW4, BW8 and BW52 also had a good maternal genetic influence ranging from 0.08-0.09.

Additive genetic (r_G) and environmental (r_E) correlation was also estimated between the traits (Table 18). In case of egg production traits, additive genetic correlation was very high and positive between the traits at consecutive ages or traits at the same phase of the production cycle. For instance, high r_G was noticed between EP24 & EP32 (0.67), EP40 & EP52 (0.91) and EP64 & EP72 (0.96) trait combinations. On the other hand, r_G was drastically reduced between the traits at the beginning and those at the end of the production period. For instance, EP24 and EP72 traits exhibited very low r_G (0.06) estimate. Similarly, genetic correlation between EP64 (primary selection trait) and egg production traits increased as the production cycle advanced (EP64 & EP32: 0.41; EP64 & EP40: 0.79; EP64 & EP52: 0.82). All the egg weight traits also exhibited very high positive additive genetic correlation (>0.80). Posterior genetic correlation between EW28 & EW40, EW28 & EW52 and EW40 & EW52 traits was 0.89, 0.65 and 0.82 respectively.

Based on the results of bivariate analysis and taking the higher additive genetic correlations between the traits into consideration, a multivariate analysis was also carried out in two sets of combinations: (i) EP52, EW40 and BW52 and (ii) EP64, EW40 and BW52. It was observed that direct additive heritability of EP52 increased

to 0.08±0.05 whereas that of EP64, increased to 0.11±0.05 (Fig. 2). Also, the corresponding h^2 estimates for EW40 and BW52 increased as compared to those obtained in univariate analysis. As compared to the bivariate analysis, trait correlations also witnessed a huge shift with the additive genetic correlation between egg production and body weight traits turning positive (EP52 & BW52: 0.40 and EP64 & BW52: 0.12). Correlation between egg production traits and EW40 also showed slightly higher negative correlation as compared to the bivariate analysis.

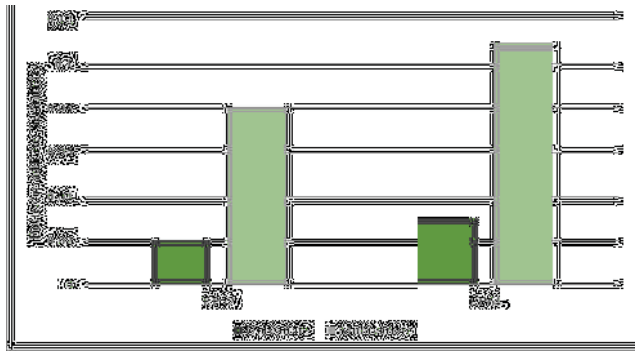


Fig. 2. Comparison of posterior direct additive heritability estimate of EP52 and EP64 obtained using univariate and multivariate approaches

Table 17. Posterior estimates of genetic parameters based on the best fitted model for the traits

TRAIT	σ^2_a	σ^2_{mat}	σ_{am}	σ^2_{mpe}	σ^2_e	$h^2_{additive}$ ± S.D.	$HPDI_{additive}$	h^2_{mat} ± S.D.	c^2_{mpe} ± S.D.	Best Model
ASM	46.60	12.50	-21.79	2.67	60.45	0.46±0.16	0.14-0.78	0.12±0.05	0.03±0.02	Model 6
EP24	9.70	3.15	-3.54	1.63	22.84	0.28±0.14	0.005-0.56	0.09±0.06	0.05±0.04	Model 6
EP32	32.90	13.43	-9.48		110.78	0.22±0.09	0.05-0.39	0.09±0.04		Model 3
EP40	48.05	47.49	-40.58		561.61	0.08±0.05	0.03-0.18	0.08±0.04		Model 3
EP52	33.19				1698.90	0.02±0.02	0.001-0.05			Model 1
EP64	42.79				1420.70	0.03±0.02	0.001-0.08			Model 1
EP72	82.14				2016.00	0.03±0.03	0.001-0.09			Model 1
EW28	39.63	8.38	-11.74	4.39	61.98	0.38±0.13	0.12-0.64	0.08±0.05	0.04±0.03	Model 6
EW40	38.50	63.28	-11.06		69.09	0.37±0.12	0.14-0.61	0.06±0.04		Model 3
EW52	44.08	14.99	-10.92		77.61	0.35±0.15	0.06-0.64	0.12±0.06		Model 3
BW0	7.08				4.13	0.63±0.07	0.48-0.77			Model 1
BW4	349.44	118.44	-116.41	65.15	928.51	0.26±0.11	0.05-0.47	0.09±0.05	0.05±0.03	Model 6
BW8	996.73	570.02	0.00	183.46	4935.60	0.15±0.07	0.006-0.29	0.08±0.04	0.03±0.03	Model 5
BW16	3151.30	545.50	-1093.00	366.31	5794.10	0.36±0.13	0.10-0.61	0.06±0.05	0.04±0.03	Model 6
BW20	6096.40	1329.90	-1891.80		7118.00	0.48±0.13	0.22-0.74	0.10±0.05		Model 3
BW40	10149.00	1793.10	-2868.70	996.20	17383.00	0.37±0.11	0.15-0.59	0.07±0.04	0.04±0.03	Model 6
BW52	7742.10	2677.30	-1501.80	1214.50	22494.00	0.24±0.12	0.009-0.46	0.08±0.05	0.04±0.03	Model 6

(Here, σ^2_a: Additive genetic variance; σ^2_{mat}: maternal genetic variance; σ_{am}: covariance between additive genetic and maternal genetic effects; σ^2_{mpe}: maternal permanent environmental variance; σ^2_a: Residual variance; $h^2_{additive}$ ± S.D.: Posterior direct additive heritability mean ± Posterior standard deviation; $HPDI_{additive}$: Highest Posterior Density Interval for direct additive heritability; h^2_{mat} ± S.D.: Posterior maternal heritability mean ± Posterior standard deviation; c^2_{mpe} ± S.D.: Posterior maternal permanent environmental effect mean ± Posterior standard deviation)

Table 18. Genetic and environmental correlation between egg production traits at different ages (Values above the diagonal indicate direct additive genetic correlation between the traits and values below the diagonal indicate environmental correlation between the traits)

	EP24	EP32	EP40	EP52	EP64	EP72
EP24		0.67	-0.21	0.23	-0.06	0.06
EP32	0.68		0.88	0.52	0.41	0.75
EP40	0.28	0.76		0.91	0.79	0.67
EP52	0.07	0.53	0.84		0.82	0.71
EP64	0.19	0.36	0.59	0.91		0.96
EP72	0.20	0.27	0.52	0.83	0.95	

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 evaluated for the second time under farm conditions. The DKH birds are multicolored with thin shanks and medium build body conformation. The body weight at 64 and 72 weeks in females was 1694.71±25.16 and 1759.96±29.13g, respectively. The respective egg weights were 55.40±0.43 and 57.91±0.50g. The 64 and 72-week egg production was 196.97±2.78 and 223.91 eggs, respectively. There is a slight reduction in egg production compared to the last generation however, it is not significant. The carcass traits of 20 males was performed at 20 weeks of age. The body live body eight at slaughter was 1647.35±33.0g. The dressing percentage was 66.54 with a dressed weight of 1096.90±26.26g

Birds of three-way cross (DKH)

MOLECULAR BIOLOGY

Generation of whole genome assembly of native Kadaknath chicken and its annotation

A high-quality haplotype resolved *De-novo* chromosomal genome assembly of black native female (#2517 Dam 9347 and Sire 25) chicken of India having unique morphological features has been assembled. The NCBI accession number for the genome assembly is JBAGCV000000000. The trio binning assemblies were created by resolving the long reads from the F1 progeny assembly using the short illumina reads of the dam and sire of the original female chicken. Predicted the gene content in the assembled genome. The Ab initio (Augustus a gene model training through the BUSCO pipeline and FGENESH), Protein (Exonerate, GenomeThreader and Minipart) and for Transcription (StringTie and Cufflinks) programs were used. The above-mentioned predicted gene models were integrated by EVM to predict final gene models and polished.

Genomic Characterization and Identification of Selection Sweeps and CNVs in Native Chicken and Duck

Selection Sweep RAiSD was run on the Daothigir and Kashmir Favorolla chicken breed separately. Chromosome wise top selection sweeps present in the gene were reported in both the chicken breeds. Enriched functions for commonly selected regions include myoblast proliferation

to body weight and stress regulator and other biological processes were identified. In Daothigir chicken breed CCDC91 (responsible in promoting myoblasts proliferation and differentiation and also reduce skeletal muscle atrophy), GPC6 (glypican-6 plays an important role in intestinal elongation), PCDH9 (associated with chicken breast percent, breast depth and body weight. In Kashmir Favorolla apart from CCDC9, GPC6 and PCDH9 the sweep present in other gene is SEMA3A (semaphorins protein having a potent multifunctional modulators function and expressed by satellite cells in injured muscle) and SLITRK1 (growth and development of nerve cells) were identified. Observed heterozygosity (O-HET) was higher than the expected heterozygosity (E-HET) in the both the chicken breeds.

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)

The two recombinant constructs were validated by SDS-PAGE and western blot under in-vitro conditions, with the human tissue plasminogen (htPA) construct showing a band at 63 kDa and the human erythropoietin (hERP) at 22 kDa. The circular plasmids of two recombinant constructs producing hERP and htPA that were previously validated under in-vitro conditions were linearized with BsaI and AatII enzymes respectively before proceeding with Sperm Mediated Gene Transfer (SMGT). Further, semen collection was carried out from 30 male chickens and promptly washed twice with 1x PBS at 1500 rpm for 15 minutes. A total of 15 µg of linearized recombinant DNA was transfected into 1ml of semen using electroporation method. The transfected semen with positive plasmids of hERP and htPA was artificially inseminated in treatment groups and untransfected semen into the control group. Further, eggs were collected, incubated and chicks were obtained. To screen the chicks using PCR, 1 set of primer for PUC57 vector backbone (F: 5'TGGGGTGCCTAATGAGTGAG 3', R: 5'GTTTCGCCACCTCTGACTTG3') along with 2 distinct sets of primers for Ovalbumin-hERP (F:5'GCCTACCATAGAGTACCCTGC3', R: 5'GTGATTGTTCGGAGTGGAGC3') and Ovalbumin-htPA (F:5'GCCTACCATAGAGTACCCTGC3', R: 5'CCGCCTTAAAGACGTAGCAC3') were designed to ensure that the recombinant constructs were integrated into the chicken genome. The blood samples were collected from the chicks during 8th week of their age for DNA isolation and PCR screening. The PCR results are found to be positive for the PUC57 backbone primer as well for the two distinct junction primers of hERP and htPA constructs.

Genomewide 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 were identified. The 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.

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

A total of 16571316 high quality SNPs in both the duck populations were identified. The quality of the transcriptome reads was assessed using FastQC v 0.11.9 before

proceeding with the downstream analysis. Differential gene expression was analysed using the DESeq function from the DESeq2 package with a false discovery rate (FDR) cut-off of ≤ 0.05 and a minimum expression log2-fold change (FC) of ≥ 2/1. A total of 259 significant upregulated genes (padj <0.05) and 323 significant downregulated genes were identified.

Genome editing as a tool for skewing sex ratio in chicken for welfare and enhanced productivity

The primordial germ cells (PGCs) were isolated from fertile chicken embryos aged 48–64 hours and successfully cultured *in-vitro*. The isolation method was standardized to ensure consistency and reproducibility. The cultured PGCs were maintained for up to 70 days under two different conditions both with and without a feeder cell layer and protocols for both methods were standardized. PGC identity was confirmed and characterized using surface-specific markers through PCR analysis.

Enrichment of egg and meat by producing bovine lactoferrin through development of transgenic chicken

The DBT project focused on enriching chicken eggs and meat with bovine lactoferrin by developing transgenic chickens. A total of 168 transgenic chicks were generated, along with 39 control chicks. The presence of the transgene was confirmed through screening with six sets of primers. Six transgenic birds were successfully produced using the sperm-mediated gene transfer (SMGT) method, achieving a transgenic efficiency of 3.57%. Bovine lactoferrin protein was then isolated from the eggs of these transgenic hens and purified via column chromatography. SDS-PAGE analysis revealed the protein's monomeric size to be 79 kDa, and its identity was further verified through Western blotting.

NUTRITION

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

An experiment was conducted to evaluate effects of low protein diet on carbon footprint reduction in commercial broiler chicken for meat production. A total of 840 vencobb 430 Y chickens were allotted to 7 groups with 8 replicate pens in each group having 15 birds per replicate. A control diet with standard concentrations of all nutrients was prepared. Three basal diets with 4% less CP and normal ME with little or no vegetable oil was prepared. Another set of three basal diets were prepared having 4% less CP but contained normal ME with 3% added vegetable oil. Three diets having 4% less CP and no vegetable oil were supplemented with 0, 1.5 and 3 kg/ ton gelatine as source of glycine and serine. Similarly the other set of diets having 4% less CP but containing 3% added vegetable oil were supplemented with with 0, 1.5 and 3 kg/ ton gelatine as source of glycine and serine as specified in the following Table (Table 1).

Performance data of broilers has been presented in Table 2. There was significant reduction in BW or feed efficiency on reduction of CP in diet. Gelatin supplementation resulted in similar BW gain to that of control diet but with significant lower feed efficiency. The reduced CP with Gelatin diets reduced carbon footprint bt 158 g / kg meat which works out to be 7.534 lakh tons of CFP reduction per year in India (Figure 1).

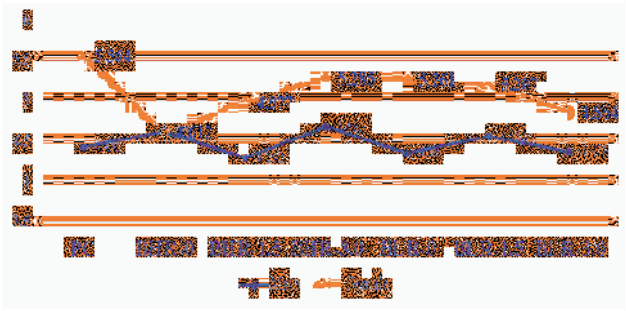


Fig. 1. Carbon Foot print of broiler fed low CP diets with graded concentrations of glycine at low and high starch:ME ratio

Table 1. Diet plan for broiler trial for carbon foot print reduction through low protein diet

Diet	CP, %	Additives	Gelatin, kg/ton
PC	Standard	nil	0
BHR-0	4% units	Glycine + Serine (0.027%)	0
BHR-1.5	4% units	Glycine + Serine (0.053%)	1.5
BHR-3.0	4% units	Glycine + Serine (0.081%)	3.0
BLR-0	4% units + OIL	Glycine + Serine (0.027%)	0
BLR-1.5	4% units + OIL	Glycine + Serine (0.053%)	1.5
BLR-3.0	4% units + OIL	Glycine + Serine (0.081%)	3.0

Table 2. Performance of broilers fed low protein diet with different supplemental glycine plus serine through gelatine at two different starch: energy ratio (1-42d)

Treat –G+S	BWG, g	FI, g/b	BWG/FI
PC	**2199^{ab}**	3772^{b}	1.716^{c}
BHR-0.027	1964^{d}	3585^{c}	1.830^{ab}
BHR-0.053	1971^{d}	3505^{c}	1.779^{bc}
BHR-0.081	1992^{d}	3583^{c}	1.801^{ab}
BLR-0.027	2104^{c}	3941^{a}	1.877^{a}
BLR-0.053	**2137^{ab}**	3899^{ab}	1.824^{ab}
BLR-0.081	**2247^{a}**	4038^{a}	**1.796^{b}**
P	**0.000**	**0.000**	**0.003**

In another experiment, effects of nutraceuticals on carbon footprint production of broiler meat were estimated.

A total of 840 vencobb 430 Y chickens were allotted to 7 groups with 8 replicate pens in each group having 15 birds per replicate. A control diet with standard concentrations of all nutrients was prepared. Six other diets were prepared by supplementing different additives as follows: BE, butyric acid 250g/ton and emulsifier (250g/ton); BP, butyric acid 250g/ton and phytase (200g/ton); BX, butyric acid 250g/ton and xylanase 200g/ton; Bpr, butyric acid 250g/ton and protease 25g/ton, BB butyric acid 250g/ton and betaine 350g/ton. Effect of treatments on performance parameters and carbon footprint has been presented in Table 3

Table 3. Effect of nutraceuticals on performance and carbon footprint in broil chicken

	BWG, g	FI, g/b	FI/BWG	CO2 eq, kg/kg
Control	2455	3982	1.622a	5.077A
BE	2405	3880	1.614ab	5.098A
BP	2460	3925	1.596bc	4.900B
BX	2439	3882	1.592c	4.914B
BPr	2445	3948	1.615ab	5.018AB
BB	2446	3941	1.612abc	5.110A
P-value	0.754	0.375	0.025	0.015

The study indicated that butyric acid plus phytase or xylanase can significantly reduce carbon footprint primarily through improvement in feed efficiency.

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.

Effect of protease enzyme supplementation in diet on broiler chicken fed BSF larva meal

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 4). 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 5). 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.

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%.

Table 4. Effect of dietary supplementation of protease on performance of broiler chicken fed BSF larva meal at graded levels

BSFLM, % in diet	Protease, 200g/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 5. 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

Effect of dietary supplementation of probiotic cum prebiotic blendon broiler chicken fed BSF larva meal

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 (300g/ton of feed) (PP blend) employing 3x2 factorial design. The blend had probiotic (1.25 billion CFU/g, *B.subtilis, B.pumilis, B.coagulansand 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 6). 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 7).

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 6. 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 7. 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, 300g/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

A feeding trial was conducted involving 300 PB1 colour broiler pure line (male) birds from about 30 sire lines were place individually in battery brooder cages after brooding period of 28days followed by adjustment period of 13 d for recording of individual feed intake and BW for 7 week recording period. All birds were offered same diet as per institute feeding schedule/ standard. Water was offered ad lib. Birds were weighed at weekly interval and also feed intake was recorded on weekly basis. Based on BW, ADG and feed intake a regression equation was fitted. Difference of Actual and predicted intake is taken as RFI. 6 birds died during experiment, hence finally data from 294 survived birds were analysed, few (4) outlier data were also removed if birds suffered from some disease during the experiment. Summary of experimental data is presented in Table 8.

Table 8. Summary of experimental dataset during test period of 7 week

	Initial BW	Final BW	Av BW	ADG	DMI	FCR	RFI
Range	700-1820	1959-4423	1329.5-3063.5	19.8-60.2	87.64-204.0	2.327-6.00	-68.9 to 38.41
Average	1395.1	3523.6	2459.4	43.4	165.6	3.869	0
N	290	290	290	290	290	290	290

Distribution of RFI data has been presented in Fig 2.

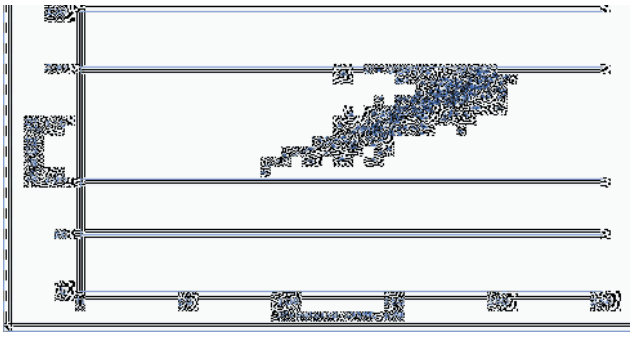


Fig. 2. Actual vs predicted DMI based on DMI prediction equation

Twelve high RFI and 12 low RFI birds were slaughtered and samples collected and utilized for further sequencing and analysis for identification of SNPs etc.

Top 12 HRFI and 12 LRFI chickens were selected for genomic analysis using resequencing approach. Detail comparative performance of PB1 chickens used for sequencing is presented in Table 9.

Table 9. Performance of PB1 chickens used for sequencing (n=12 per group) during test period of 7 week

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

Sequencing and bioinformatic analysis

Genomic DNA was isolated from blood and quantified/quality checked using Qubit Fluorometer and TapeStation automatic electrophoresis. Library preparation was undertaken using Kapa Hyperplus kit and quality checked using TapeStation. Libraries were normalized, pooled and sequenced using NovaSeq X Plus to generate 12-13 GB data / sample with 150 bp PE read length. Sequence reads were quality checked using FastQC and MultiQC tools. After demultiplexing, trimming and duplicate removal reads were aligned against reference genome for broiler chicken (GCF_016699485.2_GRCg7b) using DRAGEN Germline v 4.2.4. SNP variants were called using Illumina BaseSpace Cloud platform. VCF files wer annotated using VEP (V 110). Variants were filtered for having present in all 12 samples of a group and having minor allele Frequency of >0.01 using PLINK (v 1.9).

SNP distribution

A total of 410724 SNP variants (correspond to 19664 genes) were unique to low RFI samples, 408067 SNP variants (belong to 19571 genes) were unique to high RFI samples, whereas 265137 SNP variants were common to both groups.

Majority of variants were in intron region (about 70%), upstream (about 11%) and downstream (about 11%).

High impact variants like mutations at splice sites, start and stop codon were less than 0.1% in both high and low RFI group. Moderate impact (nonsynonymous) variants were less than 1% in both the groups, Low impact variants (synonymous mutations) were less than 2% in both the groups. Modifier (in noncoding region, upstream, downstream, untranslated but transcribed regions) constituted more than 95% of the variants.

Number of genes bearing SNPs unique to low RFI were 2702 whereas number of genes unique to high feed samples were 2609.

Mitochondria level analysis indicated SNP variants unique to low RFI was 23, unique to high RFI was 5 whereas SNPs common to both groups were 76.

Low RFI had 2 SNPs with high impact classification, 14 with moderate, 42 with low impact and 1852 with modifier classification. High RFI group had 39 SNPs of low impact, 7 of moderate and 1507 with modifier impact classification.

Transcriptome analysis

Muscle and gut tissue of 4 birds from high as well as low RFI groups were utilized for transcriptome sequencing. RNA was isolated using Trizol method. Isolated RNA was quantified using Qubit fluorometer and quality tested using Tapestation. Stranded mRNA-Seq libraries were prepared using KAPA mRNA Hyper Prep Kit for Illumina sequencing. The libraries were normalized, pooled and sequenced using NovaSeq X Plus to generate 35-40 million reads per sample with 150 bp read length. After sequencing sequences were demultiplexed and demultiplexed FASTQ samples were subjected to quality check, reads were aligned with genome and transcriptome of Chicken (GRCg7b) using Strand NGS 4.1 and trimmed. The reference transcriptome was obtained from the GRCg7b primary assembly. Gene annotations and locations were derived from NCBI Entrez Gene files dated Jan 17, 2023. Transcript annotations RefSeq were obtained from gff3 files available on NCBI updated on 04.03.2022. Post alignment quality score and QC plot were checked. Reads with N or quality score below 20 were removed. The aligned reads were converted to gene * sample matrix and counts at exon and transcript. TMM was used to normalize the raw counts. Normalized counts were utilized for further analysis. EdgeR and DESeq2 were used to identify differentially expressed genes. Clustering analysis was undertaken for grouping samples. Gene ontology analysis was performed using the hypergeometric test method to indicate biological processes involved. Pathway analysis was undertaken using Gallus gallus pathways from the KEGG website for up and down regulated

Volcano plots presented below (Figure 3 and 4) to indicate differentially expressed genes (DEGs) with high confidence [FC >= 2, PValue <= 0.05] and [FC <= -2, PValue <= 0.05].

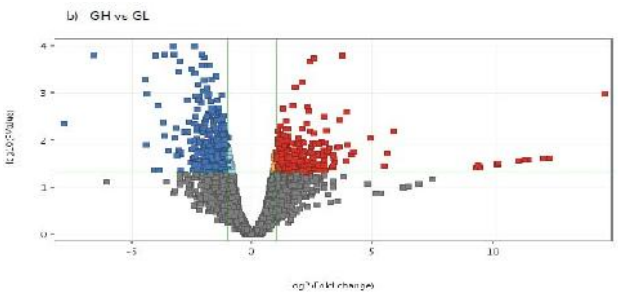


Fig. 3. Volcano plots indicate differentially expressed genes in gut samples

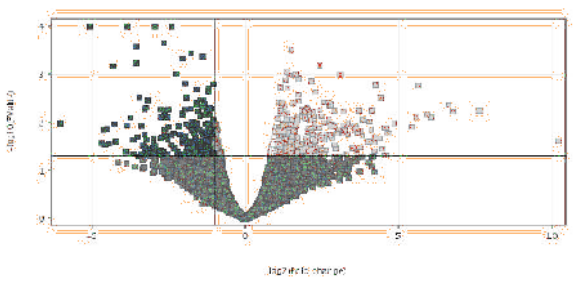


Fig. 4. Volcano plots indicate differentially expressed genes in muscle samples

Characterization of Antimicrobial Resistance in Chicken and its Production Environment Interface for Identification of Optimal Approaches for Sustainable Surveillance and Amelioration (IAEA sponsored)

One experiment involving about 1000 vencobb 430Y male broiler chicks were undertaken under deep litter system to evaluate effect of different alternative to antibiotic growth promoters on performance (growth and feed efficiency), pathogen shedding, antibiobic resistance profile (phenotyping as well and genotyping) of gut Ecoli isolates, and evaluation of resistome profile in caecal microbiome using metagenomic shotgun sequencing. Each group were allotted 8 replicate pens each containing 18 birds (Table 10).

Table 10. Experimental plan

Groups	Experimental treatments	Replicates
Group 1 (control or basal diet)	Birds fed corn-soybean based basal diet	6 birds/pen x 15 replicate
Control with dam/adult hen for 48h (gr2)	Fresh faeces from healthy adult birds were placed in each pen for 48h	
Group 3(virginamycin(AGP))	Birds were fed corn-soybean based diet and supplemented with virginiamycin 40g/t	
Group 4	Birds were fed corn-soybean based basal diet + encapsulated essential oil @ 400 g /ton	
Group5	Basal diet + encapsulated butyrate @ 300g/t	
Group6	Basal diet +one Probiotic @recommended dose[clostat 200g/t]	
Group 7	Basal diet + Prebiotic @recommended dose [seaweedextr 1kg/t]	

Performance data has been presented in following tables (Table 11). The study indicated that all the alternatives to antibiotic growth promoters had exerted comparable performance to that of the antibiotic growth promoter and the control group having exposure to adult birds performed poorly as compared to control.

Table 11. Effect of treatments on performance of broiler chickens

Week - 5			
Treatment	**BWG/bird**	**FI/bird**	**FCR**
1 (N.Control or basal diet)	2196[a]	3501	1.595[b]
2 (control or basal diet)	1965[b]	3481	1.747[a]
3 vig(AGP)	2133[a]	3323	1.559[b]
4 (Encap- essential oil)	2209[a]	3497	1.582[b]
5 (encapsulated butyrate)	2145[a]	3371	1.572[b]
6 (Closat @200g/ton)	2178[a]	3422	1.572[b]

Week - 5			
7 (Sea weed Ex @1000g/ton)	2138[a]	3366	1.574[b]
P-Value	0.000	0.057	0.000
N	8	8	8
SEM	34.91	49.81	0.011

Week - 6			
Treatment	**BWG/bird,g**	**FI/bird, g**	**FCR**
1 (N.Control or basal diet)	2808[a]	4880[a]	1.738[b]
2 (control or basal diet)	2431[b]	4548[b]	1.871[a]
3 vig(AGP)	2802[a]	4596[b]	1.641[c]
4 (Encap- essential oil)	2900[a]	4840[a]	1.669[c]
5 (encapsulated butyrate)	2767[a]	4624[b]	1.672[c]
6 (Closat @200g/ton)	2808[a]	4707[ab]	1.677[c]
7 (Sea weed Ex @1000g/ton)	2787[a]	4684[ab]	1.682[c]
P-Value	**0.000**	**0.024**	**0.000**
N	8	8	8
SEM	174.3	72.48	0.016

IOT Solution for Smart Poultry Farm Practice (MeitY sponsored project)

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.

Real time poultry environment monitoring using IoT sensors in layer and broiler farms

In this project, with inputs from the Directorate, the Centre for Development of Advanced Computing (C-DAC), Kolkata, developed a wireless Internet of Things (IoT) sensor network for real-time monitoring of critical poultry environmental parameters, such as temperature, relative humidity, dust, and gaseous emissions (CO_2, ammonia). Two different IoT sensor prototypes were developed one for layer farm (Fig. 5) and another for broiler farm (Fig 6). The prototype for layer farm can be kept either inside or outside the cage and the prototype developed for broiler farm has special provision for height adjustment and can be kept as standalone.

