PHILIPPINE CARABAO CENTER | 15th Issue, December 2024

R4D Highlights

PCC cryobank focal is named 'Face of Biotechnology'

By Ma. Cecilia I. Mariano

Dr. Lilian P. Villamor, senior science research specialist and head of the DA-PCC's Cryobank Section under the R&D Division, has been recognized as one of the eight awardees in the 9th Filipino Faces of Biotechnology.

Dr. Villamor was conferred the title "Outstanding Leader in Livestock Biotechnology Advancing Genetic Conservation and Cryopreservation for Philippine Livestock" for her leadership and contributions to livestock biotechnology.

The award highlighted her dedication to advancing genetic conservation and her efforts to improve the livelihood of small-scale Filipino farmers through research and development in livestock biotechnology.

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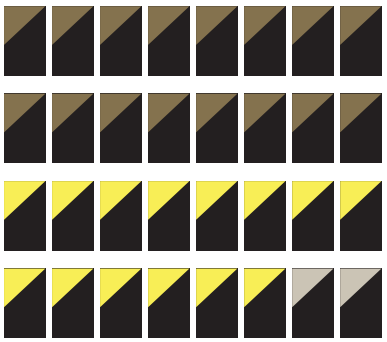
DA-PCC showcases 32 studies at annual R4D External Review, top papers recognized

By France Joseph O. Pascual

A total of 32 R&D projects from the Department of Agriculture-Philippine Carabao Center (DA-PCC) were presented during its annual external review held at the Eusebio-Castillo Hall, DA-PCC National Headquarters and Gene Pool, in Science City of Muñoz from September 25 to 27.

The event highlighted the agency's latest research efforts in the livestock sector, specifically focusing on water buffalo production.

POOL OF PAPERS IN THE 2024 R4D IN-HOUSE



LEGEND:
Research Development Academic

Over the three-day event, best papers were recognized in different categories per thematic area:

Best Research Paper in Socio-economics, Environment, and Policy: "The Financial Viability of the Dairy Buffalo Farming Business" presented by Zadieshar G. Sanchez.

Best Research Paper in Technology Transfer: "Examining the Effectiveness of School-on-the-Air on Dairy Buffalo Production II CALABARZON: An Analysis of Knowledge, Attitudes, and Practices of Participating Farmers" presented by Kyla A. Rodriguez.

Best Research Paper in Production Systems and Nutrition: "Development of Probiotics with Moringa Extract as Feed Supplement for the Health and Production Performance of Water Buffalos (*Bubalus bubalis*)" presented by Anne Franchette Asuncion.

Best Development Paper in Animal Health and Biosafety: "Development of a prototype for loop-mediated isothermal amplification (LAMP) assay for the detection or screening of lumpy skin disease (LSD)" presented by Dr. Arren Christian M. de Giua.

Best Development Paper in Animal Breeding and Genomics: "Presence of PRLR-slick mutation in Philippine cattle: A PCR approach to genetic frequency analysis" presented by Alexander M. Paraguas.

Best Undergraduate Research: "Effect of fermentation and processing procedures on the quality and safety of shelf-stable carabeef sausage sticks" presented by JC Medel A. Victorio.

Best Post-Graduate Research: "Whole genome sequencing of the Philippine Swamp buffalo and initial insights from the 1000 buffalo genomes project" by Paulene S. Pineda.

According to Dr. Eric P. Palacpac, Officer-in-Charge of the R&D Division (RDD), the event showcased research projects across seven thematic study areas, which were divided into two categories: development papers and research papers. He noted that research papers focused on generating and expanding knowledge, while development studies aimed to translate research into practical solutions for the carabao and livestock industry.

Executive Director Dr. Liza G. Battad expressed her hope that the technologies

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Photo Credit: DA Biotech Program

PCC cryobank focal... (From page 1)

In her acceptance speech, Dr. Villamor expressed gratitude for the award, stating, "I humbly accept this national award as a testament to my commitment to contributing impactful science to our livestock farmers. My sincere gratitude goes to the DA Biotech Program and the awarding bodies for recognizing the potential of biotechnology to address societal needs."

Since joining the DA-PCC in 2014, Dr. Villamor has been instrumental in advancing the operations of the Cryobank Unit. Her efforts included drafting of DA Administrative Order (AO) No. 31, Series of 2021, which declared the DA-PCC Cryobank as the National Livestock Cryobank (NLC), and Memorandum Circular (MC) No. 04, Series of 2022, which detailed the implementing guidelines for the NLC.