Fig. 5&6. Sensor Node for Broiler and Layer farms

A total of thirty-eight number of the devices were deployed in five different farms (Fig 6) including commercial layer and broiler farms (Table 12) and two years data on environmental parameters were collected. The devices and decision support system were modified based on test results and these technology is ready for ToT process

Table 12. Deployment of sensor nodes at different poultry farms

Location	Birds	Primary Produce	System of rearing	No of devices
DPR layer Farm	White leghorn layers	Egg	cage	08
DPR Broiler Farm-1	Commercial broiler	Meat	Deep litter	06
DPR Broiler Farm-2	Commercial broiler	Meat	Battery brooder	04
Commercial broiler farm	Commercial broiler	Meat	Deep litter	10
Commercial layer farm	White leghorn layers	Egg	cage	10
			Total	38

a. Broiler farm **b. Layer farm**

Fig. 7. IoT sensor nodes installed at different farms for real time environmental monitoring

IoT based automatic Sprinkler system

To control environmental temperature in poultry house, a prototype for automatic sprinkler system is developed and is deployed at layer farm (Fig 8). The system is connected with IoT sensor nodes and will automatically switch on when the environmental temperature is increased and will cut off when the temperature is reduced. The prototype has given encouraging results and proved to be very useful for maintaining optimum environmental conditions in the farm during high temperature and low humidity conditions.

Fig. 8. Automatic sprinkler system installed at DPR, Hyderabad

Sensor Node Optimization

An experiment was conducted in a commercial broiler farm to determine the sensor node requirements for environmental monitoring and the coverage area per sensor node. Ten sensor nodes were deployed (Fig 9), and the K-Means algorithm was used to divide them into 1 to 9 clusters. Over 20 months, environmental parameters were monitored (Fig 10). The optimal number of clusters was found to be two for the 671 square metre poultry shed area, indicating that one sensor node is needed for every 335 square metre area.

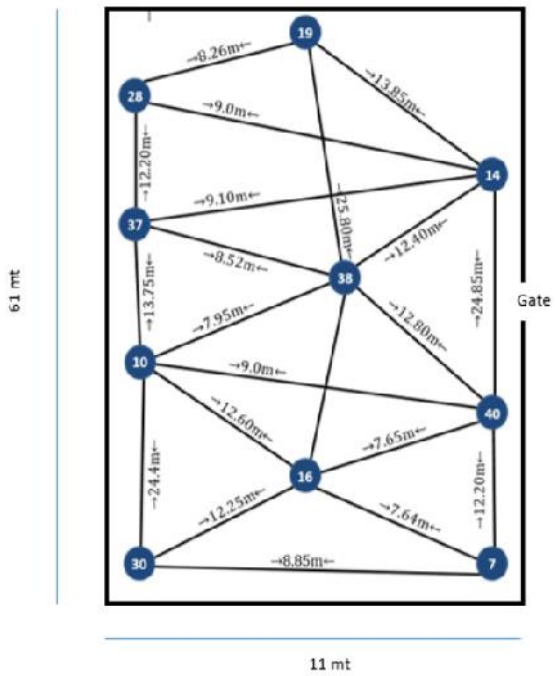


Fig. 9. Sensor node placement at commercial poultry farm for studying coverage area

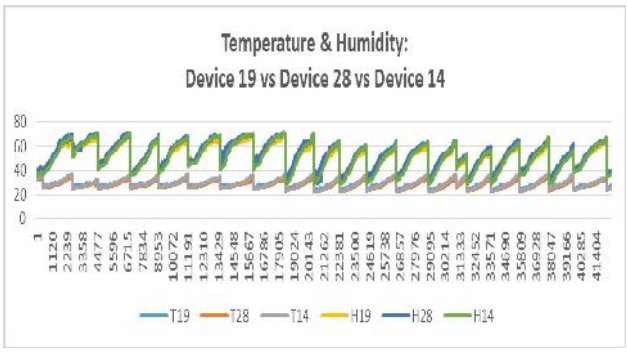


Fig. 10. Comparison of environmental parameters from different sensor nodes

Gender detection using vocalization of one day old chicks

In continuation with the last year work on gender detection of one day old chicks using vocalization, more one day old chick vocalization data of Cornish, Gramapriya, Vanaraja and White Leghorn were collected and the database was updated. After updating and revising the model, the sex detection accuracy levels was increased to more than 95% for Cornish and White Leghorn breeds. For further improving the chick vocalization data collection, a chirping studio was developed by our collaborators, CDAC, Kolkata. The newly designed box is fitted with a light source, wired microphone, and wireless recorder for improving voice recording and to reduce external noise (Fig 11). The collected audio data was analysed at audio processing laboratory of CDAC, Kolkata and a new desktop version was developed for improving the speed of the system.

a. External view **b. Internal view**

Fig. 11. Chirping studio for collection of vocalization data of day old chicks

Development of Smart poultry system

By incorporating all the results of vocalization study and environmental monitoring using sensor nodes, a smart poultry system (Fig 12) was developed with important features like automatic environment parameter monitoring, data retrieval system and alarm generation. The system also has modules for gender detection of day old chicks and stress monitoring using vocalization analysis.

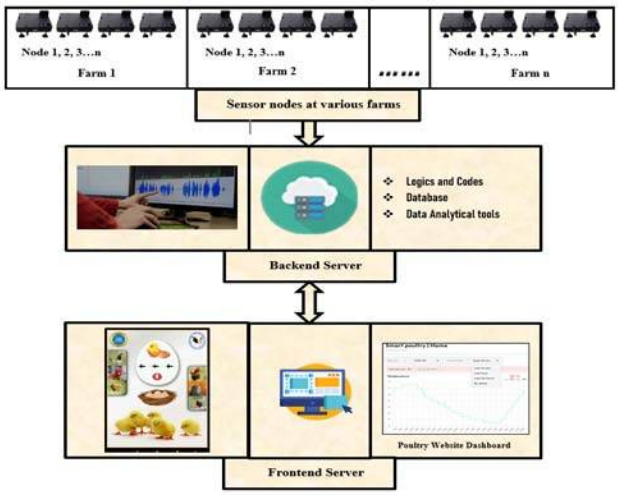


Fig. 12. Block diagram of Smart poultry system

Effect of Feeding Bio-fortified Maize (Pro-A; HQPM 5) on Performance, Antioxidant Status and Immune Response in Commercial Broiler Chicken

This study was conducted to evaluate the effect of Feeding Bio fortified (Pro- A) Maize (Pusa HQPM5) on Performance, Antioxidant Status and Immune Response in Commercial Broiler Chicken. Day old commercial broiler chicks (n=240) were randomly allotted into three dietary groups with 16 replicates for each treatment group and 5 birds in each replicate. The birds were raised in battery brooder cages under uniform management and fed with *iso caloric* and *iso nitrogenous* corn- soya based diets from day old to 6 weeks of age and fed 3 experimental diets (100% normal maize; Diet 1), 50% normal maize and 50% bio fortified Pro-A maize (Diet 2) and 100% bio fortified Pro-A maize (Diet 3). At the end of 42 days, body weight gain (BWG) (Table 13), overall feed consumption and feed conversion ratio (Table 14) did not differ significantly by the dietary replacement of normal maize (NM) with bio fortified pro-A maize. Similarly, dietary replacement of NM with Pro-A maize did not have any significant ($P>0.05$) influence on carcass parameters, except, the birds fed with 50% and 100% Pro-A maize based diets had significantly ($P<0.05$) higher breast yield compared to birds fed on the control diet.

Cell mediated and Humoral immunity were not significantly ($P>0.05$) influenced by dietary replacement of NM with Pro-A maize diets at 50% and 100% levels when compared to control group. Glutathione peroxidase (GPX), Glutathione reductase (GRX) and Superoxide dismutase (SOD) levels were not affected with dietary replacement of normal maize with Pro-A maize diet. However, lipid peroxidation (LP) levels were significantly lower ($P<0.05$) in birds fed with 50% and 100% Pro-A maize diets compared to those birds fed normal maize based diet (Diet 1) (Table 15). The pH and TBARS were significantly ($P<0.05$) reduced in birds fed with 50% and 100% bio fortified (Pro-A) maize diets when compared to control diet fed birds (Table 16). Replacement of NM with Pro-A maize at 50% and 100% level in the diets of commercial broilers has shown significant ($P<0.05$) improvement in the skin colour compared to birds fed on the control diet.

Tibial bone strength and bone ash content were not significantly ($P>0.05$) influenced by the dietary treatment groups. The concentration of calcium, phosphorus, and magnesium in the tibial bone were significantly higher ($P<0.05$) in the dietary groups where normal maize was fully replaced with Pro-A maize compared to control. Zinc concentration in the tibial bone of birds did not differ significantly ($P>0.05$) among all the treatment groups (Table 17). Further, birds fed with 50% and 100% Pro-A diets had significantly ($P<0.05$) higher total carotenoids and Beta carotene in their meat samples than birds fed with control diet containing normal maize (Table 18). The pigmentation (deep orange) colour was intense in groups fed bio fortified maize based diets (Table 19 & Fig 13) compared to control group. Based on the overall results, it is concluded that the substitution of conventional maize with bio-fortified Pro-A (HQPM5) maize in the diet has improved the meat quality, skin pigmentation, mineralisation of bone and stability of meat during storage.

Table 13. Effect of feeding Bio-fortified (Pro–A) Maize on body weight gain (g) in broilers during various phases

Diet	(0-2 weeks)	(3-4 weeks)	(5-6 weeks)	Over all (0-6 weeks)
Normal maize (NM 100%; Diet 1)	381.9	836.9	893.9	2078.0
NM 50% + Pro-A maize 50% (Diet 2)	387.8	802.0	888.2	2112.7
Pro-A maize 100% (Diet 3)	379.1	795.7	944.9	2119.6
N	16	16	16	16
SEM	4.21	10.24	15.50	23.38
P-Value	0.70	0.21	0.26	0.84

Table 14. Effect of feeding Bio-fortified (Pro –A) Maize on feed conversion ratio (g intake/ g weight gain) in broilers during various phases (same problem)

Diet	(0-2 weeks)	(3-4 weeks)	(5-6 weeks)	Over all (0-6 weeks)
Normal maize (NM 100%; Diet 1)	1.258	1.435	1.791	1.58
NM 50% + Pro-A maize 50% (Diet 2)	1.221	1.491	1.839	1.61
Pro-A maize 100% (Diet 3)	1.241	1.496	1.773	1.60
N	16	16	16	16
SEM	0.01	0.02	0.02	0.01
P-Value	0.50	0.25	0.45	0.39

Table 15. Effect of feeding Bio-fortified (Pro –A) Maize on serum antioxidant and immune response in broiler chicken

Diet	GPx (units/ ml)	GSH (units/ml)	LP (n mol MDA/ mg protein)	SOD (units/mg protein)	CMI (Thickness index)	HI ND titer (log2)
Normal maize (NM 100%; Diet 1)	554.9	494.4	7.525[a]	6.138	126.3	2.625
NM 50% + Pro-A maize 50% (Diet 2)	572.2	543.1	4.563[b]	6.100	128.4	3.063
Pro-A maize 100% (Diet 3)	618.1	544.1	3.588 [b]	5.913	130.2	3.188
N	08	08	08	08	16	16
SEM	38.63	23.33	0.52	0.17	0.79	0.27
P-Value	0.80	0.63	0.02	0.86	0.13	0.68

GPx, glutathione peroxidase; GSH, glutathione reductase; LP Lipid peroxidation; SOD, Superoxide Dismutase; CMI, Cell mediated immunity; HI, Humoral immunity

Table 16. Effect of feeding Bio-fortified (Pro-A) Maize on pH and TBARS during storage period (0, 4 and 8 d) in broiler chicken meat

Diet	pH			TBARS (mg MDA /kg)		
	0 day	4 day	8 day	0 day	4 day	8 day
Normal maize (NM 100%; Diet 1)	6.60 [a]	6.46 [a]	5.73 [a]	0.48 [a]	0.78 [a]	0.98 [a]
NM 50% + Pro-A maize 50% (Diet 2)	6.24 [b]	6.15 [b]	5.23 [b]	0.40 [b]	0.70 [b]	0.89 [b]
Pro-A maize 100% (Diet 3)	6.19 [b]	6.11 [b]	5.21 [b]	0.38 [b]	0.67 [b]	0.84 [b]
N	8	8	8	8	8	8
SEM	0.05	0.04	0.06	0.01	0.02	0.02
P-Value	0.01	0.01	0.01	0.01	0.01	0.01

Table 17. Effect of feeding Bio-fortified (Pro –A) Maize on mineral composition (%) of bone samples of broiler chicken

Diet	Ca (%)	P (%)	Zn (%)	Mg (%)
Normal maize (NM 100%; Diet 1)	25.41[b]	12.61[b]	0.14	0.80[b]
NM 50% + Pro-A maize 50% (Diet 2)	35.44[ab]	13.78[ab]	0.17	0.87[ab]
Pro-A maize 100% (Diet 3)	48.70[a]	14.56[a]	0.12	0.96[a]
N	6	6	6	6
SEM	0.33	3.67	0.02	0.03
P-Value	0.02	0.04	0.47	0.04

Table 18. Effect of feeding Bio-fortified (Pro –A) Maize on carotenoid composition of meat of broiler chicken.

Diet	Total carotenoids (µg/100g)	Beta carotene (µg/100g)
Normal maize (NM 100%; Diet 1)	152.1[c]	1.270[c]
NM 50% + Pro-A maize 50% (Diet 2)	165.0[a]	1.382[a]
Pro-A maize 100% (Diet 3)	157.6[b]	1.313[b]
N	6	6
SEM	1.32	0.01
P-Value	0.01	0.01

Table 19. Skin pigmentation in broiler chicken (Visual scoring systems)

Diets	Skin pigmentation
Normal maize (NM 100%; Diet 1)	103.1[b]
NM 50% + Pro-A maize 50% (Diet 2)	103.9[a]
Pro-A maize 100% (Diet 3)	104.0[a]
N	8
SEM	0.14
P-Value	0.02

Fig. 13. Skin pigmentation

PHYSIOLOGY

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

Different physiological parameters were estimated for White Leghorn birds during early (EP)and mid laying period (MP). Three groups of fifty birds each, ten replicates with five birds in each replicate were taken. The supplemented groups (T1, T2) WLH birds was provided with yeast selenium @ 0.3 and 0.6 ppm along with basal feed respectively. Control (C) groups were provided feed devoid of organic Se. After standardization by PCR the cDNA samples were subjected to Real time PCR for quantification of fold change expression of four amino acid transporter genes namely CAT, boAT, LAT2 and LAT4 and hormone receptors for MET and GHL of jejunum and magnum tissues collected at EP and MP period were conducted. Histology of jejunum tissue samples collected at early and mid-laying period was carried out.

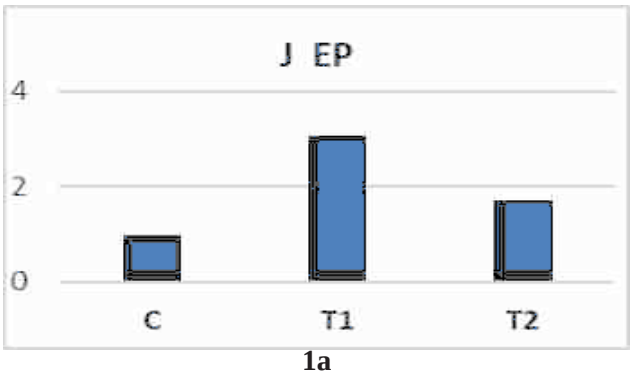
- Treatment with selenium increased levels of plasma melatonin significantly at both EP ($P<0.05$, T1; $P<0.01$, T2) and MP ($P<0.001$, T1&T2) and also increased estradiol ($P<0.05$, T1)at EP and MP ($P<0.01$, T1&T2 (Table 1).
- The fold change expression of CAT and boAT genes when compared between control (C), and treatment (T1), (T2) groups it was observed that expression of CAT and boAT significantly increased ($P<0.05$) by T1 treatment in jejunum tissue for CAT gene (Fig 1a) and decreased ($P<0.05$) in magnum tissue at EP (Fig 1c). Significant increase in CAT expression (Fig 1b) was observed by T2 treatment on jejunum tissue of MP period. Whereas fold change expression of boAT also increased ($P<0.05$) by T2 treatment in jejunum tissue of both EP and MP periods (Fig 2 a & b). There was no significant change in the fold expression of these genes in both the tissues which has not been mentioned. The fold change expression of LAT2 gene increased ($P<0.001$) by T1 treatment in jejunum of MP group (Fig 3 a) but decreased ($P<0.01$) in magnum tissue of EP (Fig 3b) by the same treatment. The fold change expression of LAT4 gene increased ($P<0.05$) by T1 treatment in jejunum of EP and MP (only T1) periods (Fig 4 a& b). Expression of GHLR increased indicating more utilization of Ghrelin in jejunum of MP and Magnum tissue of EP indicating less utilization of GHL in magnum (Fig 5 a&b).

- It was observed that villi height and crypt depth increased with supplementation of either lower dose of 0.3ppm or higher dose of 0.6ppm selenium enriched yeast over that of control group without (0ppm) organic selenium supplementation (Table 2).

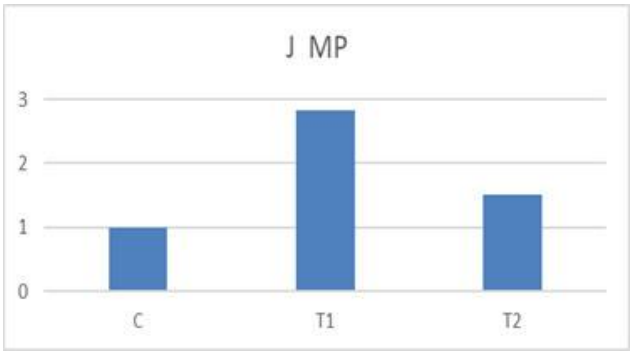
Table 1. Effect of Organic Selenium supplementation on concentration of hormones during Early and Mid Laying period

	EP (24-28 weeks)			MP (32-36 weeks)		
	C	T1 (0.3ppm)	T2 (0.6ppm)	C	T1 (0.3ppm)	T2 (0.6ppm)
Melatonin (pg/ml)	787±20	891*±22	1077**±25	524±15	1010***±11	1072***±13
Estradiol (pg/ml)	417±6	498*±5	409±7	375±8	454**±8	469**±10

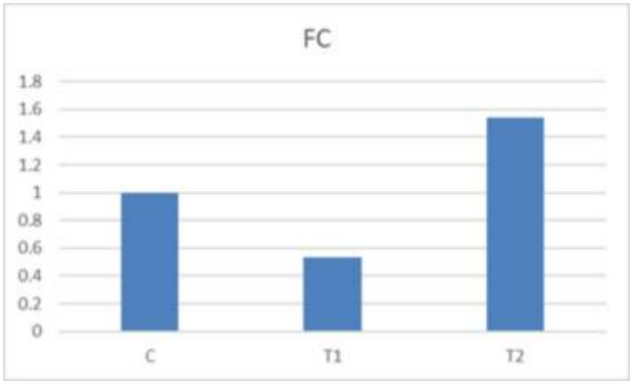
Values are expressed as Mean±SEM. EP- Early laying period; MP-Mid laying period



1a

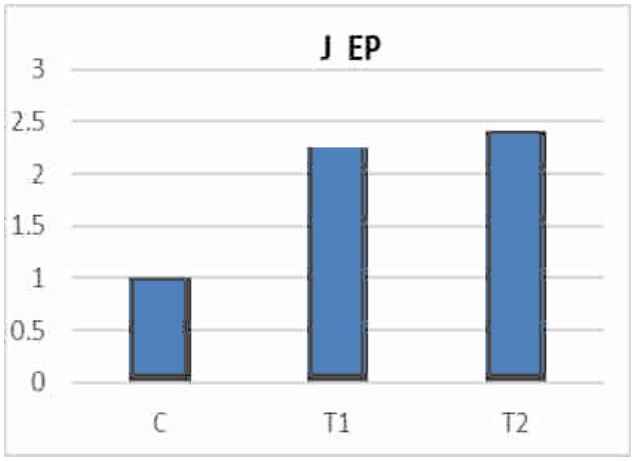


1b

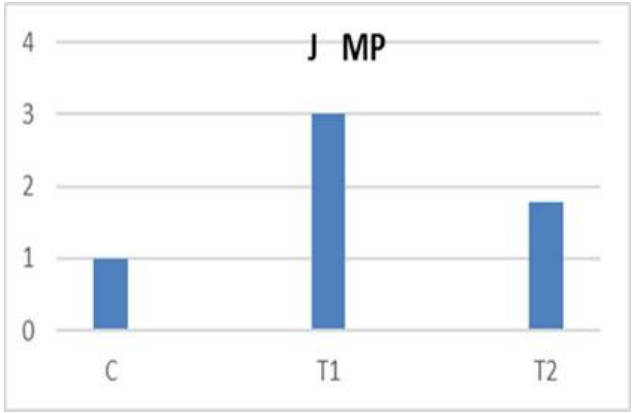


1c

Fig. 1 a, b, c. Fold change expression of CAT gene in jejunum (J, a) and magnum (M, c) tissues of early period (EP, 26 weeks), jejunum tissue of mid period (J, b, 34 weeks). C- Control, T1-Treatment 1(0.3ppm Organic selenium enriched yeast), T2-Treatment2(0.6ppm Organic selenium enriched yeast). * P<0.05

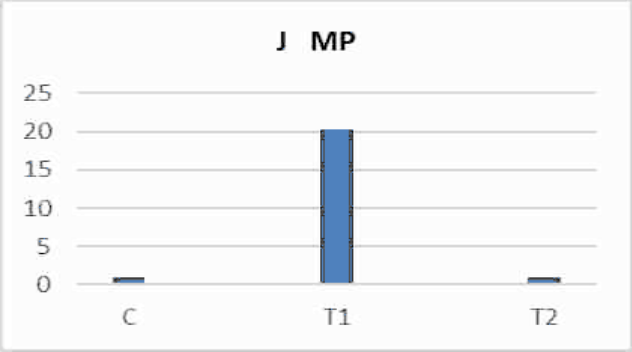


2a

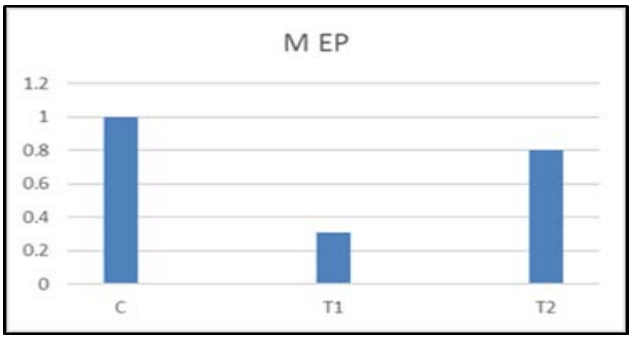


2b

Fig 2 a& b- Fold change expression of boAT gene in jejunum (J, a) tissues of early period (EP, 26 weeks), jejunum tissue of mid period (J,b, 34 weeks). C- Control, T1-Treatment 1(0.3ppm Organic selenium enriched yeast), T2-Treatment2(0.6ppm Organic selenium enriched yeast). * P<0.05

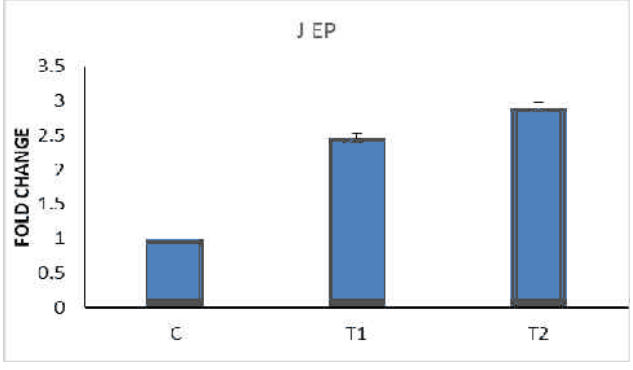


3a

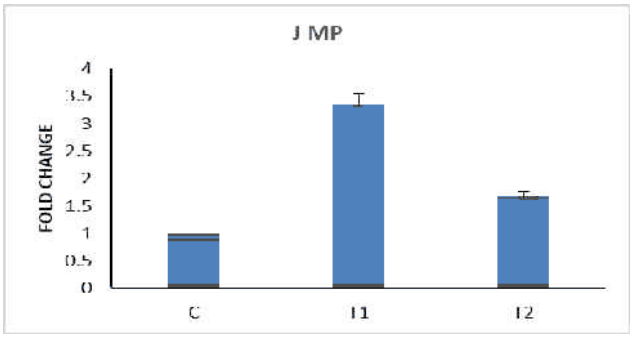


3b

Fig 3 a & b - Fold change expression of LAT 2 gene in jejunum (J, a) tissues of mid period (MP, 34 weeks), magnum tissue of early and mid period (J,b,c, 26 & 34 weeks). C- Control, T1-Treatment 1(0.3ppm Organic selenium enriched yeast), T2-Treatment2(0.6ppm Organic selenium enriched yeast). * *P<0.01, ***P<0.001

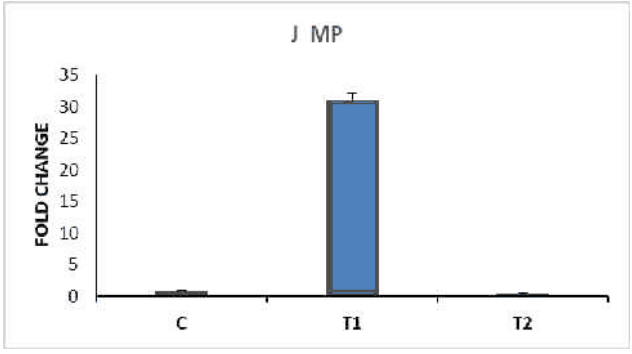


4a

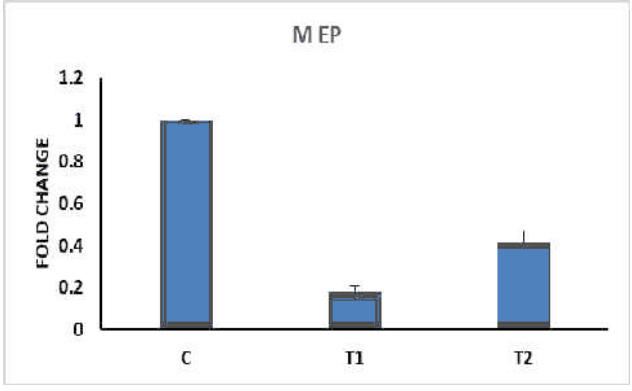


4b

Fig 4 a& b- Fold change expression of LAT 4 gene in jejunum (J, a) tissues of early (EP, 26 weeks) and mid period (MP, 34 weeks, C- Control, T1-Treatment 1(0.3ppm Organic selenium enriched yeast), T2-Treatment2(0.6ppm Organic selenium enriched yeast). * P<0.05.



5a



5b

Fig 5 a& b- Fold change expression of GHLR gene in jejunum (J, a) tissues of mid (MP, 34 weeks) and early period (EP, 26 weeks) C- Control, T1-Treatment 1(0.3ppm Organic selenium enriched yeast), T2-Treatment2(0.6ppm Organic selenium enriched yeast). * *P<0.01, ***P<0.001

Table 2. Effect of treatment with organic selenium on histomorphology of jejunum

EP	Villus height(um)	Crypt depth (um)	MP	Villus height (um)	Crypt depth (um)
C	865.76±100	79.14±10	C	962.38±120	400±30
T1 (0.3ppm)	1254**±89	109.45**±5	T1 (0.3ppm)	1387**±95	538***±60
T2 (0.6ppm)	1039.2**±105	103**±5.8	T2 (0.6ppm)	1500**±100	450**±50

Values are represented as Mean±SD. Early (EP, 24-28 weeks) and mid laying period (MP, 32-36 weeks). * P<0.05, ** P<0.01, ***P<0.001.

It can be concluded from this study that modulation of hormone levels, gene expression of amino acid transporters and hormone receptors of jejunum and magnum tissue and beneficial effect on histomorphology of jejunum might have contributed for significant increase in egg production.

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

A Feeding trial was conducted in the Moringa farm with the objective to evaluate different combinations of Moringa Leaf powder with non-traditional feed base to reduce the cost of standard feeding in poultry. Besides one control group, there were three treatment groups. Each group had 17 birds and had two replicates each. For the control group feed was made available ad lib and treatment group (T1) was offered 65g feed and 4g earthworms per bird per day, the treatment group (T2) was offered 65g feed, 4g earthworms per bird per along with 7g moringa dry leaves powder per bird per day and the last treatment group (T3) was offered 65g feed, 4g earthworms per bird per along with 7g moringa dry leaves powder and 30g broken rice per bird per day. The parameters recorded were body weight on 20th, 22nd and 24th week age of the birds. The body weight (g) was found to be 1439.97±23.67, 1459.67±30.89, 1420.82±25.08 and 1241.88±34.49 in T1, T2, T3 and Control groups, respectively at 20 weeks of age. At 22 weeks of age, the body weight was recorded as 1469.02±32.00, 1546.82±30.58, 1469.35±32.63 and 1441.11±31.24 in T1, T2, T3 and Control groups, respectively. At 24 weeks of age, the body weight was recorded as 1615.41±42.84, 1612.97±41.38, 1609.41±37.92 and 1457.88±43.83 in T1, T2, T3 and Control groups, respectively. The trial was abruptly terminated due to mortality of all the birds. Egg production was recorded in birds on 24th week of age. The average egg production was 6.11 in T1, 6.15 in T2, 8.44 in T3 and 5.83 in Control group.