Her contributions also extended to developing protocols for the collection, cryopreservation, and databanking of animal genetic resources (AnGR), facilitating access to AnGR, and conducting awareness campaigns.

Dr. Villamor described the National Livestock Cryobank as a "biological vault" or a "modern Juan's ark" that preserves valuable livestock species. She emphasized the role of biotechnology in safeguarding these resources against challenges like climate change.

"The significance of the Cryobank is undeniable, particularly with the application of biotechnology at its core. Sa Cryobank, may forever lalo na kung may application ng biotechnology!" she quipped.

In addition to her work on cryopreservation, Dr. Villamor led a research project under the DA-Biotech program that revealed the genetic diversity of the Philippine Carabao. This project identified the carabaos of Calayan Island, Cagayan, as a pure-type swamp buffalo, leading to the establishment of a carabao sanctuary. She also spearheads a team of young researchers in two national projects funded by the Department of Agriculture's Bureau of Agricultural Research and the National Livestock Program. These projects focus on optimizing the cryopreservation of genetic resources from swine, cattle, and goats for conservation and management at the National Livestock Cryobank.

The Department of Agriculture Biotechnology Program presented the award during a ceremony held at the Philippine International Convention Center in Pasay City on December 5, 2024.

Dr. Villamor joins the ranks of DA-PCC leaders, including former Executive Director Dr. Libertado Cruz and Scientist IV Dr. Claro Mingala, who were also recognized as Filipino Faces of Biotechnology in 2018 and 2019, respectively.

DA-PCC reaps awards in annual scientific convention

By France Joseph O. Pascual

Four R&D papers from the Department of Agriculture-Philippine Carabao Center (DA-PCC) were recognized during the 61st Scientific Meeting and Annual Convention of the Philippine Society of Animal Science (PSAS) held on October 22-25 at the Acacia Hotel in Davao City.

With the theme "Progressive and Food-secure for the Philippine Animal Industry," this year's convention highlighted the commitment to advancing the country's animal farming sector while ensuring sustainable food production.

Over the four-day event, the best papers were recognized in different categories:

Maureen Gajeton's study on the "Application of Microsatellite Multiplex Panels for Parentage Verification in Water Buffaloes and Cattle" was chosen as the best paper under the **applied research** category. The other authors of the study were Dr. Melinda Reyes, Maria Rica Yusi and Dr. Ester Flores.

Scientist II Dr. Eufrocina Atabay's study bagged the best paper under the biotechnology category entitled "Improved A.I. Efficiency through an Ovarian Structure-based Controlled Breeding Program in Post-partum Water Buffaloes." Her co-authors were Dr. Edwin Atabay, Dr. Carlito Dela Cruz, Dr. Excel Rio Maylem, Jhon Paul Apolinario, and Roseline Tadeo.

The research entitled "Application of Parentage Verification in Selected Cattle Farms in the Philippines," authored by Millen Angeline Garcia, was awarded the best paper in the **development** category. Her co-authors included Yujiner Dela Cruz, Maureen

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First Philippine swamp buffalo reference genome, 1000 Buffalo Genomes Project provide new insights for carabao breeding