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

The objective of the project is to conserve indigenous chicken breeds of our country by cryopreserving the primordial germ cells (PGC). During this period PGCs of Aravali and Daothigir breeds of chicken were cryopreserved.

HEALTH

Disease Monitoring, Surveillance and Control

Major diseases recorded during the period under report were septicemia, enteritis, egg-peritonitis, Newcastle disease, laryngotracheitis and aspergillosis. A total of 2851 vaginal/cloacal swabs collected from 8 pure line populations were screened for ALV by Ag ELISA. The overall ALV positive percentage was 14.49%. Positive birds were culled and ALV negative birds were retained for regeneration. The PCR analysis of 84 tumour samples revealed presence of ALV-A in 17 cases. As a part of development of ALV-AC ELISA, p27 gene was amplified and sequenced for cloning and expression of p27 protein.

Table 1. Prevalance of Avian leucosis based on ALV group specific antigen ELISA

Chicken Line	No Total	No Positive	% Positive
PD-3	520	30	5.77
IWI	204	25	12.25
IWK	244	63	25.81
IWH	254	84	33.10
GML	460	16	2.88
RC	241	25	10.37
LC	234	136	58.11
PD-2	694	34	4.90
Total	**2851**	**413**	**14.49**

Routine health care activities of all the chicken populations maintained at DPR were undertaken.

Prediction of Health Status on Poultry using Machine Learning Models

Created database of chicken farm especially from existing post-mortem (PM) reports for the years 2018-2019, 2019-2020, 2020-2021, 2021-2022, 2022-2023. Data on environmental variables of temperature, rainfall, humidity and wind speed were collected for the respective years mentioned above. Two years of data 2018-2019 and 2019-2020 were considered for model building. The shape of dataset is 24223 rows and 16 columns. Data cleaning was done. The data types were shown in Table 2. The data structuring was done for recorded health data and the environmental data. Univariate, bivariate and multivariate analysis were seen before developing models using python language. The PM diagnosis vs Strain, PM diagnosis vs Age_Sex are depicted in Figures 1 to 2. The PM diagnosis conditions with more than 5% were shown in Table 3.

Table 2. Different data types of the variables selected

Data types	
DATE	object
HOUSE NO	object
STRAIN	object
PM DIAGNOSIS	object
AGE_SEX	object
STRAIN_TYPE	object
District	object
Mandal	object
Rainfall (mm)	float64
Temp_min(C)	float64
Temp_max (C)	float64
Humididty_min (%)	float64
Humididty_max (%)	float64
Wind_speed_min (Kmph)	float64
Wind_speed_max (Kmph)	float64
dtype:object	

Table 3. PM conditions showing >5% distribution

PM Diagnosis (>5%)	Per Cent
Coccidiosis	27.753907
Laryngo Tracheitis	25.748801
Colibacillosis	15.82913
Chronic Respiratory Disease	9.135064
Enteritis	8.064014
Nephritis	7.254499
Septicaemia	6.214584

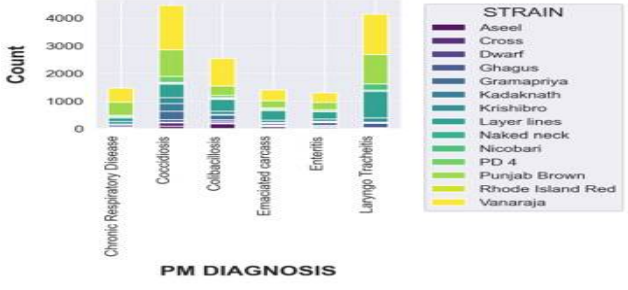


Fig. 1. PM diagnosis vs Strain

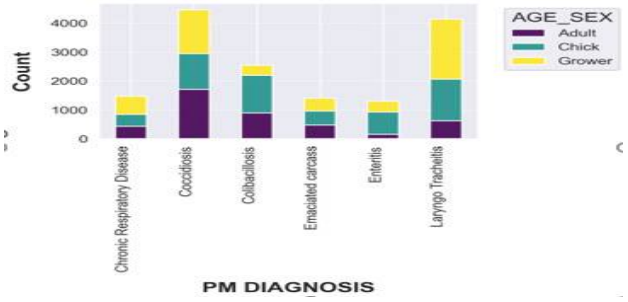


Fig. 2. PM diagnosis vs Age_Sex

Two different models of Random forest classifier, a ML-based algorithm and a basic Artificial Intelligence(AI) algorithm based model of Neural Networks for the data of 2018-2019, 2019-2020 were built with PM diagnosis as the target variable. Train test split of data was done. The training and test data were evaluated and the evaluation metrics of Random forest classifier for trained and test data are shown in Tables 4 and 5, and for neural networks are shown in Tables 6 and 7. The receiver operating characteristic (ROC) and area under curve (AUC) are depicted in Figures 3 and 4. The details of feature importance for predicting PM diagnosis is shown in Table 8. Comparison of these two models showed that Random Forest Classifier has better accuracy in predicting PM diagnostic condition as depicted in Figure 5. The interpretation of data based on these models showed that the environment variables of temperature followed by relative humidity are having greater feature importance in predicting the PM diagnosis.

Table 4. Evaluation metrics for trained data using Random Forest Classifier

	precision	recall	f1-score	support
Chronic Respiratory Disease	0.84	0.77	0.8	1140
Coccidiosis	0.99	0.98	0.98	3550
Colibacillosis	0.85	0.82	0.84	2023
Enteritis	0.83	0.72	0.77	1063
Laryngo tracheitis	0.9	0.98	0.94	3307
Nephritis	0.82	0.8	0.81	942
Septicaemia	0.83	0.85	0.84	822
Accuracy			0.9	12847
Macro avg	0.86	0.85	0.85	12847
Weighted avg	0.89	0.9	0.89	12847

Table 5. Evaluation metrics for test data using Random Forest Classifier

	Precision	Recall	F1-score	Support
Chronic Respiratory Disease	0.74	0.59	0.66	327
Coccidiosis	0.97	0.97	0.97	907
Colibacillosis	0.65	0.66	0.65	519
Enteritis	0.51	0.41	0.45	232
Laryngo tracheitis	0.85	0.95	0.9	828

	Precision	Recall	F1-score	Support
Nephritis	0.6	0.6	0.6	223
Septicaemia	0.59	0.61	0.6	176
Accuracy			0.79	3212
Macro avg	0.7	0.68	0.69	3212
Weighted avg	0.78	0.79	0.78	3212

Table 6. Evaluation metrics for trained data using Neural Network

	precision	recall	f1-score	support
Chronic Respiratory Disease	0.6	0.45	0.51	1140
Coccidiosis	0.95	0.95	0.95	3550
Colibacillosis	0.63	0.61	0.62	2023
Enteritis	0.54	0.44	0.48	1063
Laryngo tracheitis	0.79	0.96	0.86	3307
Nephritis	0.62	0.53	0.57	942
Septicaemia	0.58	0.6	0.59	822
Accuracy			0.76	12847
Macro avg	0.67	0.65	0.66	12847
Weighted avg	0.75	0.76	0.75	12847

Table 7. Evaluation metrics for test data using Neural Network

	precision	recall	f1-score	support
Chronic Respiratory Disease	0.59	0.4	0.48	327
Coccidiosis	0.94	0.94	0.94	907
Colibacillosis	0.56	0.56	0.56	519
Enteritis	0.48	0.36	0.36	232
Laryngo tracheitis	0.76	0.93	0.93	828
Nephritis	0.59	0.52	0.52	223
Septicaemia	0.44	0.46	0.46	176
Accuracy			0.72	3212
Macro avg	0.62	0.6	0.6	3212
Weighted avg	0.71	0.72	0.72	3212

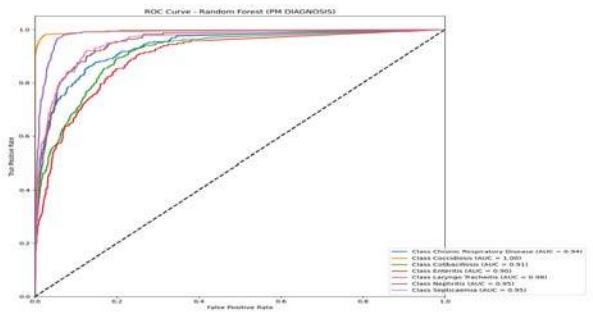


Fig. 3. ROC curve of Random Forest Classifier model

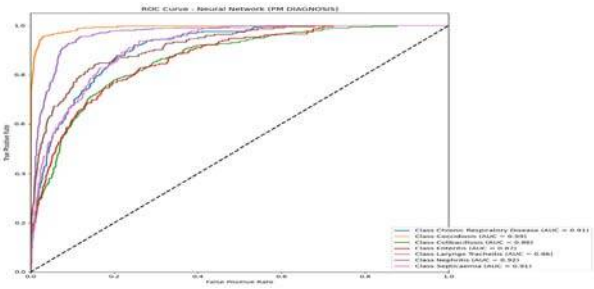


Fig. 4. ROC curve of Neural Network model

Table 8. Feature importance of different variables for predicting PM diagnosis

Feature importance for	
temp_max (C)	0.210
temp_min(C)	0.198
humididty_max (%)	0.105
humididty_min (%)	0.104
wind_speed_max (Kmph)	0.102
STRAIN	0.094
AGE_SEX	0.071
wind_speed_min (Kmph)	0.056
STRAIN_TYPE	0.045
Rainfall (mm)	0.014

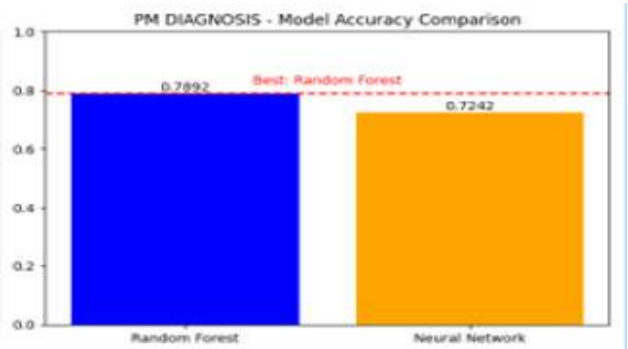


Fig. 5. Model accuracy comparison for PM diagnosis

All India Network Project on Antimicrobial Resistance in Fisheries and Livestock (AINP-AMRFL)

In this project surveillance of AMR in target microorganisms isolated from cattle, buffalo, sheep, goat, poultry and pig were done in few villages of Nalgonda district for the year 2024. Collected 64 milk samples from cattle and buffalo as well as 64 rectal swabs from cattle and buffalo. Milk samples were processed for isolating *Escherichia coli* and *Staphylococcus* species and rectal swabs for *Escherichia coli*. 56 rectal/cloacal swabs were collected from sheep, goat and poultry and processed for isolating *Escherichia coli*. Few pig nasal swabs were collected for *Staphylococcus* species isolation.

Analyzed 73 *E. coli* isolates and 44 *Staphylococcus aureus* isolates for antibiotic sensitivity (AST) using disk diffusion method. The AST pattern of *Escherichia coli* isolates are shown in Table 9 and they reveal that *Escherichia coli* isolates are resistant to ampicillin and cefoxitin and susceptible to chloramphenicol. The AST pattern of *Staphylococcus* sps are shown in Figure 6 and depicts that *Staphylococcus* species are resistant to penicillin and cefoxitin and susceptible to chloramphenicol, gentamicin and co-trimoxazole.

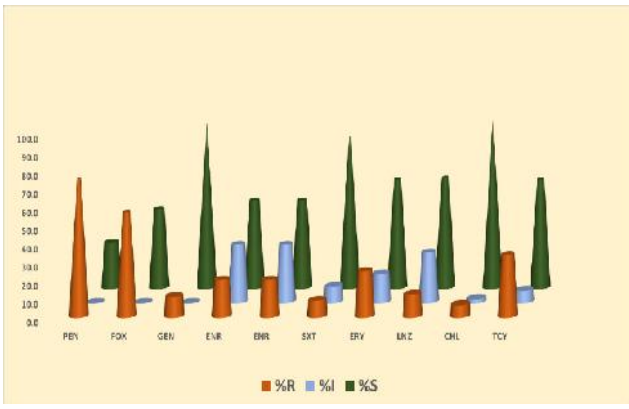


Fig. 6. AST pattern of Staphylococcus spp isolates

Table 9. AST pattern of *Escherichia coli* isolates

Antibiotic name	Antibiotic class	% Resistant	% Intermediate	% Susceptible
Ampicillin	Penicillins	47.9	8.2	43.8
Amoxyclav	Beta-lactam+Inhibitors	20.5	8.2	71.2
Ceftazidime	Cephems	5.5	19.2	75.3
Ceftriaxone	Cephems	24.7	6.8	68.5
Cefotaxime	Cephems	24.7	4.1	71.2
Cefoxitin	Cephems	42.5	1.4	56.2
Cefpodoxime	Cephems-Oral	28.8	11	60.3
Aztreonam	Monobactams	12.3	9.6	78.1
Imipenem	Penems	5.5	12.3	82.2
Amikacin	Aminoglycosides	8.2	23.3	68.5
Nalidixic acid	Quinolones	30.1	12.3	57.5
Enrofloxacin	Quinolones	11	9.6	79.5
Cotrimoxazole	Folate pathway inhibitors	21.9	1.4	76.7
Chloramphenicol	Phenicols	5.5	5.5	89
Tetracycline	Tetracyclines	27.4	2.7	69.9

Novel multi-serogroup and Outer membrane vesicles (OMVs) based nanovaccine against avian pathogenic E. Coli (APEC) for control of Colibacillosis in chicken

A total of 32 samples of avian pathogenic E. Coli (APEC) isolates were obtained from necropsy cases of air sacculitis, egg peritonitis and Colibacillosis from DPR pure line chicken. The isolates were confirmed by 16S rRNA PCR and virulence gene typing by checking for iroN, ompT, hlyF, iss and iutA genes by PCR. Three predominant serotypes will be selected from the isolates for further development of autogenous inactivated vaccine preparation.

The Current status of Marek's Disease in chicken flocks of India

The incidences and prevalence of Marek's disease from suspected MD outbreaks in different geographical regions were determined by collecting samples and identification by molecular method by PCR. The virulence type of MD positive samples was determined by sequencing and phylogenetic analysis of virulence associated genes namely MEQ, vIL-8, ICP4 and pp38. Overall incidence/prevalence of MD in suspected outbreaks is 33.5%.

EXTENSION

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

Project was ended on March 2024 with following significant findings: ICAR-DPR germplasm reached to 31.5% of districts and 75 Krishi Vignana Kendra in the country. There was significant correlation between budget expenditure and performance of DPR in terms of output indicators. During the study period of 25 years (1992-2017) there was average annual

shortfall of staff (scientific and technical) by 14.1%. In these years 37.84 million germplasm was supplied to different stakeholders (19.97% from DPR, 4.49% from PSP, 26.16% from AICRP and 49.33% from other organizations). In the past ten years (2010-20), a total of 38.71 million chicken were supplied to 3.73 lakh stakeholders of the country. On an average, 3.87 million chicken birds were supplied every year. Majority of the germplasm (75.12%) was taken by individual farmers and remaining by firms/ organizations. A total of 430 research articles and 962 other articles were published during 1992-2017 from the institute. There were 180 publications based on DPR germplasms published by different organizations in India. Similarly, there were 38 research theses having "Vanaraja" term in their titles and 138 theses had part of work on Vanaraja published by different organizations in the country. Average Annual Growth Rate (AAGR) and Compounded Annual Growth Rate (CAGR) of revenue receipt during the period were 16.75 and 13.92%, respectively. Positive and significant correlation (98%) between budget receipt and revenue generation during the study period of 25 years was noticed. Growth rate of revenue receipt was always higher by 2 to 4% than the incremental growth in budget allocation. DPR contribution in backyard improved fowl was 7.82% in 2019. The annual contribution was about Rs. 2.056 billion in last 10 years (2010-20. The successful propagation and adaptation of the backyard poultry technologies across the country has led to the significant increase in the native poultry population.

Economic evaluation of rural poultry farming in different regions of India

Under the project interview scheduled was developed to study the rural poultry production system in different regions of the country, to assess the rural poultry value chain prevalent in different regions in the country and to evaluate the poultry production economics and viability. Interview scheduled was tested in field situation and final scheduled developed for the study. Data was collected from different stakeholders from Warangal and Adilabad district of Telangana. All respondent from Adilabad were backyard farmers whereas in Warangal, there were all types of the respondents like broiler farmers, layer farmers and backyard farmers. Flock size among the respondents were 20-50 reared under semi-intensive method. Cost of the production per bird was estimated Rs. 326 (Rs 308 variable cost and Rs 18 fixed cost). Return per bird was estimated Rs 771.5 and Net return per bird was found Rs. 445.5.

Regional Station, Bhubaneswar

GENETICS AND BREEDING

Maintenance of Kuzi duck and evaluation of its crossbreds

During the year S4 generation Kuzi was evaluated up to 72 weeks of age. Conservation and hatching of none pedigree ducklings of S5 generation completed along with their selection and evaluation in respect to different parameters up to 40 weeks of age. Besides this DK and KD (two promising two-way cross) were evaluated in the farm up to 60 weeks of age in respect to different traits. These two crossbreds were supplied to the tribal farmers under TSP for their evaluation in the field and the data up to 40 weeks of age were collected. Further, production and evaluation of DK and KD crossbreds for 3rd generation continued both at farm and field and the birds are in the growing stage.

The egg production of S4 generation Kuzi from 40 to 52 weeks and 52 to 72 weeks of age were 62.13±1.99 (replicate 9 and no of female 330) and 102.15±1.88 eggs (R=3, birds 153), respectively. The combined egg production up to 72 weeks of age were 252.22 eggs. The average body weight of female at 72 week of age was 1563±12 g (N=153). Corresponding body weight of male at 72 weeks of age was 1751±52 g (N=11). The egg weight at 65 and 72 weeks of age were 76.32±0.47 (N=149) and 76.68±0.54 g (N=105),

respectively. Survivability from 40 to 72 weeks of age was 97.71%.

In S5 generation total ducklings kept at farm was 765 numbers and the fertility% was 57.42 and hatchability% and total egg set and fertile egg set basis were 43.84 and 76.35%, respectively. Corresponding fertility and hatchability % in S4 generation were 74.05, 64.42, 86.99%, respectively. Reproductive parameters declined in S5 compared to S4 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 along with growing period body weight in male and female up to 12 weeks of age are presented in Table 1. The 8th week body weight which is the primary trait of selection was 648g in current generation. The body weight reduced significantly in the present generation. The early laying period body weight in male and female are presented in Fig 1. The 20 week body weight in female was 1488±7.84 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 less days to reached the production level of 50% and 80% except age at first egg of the flock. The egg production up to 40 weeks of age was 106.58±1.80 eggs compared to 90.94±2.02 eggs in S4 generation and increased by 15.64 eggs in this generation. Duck day egg production from 40 to 47 weeks of age was 43.23±0.62 eggs. However due to scaricity of feed from 47 to 52 weeks of age the duck day egg production was low and only 16.93±1.70 eggs produced per bird. Thus the egg production up to 51 weeks of age in S5 generation was 166.74 eggs. Replicate used for egg production data up to 40 weeks was 14 numbers and from 40 to 52 weeks of age 20 replicates. The egg weight at 40 weeks of age was 73.73±0.44 g and increased by 1.6 g compared to last generation. The egg weights at different weeks of age of S5 are presented in fig 3. Numbers of eggs used for recording egg weight at different weeks of age were 100 eggs except at 20 weeks in which 49 eggs weight were recorded. Numbers of females kept for the egg production record was 279 numbers. The egg quality parameters measured at 40 weeks of age are presented in Table 2. Adult conformation traits and body parts colour in male and female are presented in table 3, 4 and 5. The mortality % from 0-8, 8-20, and 20-40 weeks of age was 26.66 (feed scarcity), 3.10 and 0.83%, respectively.

Flock photographs of Kuzi having different plumage colour pattern are given from Photo 1 to 5.

During the year Kuzi X Khaki Campbell (DK) and Khaki Campbell X Kuzi (KD) crosses were hatched and evaluated up to 60 weeks of age. The reproductive performance of these two crosses and their pure breed (Kuzi and Khaki Campbell) are presented in fig. 4. The reproductive performances of crosses were better than purebreds. It is to mention here that the data of Kuzi and Khaki Campbell set for supply of germplasm during the period were taken for comparison. The growth performances of KD and DK up to 20 weeks of age in different hatches were summarized in Table-6, for different hatches. Due to scarcity of feed during the growing period the body weights varies in different hatches and in both the crosses. Age at different production percentage of DK and KD are presented in Fig. 5. DK recorded production percentage at significantly ($P<0.05$) earlier age than the KD. The comparative duck day egg productions at different period in DK and KD are presented in Fig 6. Significant difference between the genetic groups was found for the egg production number up to 52 weeks of age only. DK egg production was better that KD at different weeks of age. The egg weights in DK and KD at different weeks of age are presented in Fig 7 and the egg weight was increased as the age

of measurement increases in both the crosses and KD recorded numerically higher weight at more numbers of age at measurement than DK. The egg quality recorded at 30, 40, 50 and 60 weeks of age are presented in Table 7. Mortality% from 0-8, 8-16, 16-20, 20-40 and 40 to 60 weeks of age in DK and KD were, 3.84, 0.45; 3.91,0.45; 0.00,0.04; 2.36,1.19 and 1.86, 0.75%, respectively. Mortality% was comparatively more in DK than KD. The results revealed that for egg production DK is performing better however for other traits KD is performing better. The photographs of DK and KD during laying period are given from photo 6 to 11. During the period from the project bird ducklings were also supplied to the farmers for duck farming.

Besides the above DK and KD ducklings were distributed to the farmers under TSP and a total of 1500 ducklings were supplied during this period. Though it is difficult to collect data from the field efforts were made to collect data whatever possible. The sample body weight at 12 week of age in KD was 1394±47 and 1207±36 g, in male and female respectively. The body weight at 38 weeks of age in DK male and female were 1422±40 and 1345±34 g, respectively. Corresponding body weight in KD was 1569±50 and 1400±34 g. The egg production up to 40 weeks of age in DK and KD were 83.41±4.73 and 48.53±2.11 egg, respectively. The age at first egg of the flock in DK and KD were 21.20 and 28.36 weeks of age, respectively. The wide variation between DK and KD may be due to different location of the distribution areas and availability of feed. However, DK is producing more egg than the KD in the field. The egg weigh at 30 weeks of age in DK and KD were 56.09±0.70 and 54.42±0.43 g, respectively. Second generation of evaluation of DK and KD both in farm and field with larger numbers of ducklings were initiated and the birds are completing 20 weeks of age and the data are being collected.

Table 1. Juvenile body weights in S5 generation of Kuzi.

Traits	Values
Day old BW (g)	44±0.14
2wk BW (g)	151±1.63
4 wk BW (g)	373±4.72
6 wk BW (g)	515±6.24
8 wk BW (g)	648±7.34
10 wk BW (g)	755±11.60 (M) 758 ±11.41 (F)
12 wk BW (g)	1452±11.46 (M) 1271±8.34 (F)

In first column BW=Body weight, wk=week; in second column M=Male and F=Female.

Table 2. Egg quality in Kuzi ducks at 40 weeks of age in S5 generation.

Parameters	Values (n=60)
Egg weight (g)	73.45±0.63
Shape index	77.26±0.35
Albumen index	0.1429±0.003
Yolk index	0.44±0.002
Yolk colour	1.28±0.08
Shell thickness without membrane (mm)	0.3521±0.003
Haugh unit	89.12±0.51
Albumen%	56.74±0.31
Yolk%	33.89±0.28
Shell%	9.88±0.28

Table 3. Conformation traits of adult Kuzi ducks in S5 generation

Traits	Male (89)	Female (154)
Bill length (mm)	65.31	59.00±0.28
Bill width (mm)	27.16 ± 0.25	24.22±0.11
Head length (mm)	49.29 ±0.51	44.46±0.39
Head width (mm)	26.22 ±0.27	23.54±0.19
Shank length (mm)	66.92±0.37	62.97±0.16
Keel length (mm)	111.60±2.02	99.94±0.76
Neck length (inch)	6.09±0.07	5.74±0.03
Body length (inch)	12.16±0.11	11.63±0.05
Body circumference (inch)	12.05±0.12	11.67±0.07
Wing span (inch)	33.72±0.45	33.54±0.17

Table 4. Adult Kuzi ducks body parts colour in percentage (%) in Male (N=89)

Body parts	Black	Brown	Yellow	White/white spotted	Black+ White	Brown+ Black	Brown+white
Shank	13.66	0.16	81.82	-	-	-	-
Bill	4.55	81.82	13.64	-	-	-	-
Feet	2.28	18.18	68.18	11.36	-	-	-
Head	72.27	11.36	-	11.36	-	-	-
Neck	-	75.00	-	11.36	13.64	-	-
Back	13.64	63.64	-	11.36	-	11.36	-
Wing	13.64	63.64	-	11.36	-	11.36	-
Belly	4.55	72.73	-	11.36	-	-	11.36

Table 5. Adult Kuzi ducks body parts colour in percentage (%) in Female (N=154)

Body parts	Black	Brown / orange	Yellow	White/white spotted	Black + White	Brown + Black	Brown + white
Shank	9.09	57.79	33.11	-	-	-	-
Bill	3.25	70.78	25.98	-	-	-	-
Feet	3.25	27.27	59.09	10.39	-	-	-
Head	13.64	75.97	-	10.39	-	-	-
Neck	-	80.52	-	10.39	9.09	-	-
Back	9.09	4.55	-	10.39		75.97	-
Wing	9.09	4.55	-	10.39	-	75.97	-
Belly	7.14	6.49	-	10.39	-	-	75.97

Table 6. Body weight (g) of different hatches of DK and KD up to 20 weeks of age.

Body weight age	DK H1	DK H2	DK H3	KDH1	KDH2
Day old (SR)	31.35±0.30 (164)	34.63±0.24 (233)	35.31±0.18 (233)	39.77±0.19 (250)	-
2 wk (SR)	270.65±3.57 (163)	262.48±2.87 (233)	212.81±2.54 (232)	164.00±1.33 (250)	243.47±2.49 (268)
4 wk (SR)	809±6.57 (162)	703±6.28 (233)	674±6.60 (233)	662±4.33 (250)	-
6 wk (SR)	1116±8.00 (161)	898±8.18 (230)	802±9.99 (223)	1055±6.21 (250)	1076±8 (249)
8 wk (SR)	1363±14 (161)	1053±13 (229)	985±15 (213)	1226±7 (250)	1090±15 (169) F
10 wk (F)	1309±14 (71)	1031±11 (110)	995±21 (94)	1321±10 (136)	1279±15 (131)
12 wk (F)	1279±13 (70)	1091±11 (107)	1161±11 (91)	1195±10 (136)	892±12(124)
16 wk (F)	1259±11 (70)	1138±11 (103)	1259±12 (91)	1341±10 (134)	1070±17 (116)
20 wk (F)	1469±15 (70)	1389±11 (102)	1390±14 (91)	1507±10 (134)	1483±10 (116)

Wk=week, F=Female, SR=straight run, figures in parenthesis are numbers of observation.

Table 7. Egg quality at different weeks of age in DK and KD under intensive system of rearing (N=60 eggs in each cross)

Parameters	DK	KD	DK	KD	DK	KD	DK	KD
Age	30 wk	30 wk	40 wk	40 wk	50 wk	50 wk	60 wk	60 wk
Egg weight (g)	64.03±0.56	65.95±0.67	65.66±0.04	69.40±0.61	69.18±0.68	71.98±0.88	74.02±0.80	74.81±0.53
Shape index	74.05±0.98	74.83±0.41	74.20±0.34	75.11±0.33	75.11±0.61	75.63±0.43	73.21±0.53	74.24±0.44
Albumen index	0.13±0.00	0.16±0.00	0.16±0.00	0.16±0.01	0.17±0.00	0.19±0.00	0.13±0.00	0.14±0.00
Yolk index	0.42±0.01	0.42±0.01	0.43±0.00	0.44±0.01	0.45±0.00	0.44±0.00	0.41±0.01	0.44±0.00
Yolk colour	1.77±0.10	2.05±0.13	1.38±0.06	1.18±0.05	1.20±0.05	1.18±0.05	1.17±0.07	1.22±0.05
Albumen%	56.54±0.44	58.54±0.27	56.54±0.31	56.74±0.23	54.43±0.37	56.39±0.45	58.13±0.36	56.78±0.34
Yolk%	33.11±0.42	31.63±0.28	33.04±0.26	33.10±0.22	33.99±0.33	32.96±0.33	32.75±0.30	33.78±0.32
Shell%	10.35±0.10	9.83±0.09	10.42±0.15	10.16±0.13	11.58±0.14	10.66±0.23	9.12±0.11	9.43±0.12
ST(mm) with mem.	0.49±0.00	0.51±0.00	0.40±0.00	0.37±0.01	0.44±0.00	0.43±0.00	0.44±0.01	0.44±0.00
ST(mm) without mem.	0.31±0.00	0.34±0.00	0.31±0.00	0.29±0.00	0.35±0.00	0.33±0.01	0.35±0.00	0.34±0.00
Haugh unit	83.94±1.02	93.24±0.84	92.27±1.04	92.37±1.09	96.16±0.48	97.44±0.53	84.89±1.15	87.26±0.92

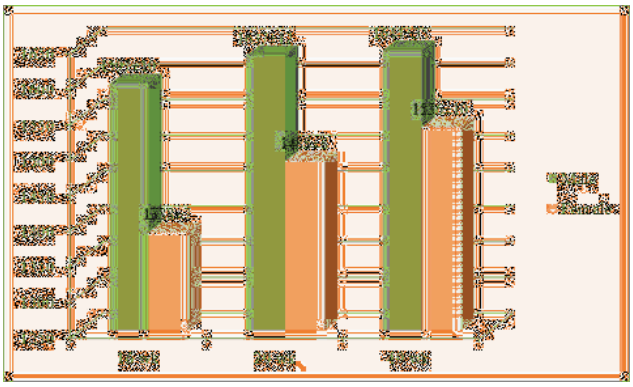


Fig. 1. Early laying period body weight (g) in S5 in Kuzi

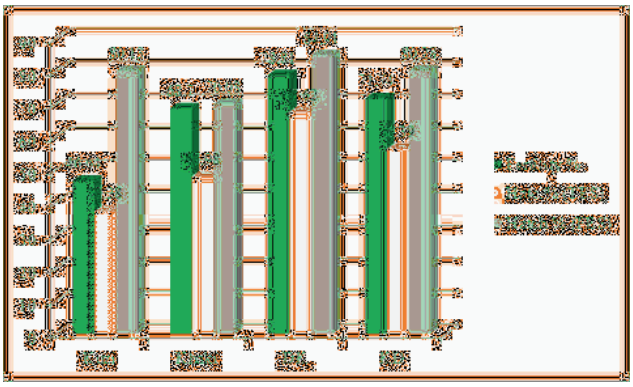


Fig. 4. Reproductive performance of DK and KD cross along with purebred Kuzi and Khaki

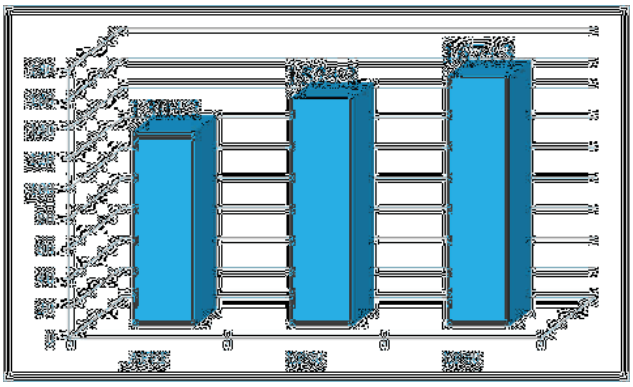


Fig.2. Age in days at different duck day production% and age at first egg of the flock (R=14)

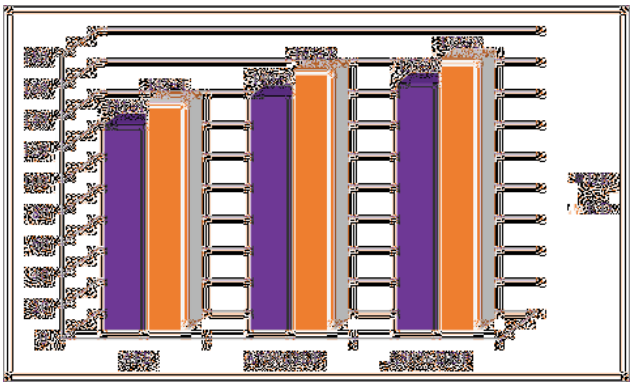


Fig. 5. Age in days at different production% in DK and KD (AFE=age at first egg of the flock, A50%DDP and A80% DDP indicates age at 50 and 80% duck day production)

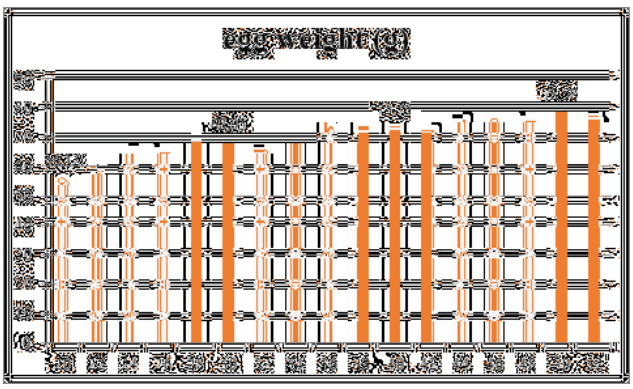


Fig. 3. Egg weights (g) at different weeks of age in S5 generation

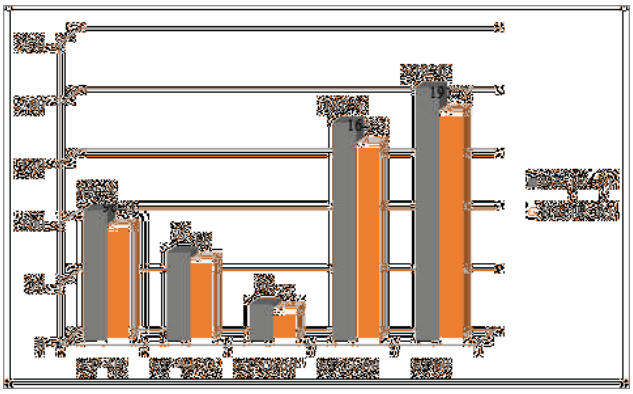


Fig. 6. Egg production at different weeks of age in DK and KD in the farm.

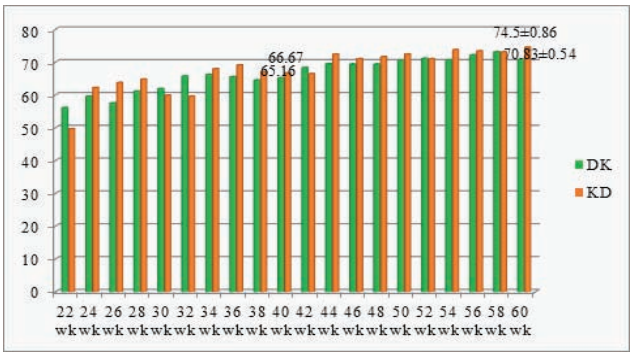


Fig. 7. Egg weight at different weeks of age in DK and KD under intensive system of rearing.

Photo 1. Kuzi multi colour

Photo 2. Kuzi multicolour

Photo 3. Kuzi male

Photo 4. DK flock.

Photo 5. KD flock

Photo 6. Data collection in the field

Photo 7. Ducks in the farmer's field

Photo 8. Duck egg collected by the farmer

Breeding for Development of Mycotoxin Tolerant Meat Type ducks

This study investigated the effects of in ovo injected Aflatoxin B1 (AFB1) and Ochratoxin A (OTA) on Pekin duck embryos and subsequent growth performance. As limited research exists on AFB1 and OTA pathology in ducks compared to chickens, we wanted to investigate their interactive effects. Owing to limitations on purified AFB1 and OTA culture's availability, we resorted to defined exposures of duck embryos, only through in Ovo injection route.

This experiment utilized 450 Pekin eggs distributed across seven treatments: AFB1 at three dosage levels (2, 4, and 6 ng/egg); OTA (50 ng/egg); combined OTA+AFB1; OTA+amino acids (Lysine and Methionine at 10 mg each/egg) and controls. OTA was administered on day 1 of incubation, while AFB1 and amino acids were injected on day 23. After hatching, ducklings were monitored for growth performance, mortality till 4 weeks of age and selected samples underwent gene expression analysis for candidate genes: IFNγ, IGF1, CYP450, and DNMT1.

The Results showed that AFB1 and OTA individually reduced hatchability by 15-32% compared to controls. The combined toxin group (OTA+AFB1) exhibited the highest early mortality rates (13.6% in week 1, 9.1% in week 2), with cumulative mortality reaching 32%. Growth performance was most severely impacted by OTA exposure, while feed efficiency was poorest in the high-dose AFB1 group (FCR>3.1). Gene expression analysis revealed significant alterations in detoxification pathways (CYP450) and epigenetic regulation (DNMT1) in mycotoxin-treated groups. Notably, Lysine and Methionine supplementation demonstrated ameliorative effects, evidenced by improved gene expression profiles for growth factors (IGF1) and immune response (IFNγ) compared to toxin-only treatments.

The study concluded that increasing AFB1 doses correlates with worsening growth depression and mortality, while combined effect of AFB1 and OTA act more extensively than either toxin alone. Although Lysine and Methionine supplementation could not completely prevent OTA-induced mortality, it effectively minimized morbidity and improved growth performance during post-natal periods. These findings warrant further investigation into optimal amino acid supplementation strategies to mitigate mycotoxicosis in duck production.

In-Ovo Potentiation of Ducks for enhanced production and Immunity using Micro-nutrient Combinations

This study conducted during the later part of the year assessed desirable impacts of two nano-selenium (Se) and a nano-composite (Cm: Nano-Se+ Nano-Iron in a composite form) on White Pekin ducklings over a period of 8 weeks, in terms of their support for growth and survival. Ten treatment groups were formed, consisting of either of these nano-compounds, which received treatments *in-ovo* and/or in-feed. The results showed that hatchability of the ducklings remained not much affected by the nano-treatment's supplementation, where as bulk of the nano materials remained non-toxic to duck embryos. The control group supplemented with in-feed nano-selenium (CtL+SeF) achieved the highest body weight (2348.4g), a 21.1% increase over the sham control (1939g), despite 7.1% mortality (Fig.8). The control group with in-feed nano-composite (CtL+CmF) showed the second-best weight gain (2241g, +15.6%) and, crucially with NIL (0%) mortality, similar to the in-ovo and in-feed nano-composite combination (CmO+CmF). In-feed supplementation generally surpassed in-ovo delivery for growth and overall uniformity of ducklings during the treatment period. The FCR of the nano-Se treatments were also non-significantly superior (2.6 versus 3.1) than both the control group of ducklings till 6 weeks of age, besides experiencing higher survival than control. While nano-selenium enhanced survival (e.g., SeO+SeF had only 5.9% mortality), the nano-composite, particularly

(CtL+CmF), provided an optimal balance of superior growth and 0% mortality, emerging as a promising supplementation strategy.

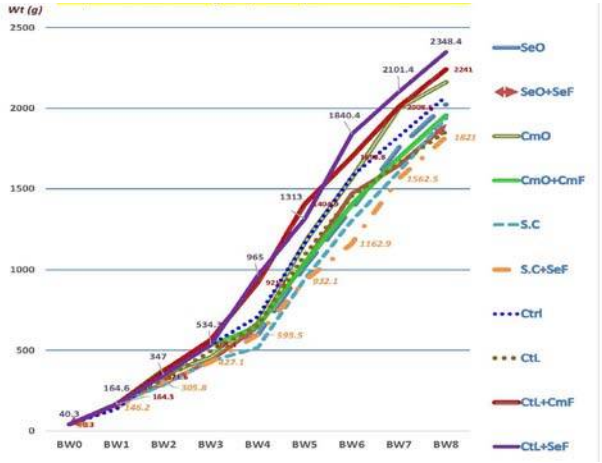


Fig. 8. Weekly live weight of duckling impacted by various nano treatments

Maintenance and Conservation of Chemballi Ducks

About 747 no of S_1 generation ducklings were hatched. The growth, egg production and egg quality data of S1 (first progeny generation) was recorded. Average body weight of day-old duckling was improved by +2.89 g over the S_0generation (40.85±0.21g in S2 vs 40.89 g in S_1 vs 37.97 g in S_0). The 8th week average body weight (pooled sex) was improved by 64.97 g over S0 generation (1302.18±2.67 g in S2 vs 1237.21 g in S0).The 12^{lth} week body weight male ducks was improved by + 17.36 g in S2 generation (1711.64±10.23 g in S_2 vs 1694.28±9.39 g in S_0) compared to S0 and +12.04 gram (1706.32±9.15 g in S_1 vs 1694.28±9.39 g in S_0); Age at first egg of the flock: S1=119.39±1.87 days vs 117.16±2.37 days in S0. Age at 50% duck housed egg production: S1 = 144.52 ± 1.69 days vs S0 = 139.00 ± 1.82 days. Duck day egg production up to 72 weeks: 173.45 eggs. Average egg weight: 66.96±1.15 (60 week) and at 72 week 68.72±2.29. The carcass quality parameters of S1 were studied and the Eviscerated Carcass was 68.77±0.23% of live weight in male and 67.19±0.17% in female. Total edible carcass as percentage of eviscerated carcass was 74.59±0.29in male and 73.53±0.22in female. Breast was the highest cut up part measuring 28.69±0.23% and 27.57±0.38% of eviscerated carcass weight in male and female, respectively followed by the back measuring 27.25±0.38% and 26.33±0.46% of eviscerated carcass weight in male and female, respectively. A comparative analysis of humoral and cell-mediated immunity of Kuttanad-Chemballi and Khaki Campbell ducks were carried out which exhibited non-significant differences among the two breeds.

NUTRITION

Standardization of Feed Restriction Schedule and Optimization of dietary Crude Protein level for White Pekin ducks.

An experiment was conducted to study the performance of White Pekin layer ducks on quantitative feed restriction. For this experiment 126 Nos (90 Female and 36 Male) of 20 weeks White Pekin layer ducks were selected. They were randomly divided into three groups having six replicates each with five females and two males in each replicate. All the birds were offered with diet containing 18% CP and 2650 k cal ME/kg feed. The group one birds were offered with 100% of recommended feed (250g), the Group-2 birds were offered 90% of recommendation (10% Reduction) i.e. 225g and the Group-3 birds were provided with 80% of recommendation (20% Reduction) i.e. 200g/d. All the birds were reared under deep litter system. Half or the measured quantity of feed was provided in the morning and half the feed in the evening. Clean drinking water was provided round the clock, Daily feed offered, residue left, egg production, egg weight and bi-weekly were recorded from 20 to 40 weeks of age. Metabolic trial was conducted at the end of 40 weeks of age. From this experiment it was observed that the duck house egg production from 20-40 weeks of age was 60 48+4.19, 60.29+4.29 and 60.09+4.40 in Gr-1, Gr-2 and Gr-3, respectively. However, no significant differences between the groups were observed, The egg quality

parameters were studied at 20th and 40th weeks of age. The Haugh unit values at 20th week were 89.92+1.27, 86.89+1.12 and 86.83+1.40 and at 20th weeks were 86.90+1.53, 84.12+1.59 and 84.70+1.72 in Gr-1, Gr-2 and Gr-3, respectively. The fertility percentage was 70.34+1.65, 70.28+2.08 and 71.06+1.86 in Gr-1, Gr-2 and Gr-3, respectively. No significant difference between the groups was observed. However, hatchability% on total egg set was significantly ($p<0.05$) higher in group-2 (59.60+6.13), than Group -1 (51.90+5.62) and group-3 (52.91+7.97). Similarly, the hatchability% on fertile egg set basis was significantly ($p<0.05$) in group-2 (76.98+2.71) than Group-2 (67.7+2.34) and Group-3 (71.01+2.14) (Fig. 9).

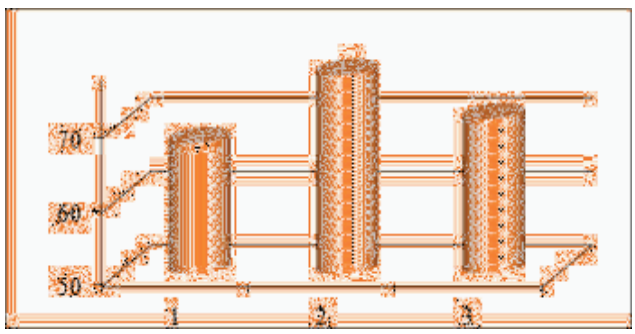


Fig. 9. Hatchability % on Fertile Egg Set Basis

Project: Production and utilization of earthworm based feed in White Pekin ducks

Effect of feeding earthworm meal as an alternative protein source replacing fish meal on the performance of white pekin ducks. An experiment was conducted to study the effect of replacing fish meal by earthworm meal on the performance of White Pekin meat type ducks. A total of 120 day-old White Pekin ducks (40-52g) were randomly distributed to 3 equal groups (4 deep litter pens per group, 10 ducklings per pen). These were reared following standard management practices for duration of 8 weeks. The earthworm meal (EWM) used in this study was prepared from *Eisenia foetida*. The earthworms were cultured using cow dung and mixture of cow dung and duck litter as biomass. The matured earthworms were killed by dipping them in warm water and dried in hot air oven (50-60^{0}C for 72 h), ground to powder form and mixed in the diet. The ducklings were assigned to one of the three treatments (Table 8) i.e. 1) Control without added EWM;2) diet with 1% EM replacing fish meal;3) diet with 2% EM replacing fish meal. The EWM contained 55.76% crude protein (Table 9). Body weight gain and FCR improved significantly ($P<0.05$) due to inclusion of earthworm meal(EWM) at a level of 1 and 2% by replacing fish meal in the control diet of White Pekin ducks at 6th and 8th week of age (Table 10). At 6th week the body weight gain was improved by 6.2% and 13.6% due to inclusion of 1% and 2%n EWM, respectively. At 8th week the body weight gain was improved by 4.1% and 9.1% due to inclusion of 1% and 2% EWM, respectively. At 6th week the FCR was improved by 3.8 and 8.8% due to inclusion of 1% and 2% EWM, respectively. At 8th week the FCR was improved by 1.6 and 6% due to inclusion of 1% and 2% EWM, respectively. The feed intake increased significantly ($P<0.05$) at both the levels of inclusion of EWM at both 6th and 8th week of age (Table 10). At 6th week the feed intake was increased by 2.1 and 3.7% due to inclusion of 1% and 2% EWM, respectively. At 8th week the feed intake was increased by 2.4 and 2.5% due to inclusion of 1% and 2% EWM, respectively. The feed cost to produce kg body weight gain was significantly ($P<0.05$) reduced due to inclusion of EWM in the diet at both the levels at 6th and 8th week of age (Table 10). At 6th week the feed cost for kg body weight gain was decreased by 4.6 and 10.3% due to inclusion of 1% and 2% EWM, respectively. At 8th week the feed cost for kg body weight gain was decreased by 2.4 and 7.3% due to inclusion of 1% and 2% EWM, respectively. It can be concluded that 2% earthworm can be included in the diet of White Pekin ducks replacing fish meal of the control diet for improved body weight gain, better feed conversion ratio and reduction in price (Rs) of feed for kg body weight gain.

Table 8. Composition of Experimental Diets

Ingredients	Diet 1	Diet 2	Diet 3
Wheat	60	60	60
Soybean meal	29	29	29
Fish meal	4.0	3.0	2.0
Earthworm meal	-	1.0	2.0
DORB	5.3	5.3	5.3
DCP	1.2	1.2	1.2
Shell grit	0.5	0.5	0.5
Tracemin mix	100g	100g	100g
L-Lysine HCl	50g	50g	50g
DL-Meth	50g	50g	50g
AB2D3K	20g	20g	20g
VitB-Complex	20g	20g	20g
VitE & Se	20g	20g	20g
Toxin Binder	100g	100g	100g
Choline Chloride	100g	100g	100g

Table 9. Chemical Composition of Fish meal, Earthworm meal and experimental diets

Analysed, %	T_1 (Control diet)	T_2 (1% EM)	T_3 (2% EM)	Fish Meal	Earthworm Meal
Crude Protein	22.54	22.86	23.05	50.32	55.76
Ether Extract	3.26	3.37	3.44	4.78	5.68
Crude Fibre	4.23	4.16	4.08	3.52	4.32
Total Ash	10.07	9.34	9.18	20.45	13.73
NFE	59.90	60.27	60.25	20.93	20.51
Calculated, %					
ME (Kcal/kg)	2900	2900	2900		
Lysine	1.00	1.00	1.00		
DL-Meth.	0.40	0.40	0.40		

Table 10. Effect of feeding earthworm meal by replacing fish meal on the performance of White Pekin ducks at 6th and 8th week of age

Treatments	Body weight gain (g)		Feed intake (g)		Feed Conversion Ratio		Feed cost (Rs) /Kg body wt. gain	
	6th Wk	8th Wk	6th Wk	8th Wk	6th Wk	8th Wk	6th Wk	8th Wk
T_1	1429^{c}	1966^{c}	3737^{c}	5960^{b}	2.615^{b}	3.032^{b}	102.73^{a}	119.10^{a}
T_2	1517^{b}	2046^{b}	3815^{b}	6104^{a}	2.515^{b}	2.984^{b}	97.99^{b}	116.26^{a}
T_3	1624^{a}	2144^{a}	3875^{a}	6109^{a}	2.386^{a}	2.850^{a}	92.20^{c}	110.43^{b}
SEM	25.21	23.33	18.96	25.20	0.03	0.03	1.39	1.20

Means bearing different superscripts within a column differ significantly ($P<0.05$)

Evaluation of Broken Rice and Maize Based Feed in Khaki Campbell Ducks under Intensive Rearing System

(i) Effect of feeding different levels of broken rice replacing wheat on the performance of White Pekin Ducks for meat production

An experiment was conducted to find out the effect of feeding different levels of broken rice replacing wheat on the performance of White Pekin ducks for meat production. White Pekin ducklings (day old; 240) were divided into three groups having four replicates per group and 20 ducklings per replicate. Three types of diets were prepared, without broken rice (BR-0) and with broken rice, replacing 25 (BR-25) and 50 (BR-50) percent wheat and were fed to the above three groups randomly for a period of eight weeks. The day old body weights (47.23-49.45) and the mean body weigh at 8th week (2195.53-2248.04, g) were similar among the groups. There was no significant difference in the daily feed intake at 8th week of age (142.97-159.76; g) among the groups. However, the cumulative feed intake up to 8 weeks of age in BR-25 group (6339.29, g) was similar to BR-0 group (6334.09, g) and both were higher than the BR-50 group (5901.58, g). The feed conversion ratio up to 8 weeks in BR-25 group (2.82) was similar to BR-0 group (2.86) and BR-50 group (2.69), which were different. There was no significant difference in the metabolisability (%) of various nutrients *viz.* dry matter (60.29-63.32), organic matter (62.44-64.80), crude protein (68.86-72.19), ether extract (77.26-82.04) and crude fibre (50.34-54.79). The nitrogen balance (3.24-3.68, g/d) was also similar among the groups. The cost (Rs.)/ kg live bird was significantly ($P<0.05$) lower in BR-50 group (100.37) than BR-0 group (110.39) and BR-25 Group (107.67), which were similar. There was no significant difference in different blood biochemical parameters *viz.* glucose, total protein, albumen, globulin, triglycerides, cholesterol, urea, uric acid and calcium among the groups. At eight weeks, the eviscerated weight as percentage of body weight (70.13-70.70) was similar among the groups. There were no significant differences in various body parts as percentage of eviscerated weight *viz.* neck (10.07-10.92), legs (21.57-21.91), breast (25.04-25.20), back (25.61-27.35) and wings (13.84-14.74) among the groups. The study concluded that wheat can be replaced by broken rice at 50% level in the diets of White Pekin ducks up to eight weeks of age for meat production.

(ii) Effect of feeding different levels of broken rice replacing wheat on the performance of Khaki Campbell ducks during starter phase

An experiment was conducted to find out the effect of feeding different levels of broken rice replacing wheat on the performance of Khaki Campbell ducks during starter phase. Khaki Campbell ducklings (day old; 240) were divided into three groups having four replicates per group and 20 ducklings per replicate. Three types of diets were prepared, without broken rice (BR-0) and with broken rice, replacing 25 (BR-25) and 50 (BR-50) percent wheat and were fed to the above three groups randomly for a period of eight weeks. The day old body weights (34.66-35.64) and the mean body weigh at 8th week (1058.93-1096.90, g) were similar among the groups. There was no significant difference in the daily feed intake at 8th week of age (88.43-92.58; g) and cumulative feed intake up to 8th week age (3522.50-3628.25; g) among the groups. The metabolisability (%) of dry matter, organic matter, crude protein, ether extract and crude fibre were similar among the groups. The feed conversion ratio up to 8 weeks (3.36-3.44) was similar among the groups. The cost (Rs.)/ kg live bird was significantly ($P<0.05$) lower in BR-50 group (137.84) than BR-0 group (146.91) and BR-25 Group (142.70), which were similar. The study concluded that wheat can be replaced by broken rice at 50% level in the diets of Khaki Campbell ducks up to eight weeks of age.

(iii) Effect of feeding different levels of broken rice replacing wheat on the performance of Khaki Campbell ducks during grower phase

An experiment was conducted to find out the effect of feeding different levels of broken rice replacing wheat on the performance of Khaki Campbell ducks during grower phase. Khaki Campbell ducks (9 weeks; 114) were divided into three groups having four replicates per group and 12 ducks per replicate. Three types of diets were prepared, without broken rice (BR-0) and with broken rice, replacing 25 (BR-25) and 50 (BR-50) percent wheat and were fed to the above three groups randomly for a period of 12 weeks. The body weight at 9th week (1191.40-1176.67; g) and 20th week (1418.77-1429.30; g) were similar among the groups. There was no significant difference in the daily feed intake at 20th week of age (101.37-104.45; g) and cumulative feed intake up to 20th week age (14204.50-14294.00; g) among the groups. During 9-20 weeks, the total feed cost (Rs.) in BR-50 group (287.11) was significantly ($P<0.05$) lower than the BR-0 group (305.03); however, both the groups were similar to BR-25 group (295.49). Similarly, up to 20 weeks, the total feed cost (Rs.) in BR-50 group (424.95) was significantly ($P<0.05$) lower than the BR-0 group (451.94); however, both the groups were similar to BR-25 group (438.20). The study concluded that wheat can be replaced by broken rice at 50% level in the diets of Khaki Campbell ducks during the grower phase (9-20 weeks).

POST HARVEST TECHNOLOGY

Formulation of Duck Meat Based Products

A new product "Duck Meat Popcorn" was developed with an aim to popularize the duck meat as ready to eat snack. The boneless duck meat was marinated with vinegar, turmeric powder, table salt, condiments, spices mix., salt, etc. for about 5-15 hours. Then marinated meat was cooked for about 15 minutes. The cooked meat was minced and to that spice mixture, chilli flakes, oregano and chicken egg beat was added. The mixture was rolled over corn flour and bread crumps to give a dice appearance. The product was fried using edible refined oil in a low to medium flame till crispy product was obtained. The salt and black pepper powder was sprinkled over the product before serving. The duck meat popcorn so developed was subjected to organoleptic evaluation by the expert sensory panel and adjudged "Good" (6.8 out of 8 in score chart) rating of acceptance by sensory panel (Table 11). The image of Duck meat popcorn (Fig. 10) is given below.