By France Joseph O. Pascual & Paulene S. Pineda

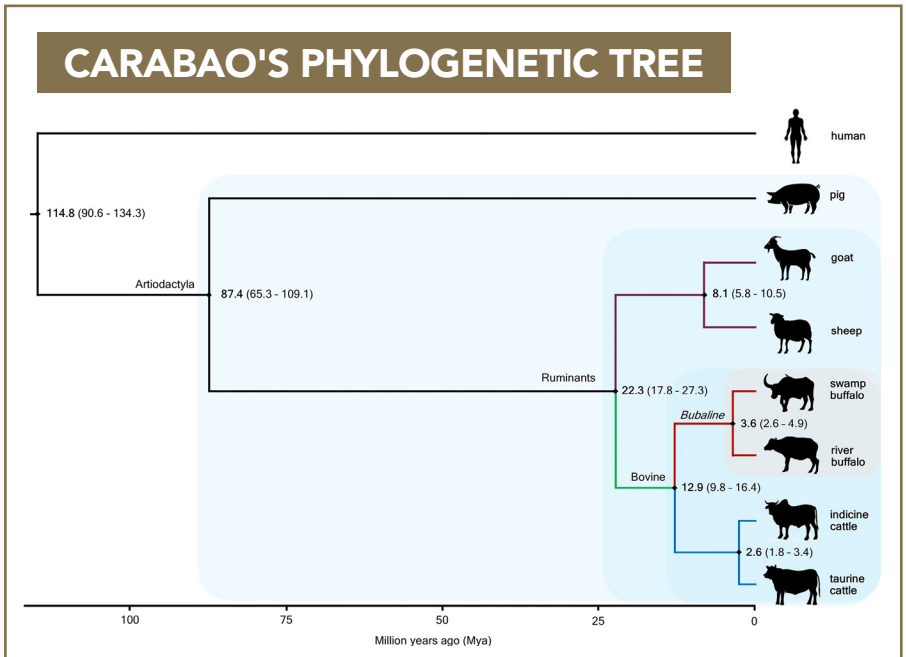


FIG. 1. The phylogenetic tree of 8 species using single-copy ortholog genes indicating estimated time divergence and confidence interval from the present in million years ago.

Carabaos are genetically classified into two distinct subspecies: the river and the swamp, which are different in terms of geographical distribution, biological traits, body size, draft capacity, and milk and meat production.

The 1000BGP, on the other hand, is an international consortium of 38 researchers from 15 countries formed in 2022, which aims to provide genetic resources for the global population of water buffaloes and develop high-quality reference genomes and genotyping tools to breed more sustainable and productive buffaloes. While molecular genetic information has been accumulating for river buffalo, there are limited resources for swamp-type buffalo since the existing genotyping tool for river types is not suitable for use in genomic analysis. A reference genome serves as the blueprint of a species, which is used as a reference to map DNA sequences and determine differences within a population.

Fortunately, a recent project assembled a high-quality reference genome for the Philippine swamp buffalo, which is essential for accurate variant detection and contributing to conservation efforts and selective breeding to enhance productivity and health.

Key findings of the study include a quality genome assembly from swamp buffaloes. The final swamp buffalo genome assembly (PCC_UOA_SB_1v2) was reported to have the highest contiguity compared to previous water buffalo genome assemblies. The study achieved a ~86 Mb contig N50, with a final genome size of 2.90 Gb genome size consisting of 23 autosomes and X chromosomes. This genome assembly also has a base pair quality value of 45.6 (Merqury) and a 95.7% BUSCO completeness score, demonstrating a high-quality and complete sequence. This result provides a more accurate reference genome for genetic studies and breeding programs in water buffaloes, mainly in Southeast Asia. The study also found a ~1.5% genetic difference between the swamp and river buffalo, which distinguishes the two breeds.

Approximately 41.6 million single nucleotide polymorphisms (SNPs) were also identified using the swamp buffalo reference, which offers an extensive database of swamp buffalo SNPs to enable a better understanding of breed-specific traits in swamp buffaloes and can guide selective breeding programs for improving milk and meat production. From these variants that were polymorphic in swamp buffaloes, genes such as KISS1 and KISS1R that were linked to fertility traits and CAST and CAPN that determine carabao's meat tenderness were identified to improve reproductive efficiency and meat quality through selective breeding using targeted molecular markers.

According to the study, swamp buffaloes diverged from their river counterpart 3.1 million years ago with a clear genetic differentiation, which can assist scientists to better understanding the evolution of

CITATION

Pineda, P.S., Flores, E.B., Villamor, L.P., Parac, C,J,M., Gajeton, M.B., Matias, S.D., Khatkar, M.S., Hien To, T., Smith, T.P.L., Rosen, B.D., Marsan, P.A., Colli, L., Williams, J.L., Low. W.Y., and 1000 Buffalo Genomes Consortium (2023). Whole genome sequencing of the Philippine swamp buffalo and initial insights from the 1000 Buffalo Genomes Project. BG21001-RC.

buffaloes and guide conservation strategies for maintaining the genetic diversity of carabaos.

The study also analyzes the SNPs that were concordant with the water buffalo genotyping tool (Axiom 90K SNP panel) on swamp buffaloes and found that 55% of SNPs in swamp buffalo samples have low minor allele frequency (MAF < 0.1), which demonstrates the need for developing new genotyping tools designed explicitly for swamp buffaloes. The study also found 39,000 SNPs shared between river and swamp types and 26,890 SNPs polymorphic only in river-type when using the genotyping SNP panel.