Fig. 10. Duck meat popcorn

Dressed duck carcass (8 wk old Pekin ducks)
↓
Harvested deboned meat
↓
Marinate with vinegar and, turmeric powder, table salt, condiments, spices mix., salt, etc.
↓
Marination (5, 10, 15hrs)
↓
Cooking (15 min.)
↓
Spices mixture, chicken egg beat, chilli flakes and oregano were added
↓
Rolled over corn flour and bread crumps giving a dice appearance
↓
Fried using edible refined oil in low to medium flame
(crispy product)
↓
Salt and black pepper powder were sprinkled over the product
(for better aroma and taste) ↓
Serve hot

Table 11. Organoleptic evaluation of duck meat popcorn

Process	Colour and appearance	Flavour	Binding	Texture	Juiciness	After Taste	Overall acceptability
Marination 5hrs, Cooking 15 minutes	4.23± 0.05	4.42±0.06	4.46±0.34	4.51±0.61	4.67±0.34	4.62±0.74	4.27±0.36
Marination 10hrs, Cooking 15 minutes	5.14±0.24	5.32±0.57	5.53±0.41	5.64±0.19	5.37±0.26	5.38±0.53	5.42±0.43
Marination 15hrs, Cooking 15 minutes	6.85±0.52	6.75±0.28	6.88±0.16	6.93±0.45	6.81±54	6.97±0.41	6.84±0.26

PHYSIOLOGY AND REPRODUCTION

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

In-order to encourage duck farming for commercial purpose, attempts were made to rear ducks in cages like chickens. A total of 300 day old Khaki Campbell ducklings were brooded and grown upto 6wks age under normal management practice after which 75 ducks were caged in 15 number of cages (5 ducks per cage) and 75 ducks were maintained in 3 pens (25 in each) with a similar floor space provision in cage and pen. The floor of the cage were fitted with plastic coated wire net (small whole) so that there was no injury to the web of the birds. Feed and water provision were made inside the cages. Further ducks in the pen were maintained with dry sand as litter material and standard feeding and watering practices. Initial body wt (g) at 6 wks age was 600.82±6.98g. Growth performance of ducks were presented up to 40 wks of age. It is observed that at 12th and 32nd week of age growth of birds were significantly ($P<0.05$) higher in cages which is indicative of better management in cages over floor (Table 12). Further, no mortality was observed in cages upto 40 wks of age where as mortality was up to 3 percent in the pens/floor between 6-32 wks of age. The egg production parameters recorded for both cage and floor management were presented in table 13.

Table 12. Growth performance of ducks (KC) in cage and floor management

Age (wk)	Sex	Body wt (g)			
		Cage		Floor	
		Mean	± S.E	Mean	± S.E
6 (initial B.wt)	both	600.82	6.98	600.82	6.98
8	both	836.36	13.12	830.28	13.79
12	both	1332.04*	11.36	1199.07	15.4
16	female	1343.65	12.48	1321.83	16.38
20	female	1301.84	8.72	1351.13	11.29
24	female	1320.41	14.58	1357.72	16.55
28	female	1339.21	13.82	1313.12	15.17
32	female	1452.2*	12.49	1363.01	13.07
40	female	1424.17	20.58	1427.64	14.43

Indicates significant difference ($p<0.05$) between the groups.

Table 13. Egg production performances of ducks (KC) in cage and floor management

Parameters		Egg production performances			
		Cage		Floor	
		Mean	± S.E	Mean	± S.E
Age at first egg (day)		145.33*	1.05	136.33	4.26
Egg prod upto 40wk age (nos)		53.34*	3.54	45.32	6.23
Age at 50% egg		165.00	4.58	229.33**	3.93
Egg wt (g)	24 wk	54.48	0.27	56.16	0.27
	28 wk	61.24	0.32	61.32	0.29
	32 wk	63.04*	0.37	61.26	0.40
	40 wk	63.58*	0.38	61.38	0.34

The age at first egg, egg production upto 40 weeks of age and egg weight at 32 and 40 weeks of age are significantly ($p<0.05$) higher in cage rearing where as age at 50 percent egg production in the flock is significantly ($p<0.01$) higher in floor management of birds. More egg production with higher weight in cage reared birds are indicative of better feeding management in cages than floor.

HEALTH

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

Effect of Thymol supplementation in Chambelli ducks

An experiment was conducted to evaluate the effect of thymol on growth parameters, FCR, haemato-biochemical as well as carcass characteristic of Chambeli ducks which were divided into four groups (T1- Control with no supplementation in diet, T2- Antibiotic treated, T3- Thymol @ 240 mg/kg of feed and T4 group with thymol addition @ 480 mg/kg of feed) and reared in the ICAR-DPR Bhubaneswar. Thymol addition @ 240 mg/kg of feed in T3 and as well as in T4 group with thymol addition @ 480 mg/kg showed significant increase in their body weight gain with Mean±SE of 165.70±1.77 and 225.86±4.75 respectively as observed in 8th week as compared to control and antibiotic treated group. The higher dose of thymol (T4: 480 mg/kg) had a more substantial impact on reducing FCR compared to the lower dose (T3: 240 mg/kg). Thymol supplementation resulted in notable improvements in Hb, PCV, RBC, and lymphocyte counts, while reducing heterophils and influencing TLC levels, indicating its potential positive impact on hematological health in ducks. Present study recorded that thymol supplementation significantly influenced BUN, uric acid, creatinine, triglyceride, and cholesterol levels in ducks, with higher doses (particularly-T3) showing notable improvements, especially in reducing triglyceride and cholesterol levels. Study on antibiotic sensitivity pattern for fecal E. coli was really encouraging with Colistin sulphate, Ampicilin, Cefotaxime, oxytetracycline and amoxiclav showing sensitive in T4 groups treated with thymol @ 480 mg/kg which was found resistant in control groups. Colistin sulphate was found resistant even in T2 (antibiotic treated groups) as well as in T3 groups with thymol@240mg/kg but

showing sensitivity to fecal E. coli in groups (T4) treated with higher doses of thymol indicative of its usefulness as a feed additive in lowering the pathogenic gut microbiota such as E. coli as observed in this study. The carcass quality evaluation showed that thymol supplementation, particularly at the higher dose of 480 mg/kg (T4), significantly improved body weight, heart weight, neck weight, thigh weight, and drumstick weight compared to the control group (T1) and the antibiotic group (T2). Proximate composition in thymol treated groups as evident withT4 (Thymol 480 mg/kg) showing the highest moisture level, suggesting a positive impact on meat quality by retaining more moisture, thus impacting a better juiciness, considered as a positive attribute of meat quality. Thymol supplementation, especially at higher concentrations, could improve the visual appeal and potentially the oxidative stability of duck meat. Thymol supplementation had a significant impact on pH, WHC, and TBARS values in duck meat. The SEM analysis reveals that thymol supplementation (480 mg/kg of feed) suggests potential impacts on meat quality attributes, such as texture and tenderness. FTIR analysis revealed that thymol supplementation at both 240 mg and 480 mg doses/kg of feed resulted in noticeable changes in the biochemical composition of duck meat tissues. Thymol supplementation at 240 mg/kg and 480 mg/kg showed more favorable outcomes in ileum histomorphometry compared to the antibiotic group and control. Enhanced villus height (534.66±1.76 µm), villus width (74.33±1.45 µm), crypt depth (71.33±0.88 µm) and an improved villus height-to-crypt depth ratio (7.49:1), especially in T4, underline the potential of thymol as a beneficial alternative to antibiotics, supporting healthier intestinal architecture and efficient nutrient absorption in ducks.

EXTENSION

i. Exhibition Stall on behalf of Regional Station at the "Agricultural Exhibition" in the three days workshop on "Technological Empowerment for SC Farm Women" to be organized at ICAR -CIWA, Bhubaneswar on 06-08 November, 2024.

ii. Participated and put up the Exhibition Stall on behalf of Regional Station on 17.02.2024 at the "Agricultural Exhibition" on 29th Foundation Day of ICAR-CIWA, Bhubaneswar.

iii. Participate and put up the Exhibition Stall on behalf of Regional Station from 16.02.2024 to 18.02.2024 for the "Matsya-PraneeSamavesh Odisha (MPSO) -2024" at Janata Maidan, Bhubaneswar.

iv. Participated in the "Exhibition of innovative Agricultural technologies" program in celebration of 37th foundation day of ICAR- Indian Institute of Water Management (ICAR-IIWM), Bhubaneswar on 12th May, 2024.

v. Participated in the exhibition at National Foundation Day NIFMD, Arugul, Bhubaneswar on 5th July, 2024.

Inter-institutional Collaborative project:

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

Like previous years, the adopted farmers under this programme were guided throughout the year for different

agricultural practices including backyard poultry and duck rearing. One training programme under capacity building was conducted on "Commercial Poultry production and Nutritional management of animals". As the critical input, the day old Vanaraja chicks (1500 nos) from CPDO, Bhubaneswar were supplied to 38 women farmers in five villages under operations (newly adopted). Their activities were monitored. The performances of birds were found satisfactory with least mortality in the villages. Besides the old farmers were continuing the practice with their own resources generated through previous year's profit.

Farmers training conducted in village Gopinathpur (Under Farmers FIRST programme)

Survey and application for Registration of Native Duck Breed: Kudu Duck of Mayurbhanj

A native duck breed of Mayurbhanj district of Odisha (Kudu Duck of Mayurbhanj) has been surveyed and data related to morphology, performance etc. was collected from more than 200 families. This breed shows following distinguished characteristic:

- White ring around neck is present in most of the male and female birds.
- Majority of the male and female ducks are having mosaic pattern plumage.
- More than 50% female and 35% males are having light brown plumage colour.
- More than 70% of the male and female ducks have orange shank and feet.
- Majority of the females showed broodiness.

Application form has been submitted to National Bureau of Animal Genetic Resources, for completing formalities for registration of native duck breed: Kudu duck of Mayurbhanj.

Characteristics of Kudu Ducks of Mayurbhanj of Odisha

The former Rulers of Mayurbhanj had possibly introduced this duck breed in this state. This breed is being reared for both meat and egg purposes since generations. There is no scientific study on this breed. Hence a survey work was carried out by the team of scientists from the Regional Station, ICAR-DPR in the Mayurbhanj district of Odisha. After collection of data (through visits and survey of different subdivisions /blocks/ panchayats and villages) the following information was compiled (Table 14).

Table 14. Characteristics of Kudu Ducks Physical Characteristics:

1. Plumage Colour	**Male**	**%**	**Female**	**%**
	Black	21.93	Black	11.11
	Light Brown	35.09	Light Brown	50.69
	Grey	19.30	Grey	20.14
	White	1.75	White	4.17
	Mixture of black, grey, brown and White	21.93	Mixture of black, grey, brown and white	13.89
Head	**Male**	**%**	**Female**	**%**
	Black	59.65	Black	13.89
	Light Brown	11.40	Light Brown	36.81
	Grey	7.02	Grey	21.53
	White	2.63	White	6.94
	Peacock green	3.51	Mixture of black, grey, brown and white	20.83
	Mixture of black, grey, brown and white	15.79		
Neck	**Male**	**%**	**Female**	**%**
	Black	5.26	Black	2.78
	Light Brown	14.91	Light Brown	24.31
	Grey	11.40	Grey	14.58
	Peacock green	6.14	Presence of White ring	58.33
	Presence of White ring	49.31		
2. Plumage Pattern	**Male**	**%**	**Female**	**%**
	Mosaic	88.60	Mosaic	87.50
	Solid	11.40	Solid	12.50
3. Bill Colour	**Male**	**%**	**Female**	**%**
	Black	3.51	Black	10.42
	Brown	1.75	Brown	9.03
	Grey	16.67	Grey	13.89
	Metallic green	41.23	Metallic green	15.97

	Orange	4.39	Orange	13.89
	Pink	8.77	Pink	14.58
	Yellow	23.68	Yellow	22.22
4. Shank Color	**Male**	%	**Female**	**%**
	Black	6.14	Black	6.25
	Brown	1.75	Brown	9.72
	Orange	78.95	Grey	6.25
	Pink	1.75	Orange	70.14
	Yellow	11.40	Pink	4.17
			Yellow	4.17
5. Feet/Web Colour	**Male**	%	**Female**	**%**
	Black	6.14	Black	6.25
	Brown	0.88	Brown	10.42
	Grey	4.86	Grey	6.25
	Orange	72.81	Orange	68.75
	Pink	3.51	Pink	4.17
	Yellow	10.53	Yellow	4.17

Body weights:

Body weight at	**Average**	**Range**	**N**
Hatching (g)	34.78±0.36	28.00-44.60	100
4 weeks (g)	411.0±12.10	290.0-532.0	100
8 weeks (g)	799.4±10.12	509.0-1007.0	100
12 weeks (g)	888.3±15.85	676.0-1078.0	100
6 months (kg)	1.087±0.018	0.725-1.217	100
8 months (kg)	1.147±0.005	1.050-1.300	100
12 months (kg) Adult – Male	1.292±0.017	0.850-1.944	150
Adult - Female	1.231±0.015	0.897-1.882	150

Egg production characteristics:

Traits	Average	Range	N
a) Age at first egg (days)	179.66±1.88	130-270	204
b) Annual egg production	148.48±1.59	90-220	204
c) Age at culling (days)	801.18±11.40	540-1080	204
d) Clutch size (days)	18.88±0.34		
e) Clutch interval (days)	23.20±0.58		
f) Laying cycle (months)	26.71±0.41		

3. TECHNOLOGIES ASSESSED AND TRANSFERRED

Exposure Visit

Exposure visit for farmers, students, faculties and other stakeholders were organed to create awareness about the institute technologies. About 1196 stakeholders visited during 2024 at ICAR-DPR from different parts of the country as well as from other countries.

Exposure Visit of Farmers from Chhattisgarh to the Regional Station

Farmers from Chhattisgarh State under the Krushak Kaushal Vikas Yojna, of Pashudhan Vikas Vivag, Chhattisgarh visited the Regional Station and gained knowledge regarding different duck breeds, different aspects of scientific duck farming, backyard duck farming.

Germplasm distribution during 2024

S.No.	Particulars	Numbers
A.	**Hatching Eggs**	
	Krishibro	432
	Vanaraja	17,916
	Colored Gramapriya	3,307
	Srinidhi	2,122
	Aseel	233
	Vanashree (PD-4)	389
	Ghagus	155
	Kadaknath	2,103
	Nicobari	113
	Janapriya	
	Layer	16
	Layer Control (CT)	
	Broiler Control (CB)	
	Embryonated eggs supply	6,677
	Total	**33,463**
B.	**Day Old Chicks**	
1	**Commercial Day Old Chicks Supply**	
	Krishibro	563
	Vanaraja	34,709
	Colored Gramapriya	12,984
	Srinidhi	4,033
	Aseel	2,688
	Vanashree (PD-4)	3,763
	Ghagus	950
	Kadaknath	7,607
	Nicobari	1,852
	Janapriya	0
	Aslibro	262
	Layer	0
	Total	**69,411**
2	**Parent Day Old Chicks Supply**	
	Krishibro	0
	Vanaraja	7,687
	Gramapriya	0
	Srinidhi	1,255
	Total	**8,942**
C	**Total Grownup Birds supply**	**8,694**
	Grand Total	**1,20,510**
D	**Different pure line & commercial for Farm**	**59,036**
E	**Total Feed supply in kg**	332
F	**Revenue Generated (Rs.)**	
1	Germplasm Supply (Hatchery)	1,04,35,940
2	TOT Supply (Sales)	71,25,293
3	Refunds	10,84,425
G	**Total Revenue Generated**	**1,64,76,808**

Germplasm supply and revenue generation:

A total of 84,436 duck germplasm was supplied to farmers, Govt and Private organization during January to December, 2024 as per the details given below. During this period a total revenue of Rs 23, 39, 445/- was generated through sale of farm produce.

Germplasm supply (number) from Regional Station, ICAR-DPR, Bhubaneswar during the year 2024							
Variety of Duck	**Kuzi**	**Khaki**	**White Pekin**	**Chemballi**	**Cross Breed**	**Regeneration prog**	**Total**
Jan - Dec., 2024	12,533	22,330	7,229	14,159	23,327	4,858	84,436

Development Action Plan for Scheduled Caste (DAPSC)

The DAPSC programme of the Directorate is aimed at improving the livelihood and nutritional security of SC families through enhanced egg and meat production by facilitating backyard poultry farming. During this year, DAPSC programme was implemented in four states (Orissa, Telangana, Kerala, and Tamil Nadu) directly and also through 9 AICRP centres (Bangalore, Jabalpur, Anand, Ludhiana, Kerala, Warangal, Tirupati, Hosur and Patna). During the year 2024, 25 training programmes were conducted on backyard poultry benefiting 1040 farmers. Twenty one awareness camps were also organised for 71327 farmers. During this period, a total of 26140 chicks, 750 night shelters, 822 no of feeder/ drinker, 1496 doses of medicines, 10660kg feed, 2993 no of literature, were distributed among the farmer families to enable them to start back yard poultry farming. Ten animal health camps were also organised benefitting 505 livestock farmers.

Distribution of night shelter at Kondampet, Telangana

Distribution of night shelters to SC beneficiaries by Sh C. Gopa Kumar, Deputy Speaker, Kerala Legislative Assembly under DAPSC Scheme of the Directorate.

Sh C. Gopa Kumar, Deputy Speaker, Kerala Legislative Assembly explaining the benefits of backyard poultry farming to SC beneficiaries

Training programme-cum-input distribution programme at Village- Haradakhol, Janmura, Sasamura and Bagbar, Dist: Sonepur, Odisha

Regional Station, ICAR-Directorate of Poultry Research, Bhubaneswar organised a Training program-cum-Duck distribution programme at KVK, Subranapur on 20-08-2024. Ducklings (430 nos.) along with feed, feeder, waterer, were distributed among 50 selected schedule-caste beneficiaries from villages Haradakhol, Janmura, Sasamura and Bagbar under SCSP programme.

Training -cum-awareness programme about backyard duck rearing at Village- Lakarma, Dist: Sonepur, Odisha

On 21.8.2024, Regional Station, ICAR-DPR organized a field training programme on "Low cost based modern duck farming for profitable duck production" in village-Lakarma, Subdivision and District – Subarnapur (Odisha) under SCSP programme. Nearly 55 women and men SC farmers participated in this programme.

Training programme-cum-input distribution programme at Village: Sansamura, Bagbar, Kumarkeli, Haradkhol, Paikapali, Panchmahala , Dist: Sonepur, Odisha

Regional Station, ICAR-Directorate of Poultry Research, Bhubaneswar organised a Training program-cum-Duck input distribution programme at KVK, Subranapur on 11-09-2024. Night shelter (68 nos.) were distributed among 68 selected schedule-caste beneficiaries from villages Sansamura, Bagbar, Kumarkeli, Haradkhol, Paikapali, Panchmahala under SCSP programme.

Training programme-cum-input distribution programme at Village- Badajhinki,Menda, Tileimal, Mahulpali , Dist: Sonepur, Odisha

Regional Station, ICAR-Directorate of Poultry Research, Bhubaneswar organised a Training program-cum-Duck input distribution programme at KVK, Subranapur on 12-09-2024. Night shelter (104 nos.) were distributed among 104 selected schedule-caste beneficiaries from villages Badajhinki,Menda, Tileimal, Mahulpali under SCSP programme.

Training programme-cum-input distribution programme at Village: Lakarma, Bhaludunguri, Bankabija Dist: Sonepur, Odisha

Regional Station, ICAR-Directorate of Poultry Research, Bhubaneswar organised a Training program-cum-Duck input distribution programme at KVK, Subranapur on 17-12-2024. Night shelter (104 nos.) were distributed

among 78 selected schedule-caste beneficiaries from villages Lakarma, Bhaludunguri,Bankabija under SCSP programme.

Developmental Action Plan for Schedule Tribe (DAPST)

This Directorate is working actively with tribal farmers under Developmental action plant for schedule tribe (DAPST), mainly imparting training and giving inputs related to strengthen backyard poultry production system. The activities mainly carried out in Adilabad Dist of Telangana, Kalaburgi Dist of Karnataka, Alluri Sitharama Raju (Erstwhile Vizag District) of Andhra Pradesh and Washim District of Maharashtra. A total of 250 farmers from Kallurguda, Paspulla, Venunagar and Laxmipur were trained for Backyard Poultry Production and Management at their villages in Adilabad Dist of Telangana. About 3600 chicks were distributed to tribal farmers of Adilabad Dist. A total of 750 Night Shelters were distributed to tribal farmers of Kalaburgi of Karnataka, Washim of Maharashtra, ASR Dist of AP and Adilabad of Telangana. The predation and housing are the major problem in backyard poultry production success among resource poor tribal communities. This Directorate has fabricated the Night Shelter, which is being distributed by many Institute under various schemes and being extensively used by farmers for up keeping of backyard poultry production.

Distribution of Night shelters at Paspulla Village, Pembi, Adilabad

Distribution of Night shelters at Kallurguda Village, Utnoor, Adilabad

Imparting Training to the tribal farmers of Kalaburgi, Karnataka

Distribution of night shelters to tribal farmers of Kalaburgi, Karnataka

The DAPST programme in the regional station aimed to improve the livelihood and nutritional security of tribal families through backyard duck rearing and to enhance duck egg and meat production. During the year awareness training programme was conducted and crossbred ducklings along with feed as well as feeder and waterer were distributed at different tribals village of Kandhamal and Keonjhar districts.

Inputs distribution programme at Alamai village of Phulbani block, Kandhamala district

On 8th January, 2024 Regional station, ICAR-DPR, Bhubaneswar conducted inputs distribution under DAPST programme. The inputs distribution programme was attended and graced by Chief District Veterinary officer, of Kandhamala Dr. S. K. Patel, Head of the Regional Station Dr. S.K. Bhanja, Dr. S. K. Sahoo, principal scientist of RS, ICAR-DPR, Bhubaneswar and Dr A K Dora, DD, DVH, Phulbani. Each tribal farmer was given inputs of 20 ducklings of 3 to 4 weeks old and 20 kg of duck starter feed by the hand of the dignitaries. Dr M K Padhi, I/C of DAPST programme of RS, ICAR-DPR, Bhubaneswar coordinated the programmee. A total of 25 farmers (9 male and 16 female) benefited from the DAPST programme.

DAPST Activities During the year 2024

S. No.	Name of Village, Mandal and Dist	Training and beneficiaries	Inputs distributed
1	Kallurguda, Utnoor, Adilabad	100 Farmers	100 Night shelters, 600 Vanaraja birds, 100 feeders, 100 waterers and 2.0 Ton Feed
2	Indervally (Leemguda), Utnoor (Rajampet), Narnoor (Empally), Shampoor (Kamaipet) of Adilabad	100 Farmers	100 Night shelters, 3000 Chicks
3	Kalaburgi, Karnataka	200 Farmers	200 Night shelters
4	Venunagar, Laxmipur, Paspulla, Pembi Mondal Adilabad (Old Dist)	150 Farmers	150 Night shelters
5	Pedda Kithari, Saria, Badde Metta, Peddarai, Padma Puram and Neelametta of G Madugula, Vizag, AP	100 Farmers	100 Night shelters
6	Washim Dist, Maharashtra	100 Farmers	100 Night shelters

Inputs distribution programme at Alami village in Kandhamala

Awareness cum training programme organized at Mundigarh, Timudibandha, Kandhamala

On 9th January 2024 an awareness cum training programme on backyard duck farming was organized at Mundigarh, Timudibandha block of Kandhamala district. Total number of tribal participants farmers were 50 (28 male 22 female).

Awareness programme at Timudibandha

Inputs distribution programme at Chunga padar, Timudibandha

On 10th January 2024, an input distribution programme was organized at Chunga padar village of Timudibandha block of Kandhamala district, in which 26 tribal farmers (23 male 3 female) were the beneficiaries. Each farmer was supplied with 20 numbers of 3 to 4 weeks ducklings and 20 kg of feed.

Inputs distribution programme at Chunga padar at Timudibandha

Inputs distribution programme at Garabanda

On 3rd July, 2024 in village Grabanda of Phulbani block, Kandhmala district inputs (feeder and drinker tubs) were distributed to the beneficiaries rearing ducks given to them earlier. Feedback about the performances ducks at their backyard were also recorded from the beneficiaries by visiting their houses.

Feeder and drinker distribution programme at Garabanda

Feeder and drinker tub distribution programme at Alami

Inputs distribution programme of feeder and drinker plastic tub to the earlier beneficiary of Alami village was organized on 4th July, 2024. Each beneficiary was also provided a soft bound copy and pen for recording of data in respect to production. The inputs were distributed by the guests and feedback was also collected from the field on performances of our supplied duck germplasm.

Feeder and drinker distribution programme and feedback data at Alami village.

Feeder and drinker tub distribution programme and feedback collection at Timudibandha

Distribution programme of feeder and drinkers to the earlier beneficiaries who were supplied ducklings was organized at Timudibandha , Kandhamala of 5th July 2024. The distribution programme was organized at Chungapadar village and Regional station head Dr S. K. Bhanja, Dr S. K. Sahoo, principal scientist of RS, ICAR-DPR, Bhubaneswar graced in the programme and the inputs were distributed to the beneficiaries. The team visited the farmer's field for collection of feedback data before the distribution programme.

Inputs distribution and feedback photos at Timudibandha

Awareness- cum training programme and inputs distribution programme at KVK Keonjhar

On 4th October, 2024 one awareness–cum training programme was organized at KVK, Keonjhar by our station on TSP programme, in which 39 tribal farmers (26 male 13 female) were imparted training on various aspects of backyard duck farming. After the training programme in the afternoon 36 tribal farmers (23 male and 13 female) were distributed inputs and the farmers received the same from the experts and guests. Each farmer was supplied with 10 numbers of 4 weeks old ducklings, 15 kg of feed, one soft bound copy for recording of data, one pen and plastic folder.

Awareness-cum training programme and distribution programme at Keonjhar

Awareness-cum training programme and inputs distribution programme at KVK Keonjhar

Awareness-cum training programme was organized on Backyard duck farming at KVK, Keonjhar under TSP programme by our station. Total numbers of the tribal farmers attended were 52 numbers (24 male and 28 female) came from different villages of nearby blocks of Keonjhar districts nearer to KVK. Each farmer was supplied with 10 numbers of 4 weeks old ducklings, 15 kg of feed, one soft bound copy for recording of data, one pen and plastic folder.

Training and inputs distribution programme

4. TRAINING AND CAPACITY BUILDING

Trainings Attended

S. No.	Particulars of training	Official (s)	Duration	Organiser/ Venue
1	Online training on "Omics Analysis in the era of AI"	Dr. Aneet Kour	6-12, June, 2024	ICAR-IASRI, New Delhi
2	Training Programme on Practical Compliance & implementation on official language	Dr. Satyapal Yadav, Prl. Scientist Sri. J. Srinivasa Rao, ACTO	28-29, May, 2024	NAARM Hyderabad
3	Online training program on "Online Course on Genome editing by CRISPR-Cas9"	Dr. S. Jayakumar	25–29, November 2024	Conducted online by IISc, Bangalore
4	NABL Refresher training program	Dr. S. Jayakumar Online mode.	27 September 2024	Gokulam Grand Hotel, Bengaluru

Trainings Organised

The Directorate organized training programs for different stakeholders in poultry production and Entrepreneurship in poultry. The details are presented below.

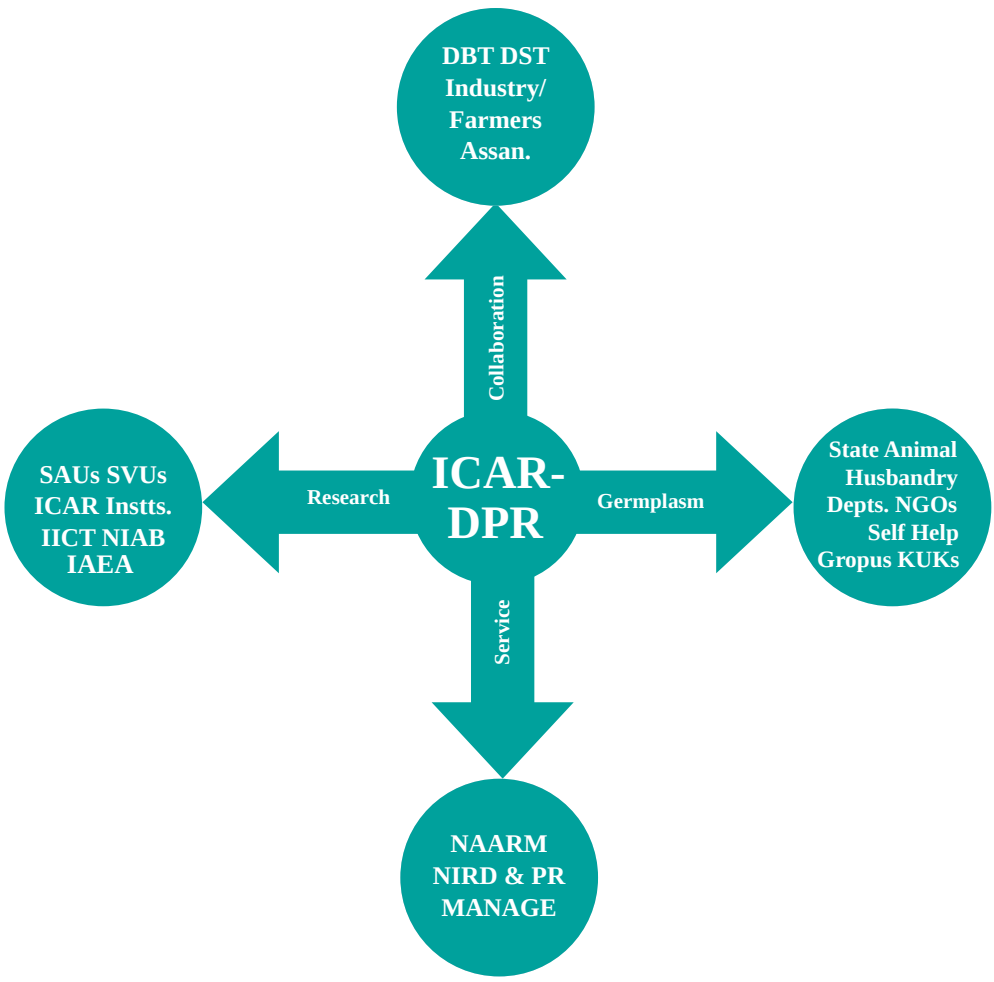
S.No.	Name of training	Participants	Duration
1	Enterprise model for commercial backyard poultry with integration of moringa cultivation at NIRD Hyderabad	30 Officials from 6 states	4-8 March 2024
2	Biosecurity in Poultry Farm (Onsite training for M/S Indbro Research and Breeding Farms Pvt Ltd, Hyderabad)	10 staff	10 April 2024
3	Commercial Poultry Production and Management (In collaboration with MANAGE Hyderabad)	56 entrepreneurs	11-13 June 2024
4	Farmers training on poultry production and management	17 farmers	3-5 June 2024
5	Farmers training on scientific poultry production	23 farmers	11-13 September 2024
6	Farmers training on poultry production	100 farmers	13 September 2024
7	Farmers training on scientific poultry production	23 farmers	24-26 September 2024

5. AWARDS AND RECOGNITIONS

- Dr. U. Rajkumar, Head, PGB Division, was conferred with the 'Fellow of the Indian Poultry Science Association (IPSA)' for the year 2024.
- Dr. Anand Lakshmi was awarded the 'Best Women Scientist Award' in recognition of her exceptional contributions during the 8th International Hybrid Conference on Veterinary and Livestock, held on 26-27 April, 2024, organized by Conference Mind at Goa, India.
- Dr. A. Kannan and his team comprising Dr. B. Prakash, Dr. S.S. Paul, Dr. M.V.L.N. Raju, and Dr. S.V. Rama Rao received the 'Second Best Technology Award in Animal Science discipline for 2023-24'. The award was presented by the Hon'ble Minister of Agriculture and Farmers Welfare on the occasion of the 96th ICAR Foundation Day and Technology Day, held at NASC Complex, New Delhi, on 16th July, 2024.
- Dr. A. Kannan, Principal Scientist, contributed as Editor (Poultry Nutrition) of the Indian Journal of Animal Nutrition.
- Dr. Santosh Haunshi, Principal Scientist, contributed as the Section Editor of the Indian Journal of Animal Sciences.
- Dr. Shanmugam and Dr. R.K. Mahapatra were awarded ICAR certificate for methodology-Methods to cryopreserve chicken semen.
- Dr. Santosh Haunshi, Principal Scientist was nominated as the Principal Member of the Animal Husbandry and Equipment Sectional Committee, Food and Agricultural Department (FAD) 32 of the Bureau of Indian Standards (BIS), New Delhi. He contributed to the revision of standards as an expert member and the convener of the expert panel (P-3) of FAD 32 constituted to coordinate the review of the B.I.S. Standards on 'Poultry Equipment, Housing and Transport'.
- ICAR-DPR was awarded the Third Prize by the Town Official Language Implementation Committee (TOLIC)–2, Hyderabad, for the year 2023–24.
- Dr. Rana D.S., was awarded the 'Best Poster Presentation Award' for the paper titled "Prevalence of Avian Leukosis Virus in a Pure Line Farm Based on Antigen Capture ELISA" authored by Rana, D. S., Prince, L. L. L., Kour, A., Niranjan, M., Rajkumar, U., Reddy, B. L. N., Bhanja, S. K., Priyanka, E. and Reddy, M. R. 6th Biennial Poultry Health Conference and National Symposium (AAHP), organized at Hyderabad, Telangana, from 23rd–24th February, 2024.

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.



Collaboration 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.

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 improved 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.

At present, there are twenty centres of AICRP on Poultry Breeding *viz*. KVASU, Mannuthy; KU, Anand; KVAFSU, Bengaluru; GADVASU, Ludhiana; ICAR-CARI, Izatnagar; ICAR-RC for NEH region, Agartala; NDVSU, Jabalpur; AAU, Guwahati; BAU, Ranchi; MPUAT, Udaipur, CSKHPKVV, Palampur; 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; Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Srinagar; PVNR Telangana Veterinary University (PVNRTVU), Warangal; Sri Venkateswara Veterinary University (SVVU), Tirupati and ICAR - Research Complex for NEH Region, Umiam, Meghalaya.

GBPUAT, Pantnagar was added as a non-funded centre of AICRP-PB from 26 August 2024. . Four centres including OUAT, Bhubaneswar; ICAR-CCARI, Goa; ICAR-CIARI, Port Blair and WBUAFS, Kolkata were discontinued with effect from 30th September, 2024.

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 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 control populations were supplied to different centres for estimating the genetic progress. The institute also supplies parent chicks to the different centres and 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 2024 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 2024, under AICRP-PB, a total of 11,77,284 number of chicken germplasm was distributed to 16,635 farmer beneficiaries and the total revenue generated during the year was Rs. 353.45 lakhs.

The centre-wise performance during the calendar year 2024 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-7 generation of native chicken germplasm from 28 to 40 weeks of age. The hen day egg production up to 40 weeks of age was 89.44, which increased by 13.69 as compared to the previous generation. The centre also evaluated the S-34 generation of IWN and IWP strains of White Leghorn up to 72 weeks of age. During the year 2024, the centre distributed 1,50,658 germplasm to 650 farmers and generated revenue of Rs. 23.50 lakhs.

KU, Anand: Anand (Gujarat) centre has evaluated native chicken breed "*Ankaleshwar*" and White Leghorn strains (IWN, IWP, IWD and IWK) during the year 2024. The egg production up to 40 weeks of age was 87.62 eggs in S_5 generation of *Ankaleshwar*, which registered an increase over the previous generation. Egg production up to 64 weeks of age in IWD and IWK strains strains (S_{11} Gen.) was 217.48 and 211.78 eggs respectively. In IWN and IWP strains (S_4 Gen.), egg production up to 72 weeks of age was 304.05 and 301.05 eggs respectively. The centre has supplied a total of 52,264 chicken germplasm to 505 farmers and generated a revenue of Rs. 31.79 lakhs during the year 2024.

KVAFSU, Bengaluru: Bengaluru centre evaluated S-16 generation of PB-1, S-29 generation of PB-2 and S-7 generation of native chicken during the report period. The average body weight at 20 weeks in PB-1 and PB-2 females was 2337.33 and 2188.63g respectively while the body weight at 40 weeks was 2922.49 and 3031.04g respectively. The average hen housed egg production up to 40 and 52 weeks of age was 53.62 and 89.03 eggs respectively in PB1 and 56.90 and 90.00 eggs respectively in PB2. In native chicken, the average body weight at 8 weeks of age in male, female and combined was 625.94, 541.38 and 552.51g respectively. The average body weight of female native birds at 20 and 40 weeks of age was 1135.44 and 1343.03g respectively and the HHEP up to 40 weeks was 34.70 eggs. In native male birds, body weight at 20 and 40 weeks was 1498.78 and 1920.0g respectively. Raja II coloured broiler from the centre participated in 58th Random Sample Broiler test and ranked second on 7 weeks body weight and FCR with the estimates as 1.987 kg and 2.365 respectively. During 2024, the total germplasm supply was 1,52,731 and 489 farmers were benefitted, thus generating a total revenue of Rs. 44.06 lakhs.

GADVASU, Ludhiana: Ludhiana centre evaluated PB-1 and PB-2 lines and native chicken population (*Punjab Brown*). The body weight at 5 weeks of age was 1242 and 1124g in PB-1 and PB-2, respectively. The average egg production up to 40 weeks of age in PB-1 and PB-2 was 58 and 67 eggs, respectively. The body weight in *Punjab Brown* population at 4, 8, 16, 20 and 40 weeks of age was 338, 677, 1445, 2105 and 2811g, respectively and the average egg production up to 40 weeks was 56 eggs. During the calendar year, a total of 79,118 germplasm were supplied to 610 farmer beneficiaries and Rs. 19.50 lakhs was generated as revenue.

ICAR-CARI, Izatnagar: During the report period, ICAR-CARI, Izatnagar maintained and evaluated CSML and CSFL lines and their crosses. 24,856 numbers of germplasm was supplied to 35 farmers during the year and the total revenue generated was Rs. 22.35 lakhs.

MPUAT, Udaipur: Udaipur centre evaluated *Mewari* and *Pratapdhan* populations during the calendar year. The body weight at 20 and 40 weeks of age was 1432 and 1687g in *Mewari* females while the egg production was 38.78 and 55.09 up to 40 and 52 weeks of age respectively. In *Pratapdhan* females, the body weight at 20 weeks of age was 2028.09g and the egg production up to 40, 52 and 72 weeks of age was 54.69, 94.66 and 163.03. A total of 57,412 improved chicken germplasm was distributed during the reporting period benefitting 402 farmers. Revenue generated from the distribution of germplasm for the period was Rs 14.28 lakhs.

AAU, Guwahati: AAU, Guwahati centre evaluated the *Kamrupa* variety, Indigenous chicken, *Daothigir* breed, PB-2 and the crosses of PB- 2 x Indigenous chicken germplasm. At 20 weeks of age, the body weight of *Kamrupa* was recorded as 1780.83 ± 10.14g for males and 1563.50 ± 5.33g for females. The corresponding body weight of Indigenous chicken was 1474.95 ± 2.68g for males and 1289.87 ± 4.63g for females and in *Daothigir* breed, the estimates were 1495.45 ± 5.02g and 1216.82 ± 2.59g for males and females, respectively. Body weight at 40 weeks of age in *Kamrupa* was 2817.94 ± 9.84g for males and 2457.92 ± 2.41g for females. Indigenous males and females weighed 1984.41 ± 13.18g and 1636.14 ± 6.48g respectively while *Daothigir* males and females weighed 2022.50 ± 44.62g and 1870.79 ± 16.30g, respectively at 40 weeks of age. Egg production up to 72 weeks was 163.44, 117.04 and 122.59 in *Kamrupa*, indigenous and *Daothigir* birds, respectively. During the year 2024, total revenue of Rs. 10.89 lakhs was generated through the supply of 51,606 numbers of improved germplasm to 634 farmers.

CSKHPKVV, Palampur: Palampur centre evaluated the S-2 generation of *native* chicken germplasm, G-3 generation of Dahlem Red and *Himsamridhi* during the year 2024. Hen day egg production (HDEP) at 52 and 72 weeks of age in native germplasm was 84.24 and 118.48 eggs respectively whereas in Dahlem Red, the corresponding estimates were 83.21 and 138.36 eggs respectively. HDEP at 40 weeks and 52 weeks for Dahlem Red x Native (DN) birds was 62.65 and 105.49 eggs respectively. In *Himsamridhi*, a location-specific poultry variety, the HDEP) at 40 weeks and 52 weeks was 71.73 and 121.72 eggs respectively under farm conditions and was comparable to previous evaluation. During the year, the centre supplied 72,372 chicks/growers of *Himsamridhi*, Native and other crosses to 821 farmers and realized receipts of Rs. 18.65 lakhs.

ICAR-RC NEH, Tripura: Tripura Centre evaluated the performance of *Tokbari* (BND cross), BN Cross, *Tripura Black*, Dahlem Red and Coloured Synthetic Female Line (CSFL) populations. In E-7 evaluation of *Tokbari*, the 72 weeks egg production was 161.59 and 136.5 eggs under farm and field conditions, respectively. The performance of *Tripura black*, Dahlem Red and Coloured Synthetic Female Line was evaluated up to 52 weeks of age at the institute farm. The centre supplied 23,190 poultry germplasm among 559 farmer beneficiaries and total revenue of Rs. 11.31 lakhs was generated.

NDVSU, Jabalpur: During the year 2024, Jabalpur centre evaluated G-4 populations of *Jabalpur colour* and *Kadaknath* up to 52 weeks of age. Body weight of *Jabalpur colour* birds at 20, 40 and 52 weeks of age was recorded as 1602, 2087 and 2190 g respectively whereas, *Kadaknath* birds weighed 1098, 1610, and 1701 g, respectively. Hen day egg production upto 40 and 52 weeks of age was recorded as 99.30 and 163.2 eggs respectively in *Jabalpur colour* and 64.2 and 93.6 eggs respectively in *Kadaknath.* In *Narmadanidhi* population, 8 and 20 weeks body weight was 1021 and 1507g respectively in males and 730 and 1383g respectively in females under farm conditions whereas under field conditions,

the corresponding estimates were 775 and 1441g in males and 689 and 1206g in females. In the same population, egg production up to 40 and 52 weeks was 58 and 109 eggs respectively under farm conditions and 42 and 93.2 eggs respectively under field rearing. A total of 29,986 chicken germplasm was distributed to 675 farmers with revenue receipts of Rs. 21.96 lakhs.

BAU, Ranchi: BAU, Ranchi centre has maintained *Desi*, PB2, *Desi* X PB2, Dahlem Red and *Jharsim* birds. During the report period, the centre evaluated native birds up to 20 weeks of age, Dahlem Red up to 64 weeks of age and *Jharsim* birds up to 72 weeks of age in 11th Generation and up to 8 weeks of age in 12th Generation. The centre supplied 47,522 numbers of germplasm to 438 farmers/NGOs/KVKs, and other agencies. The centre generated receipt of Rs. 5.48 lakhs during the calendar year 2024.

BASU, Patna: During the report period (2024), BASU, Patna centre distributed a total of 92,829 germplasm amongst 2,122 farmer beneficiaries and generated revenue receipts of Rs. 25.32 lakhs.

ICAR-RC for NEH, Nagaland: During 2024, Nagaland Centre reared one batch of *Vanaraja* and one batch of *Srinidhi* parent stock. In total, 81,663 numbers of improved germplasm were supplied to 1,249 beneficiaries of 186 villages in different districts of Nagaland. The revenue generated during the period was Rs. 32.66 lakhs.

ICAR-RC for NEH, Sikkim: Under the Project, Sikkim centre has produced and distributed a total of 46,172 nos. of *Vanaraja* day old chicks (DOC) to the farmers during the year 2024. Out of this, 20,387 numbers of DOCs were distributed under tribal sub-plan while 25,785 nos. were sold to the farmers. A total of 1,225 farmers belonging to 227 villages were benefitted during this period. Revenue receipts of Rs. 27.16 lakhs were realized by the centre during the reporting period.

ICAR-RC for NEH, Manipur: *Srinidhi* germplasm supplied by the Manipur centre during the calendar year was 13,913. 168 farmers from different districts of Manipur were benefitted from the germplasm supply and the revenue generated during the reporting period was Rs 4.26 lakhs.

TANUVAS, Hosur: TANUVAS, Hosur centre distributed 58,993 germplasm (including 35161, 9445, 9035 and 5352 germplasm of *Gramapriya*, *Vanaraja*, *Aseel* and *Kadaknath* chicken) among 724 farmer beneficiaries during the year 2024. A sum of Rs. 9.16 lakhs has been generated as revenue from the sale of germplasm during the year 2024.

SKUAST, Srinagar: During the year 2024, SKUAST, Srinagar centre has initiated work on characterization and conservation of *Kashmir Favorella* breed. The centre has distributed a total of 40,343 numbers of germplasm among 2805 farmer beneficiaries, resulting in the revenue of Rs. 8.97 lakhs.

ICAR-RC for NEH, Barapani: At ICAR-RC for NEH, Umiam centre, 23,072 chicks of improved germplasm were distributed amongst 593 beneficiaries. A sum of Rs. 10.44 lakhs was generated as revenue during the calendar year.

PVNRTVU, Warangal: PVNRTVU Warangal centre reared one batch each of *Gramapriya* parent stock, *Aseel*, *Nicobari*, *Vanashree*, *Kadaknath* and *Ghagus* during the reporting period. The centre supplied around 23,694 chicks of the native and improved varieties along with 3500 fertile eggs to 29 farmers, 3 KVKs, AH department and veterinary colleges. The total revenue generated during the period was to the tune of Rs. 5.76 lakhs.

SVVU, Tirupati: During the year 2024, a total of 54,890 *Vanaraja* germplasm was supplied by the centre to 2306 farmers and a sum of Rs 5.95 lakhs was generated as the revenue.

Table 1. Germplasm distributed, farmers benefitted and revenue generation under AICRP on Poultry Breeding during 2024

Centre	Germplasm supplied (Nos.)	Farmers benefitted (Nos.)	Revenue generated (Rs. in lakhs)
KVASU, Mannuthy	1,50,658	650	23.50
KU, Anand	52,264	505	31.79
KVAFSU, Bengaluru	1,52,731	489	44.06
GADVASU, Ludhiana	79,118	610	19.50
ICAR-CARI, Izatnagar	24,856	35	22.35
MPUAT, Udaipur	57,412	402	14.28
AAU, Guwahati	51,606	634	10.89
CSKHPKVV, Palampur	72,372	821	18.65
ICAR-RC, NEH, Agartala	23,190	155	11.31
NDVSU, Jabalpur	29,986	675	21.96
BAU, Ranchi	47,522	438	5.48
BASU, Patna	92,829	2,122	25.32
ICAR-RC, Jharnapani, Nagaland	81,663	1,249	32.66
ICAR-RC, Gangtok, Sikkim	46,172	1,225	27.16
ICAR-RC, Imphal, Manipur	13,913	168	4.26
TANUVAS, Hosur	58,993	724	9.16
SKUAST, Srinagar	40,343	2,805	8.97
ICAR-RC for NEHR, Umiam	23,072	593	10.44
PVNRTVU, Warangal	23,694	29	5.76
SVVU, Tirupati	54,890	2,306	5.95
Total	**11,77,284**	**16,635**	**353.45**

8. POST-GRADUATION EDUCATION AND RESEARCH

The ICAR-Directorate of Poultry Research, Hyderabad, was chosen as the Hyderabad Hub of ICAR-Indian Veterinary Research Institute, deemed to be university, Izatnagar, for initiation of the full-fledged programs on post-graduation education and research (MVSc and PhD) in the discipline of Poultry Science. Dr. R.N. Chatterjee, Director, was designated as the Coordinator and Dr. Santosh Haunshi, Pr. Scientist was identified as the Associate Coordinator of the Hyderabad Hub to coordinate and monitor the academic activities of these programs. The academic activities of the programs were started on 31st January 2024 for the academic session 2023-24 through the admission of five MVSc students and three PhD students in the discipline of Poultry Science. The students directly reported at the institute for their admission as per the direction given by the ICAR-IVRI, Izatnagar. Accommodation for students is being provided in the residential quarters of ICAR-DPR, Hyderabad. Dr. B. Prakash Pr. Scientist was designated as Warden, Boys' hostel and Dr. M. Shanmugam, Pr. Scientist was nominated as Students' Welfare Officer.

Board of Studies (BoS) members

Dr. S.V. Rama Rao, Pr. Scientist and Dr. Santosh Haunshi, Pr. Scientist from Hyderabad Hub were inducted in to the Board of Studies (BoS) of Poultry Science discipline of ICAR-IVRI, Izatnagar with effect from 18th January 2024. These scientists have attended the BoS meetings conducted in hybrid mode.

The scientists of ICAR-DPR have become the faculty of ICAR-IVRI Deemed to be University, Izatnagar, in Poultry Science and different disciplines as dual faculty wide effect from as indicated in the following Table.

PG Faculty of ICAR-IVRI from ICAR-DPR, Hyderabad and R.S. ICAR-DPR, Bhubaneshwar

Sl. No.	Discipline	Name	Designation	Date of induction
1.	Poultry Science	Dr. Santosh Haunshi	Pr. Scientist	06.12.2023
2.	Poultry Science	Dr. K.S. Rajaravindra	Sr. Scientist	06.12.2023
3.	Poultry Science	Dr. Satya Pal Yadav	Pr. Scientist	06.12.2023
4.	Veterinary Extension and Education	Dr. Vijay Kumar	Sr. Scientist	06.12.2023
5.	Veterinary Microbiology	Dr. T.R. Kannaki	Sr. Scientist	06.12.2023
6.	Veterinary Physiology	Dr. R.K. Mahapatra	Pr. Scientist	06.12.2023
7.	Veterinary Physiology	Dr. M. Shanmugam	Sr. Scientist	06.12.2023
8.	Animal Genetics and Breeding	Dr. U. Rajkumar	Pr. Scientist & Head (PGB)	06.12.2023
9.	Animal Genetics and Breeding	Dr. L. Leslie Leo Prince	Pr. Scientist	06.12.2023
10.	Animal Genetics and Breeding	Dr. Aneet Kour	Scientist	06.12.2023
11.	Animal Nutrition	Dr. A. Kannan	Pr. Scientist	06.12.2023

Sl. No.	Discipline	Name	Designation	Date of induction
12.	Animal Nutrition	Dr. Bhukya Prakash	Pr. Scientist	06.12.2023
13.	Veterinary Medicine	Dr. Dande Suchitra Sena	Pr. Scientist	06.12.2023
14.	Poultry Science	Dr. U. Rajkumar	Pr. Scientist & Head (PGB)	20.03.2024
15.	Poultry Science	Dr. Aneet Kour	Scientist	20.03.2024
16.	Poultry Science	Dr. Shyam Sundar Paul	Pr. Scientist & Head (PNHP)	20.03.2024
17.	Poultry Science	Dr. A. Kannan	Pr. Scientist	20.03.2024
18.	Poultry Science	Dr. Bhukya Prakash	Pr. Scientist	20.03.2024
19.	Poultry Science	Dr. M. Shanmugam	Pr. Scientist	20.03.2024
20.	Poultry Science	Dr. T. R. Kannaki	Pr. Scientist	20.03.2024
21.	Animal Genetics and Breeding	Dr Jayakumar S.	Sr. Scientist	20.03.2024
22.	Animal Nutrition	Dr. Shyam Sundar Paul	Pr. Scientist & Head (PNHP)	20.03.2024
23.	Animal Nutrition	Dr Prafulla Kumar Naik Pr. Scientist	Pr. Scientist	20.03.2024
24.	Poultry Science	Dr. D. Suchitra Sena	Pr. Scientist	21.05.2024
25.	Poultry Science	Dr. Leslie Leo Prince	Pr. Scientist	21.05.2024

Academic Council, ICAR-IVRI Deemed to be University, Izatnagar

Dr. R. N. Chatterjee, Director, ICAR-DPR, Hyderabad, was inducted as a member into the Academic Council of ICAR-IVRI Deemed to be University, Izatnagar wide effect from 20.02.2024 for a period of three years.

At the end of the year 2024, two PhD students and three MVSc students of Hyderabad Hub were on roll.

Some of the PG and PhD students from ICAR-IVRI, Izatnagar have also chosen scientists of ICAR-DPR, Hyderabad as thesis research guide for their thesis research work at this institute during the period.

Students from ICAR-IVRI, Izatnagar working under Thesis Research Guides/ Local Supervisor at ICAR-DPR, Hyderabad

S.No.	Name of the student	Degree	Discipline	Thesis Research Guide
1.	Dr. Abdul Muneer K.	PhD	Poultry Science	Dr. S.V. Rama Rao
2.	Dr. T. Vagdevi	PhD	Veterinary Pathology	Dr. M.R. Reddy
3.	Dr. Diwakar Singh Rana	PhD	Veterinary Pathology	Dr. M.R. Reddy, Local Supervisor
4.	Dr. Priyanka	MVSc	Animal Genetics and Breeding	Dr. U. Rajkumar
5.	Dr. Shreyasi	MVSc	Animal Genetics and Breeding	Dr. Aneet Kour

Memorandum of Understanding (MoU)

The institute has a Memorandum of Understanding (MoU) with six different State Veterinary and Agricultural Universities for facilitating students' training/postgraduate research work as per the ICAR guidelines. Under this program, a few PG and PhD students are working on their thesis work at this institute under the guidance of institute scientists (co-chairman or member of the students' advisory committee). Recently, the institute has signed a MoU with Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar on 4th December 2024 for this purpose.

Signing of MoU with the KVAFSU, Bidar

List of MoUs with State Veterinary or Agricultural Universities

S.No.	Name of the University	MoU valid up to
1.	Sri Venkateshwara Veterinary University, Tirupati, Andhra Pradesh	26-01-2025
2.	West Bengal University of Animal and Fishery Sciences, Kolkata, West Bengal	14-06-2025
3.	Chattisgarh Kamdenu Vishwavidyalay, Durg, Chhattisgarh	15-06-2025
4.	PV Narasimha Rao Telangana Veterinary University, Hyderabad, Telangana	24-10-2026
5.	Odisha University of Agriculture and Technology, Bhubaneswar, Odisha	26-02-2028
6.	Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar, Karnataka	03-12-2029

Students from State Veterinary Universities working for thesis under MoU

S.No.	Name of the student	Degree	Discipline	Co-chairman/Member, SAC
1.	Dr. Katam Divya	PhD	Animal Genetics and Breeding	Dr. U. Rajkumar, Member
2.	Dr. CH Sai Nikhita	MVSc	Animal Genetics and Breeding	Dr. S. Jayakumar, Member
3.	Dr. M. Mounika	MVSc	Poultry Science	Dr. B. Prakash, Co-chairman
4	Dr. Hazra	MVSc	Animal Genetics and Breeding	Dr. S. Jayakumar, Co-chairman
5.	Dr. K. Mariastepy	MVSc	Animal Physiology	Dr. M. Shanmugam, Co-chairman

Details of MoU students who completed their thesis work in the calendar year 2024

S.No.	Name of the student	Title of the thesis	Date of thesis submission	University	Degree awarded	Name of the advisor from ICAR-DPR
1.	Dr. Mullu Atchuta Rao	Genome wide profiling of Mirna and their differential expression to understand the asymmetric ovarian development of embryonic chicken	13 February 2024	P.V. Narsimha Rao Telangana Veterinary University	MVSc	Dr. Jayakumar S. Sr. Scientist Member of SAC
2.	Dr. P.J. Sushanth Reddy	Prevalence of Colibacillosis in poultry and molecular detection of virulence and antimicrobial resistance genes in APEC	2 April 2024	West Bengal University of Animal and Fishery Sciences, Kolkata	MVSc	Dr M. R. Reddy, Pr. Scientist, Member of SAC

Students' Seminars conducted

Type of seminar	PhD	MVSc
Credit Seminars	6	3
ORW Seminars	1	-
Pre-thesis submission seminars	-	-

Post-graduation Education (PGE) Section: Following committee was constituted to carry out the academic activities of the PGE section wide effect from 26 May 2023.

Dr. Santosh Haunshi Pr. Scientist	**In-charge**
Dr. Rajaravindra, K.S. Sr. Scientist	Member
Dr. Jayakumar S. Sr. Scientist	Member
Smt. T.R. Vijayalaxmi A.A.O.	Member Secretary

9. PUBLICATIONS

I. Headquarters, ICAR-DPR, Hyderabad

Research Papers

International Journals

Kour, A., Chatterjee, R.N., Rajaravindra, K.S, Prince, L.L.L., Haunshi, S., Niranjan, M., Reddy, B.L.N., and Rajkumar U., 2024. Delineating maternal influence in regulation of variance in major economic traits of White Leghorns: Bayesian insights. *PLoS ONE*, 19(7): e0307987. https://doi.org/10.1371/journal.pone.0307987

Nidamanuri, A.L., Murugesan, S., Sivalingam J., Mahapatra, R.K. and Konadaka. S.R.R. 2024. Plasma hormone amino acid expression of amino acid transporters hormone receptors and their modulation by organic selenium in laying hens. *Acta Scientifica Veterinary Sciences*, 6(9): 33-45. https://actascientific.com/ASVS-6-9.php

Paul, S.S., Kannaki T.R., Hemanth Giri Rao V.V., Rama Rao, S.V., Raju, M.V.L.N., Sinduja R., Sri Sailaja N., Shrikumar S., Reddy, G.N., Santosh P.K.P, Prasad, C.S. and Chatterjee, R.N. 2024. Evaluation of the potential of extract of seaweed Eucheuma denticulatum as an alternative to antibiotic growth promoter in broiler chickens, *Heliyon*, 10(3). e25219, https://doi.org/10.1016/ j.heliyon. e25219.

Rama Rao, S.V., Hulegondi, N., Anusha, S., Raju, M.V.L.N., Nagalakshmi, D., Prakash, B., Srilatha, T., Paul, S.S. and Kannan, A. 2024. Supplemental phosphorus can be completely replaced with microbial phytase in White Leghorn layer diets. *British Poultry Science*, 1-7. https://doi.org/10.1080/00071668.2024.2332721.