The collaborative effort of researchers to the 1000 Buffalo Genomes Project (1000BGP) offers relevant insights into swamp buffalo's genetic diversity, evolutionary divergence, and

(Continued on page 7)

'SLICK' gene discovery unlocks the key to identify heat-resilient cattle in the Philippines

By France Joseph O. Pascual & Alexander M. Paraguas

The Philippines, an archipelago in Southeast Asia, experiences a humid climate with intense heat from March to September, which can lead to heat stress in animals. This can be particularly challenging for livestock, especially for cattle, requiring careful management and protection to ensure their well-being.

The optimal temperature range for dairy cows is between -0.5°C to 20°C, with critical stress occurring above 25-26°C. Considering how the Philippines can get peak heat up to 50°C, identifying the SLICK 1 mutation in the prolactin receptor (PRLR) gene is crucial as it results in a short-hair coat and increased ability to regulate body temperature during heat stress.

The objective of this study was to screen for the presence and frequency of the PRLR-Slick mutation in dairy cattle populations from three selected farms in the Philippines using the PCR-RFLP method.

For the non-SLICK genotype, the Homozygous (C) genotype is identified by a single band at 338 bp. The hetero-SLICK genotype shows bands at 338 bp, 204 bp, and 133 bp. Finally, the Homozygous SLICK (T) genotype is characterized by the presence of bands at 204 bp and 133 bp.

PCR-RFLP genotyping proved to be as reliable as the TaqMan array in identifying slick gene variants, where both methods showed complete concordance in detecting slick, hetero-slick, and non-slick genotypes, which further validates PCR-RFLP as a more cost-effective-alternative for genetic screening.

Cattle with the Slick1 mutation exhibit a "slick hair" phenotype, which enhances heat tolerance by improving heat dissipation. These findings provide a foundation for developing better livestock management in tropical countries like the Philippines, where, similar to water buffaloes, cattle need to adapt to hot and humid conditions.

The study recommends implementing PCR-RFLP tests routinely, developing targeted breeding programs, and expanding genetic research focused on heat stress resilience. By implementing these recommendations, the livestock industry can enhance cattle's heat tolerance and overall resilience, ultimately improving productivity and sustainability in hot climates.

CITATION

Flores, E.B., Prades, K.J.B., Herrera, J.R.V., Maylem, E.R.S., Reyes, M.N., Pineda, P.S., Bantug, K.M.R., dela Cruz, Y.C., Matias, S., and Paraguas, A.M. (2023). Screening of PRLR-SLICK Gene Mutation in Selected Cattle Farms in the Philippines using PCR-RFLP Method. BG20003-RC.

Genetic screening for healthier, more productive cattle and buffaloes in the Philippines

By Ronaline C. Canute & Yujiner C. dela Cruz

Livestock breeding is a major component in the animal industry, particularly in countries such as the Philippines, where cattle and buffaloes are a crucial component in food security, draft power, and economic livelihood. As the demand for meat, milk, and other dairy products increases, the need to breed animals with desirable characteristics—such as improved meat quality, milk yield, and disease resistance becomes a priority.

However, with the rise of trade in livestock, there is also the risk of introducing harmful genetic defects through the importation of animals. At the forefront of this concern is a pioneering study titled, "Development of Screening Protocols for Genetic Defects and other Economically Important Traits in Cattle and Buffaloes in the Philippines". The study aimed to develop an advanced molecular screening protocol to identify favorable genetic markers for key production traits and simultaneously detect carriers of harmful genetic mutations. This was carried out by a team of researchers from DA-PCC who set out to develop a new, innovative genetic screening protocol to help farmers and breeders identify both the best traits for productivity and the genetic defects that could affect herd health.

The study focused on identifying genes associated with a wide range of traits

An easily available paternity testing for buffaloes!

By Ronaline C. Canute & Maureen M. Gajeton

Difficulty in tracking the genetic lineage of animals is one of the primary challenges in livestock breeding.

Breeding efforts may be distorted in the absence of precise and validated pedigree data, producing unsatisfactory results and possibly limiting the genetic advancement of entire herds. Genetic evaluation's usefulness depends on how accurate the data it uses is; the more accurate the pedigree records, the more accurate the breeding value predictions are, and this in turn affects the herd's genetic improvement.

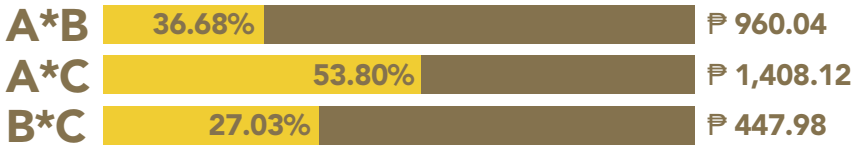
As with any system that depends on human records, errors can happen, though, and breeding errors can arise from inaccurate or lacking data, such as missing information on an animal's parentage. These errors could result in inaccurate genetic evaluations, which would reduce breeding programs' overall efficacy. The DA-PCC looked for a method to more precisely and accurately confirm parentage in order to reduce these risks.

In 2019, the DA-PCC's Animal and Breeding Genomics Section (ABGS) introduced the country's first paternity testing program for cattle and buffalo in order to address these issues. By enabling breeders to verify animal parentage and guarantee that breeding activities were founded on reliable, verifiable data, this service transformed the way genetic evaluations were carried out. In the beginning, the paternity test was conducted using a single-plex panel that tested individual microsatellite markers to confirm parentage. But as the demand for a more effective and scalable solution increased, ABGS started a bold plan to improve this service by switching to a multiplex panel, which would enable the testing of multiple markers at once. This enhancement was expected to increase applicability and streamline the process,

PARENTAGE ANALYSIS

FIG. 2. Estimated costing of Parentage Analysis resources per sample (Villanueva et al., 2023)

Costing	Singleplex (A)	PostPCR (B)	PrePCR (C)
DNA Extraction	300	300	300
PCR Amplification	597.33	597.33	149.33
Fragment Analysis	1,280	320	320
Utilities, Maintenance and Labor	247.2	247.2	247.2
Other MOOEs	192.8	192.8	192.8
Total	PHP 2617.33	PHP 1657.33	PHP 1209.33



CITATION

Yusi, M.R.M., Gajeton, M.B., Reyes, M.N., and Flores, E.B. (2023). Development of a multiplex panel of microsatellite markers for routine parentage testing in buffalo and cattle. BG15003-RC.

that are crucial for the Philippine livestock industry, including economically important traits such as marbling and tenderness in meat and milk quality. At the same time, the researchers screened for genetic disorders like Bovine Leukocyte Adhesion Deficiency (BLAD), Citrullinemia, and Complex Vertebral Malformation (CVM), all of which can have serious consequences for cattle health.

In total, 1,394 animal samples were collected, tested, and analyzed—each sample carefully screened for various genetic markers. The results were both enlightening and significant for the future of Philippine livestock breeding.

The key findings of the study include:

Bovine Leukocyte Adhesion Deficiency (BLAD) was found in 0.91% of the animals, with carriers identified in four mother-daughter pairs. Cattle affected by BLAD are more prone to having severe, recurrent and prolonged infection. Animal show varied sign of immunodeficiency such as pneumonia, gingivitis, delayed wound healing, stunned growth and persistent marked neutrophilia. Deficiency of Uridine Monophosphate Synthase (DUMPS) was not detected in any of the 437 samples, as all were non-carriers. Similarly, Citrullinemia was absent in all 192 samples. For Complex Vertebral Malformation (CVM), 4% out of 286 animals were found to be carriers. This genetic defect can lead to embryonic death and reduced fertility, but early screening allows for the selection of non-carrier replacements to prevent reproductive losses.

The study examined a number of genes linked to characteristics including fat accumulation, marbling, and softness in relation to meat quality. The tenderness-related gene CAST (Calpain and Calpastatin) displayed a larger frequency of advantageous alleles than anticipated, especially in Brahman and Brahman-cross cattle, which may present chances to enhance the tenderness of meat in these breeds. Additional potential for improving meat quality, particularly in terms of marbling and fat content, was indicated by the varied frequencies of other genes, including TFAM, CAPN, FABP4, and TTN.