Rama Rao, S.V., Paul S.S., Raju, M.V.L.N., Nagalakshmi D., Prakash B. and Santosh P.K.P. 2024. Requirements of metabolisable energy, crude protein and methionine for growing white leghorn chicken under tropical condition. *Animal Nutrition and Feed Technology*, 24(1):1-13. DOI : 10.5958/0974-181X.2024.00001.5.

Rama Rao, S.V., Raju, M.V.L.N., Nagalakshmi, D., Srilatha, T., Paul, S.S., Prakash, B. and Kannan, A. 2024. Higher concentrations of folic acid reduced the dietary requirements of supplemental methionine for commercial broilers. *Animal Bioscience*, 37(5):875-882. https://doi.org/10.5713/ab.22.0374.

National Journals

Kannaki, T.R. and E Priyanka. 2024. Development and validation of duplex PCR assay for simultaneous detection and differentiation of Mycoplasma gallisepticum and Mycoplasma synoviae in poultry. *Indian Journal of Animal Research*, 10.18805/IJAR.B-5385.

Kumar, V., Prakash, B., Prince, L.L.L. and Rajkumar, U. 2023. Empowering tribal livilhoods: Backyard poultry intervention in Adilabad, Telangana. *Indian Journal of Poultry Science*, 58(3):295-300. DOI: 10.5958/0974-8180.2023.00033.8. (Published in 2024).

Mohd, S., Sivalingam, J., Sridevi, B., Shanmugam, M., Reddy, B.R., Chatterjee, R.N., Rajkumar, U., Yadav, S.P. and Bhattacharya, T.K., 2024. Deciphering the putative genes for the regression of chicken right ovary during embryonic and post hatch period. Indian Journal of Animal Research, 58(11):1860-1866.

Mounika, T., H Rao, T Srilatha, B Prakash, G Srinivas and Mounika, M. 2024. Impact of phytogenic feed additives on growth performance, carcass traits and immune response in broilers under summer stress. *Indian Journal of Animal Nutrition*, 41(3):498-504.

Pappula, R., Kondaveti, V.L., Prakash B. and Nagalakshmi, D. 2024. Effect of supplementation of lauric acid, probiotic and their combination on nutrient retention, total bacterial count, gut pH and cost economics of commercial broiler chicken. *Indian Journal of Animal Nutrition*, 41(1):157-162.

Ravi Kumar, M., Roy, B., Kannan A., Shanmugam M., Venkateswarlu R., Kannaki R., Muthu Kumar, M. and Rani, K.S. 2024. Effect of biosynthesized nano zinc on growth performance, nutrient utilization and tissue mineral concentration in Vanaraja chicken. *Journal of Krishi Vigyan*,12(4):815-823.

Ravi Kumar, M., Roy, B., Kannan A., Shanmugam M., Venkateswarlu R., Kannaki R., Muthu Kumar, M. and Rani, K.S. 2024. Effect of biosynthesised nano-zinc on blood biochemical profile, antioxidant status and immune response in Vanaraja birds. *International Journal of Bio-resource and Stress Management*, 15(9):01-09. https:// doi. Org/10.23910/1.2024.5571.

Shivani, B., Jayakumar Sivalingam, Velpula Chinnipreetam, Daida Krishna, Shanmugam Murugesan, B Rajith Reddy, Tarun Kumar Bhattacharya, and Rajkumar U. 2024. Differential expression and genetic polymorphism of DMRT1 and FOXL2 genes in the gonads of *Kadaknath* chicken. *Indian Journal of Animal Sciences*, 94 (7):620-625.

Sivalingam, J., Athe, R.P., Bhattacharya, T.K., Chatterjee, R.N., Kumar, U.R., Yadav, S.P., Ravindra, K.S., Balakrishnan, M. and Chaudhari, M.V., 2024. Complete chromosome wise identification of SSRS in the two published chicken genome assemblies. *Indian Journal of Animal Research*, 58(9):1474-1479.

Susmita, T., K Vijayalakshmi, DS Kumar, B Prakash and SV Ramarao. 2024. Effect of betaine supplementation to methionine-deficient diet on growth performance, carcass characteristics, blood parameters and economic efficiency of broilers. *Asian Journal of Dairy and Food Research*, 43 (2):230-234.

Umesh, B.U., Chinni Preetam, V, Thirumalesh, T., Raju, M.V.L.N. and Nagalakshmi, D. 2024. Effect of superdosing of phytase on the productive performance of laying hens under varying levels of phosphorus. *Indian Journal of Poultry Science*, 59(1):35-39.

Yadav, SP., Jayakumar S, Kannaki TR, Prince LLL, Chatterjee RN, Mahapatra RK, Paul SS and Rajkumar U. 2024. Genetic polymorphism of TAP1, TAP2 and Tapasin, genes in exotic and Indian native chicken breeds. *Indian Journal of Animal Research*, 10.18805/IJAR.B-5369.

Lead Papers/ Invited Papers

Chatterjee, R.N., Rajkumar U. and Aneet Kour. 2024. Augmenting poultry production safeguarding the welfare of poultry using breeding and molecular techniques. XVIII Annual Convention and National Conference of ISAGB held at Bihar Veterinary College, BASU, Patna, 21 to 22 November 2024. Pp. 85-89.

Kumar, V. 2024. Empowering underprivileged society through backyard poultry intervention in Telugu states of India. International Conference on Innovative Education, Research and Extension Approaches for Transmitting Scientific Know-How to augment Livestock Production in the

Contemporary Scenario. held at Veterinary College and Research Institute, Orathanadu, Thanjavur, Tamil Nadu, 10-12 July 2024. Pp. 185.

Nidamanuri. A. L. and Mahapatra, R. K. 2024. Efficacy of organic selenium in increasing production performance in White Leghorn layers through modulation of hormones receptors and amino acid transporters. In the compendium of International Conference on Nutrition and Healthcare held in Bangkok, Thailand, 18-19November 2024. Pp 38.

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Radio Talks Delivered

Dr. S.K. Mishra, Pr. Scientist, R.S., ICAR-DPR, Bhubaneswar delivered radio talk (All India Radio, Puri): 'Byabasayika Padhatire Kukuda Palann Madhyama re Adhika Rojagara Brudhi' on 14 June 2024, respectively at AIR, Puri.

Other Institutes' Publications

Research Papers

Agashe, J., Deo, C., Biswas, A., Mukesh, N., Divya, Bhanja, S.K., Jadhav, S.E.1, Vikas, B. 2024. Effect of feeding different dietary levels of zinc and iron on growth performance immune response and hematological parameters of growing Turkey poults. *Animal Nutrition and Feed Technology*, 24(1):227-238. https://10.5958/0974-181X.2024.00017.9**.**

Anjana, P., Bhanja, S.K., Basil, H. and Shriram, A.G. 2024. Developing predictive models for sex determination based on egg weight, length and width in White leghorn laying hens. *Journal of Veterinary and Animal Sciences*, 55(4):744-747. https://doi.org/10.51966/jvas.2024.55.4.

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10. RESEARCH PROJECTS IN OPERATION

LIST OF PROJECTS (2024)

ICAR-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	Apr, 2020-Mar, 2025
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	Apr, 2020-Mar, 2025
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 (NMRI)	Apr, 2020-Mar, 2025
4.	Improvement and maintenance of elite layer germplasm (Project No. ANSCDPRSIL202000500075)	Dr. Aneet Kour	Dr. R.N.Chatterjee Dr. K.S. Rajaravindra Dr. M.Niranjan Dr. U.Rajkumar Dr. S.Haunshi Dr. L.L.L.Prince	Apr, 2020-Mar, 2025
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	Apr, 2023-Mar, 2026
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	Apr, 2020-Mar, 2025
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	Apr, 2019-Mar, 2024, extended up to Mar, 2025

S.No.	Project Title	PI	Name of Co-PIs	Duration
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	2020-23, Extended up to Mar, 2024 (Project Completed)
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 Dr. Aneet Kour	Feb, 2022-Jan, 2025
10.	Genomic selection for improving productivity in chicken (Project No. ANSCDPRSIL202400300108)	Dr. S.P. Yadav	Dr. S. Jayakumar Dr. S.S. Paul Dr. Aneet Kour Dr. K.S. Rajaravindra Dr. A. Kannan Dr. U. Rajkumar	Sept, 2024-Aug, 2027
11.	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	Nov, 2021-Jun, 2025
12.	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	Feb, 2021-Mar, 2024 (Project Completed)
13.	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	Jun, 2023-May, 2025
14.	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	Apr, 2023-Mar, 2025

S.No.	Project Title	PI	Name of Co-PIs	Duration
15.	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. S.V. Rama Rao Dr. S. Jayakumar Dr. M.V.L.N Raju Dr. A. Kannan Dr. S.P. Yadav Dr. B. Prakash	Nov, 2021-Oct, 2024
16.	Evaluation of Insect larva meal as a novel protein source in chicken diet (Project No. ANSCDPRSIL202000700077)	Dr. M.V.L.N. Raju	Dr. S.V. Rama rao Dr. S.S. Paul Dr. B. Prakash Dr. A. Kannan Dr. M. Shanmugam Dr. M.R. Reddy	Oct, 2020-Sept, 2023 Extended up to Mar, 2025
17.	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-Sept, 23 Extended up to Mar, 2025
18.	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	Mar, 2023-Jan, 2026
19.	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	Dec, 2019-Nov, 2023 (Project Completed)
20.	Novel multi-serogroup and Outer membrane vesicles (OMVs) based nanovaccine against avian pathogenic E. Coli (APEC) for control of Colibacillosis in chicken (Project No. ANSCDPRSIL202500100110)	Dr. T.R. Kannaki	Dr. M R Reddy, Dr. Nooruddin Khan (UoH), Dr. Ashok Kumar (IVRI)	Jan,2025 - Dec, 2027
21.	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	Sep, 2022-Jul, 2025
22.	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	Oct, 2020-Sept, 2024

S.No.	Project Title	PI	Name of Co-PIs	Duration
23.	Cryopreservation of blastodermal cells and production of chicken chimera (Project No. ANSCDPRSIL202100400088)	Dr. M. Shanmugam	Dr. N. Anand Laxmi	July, 2021-June, 2024 (Project Completed)
24.	Characterization and differentiation of chicken mesenchymal stem cells into male germ cell (Project No. ANSCDPRSIL202400400109)	Dr. M. Shanmugam	Dr. R.K. Mahapatra, Dr. S. Jayakumar Dr. Monika Sachdev, CSIR-CDRI	Sept, 2024-Aug, 2026
25.	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	Apr, 2020-Mar, 2024 (Project Completed)
26.	Economic evaluation of rural poultry farming in different regions of India (Project No. ANSCDPRSIL202400100104)	Dr. Vijay Kumar	Dr. U. Rajkumar Dr. S.V. Rama Rao Dr. B. Prakash	Apr, 2024-Mar, 2027

B. List of externally funded research projects

S.No.	Project Title	PI	Name of Co-PIs	Duration
1.	Characterization of antimicrobial resistance in chicken and its production environment interface for identification of optimal approaches for sustainable surveillance and amelioration (IAEA)	Dr. S.S. Paul	Dr. T.R. Kannaki Dr. Jayakumar S Dr. S.V. Rama Rao	2024-29
2.	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	2021-25
3.	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	2021-26
4.	Enrichment of egg and meat by producing bovine Lactoferrin through development of transgenic chicken (DBT)	Dr. K.S. Rajaravindra	Dr. Nirmalya Ganguli, NIAB	2022-25

S.No.	Project Title	PI	Name of Co-PIs	Duration
5.	Development of myostatin gene edited chicken using CRISPR/ Cas9 for augmenting growth and it's evaluation for the feed efficiency (ICAR-NPGET)	Dr. S. Jayakumar	Dr. S.P. Yadav Dr. S.S. Paul Dr. T.R. Kannaki Dr. S. Haunshi	2024-26
6.	Genome editing as a tool for skewing sex ratio in chicken for welfare and enhanced productivity (ICAR-NPGET)	Dr K.S. Rajaravindra	Dr. M. Shanmugam Dr. Aneet Kour Dr. L. Leslie Leo Prince Dr. U. Rajkumar Dr. R.N. Chatterjee	2024-26
7.	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 (Project Completed)
8.	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
9.	Mapping of biochemical regulations in native chicken breeds (*Kadaknath*, Aseel) in comparison with broiler chicken through metabolomics (DAHD, National Livestock Mission)	Dr. S.P. Yadav	Dr. S.S. Paul Dr. A. Kannan Dr. Vijaya Kumar	Feb, 2025-2027
10.	Consortium Research Platform (CRP) on Agro- biodiversity (ICAR- NBAGR)	Dr. M. Shanmugam	Dr. S. Jayakumar	2021-26
11.	All-India Network Project on "Challenging and Emerging Diseases of Animals" (AINP-CEDA))	Dr. M.R. Reddy	Dr. T.R. Kannaki	2024-26
12.	National Centre for Veterinary Type Cultures: Vet. Microbes Centre	Dr. M.R. Reddy	Dr. T.R. Kannaki	2024-26
13.	All India Network Project on Antimicrobial Resistance in Fisheries and Livestock (AINP-AMRFL)	Dr. D. Suchitra Sena	Dr. M.R. Reddy Dr. S.K. Bhanja Dr. T.R. Kannaki	2024-26

DPR Regional Station, Bhubaneswar

C. List of institute funded research projects

S.No.	Project Title	PI	Name of Co-PIs	Duration
1.	Maintenance of Kuzi duck and evaluation of its crossbreds (Project No. ANSCDPRSIL 202200200092_B)	Dr. M.K. Padhi	Dr. S.C. Giri	Jan, 2022-Dec, 2024 Extended up to Mar, 2025
2.	Breeding for development of mycotoxin tolerant meat type ducks (Project No. ANSCDPRSIL 202100500089_B)	Dr. S.K. Mishra	Dr. C.K. Beura Dr. P.K. Naik Dr. B.K. Swain Dr. D. Kumar Dr. Rajalaxmi Behera	2021-24 (Project Complet-ed)
3.	In-Ovo Potentiation of Ducks for enhanced production and Immunity using Micro-nutrient Combinations (Project No. ANSCDPRSIL 202400100106_B)	Dr. S.K. Mishra	Dr. B.K. Swain, Dr. P.K. Naik, Dr. D. Kumar, Dr. R. Behera Dr. Parikshit Moitra, IISER, Odisha	October 2024 to October 2026
4.	Maintenance and Conservation of Kuttanad ducks (Project No. ANSCDPRSIL 202200300093_B)	Dr. Rajalaxmi Behera	Dr. M.K. Padhi	Jan, 2022-Dec, 2024 Extended up to Mar, 2025
5.	Formulation and evaluation of duck meat based products (Project No. ANSCDPRSIL 202300800102_B)	Dr. C.K. Beura	Dr. B.K. Swain Dr. P.K. Naik Dr. S.K. Mishra Dr. D. Kumar	2023-Feb, 2025
6.	Production and utilization of earthworm based feed in White Pekin ducks (Project No. ANSCDPRSIL 202100600090_B)	Dr. B.K. Swain	Dr. P.K. Naik Dr. S.K. Sahoo Dr. S.K. Mishra Dr. D. Kumar Dr. C.K. Beura	Apr, 2021-Mar, 2023 Extended up to Mar, 2024 Project Completed
7.	Evaluation of composite feed using alternative feed resources to economize meat and egg production in ducks (Project No. ANSCDPRSIL 202400200107_B)	Dr. B.K. Swain	Dr. B.K. Swain Dr. S.K. Sahoo Dr. P.K. Naik Dr. C.K. Beura Dr. Dhirendra Kumar Dr. S.K. Mishra Dr. S.K. Bhanja	Aug, 2024 to July, 2027

S.No.	Project Title	PI	Name of Co-PIs	Duration
8.	Evaluation of broken rice and maize based feed in Khaki Campbell ducks under intensive rearing system (Project No. ANSCDPRSIL 202300400098_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	Aug, 2023-July, 2026
9.	Standardization of Feed restriction schedule and optimization of dietary crude protein level in White Pekin ducks (Project No. ANSCDPRSIL 202300700101_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	Sept, 2023-Aug, 2025
10.	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. ANSCDPRSIL 202300100095_B)	Dr. S.C. Giri	Dr. M.K. Padhi Dr. S. K. Sahoo Dr. B.K. Swain Dr. D. Kumar	Apr, 2023-Mar, 2026
11.	Investigating the role of GRAS Compounds as alternatives to antimicrobial in ducks (Project No. ANSCDPRSIL 202300900103_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	July, 2023-June, 2026
12.	Monitoring of duck diseases and their biosecurity measures (Project No. ANSCDPRSIL 202301100105_B)	Dr. D. Kumar	Dr. S.K. Mishra Dr. S.C. Giri	Apr, 2023-Mar, 2028
	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, Cuttack)	Dr. S.C. Giri	2019-24

11. CONSULTANCY, CONTRACT RESEARCH AND COMMERCIALIZATION OF TECHNOLOGIES INSTITUTE TECHNOLOGY MANAGEMENT UNIT (ITMU)

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, copyrights, approval of the technology for commercialization, pricing of the technologies ready for commercialization etc. ITMC is chaired by the Director.

ITMC Meetings Conducted

ITMC meeting was conducted on 24-9-2024 under the chairmanship Dr R N Chatterjee, Director DPR and Chairman ITMC. A total of 11 proposals including 4 technology commercialization, 2 technology certification, 2 Trademark and 3 copyright applications were reviewed and approved.

Patents and Designs

A patent application **"Herbal Growth Promoter"** by Dr D Suchitra Sena was filed on 27-03-2024 at Indian Patent office. A design **"Feeder Tray"** by S C Giri, was granted on 23-02-2024 by Indian Patent Office.

Trademark Filed

One "word" Trademark **"JANAPRIYA"** and **"ASLIBRO"** for the technologies developed at ICAR-DPR was filed with Indian Trademark office on 30-12-2024.

Two trademarks **"OXYCURE"** and **"VERMIPOUL"** were granted on 15-09-2024 and 07-07-2024, respectively

Contract Research

The facilities of the Directorate were extended for the benefit of poultry industry through the contract research mode of ICAR. Details of Contract research projects are given in Table 1.

Table 1. List of MoUs entered in Contract Research mode during 2024

S. No.	Organization with whom MOU signed	Title of the Project	Date of Agreement	Project PI	Total cost in Rs in Lakhs
1	Ajay Bio-Tech (India) Ltd. Pune	Field trials of Ayurvedic Medicinal lotion on poultry birds to control external parasitic infestation	24-01-2024	Dr. M.R. Reddy	0.74

12. COMMITTEES

Institutional Animal Ethics Committee

The IAEC meetings of ICAR-DPR were conducted on 3rd July 2024 and 16th December 2024 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. Venkaiah attended both the meetings. The annual inspection of the facility was conducted on 16th December 2024.

The IAEC meeting (3 July 2024) is in progress

Institutional Biosafety Committee

The 17th and 18th Institutional Biosafety Committee (IBSC) meetings were held on 26th March 2024 and 30th September 2024 respectively, under the chairmanship of Dr. R. N. Chatterjee, Director ICAR-DPR. During these meetings, various new projects were reviewed and approved. Additionally, previously approved projects by the IBSC and RCGM were reviewed to ensure compliance with established biosafety guidelines.

Institute Joint Staff Council

Third, fourth, fifth and sixth meetings of 12th Institute Joint Staff Council (IJSC) were held on 26/03/2024, 02/07/2024, 19/09/2024 and 13/12/2024 respectively.

Internal Complaints Committee

Internal Complaints Committee meetings were held on 28/03/2024, 01/07/2024, 24/09/2024 and 19/12/2024.

Women's Grievances Committee

Women's Grievance Committee meetings were held on 28/03/2024, 01/07/2024, 24/09/2024 and 19/12/2024.

Institute Management Committee

43rd Institute Management Committee meeting was held at this Directorate on 12/09/2024.

Institute Research Committee

Annual IRC Meeting of DPR Main Institute, Hyderabad

The annual meeting of the Institute Research Committee (IRC) for the period 2023-24 was held on 2–3 April and 23 July 2024 at the Directorate. It was chaired by Dr. R.N. Chatterjee, Director, to review the research projects of ICAR-DPR, Hyderabad, for the period 2023-24. Dr. L. Leslie Leo Prince, In-charge, PME Cell and Member Secretary of IRC, welcomed Dr. R.N. Chatterjee and expert Dr. R.P. Sharma, Former Director, ICAR-DPR. The committee reviewed the progress of the institute's research projects and made suitable recommendations. New project proposals were presented by the PIs and approved by the IRC. Dr. R.N. Chatterjee praised all scientists for their hard work, excellent presentations, and active participation during the meeting

The Annual IRC meeting is in progress

Annual IRC Meeting of DPR, R.S., Bhubaneswar

The annual meeting of the Institute Research Committee (IRC) for 2023-24 was held on 22 April 2024 at the DPR Regional Station, Bhubaneswar to evaluate the research projects of Regional Station. The meeting was chaired by Dr. R.N. Chatterjee, Director. Dr. S.K. Bhanja, Head of the Regional Station, welcomed the Director and other IRC members. The committee reviewed the progress of the research projects of

the station and made useful recommendations. New project proposals were presented by the PIs and approved by the IRC. In his closing remarks, Dr. R.N. Chatterjee encouraged the scientists to work on improving the visibility of the station.

The IRC meeting at R.S., ICAR-DPR, Bhubaneshwar is in progress

Quinquennial Review Meeting

a. Visit to AICRP Center, KVASU, Mannuthy on 16th to 17th January 2024

The Members of QRT Dr. C.S. Nagaraja, Dr. Rishendra Verma, and Dr. Lakhan Singh visited the centre and reviewed the work done during the period. The members visited villages where improved germplasm has been supplied and interacted with stakeholders/farmers and nearby KVK staff.

b. Visit to AICRP Center, AAU Guwahati on 27th to 29th January 2024

The Chairman of QRT Dr. K.M.L. Pathak and member Dr. C.S. Prasad visited the centre and reviewed the work done during the period. The members visited villages where improved germplasm has been supplied and interacted with stakeholders/farmers.

c. Visit to AICRP center, ICAR RC for NEH, Umiam (Barapani) on 30th to 31st January 2024

The Chairman of QRT Dr. K.M.L. Pathak and member Dr. C.S. Prasad visited the center and reviewed the work done during the period. The members visited villages where farmers were provided improved germplasm and interacted with stakeholders/farmers. The QRT interacted with women farmers who were the major beneficiaries of the seed project. The woman empowerment through this project was very much visible in this area.

d. Visit to AICRP Center, MPUAT, Udaipur on 16th to 17th January 2024

Dr. C.S. Nagaraja and Dr. P.K. Shukla, Members of QRT visited the centre and reviewed the work done during the period. The members visited villages where improved germplasm has been supplied and interacted with stakeholders/ farmers.

e. Meeting at ICAR-DPR, Hyderabad on 4th and 5th July 2024

Dr. K.M.L. Pathak, Chairman and members of QRT Dr. C.S. Nagaraja, Dr. C.S. Prasad, Dr. Rishendra Verma, Dr. Pankaj Shukla and Dr. Lakhan Singh, attended the meeting. The QRT members interacted with the scientific and other staff for the second time to have their inputs. The QRT report and recommendations were discussed and drafted

f. Online meeting with all AICRP centres on 5th July 2024

All the QRT members attended the meeting to understand the problems and seek suggestions from all the PIs as it was not possible to visit all the centres physically. PIs were asked to grade their outcome on a scale of 10. The major issues were of lack of infrastructure and recurring funds. Frequent changes of PI by SAUs were greatly affecting the performance of the centres.

QRT meeting is in progress at ICAR-DPR Hyderabad, 4-5 July 2024

Research Advisory Committee Meeting

The Research Advisory Committee (RAC) Meeting of ICAR-Directorate of Poultry Research, Hyderabad was held during 05-06 February 2024. Dr. R. Prabakaran,

Chairman, RAC chaired the meeting that was attended by other committee members, Dr. GK Gaur, Dr Jalaludeen, Dr. C.G. Joshi and Dr. S. Mukhopadhyaya. The meeting was also attended by Dr. R.N. Chatterjee, Director, DPR and the Head of Division of the various divisions, scientists of Hyderabad campus and Dr. S.K. Bhanja, Head, DPR RS, Bhubaneswar while Dr. U. Rajkumar acted as Member Secretary. The research progress of the institute was reviewed in the meeting and constructive suggestions were made to improve the research programs of the institute. The chairman appreciated the work done and suggested that the impact of the research work should be at international level. Dr. GK Gaur, ADG (AP&B) informed the house that India has vast ANGR and DPR need to address the characterization of non-descriptive chicken population. The Chairman expressed satisfaction with the research work being carried out at ICAR-DPR, Hyderabad and at Regional Station Bubhaneswar. The meeting ended with vote of thanks by Dr. U. Rajkumar, Member Secretary.

The Research Advisory Committee (RAC) Meeting is in progress

Annual Review Meeting, AICRP on Poultry Breeding and Poultry Seed Project

The annual review meeting of All India Coordinated Research Project on Poultry Breeding and Poultry Seed Project (PSP) for the year 2022-23 was organized at ICAR Research Complex for North Eastern Hill Region, Nagaland Centre, Jharnapani, Medziphema, Nagaland on 2nd and 3rd May 2024.

Dr. Raghavendra Bhatta, Deputy Director General (Animal Science), ICAR applauded the AICRP on Poultry Breeding's contribution in developing the poultry sector in the country over the last 50 years. Dr. Bhatta stressed on further increasing the backyard poultry's contribution to the total poultry production. He also released a dual-purpose backyard poultry "Tokbari" developed by AICRP on Poultry breeding Centre for NEH region Tripura Centre, Agartala, Tripura.

Dr. G.K. Gaur, ADG (AP&B), ICAR accentuated on the need of conserving the indigenous chicken breeds and large-scale dissemination of superior backyard poultry. He further emphasized on developing entrepreneurs and second line breeder in rural poultry. Dr. R.N. Chatterjee, Director, ICAR-Directorate of Poultry Research, Hyderabad apprised about the genesis of the Project and its salient achievements made during the last 50 years. Dr. Girish Patil, Director, NRC Mithun praised the ICAR-DPR, Hyderabad and AICRP on Poultry Breeding for its significant contribution to the livelihoods of NEH Region. Dr. U. Rajkumar, in-charge, AICRP on Poultry Breeding, ICAR-DPR, Hyderabad presented the action taken report and the progress report of the project during the year 2022-23. Earlier, Dr. H. Kalita, Head of the Regional Centre, ICAR Nagaland Centre welcomed the delegates for Annual Review Meeting of AICRP-on Poultry Breeding Annual Review Meeting and also to ICAR Nagaland. He also highlighted the impact of this project in North East in general and in Nagaland in particular.

The Centre In-charges of 12 AICRP on Poultry Breeding and 12 Poultry Seed Project Centres covering different states of the country and the scientists from ICAR RC for NEH Region,

Nagaland Centre and NRC-Mithun, participated in the Review Meeting. The PIs presented the progress of the centres and it was critically reviewed by the DDG(AS), ADG(AP&B) and Director, ICAR-DPR, Hyderabad. Constructive suggestions were offered for the improvement of the Centres. The meeting ended with vote of thanks from Dr. U. Rajkumar, Head, PGB Division, ICAR-DPR, Hyderabad.

DDG (AS) released the *Tokbari* chicken variety

Distribution of *Tokbari* chicken variety to farmers

DDG (AS) and other dignitaries releasing the annual report

Institute Technology Management Committee (ITMC)

Institute Technology Management Unit at ICAR-DPR is managed by the 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 commercialisation, pricing of the technologies ready for commercialisation, etc. ITMC is chaired by the Director.

Constitution of the Institute Technology Management Committee (ITMC)

Dr. R.N. Chatterjee, Director
ICAR-DPR- Chairman

Dr. S.V. Ramana Rao, Principal Scientist,
ICAR-IIOR- Member

Dr. MVLN Raju, Principal Scientist,
ICAR-DPR- Member

Dr. LLL Prince, Principal Scientist,
ICAR-DPR- Member

Dr. Vijay Kumar, Scientist,
ICAR-DPR- Co-PI

Dr. M.R. Reddy, Principal Scientist,
ICAR-DPR- Member Secretary

ITMC Meetings Conducted

ITMC meeting was conducted on 24th September 2024 for assessment of products/technology for certification, to examine Patent applications for their novelty and commercial applicability and to review trademark applications and evaluation of technologies developed at this Directorate for commercialisation.