Finally, the study evaluated genes linked to the quality of milk. Both CSN3 (Kappa-casein) and BLG (Beta-Lactoglobulin), which affect milk composition and yield, displayed positive genotypic distributions, with CSN3 being more useful for manufacturing cheese. With a comparatively high frequency of the KA genotype, the polymorphic DGAT1 gene—which is connected to milk fat content—suggests that selective breeding may increase milk fat content. The study also looked at the milk yield-related genes PIT1 and PRL, which revealed different frequencies of advantageous genotypes for enhancing milk output.

CITATION

Flores, E.B., Herrera, J.R.V., Prades, K.J.V., Reyes, M.N. Maylem, E.R.S., Paraguas, A.M., Bantug, K.M.R., and dela Cruz, Y.C. (2024). Development of Screening Protocols for Genetic Defects and other Economically Important Traits in Cattle and Buffaloes in the Philippines. BG20003-RC

making it more accessible to farmers nationwide.

ABGS developed seven multiplex PCR panels that can regularly verify parentage across a variety of Philippine cattle and buffalo breeds by refining 28 microsatellite markers. These markers effectively differentiate between the genetic profiles of various animals and are very informative. This update lowers the time and expense required to confirm parentage while simultaneously increasing testing accuracy.

The ABGS tested this new protocol on a group of 16 animals with different genetic backgrounds to make sure it worked for a variety of breeds. In addition to dairy and beef cattle, the test subjects included buffalo of several varieties, including swamp buffalo (SB), Bulgarian Murrah buffalo (BMB), Italian Murrah buffalo (ItMB), and crossbred buffalo (CB). The new multiplex panel operated seamlessly across all breeds, according to the results of a thorough testing and cross-checking of the protocol against single-plex results. The results of the multiplex and single-plex tests did not differ significantly, confirming the new system's validity and dependability.

ABGS has made it possible for local farmers and breeders to take a more active role in genetic improvement initiatives by offering a reliable and effective method for confirming parentage. Farmers can now choose which animals to breed with greater knowledge thanks to a more easily available paternity testing service, which will ultimately improve the genetic quality of their herds. This is particularly crucial for increasing the productivity of the country's cattle and buffalo populations, which are essential to the agricultural economy.

First Philippine swamp buffalo reference...

(From page 4)

traits like milk production and fertility, which are essential for improving agricultural practices and understanding water buffalo genetics.

Researchers need to expand the dataset on global buffalo populations, as the study serves as a benchmark for the 1000BGP. They also aim to create a pangenome graph for buffalo and generate a phased telomere-to-telomere complete genome assembly from a river and swamp buffalo hybrid. This work will enable the complete characterization of centromeres and other challenging genomic regions that are difficult to assemble.

DA-PCC researchers develop quick, inexpensive LAMP test kit to detect LSD

By France Joseph O. Pascual & Marvin A. Villanueva

Researchers from the DA-Philippine Carabao Center (DA-PCC) created a fast, reliable, yet cost-effective test kit for lumpy skin disease (LSD) in preparation to safeguard carabaos and other ruminants in the country as Africa and the neighboring Asian countries face a disease of high economic pressure and severe production loss in cattle.

LSD is a viral disease that affects cattle and water buffaloes, characterized by fever and skin nodules on the head and neck. It is caused by the Capripox virus and is transmitted through insect bites, direct contact, and contaminated needles. Since the Philippines is involved in diverse wildlife trade, imported cattle from China, the Middle East, parts of South Asia, and most African countries may carry such diseases. This poses a national concern that can compromise food security, milk yield to 5L/day and result in morbidity rates of 22.5% for crossbreeds and 25.9% for local breeds, as well as infertility.

Although a vaccine is available on the market, the diagnosis of LSD requires laboratory testing. Existing techniques for detecting the disease rely on specialized lab equipment and trained personnel, often incurring significant cost.

The new test kit employs the Loop-Mediated Isothermal Amplification (LAMP) primers optimized for varying temperatures, incubation time, and dyes targeting a synthesized G protein-coupled LSD receptor with 233 base pair (bp) nucleotides and the viral P37 attachment protein. Polymerase Chain Reaction (PCR) methods were also used to test the assay's sensitivity for disease surveillance.

Results indicated a 100% sensitivity and a 99.19% specificity for the optimized LAMP assay across multiple independent laboratories, confirming its reliability as a diagnostic tool. At temperatures of 60°C and 63°C, the assay demonstrated strong fluorescence intensity using SYBR Green as a visual marker, highlighting the temperature sensitivity of the LSD LAMP and enabling more accurate interpretation of screening results. For incubation time optimization, various durations were tested, with the study identifying a 45 to 60-minute interval as optimal for robust gene amplification. As a result, a range of 0.2 to 0.5 µL of SYBR Green is recommended for achieiving optimal sensitivity and specificity in the protocol.