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

S. No.	Particulars of Seminars/ conferences/workshops	Official(s)	Schedule	Venue/ Organised by
1.	Online Workshop Organized by Nano Science & Consortium, New Delhi	Dr. K.S. Rajaravindra, Sr. Scientist	04-06 January 2024	Online
2.	20th Biennial International Conference of Animal Nutrition Society of India	Dr. S.S. Paul, HoD, PNHP Dr. A. Kannan, Pr. Scientist Dr. P.K. Naik, Pr. Scientist RS, ICAR-DPR, BBSR	23-25 January 2024	TANUVAS, Chennai
3.	National Seminar by The Society for Conservation of Domestic Animal Biodiversity (SOCDAB)	Dr. U. Rajkumar, HoD (PGB) Dr. L.L.L. Prince, Pr. Scientist Dr. M. Shanmugam, Pr. Scientist Dr. K.S. Rajaravindra, Sr. Scientist Dr. Aneet Kour, Scientist	15-16 February 2024	College of Veterinary Science, Gannavaram, Vijayawada
4.	National Seminar on Smart Technologies for Sustainable Agriculture and Environment jointly organized by Indian Society of Agrophysics, New Delhi and ICAR-CRIDA, Hyderabad	Dr. Vijay Kumar, Sr. Scientist	22 -23 February 2024	ICAR-Central Research Institute for Dryland Agriculture, Hyderabad
5.	5th Biennial Poultry Health Conference & National Symposium of Association of Avian Health Professionals (AAHP-2024)	Dr. R.N. Chatterjee, Director Dr. S.S. Paul, HoD (PNHP) Dr. U. Rajkumar, HoD (PGB) Dr. S.V. Rama Rao, Pr. Scientist Dr. M.V.L.N. Raju, Pr. Scientist Dr. B.L.N. Reddy, Pr. Scientist Dr. Anand Laxmi, Pr. Scientist Dr. M.R. Reddy, Pr. Scientist Dr. M. Niranjan, Pr. Scientist Dr. R.K. Mahapatra, Pr. Scientist Dr. L.L.L. Prince, Pr. Scientist Dr. Santosh Haunshi, Pr. Scientist Dr SP Yadav, Dr. A. Kannan, Pr. Scientist Dr. B. Prakash, Pr. Scientist Dr. M. Shanmugam, Pr. Scientist Dr. T.R. Kannaki, Pr. Scientist Dr. K.S. Rajaravindra, Sr. Scientist Dr. S. Jayakumar, Sr. Scientist Dr. Vijay Kumar, Sr. Scientist	23-24 February 2024	ICAR-DPR at PJTSAU, Hyderabad
		Dr. Aneet Kour, Scientist Dr. S.K. Bhanja, C.T.O Dr. Diwakar Singh Rana, Sr. T.O		

S. No.	Particulars of Seminars/ conferences/workshops	Official(s)	Schedule	Venue/ Organised by
6.	IV Annual Convention of Animal Physiologists Association and National Symposium on "Advanced Physiological Strategies for Sustainable Livestock Production and Reproduction" (APACON-2024)	Dr. Anand Laxmi, Pr. Scientist	1-2 March 2024	ICAR-CSWRI, Avikanagar
7.	8th International Hybrid Conference on Veterinary and Livestock	Dr. Ananda Laxmi, Pr. Scientist	26-27 April 2024	Online, Conference Mind in association with (Agriculture and Forestry University, Nepal)
8.	Workshop on Promotion of Climate Resilient Crops/ Varieties/ seeds (Climate Resilient/ Smart Agriculture)	Dr. Vijay Kumar, Sr. Scientist	23 April 2024	ICAR-CRIDA, Hyderabad
9.	Training Programme on Practical Compliance & implementation on official language	Dr. S.P. Yadav, Pr. Scientist Sri. J. Srinivasa Rao, ACTO	28-29 May 2024	NAARM Hyderabad
10.	XVI European Poultry Conference	Dr. Ananda Laxmi, Pr. Scientist	24-28 June 2024	Valencia, Spain, WPSA, Spanish Branch
11.	Innovative education, research and extension approaches for transmitting scientific know-how to augment livestock production in the contemporary science	Dr. Vijay Kumar, Sr. Scientist	10-12 July 2024	TANUVAS, Chennai
12.	1st International Conference on Genome Editing Tool	Dr. S. Jayakumar, Sr. Scientist	22-26 July 2024	Glostem Private Limited, Chandigarh
13.	National Conference on Stepping up Agricultural Research & Educational for next Generation: Researchers Perspectives. (ARSSF-2024)	Dr. U. Rajkumar, HoD (PGB) Dr. Niranjan, Pr. Scientist Dr. R.K. Mahapatra, Pr. Scientist Dr. L.L.L. Prince, Pr. Scientist Dr. K.S. Rajaravindra, Sr. Scientist	29-30 July 2024	ICAR-IIRR, Hyderabad
14.	Brainstorming Session on "Breeding strategies for Diversified Poultry: Issues and Way Forward"	Dr. U. Rajkumar, HoD (PGB) Dr S K Bhanja, Head, RS, ICAR-DPR, Bhubaneswar	28 August 2024	ICAR-Central Avian Research, Institute Izatnagar

S. No.	Particulars of Seminars/ conferences/workshops	Official(s)	Schedule	Venue/ Organised by
15.	South Zonal IAVP Conference-2024	Dr M R Reddy, Pr. Scientist	26-27 September 2024	Veterinary College, Shivamogga, Karnataka
16.	39th Annual Conference and Symposium of IPSA (IPSACON-2024)	Dr. U. Rajkumar, HoD (PGB) Dr. Santosh Haunshi, Pr. Scientist Dr. M. Shanmugam, Pr. Scientist Dr. M.V.L.N. Raju, Pr. Scientist Dr. S.K. Mishra, Pr. Scientist Dr. B.K. Swain, Pr. Scientist	16-18 October 2024	MAFSU-Nagpur Veterinary College, Nagpur
17.	XVIII Annual Convention & National Conference of Indian Society of Animal Genetics & Breeding (ISAGB)	Dr. U. Rajkumar, HoD (PGB) Dr. M.K. Padhi, Pr. Scientist	21-22 October 2024	BASU, Patna
18.	4th International Conference on Nutrition and Healthcare	Dr. Ananda Laxmi, Pr. Scientist	11-12 November 2024	Online, Bangkok, Thailand
19.	Online Course on Genome editing by CRISPR-CAS 9	Dr. S.P. Yadav, Pr. Scientist Dr. S. Jayakumar, Sr. Scientist	25– 29 November 2024	Online
20.	Poultry Knowledge Day Seminar	Dr. M.V.L.N. Raju, Pr. Scientist Dr. S.P. Yadav, Pr. Scientist	26 November 2024	HICC (Hitex), Novotel, Hyderabad
21.	16th Edition of Poultry India by Indian Poultry Equipment Manufacturers Association at Hitex, Hyderabad	Dr. M.R. Reddy, Pr. Scientist Dr. Santosh Haunshi, Pr. Scientist Dr. Leslie Leo Prince, Pr. Scientist Dr. S.P. Yadav, Pr. Scientist	27-29 November 2024	Hitex, Hyderabad
22.	National Conference on Hill-Agro-Ecosystem: Challenges & Opportunities for Achieving Sustainable Development Goals	Dr. R.N. Chatterjee, Director Dr. U. Rajkumar, HoD (PGB)	29-30 November 2024	ICAR-Research Complex for NEH Region, Nagaland Centre
23.	International workshop cum webinar on “CRISPR construct design” for efficient genome editing in plants	Dr. K.S. Rajaravindra, Sr. Scientist	4-6 December 2024	Online
24.	33rd National Congress of Veterinary Parasitology and national symposium	Dr. M.R. Reddy, Pr. Scientist	17-19 December 2024	College of Veterinary Science, Rajendranagar, Hyderabad

14. PERSONNEL

ICAR-DPR, Headquarters, Hyderabad

Research and Management Position:

Dr. R.N. Chatterjee, Director

Head of the Division :

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, Pr. Scientist
15. Dr. T.R. Kannaki, Pr. Scientist
16. Dr. K.S. Rajaravindra, Sr. Scientist
17. Dr. S. Jaya Kumar, 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.) --Till 30/06/2024
3. Sri D. Pratap. A.C.T.O. (Field/Farm) --Till 30/11/2024
4. Sri J. Srinivasa Rao, A.C.T.O. (Hindi Translator)
5. Sri. Diwakar Singh Rana, Sr.T.O (Field/Farm)
6. Sri G. Rajeshwar Goud, Tech. Officer (Field/ Farm)
7. Smt. G. Madhukar, Tech. Officer (IT)
8. Sri Md. Maqbul, Tech. Officer (Driver) --Till 31/07/2024
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)
12. Sri Dhawan Chand, Technician- (Field/Farm) -- Till 05/11/2024
13. Sri Akash Mahadeo Thorat, Technician- (Field/ Farm)

Administrative:

1. Sri S. Bala Kamesh, F. & A.O. --Till 31/10/2024
2. Sri. M.Bhargav, A.O
3. Smt. T.R. Vijaya Lakshmi, A.A.O.
4. Smt. M. Kamala, A.A.O.
5. Sri. T.V. Ramadas, P.S
6. Sri Rajesh Parashar, Asst.
7. Sri L.V.B. Prasad, Asst.
8. Sri. Suryansh Srivastava, Asst.
9. Sri Rahul Kumar, Asst.
10. Sri. Rohit Kumar, Asst.
11. Sri. Amit Dhaka, Asst.
12. Sri. R. Ganesh, U.D.C.

Supporting:

1. Sri Syed Mujtaba Ali, SSS
2. Sri N. Manyam, SSS
3. Sri K. Charles, SSS
4. Sri G. Narsimha, 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

ICAR-DPR, Regional Station, Bhubaneswar

Head, Regional Station, Bhubaneswar

Dr. Subrat Kumar Bhanja, HoRS

Scientific:

Dr. C.K. Beura, Principal Scientist

Dr. S.K. Sahoo, Principal Scientist

Dr. S.K. Mishra, Principal Scientist

Dr. M.K. Padhi, Principal Scientist

Dr. P.K. Naik, Principal Scientist

Dr. B.K. Swain, Principal Scientist

Dr. S.C. Giri, Principal Scientist

Dr. Dhirendra Kumar, Sr.Scientist

Dr. Rajalaxmi Behera, Scientist

Technical:

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

Administrative:

Sri. Sukul Hansda, Assistant

Supporting:

Sri Birendra Kumar Behra

Sri. Haresh Chandra Sahoo

Promotions:

Promotion in respect of Dr. T.R. Kannaki, Sr. Scientist, from the Grade Pay of Rs.9000-00 to Rs.10000-00 in the post of Pr. Scientist w.e.f. 07/01/2023

Promotion in respect of Dr. M. Shanmugam, Sr. Scientist, from the Grade Pay of Rs.9000-00 to Rs.10000-00 in the post of Pr. Scientist w.e.f. 07/01/2023

Promotion in respect of Sri. R. Ganesh, L.D.C to the post of U.D.C w.e.f 04/01/2024 (A.N)

New Joinings:

1. Sri. M. Bhargav, Administrative Officer has joined on 20/03/2024 (F.N) through Direct Recruitment by ASRB, New Delhi
2. Sri. Akash Mahadeo Rao Thorat, Technican (T1-Trainee) has joined this Directorate on 30/04/2024 (F.N) through Direct Recruitment by ICAR-IARI, New Delhi
3. Sri. Dhawan Chand, Technican (T1-Trainee) has joined this Directorate on 01/05/2024 (F.N) through Direct Recruitment by ICAR-IARI, New Delhi
4. Sri. Rohit Kumar, Assistant has joined this Directorate on 22/08/2024 (F.N) through Direct Recruitment by ICAR-IARI, New Delhi
5. Sri. Suryansh Srivastava, Assistant has joined this Directorate on 05/09/2024 (A.N) through Direct Recruitment by ICAR-IARI, New Delhi
6. Sri. Amit Dhaka, Assistant has joined this Directorate on 27/09/2024 (F.N) through Direct Recruitment by ICAR-IARI, New Delhi
7. Sri. Rahul Kumar, Assistant has joined this Directorate on 15/10/2024 (F.N) through Direct Recruitment by ICAR-IARI, New Delhi

Retirement:

1. Sri. V.V. Rao, C.T.O. has retired on superannuation on 30/06/2024
2. Sri. Maqbul, Technical Officer (T-5) (Driver) has retired on superannuation on 31/07/2024
3. Sri. S. Bala Kamesh, F.A.O. has retired on superannuation on 31/10/2024
4. Sri. D. Pratap, C.T.O. has retired on superannuation on 30/11/2024.

Resignation From Service:

Sri. Dhawan Chand, Technician (T-1 Trainee) was selected as V.D.O. at Haryana State Government and relieved on 05/11/2024.

15. OTHER RELEVANT INFORMATION

Experimental Hatcheries

The ICAR-DPR had developed many improved varieties of chicken to benefit farmers and other stakeholders. These birds were supplied to farmers and other stakeholders on their demand at nominal cost in different parts of the country. These are supplied in the form of parent lines chicks; Day old chicks, fertile eggs and grownup birds for Commercial birds. Last year total germplasm were supplied 1,20,510 (33463 fertile eggs, 69411 commercial DoC, 8942 parent line DoC and 8694 grown up birds). Rs. 1,64,76,808 was generated through supply of germplasm.

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 germplasm 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.

Feed Compounding Unit

The Feed Compounding Unit, one of the important central facilities at the institute, supplied compounded 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.

Agricultural Knowledge Management Unit

Internet Connectivity under NKN

The National Knowledge Network (NKN) provides a high-speed Internet leased line with a speed of 100Mbps, ensuring reliable and stable connectivity. To enhance security, this connection is safeguarded by a firewall, protecting against potential cyber threats. In case of any disruptions, a backup connection is available through the BSNL fibre line, ensuring uninterrupted Internet access. This robust connectivity is effectively utilized by the staff for various academic and professional activities. It enables seamless participation in online meetings, webinars, and virtual discussions. Additionally, it plays a crucial role in conducting online classes for students at ICAR-IVRI. The connectivity also allows students at IVRI Hyderabad Hub, DPR to attend online classes conducted by ICAR-IVRI Izatnagar, facilitating smooth and efficient digital learning across campuses.

DPR Webpage

The official website of the Directorate (https://pdonpoultry.org) has undergone a major Website Overhaul, featuring a complete redesign and restructuring. This update ensures that the site remains modern, user-friendly, and informative, catering to the needs of researchers, farmers, and stakeholders in the poultry industry. In 2024, the website received 13.97 lakh hits, averaging approximately 3,826 visits per day. The DPR webpage has a

Payment Gateway link, enabling the convenient booking and purchase of chicken germplasm. The website provides brochures and manual of poultry varieties and technologies developed under DPR and AICRP-PB.

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 2024, the channel saw a total of 14,446 views across its diverse content. Since its launch, the channel has gained 4,802 subscribers and accumulated 2,11,453 views on different informative videos.

Social Media

The Facebook page https://www.facebook.com/ICAR.DPR.Hyderabad, Twitter (X) handle https://x.com/IcarPoultry and LinkedIn Page https://www.linkedin.com/company/icar-directorate-of-poultry-research were actively managed to share important info with farmers, students, researchers and poultry entrepreneurs. We regularly posted updates, relevant news, and useful insights on these platforms. Since the beginning, the Facebook page has 1,205 followers, and the X (Twitter) handle has 343 followers, showing a growing and engaged audience. ICAR-DPR has a 4.4-star rating on Google Maps based on 264 reviews, reflecting positive feedback from visitors.

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. The app recorded a total of 4,203 downloads since its launch. Impressively, the app has garnered an average rating of 4.43 out of 5, based on feedback from 35 users.

Celebration of Republic Day at ICAR-DPR, Hyderabad

ICAR-DPR celebrated 75th Republic Day. Dr. R.N. Chatterjee, Director, unfurled the national flag and delivered an address to the staff in commemoration of the occasion.

Celebration of Republic Day at ICAR-DPR, RS, Bhubaneswar

Regional Station, Bhubaneswar celebrated the 75th Republic Day. Dr Subrat Kumar Bhanja, Principal Scientist & Head, Regional Station unfurled the National Flag in presence of Scientist, Technical Officers, Administrative and supporting staffs and the contractual skilled and non-skilled staffs. Head, RS addressed gathering regarding the importance of republic day, the glory of our nation and way forward for the regional station to serve the nation better.

Celebration of Independence Day at ICAR-DPR, Hyderabad

ICAR-DPR celebrated the 78th Independence Day. Director ICAR-DPR hoisted the National Flag in presence of Scientists, Technical Officers, Administrative, supporting staffs, security, contractual skilled and non-skilled staffs of the institute followed by the National Anthem.

Celebration of Independence Day at Regional Station, Bhubaneswar

Regional Station, Bhubaneswar celebrated the 78th Independence Day. Head, Regional Station hoisted the National Flag followed by the National Anthem.

Observation of Vigilance awareness week at the Regional Station, Bhubaneswar

Vigilance awareness week was observed at the Regional Station from 28th October, 2024 to 3rd November, 2024. All the staffs of the station gathered in front of the Administrative Building and took Pledge to keep themselves away from corruption.

Hindi implementation at ICAR-DPR

The Directorate conducted four quarterly meetings of Official Language Implementation Committee on 27-03-2024, 21-06-2024, 10-09-2024 and 31-12-2024, in which different issues related to effective implementation of Hindi Language in office were discussed. The Directorate also conducted Four Hindi workshops, i.e. on 27-03-2024, 25-06-2024, 23-09-2024 and 31-12-2024 for employees to upgrade their Hindi language skills as official language usage, 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 14-28, September 2024 and Hindi Day on 14th September 2024, during these celebrations different literary competitions were conducted for the staff members. Dr. R.N. Chatterjee, Director, ICAR-DPR heightened the importance of Hindi language and its vast usage in all different corners of India, he also presented cash awards and certificates to all winners. Directorate Received TOLIC-2 Award on 28-11-2024 at NIPHM, Rajendranagar, Hyderabad for best Hindi Implementation in the institute.

Celebration of Hindi Pakhwada at the Regional Station

Hindi Pakhwada was observed at the regional station from 14-09-2024 to 29-09-2024 to enhance the awareness in the staffs of the station about the importance of Hindi Language, and promoting the usage of Hindi language in the official forum as well as in personal sphere. Several competitions among the staffs were organized viz; Hindi Anuwad Pratiyogita, Hindi Shabdawali Pratiyogita, Hindi Vad Vivad Pratiyogita and Hindi Kavita Paath. Dr Nitish Kumar, Scientist, ICAR-Central Institute of Women in Agriculture was the invited as Judge for the competitions organized. Dr B.K. Panda, Ex- Head of the regional Station was the Guest of Honor. Prized were distributed to the winners of different competitions.

Internship Training Program at Regional Station, Bhubaneswar

A 20 days Internship Training Program for the 5th Professional Year, B.V.Sc &A.H (2019 Batch) students of College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar was organized at Regional Station, as per the following schedule:

Internship Training Batch	Date of Training	Duration	Number of Internee
A	02/02/2024 to 06/02/2024	5 days	21
B	13/01/2024 to 17/01/2024	5 days	21
C	18/03/2024 to 22/03/2024	5 days	22
D	27/02/2024 to 02/03/2024	5 days	21

A total of 85 students participated in the training program. All the scientists of the regional station delivered the training lectures and imparted practical demonstrations/farm visit/hatchery visit/feed unit visits etc. Different aspects of Avian Production and Management especially several aspects of scientific duck farming viz; Important Duck breeds and their production potential, scientific duck farming, scientific feeding, breeding, breed and variety development, identification of male and female ducks, handling of ducks, bio-security of poultry/ duck farm, sample collection, post-mortem examination, farm economics, status of duck farming in India, reproductive management of ducks for optimal fertility and hatchability etc were taught to the students. Practical on proximate analysis of feed, exposure visit of institute duck farm by the students to gain practical knowledge on different husbandry practices at duck farm, visit to institute hatchery and feed processing unit were carried out. Dr Dhirendra Kumar and Dr Rajalaxmi Behera were the coordinators of this training program.

Educational and Practical Classes for Ambulatory Clinic (VCP-II) Course of 4th Professional Year of BVSC & AH Students at Regional Station, Bhubaneswar

Two Educational and Practical Classes for Ambulatory Clinic (VCP-II) Course of the 4th Professional Year, B. V. Sc & A.H (2020 Batch) students of College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar was organized at Regional Station as per the following schedule:

Ambulatory Clinic (VCP-II)	Date of Training	Duration
Group A and B	10-05-2024	1 day
Group C and D	15-05-2024	1 day

Different aspects of Duck Production and Management like important duck breeds, scientific feeding, breeding, handling of ducks, identification of male and female ducks, bio-security of duck farm, reproductive management etc. were taught to the students. The students

visited the Institute Duck Farm, Hatchery and Feed Processing unit. Dr. Dhirendra Kumar and Dr. Rajalaxmi Behera coordinated this program.

RS ICAR-DPR, Bhubaneswar Participated in the "Exhibition of innovative Agricultural technologies" at ICAR-IIWM, Bhubaneswar

Regional Station of ICAR-DPR, Bhubaneswar participated in the "Exhibition of innovative Agricultural technologies" program on the occasion of celebration of 37th foundation day of ICAR-Indian Institute of Water Management (ICAR-IIWM), Bhubaneswar on 12th May, 2024. Dr. S.K. Chaudhari, DDG (NRM, ICAR) graced the occasion as the Chief Guest along with other dignitaries like the Vice Chancellor of OUAT, Directors of ICAR institutes, state government officials, representatives of irrigation companies, startups etc. Dr. S.K. Bhanja, Head participated in the program as invited dignitary member. Scientific faculty of the station Dr Dhirendra Kumar, Dr Rajalaxmi Behera and supporting staffs Sh. Haresh Chandra Sahoo and Sh. Birendra Ku Behera participated in the exhibition. Different aspects of Scientific Duck Farming were displayed as posters and the technologies were explained by the scientists to the farmers, dignitaries and stakeholders visiting the stall. Furthermore, attempt has been made to popularize the importance of duck meat and eggs drawing attention of the visitors to the health benefits of these products.

ICAR-DPR, Hyderabad celebrated its 37th Foundation Day

ICAR- Directorate of Poultry Research, Hyderabad celebrated its 37th Institute Foundation Day on 1st March 2024. Dr. P. Chandra Shekara, Director General, MANAGE, Hyderabad, graced the occasion as the Chief Guest, and Dr. R. N. Chatterjee, Director, ICAR-DPR, presided over the function. The foundation day programme of ICAR-DPR started with an ICAR song and the lighting of a lamp. Dr. P. Chandra Shekara, DG, MANAGE during his address, appreciated the contribution of ICAR-DPR in the growth and development of poultry production in the country, particularly backyard poultry production. The role of this directorate in rural chicken variety development, dissemination of improved chicken varieties, technology development, and extension activities across the country, was appreciated. He emphasised the need to give more training to the farmers and translate the research to the field level for improving rural livelihoods and nutritional security.

On this occasion, a booklet entitled "ICAR-DPR Backyard Chicken Germplasm: Contribution and Impact" authored by Drs. Vijaykumar, U. Rajkumar, SV Rama Rao and RN Chatterjee" was released. The chief guest distributed the prizes to the winners of the sports competitions organized for the staff of the institute.

Presidential address by Director, DPR Address by Chief Guest, DG, MANAGE, Hyderabad

Dr. R. N. Chatterjee, Director, ICAR-DPR presided over the function and highlighted the role and contribution of ICAR-DPR in the poultry sector of the country through its various activities. He also appraised the house about the long association of ICAR-DPR with the MANAGE, Hyderabad and elaborated on the evolution of ICAR-DPR as well as its present status with well-furnished labs and a regional centre at Bhubaneswar. He also informed the house about the various national and international training programmes organised by ICAR-DPR and sponsored by MANAGE and briefed about the salient achievements of the institute, including flagship research programmes.

Earlier, Dr. S.S. Paul, Head, Division of Poultry Nutrition, Health, and Physiology, welcomed the dignitaries. The programme ended with the formal vote of thanks proposed by Dr. A. Kannan, Principal Scientist and Chairman of the organising committee. Around 75 participants were present in the programme.

Release of bulletin

ICAR-DPR celebrated International Day of Yoga-2024

On the occasion of the International Yoga Day, Director, ICAR-DPR and staff participated in yoga practice session on 21 June 2024.

Celebration of International Yoga Day at Regional Station 2024

Vigilance Awareness Week

Staff of ICAR-DPR took Pledge during Vigilance Awareness Week (28.10.2024 to 03.11.2024).

Pledge during Vigilance Awareness Week

World Egg Day 2024

World Egg Day 2024 was celebrated at ICAR-Directorate of Poultry Research, with the theme of "United by Eggs' on 11th October, 2024 highlighting how eggs bring people together worldwide from nutrition to sustainability and cultural significance.

Library

The Directorate is having a small and well-equipped resource full collection of books in its library, which is very much useful to the readers like scientific, technical, administrative staff of the institute, at present more than nine hundred reference books are available. Besides this the other users from veterinary universities and poultry industry people for their resource material available at institute library. From academic year (2023-24) PG and Ph.D students/scholars of this institute are utilizing institute library facilities largely.

The library is having a large collection of International and Indian journals/magazines since 1988 onwards, on poultry and veterinary science and also having about nine hundred reference books on different aspects of poultry science, veterinary science and livestock as well other general subject books. Institute staff and students utilizing Cera consortia (Jgatenext) services for latest references. The library also subscribes daily newspapers in Hindi, Telugu and English for readers. We also digitalized all our publications (such as annual reports, newsletters, un-priced books). The facilities of this library is being utilized by the institute scientist, scholars and students and faculty members of neighbouring veterinary college as well from other parts of India.

Research-Extension-Farmers Interface Meeting

ICAR-Directorate of Poultry Research in Collaboration with AICRP on Poultry Breeding Center of P.V. Narsimha Rao Telangana Veterinary University (Hyderabad) organized one day Research-Extension-Farmers Interface meeting on Poultry Production at Livestock Research Station Mamnoor, Warangal, Telangana on 30th July 2024. About 110 farmers, Officers of State Veterinary Department, Officers of PVNRTVU and other stakeholders were present in the meeting. Poultry farmers raised the issues of disease diagnostic facility, lice problems in commercial farm, unavailability of important vaccine, management of cold-chain, issue of disposal of dead birds, market volatility of inputs as well output that results to heavy losses, price mechanism of eggs and broiler, availability of herbal Antimicrobial Growth Promoters (AGPs) etc.

ICAR-DPR in Collaboration with The District Rural Development Agency (DRDA), Utnoor, Adilabad organized one day Research-Extension-Farmers Interface meeting on 4 December, 2024 at Integrated Tribal Development Agency (ITDA) Utnoor, Adilabad, Telangana. At the meeting 136 backyard poultry farmers specially women, Officers of line departments, Extension Officers and other stakeholders were participated. Poultry farmers raised the issues of unavailability of suitable chicks, high feed cost, fowl pox and cannibalisms disease in adult, unavailability of vaccine and lack of veterinary help, lack of money and space to provide proper house to birds, predator attack on birds and marketing of the poultry produce specially eggs on desired price.

Exhibition and Mela

ICAR-DPR participated in the following exhibition and mela during 2024.

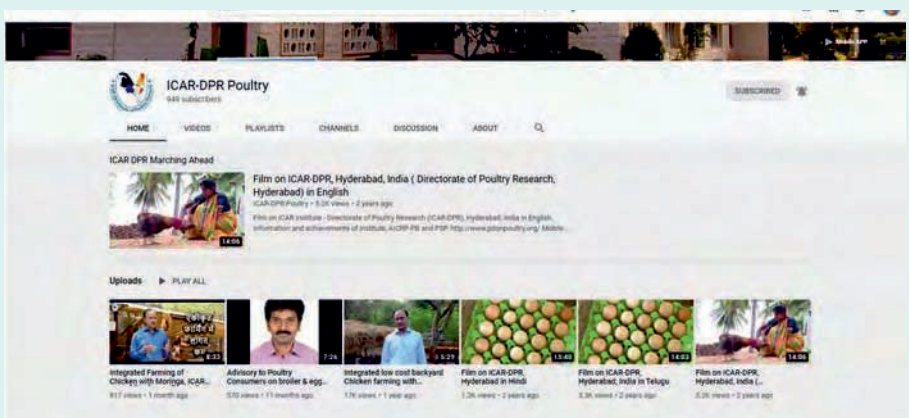
1. National Science Day at ICAR-DPR Hyderabad (28 Feb 2024).
2. Seed Mela at PJTAU Rajendranagar, Hyderabad (24.5.2024).
3. 96th ICAR Foundation Day, NASC Complex, New Delhi (15-16 July, 2024).
4. Poultry India Expo2024, Hitex Hyderabad (27-29 Nov 2024).
5. Agricultural Exhibition and Kisan Mela at PJTAU, Rajendranagar (20-21 Dec 2024).

DPR

DPR-App

Face Book

Twitter



YouTube

भाकृअनुप – कुक्कुट अनुसंधान निदेशालय

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