The paper demonstrated that the LAMP assay has heightened sensitivity, which contributes to the apparent detection of lower concentrations of the target DNA. Despite challenges related to contamination affecting specificity, the potential of the LSD LAMP is an effective and reliable screening method for identifying LSD virus DNA in blood samples. Additionally, the estimated cost per reaction was PHP 48.80 for the developed LSD LAMP assay test kit, based on the 2023 price list for the reagents and PCR tubes.

The LAMP assay promises a powerful solution for LSD detection, improving the Philippines' preparedness against the disease. To achieve widespread use, the researchers rec focusing on commercialization, securing intellectual property rights, partnering with manufacturers for scaling production, and obtaining the necessary regulatory approvals.

Soon, this compact kit could become a mighty weapon in preventing significant outbreaks such as LSD in the future.

CITATION

Villanueva, M.A., Tubalinal, G.A.S.P., de Guia, A.C.M., Belotindos, L.P., and Mingala, C.N. 2023. Development of a Prototype for Loop-Mediated Isothermal Amplification (LAMP) Assay for the Detection or Screening of Lumpy Skin Disease (LSD). AH 23003-ROG

DA-PCC reaps awards...

(From page 3)

Gajeton, Maria Rica Yusi, Melinda Reyes, and Dr. Ester Flores.

Finally, the study "Effectiveness of KBGAN Learning Videos on Improving the Knowledge, Attitude, and Practices of Dairy Carapreneurs" was chosen as the best paper under the **socioeconomics** category presented and authored by Dr. Eric Palacpac. The other authors of the study were Ronaline Canute, Camille De Gracia, Rowena Galang, and Ma. Cecilia Mariano.

Meanwhile, select DA-PCC researchers were also recognized:

Dr. Peregrino Duran as 2024 COMPANIA J.M. INC. Distinguished Researcher in Animal Science Awardee; Dr. Lawrence Belotindos as 2024 PSAS-Vethealth Corporation Outstanding Young Professional in Animal Science Research Awardee; and Joel Cabading as 2024 PSAS-Superior Stock Farm Outstanding Young

Reducing embryonic loss and enhancing AI efficiency in dairy buffaloes

By Ronaline C. Canute & Roseline D. Tadeo

Embryonic loss in dairy buffaloes is a significant concern as it directly impact productivity and profitability. Local dairy farmers face the challenge of ensuring consistent and efficient reproductive success, especially when utilizing artificial insemination (AI).

A research team from the R&D Division of DA-PCC conducted a study titled, "Detection and Management of Embryonic and Fetal Loss in Dairy Buffaloes." The team aims to find ways to improve pregnancy rates and decrease embryonic losses through better reproductive management. The researcher aimed to enhance AI efficiency and help dairy farmers increase their herd's productivity by testing several estrus synchronization protocols.

The study was grouped into multiple experiments. For study 1, post-partum dairy buffaloes exhibiting natural estrus were artificially inseminated, serving as controls; in study 2, the size of pre-ovulatory follicles was measured and categorized. The researchers used this data to determine the ideal timing for AI, hypothesizing that larger follicles would yield better results. Study 3 involved grouping buffaloes by breeding seasons, from January through December. Buffaloes in this phase were treated with the CIDR-Synch-hCG estrus and ovulation synchronization protocol and inseminated on Day 10 of the protocol.

The key findings of the study revealed that CIDR-hCG protocol (T2) and natural estrus (T1) showed similar pregnancy rates, but CIDR-hCG had lower embryonic loss; PGF2 protocol (T3) had the lowest pregnancy rate and highest embryonic loss, indicating that this protocol was less effective; larger follicle size (≥12 mm) resulted in the highest pregnancy rates and lowest embryonic losses; and insemination during cooler months (January-March and October-December) led to higher pregnancy rates and lower embryonic loss compared to warmer months.

CITATION

Atabay, E.C., Atabay, E.P., dela Cruz, C. F., Maylem, E. R. S., Apolinario, J.P. R., Lofranco, O. C., and Tadeo, R. D. (2024). Detection and Management of Embryonic and Fetal Loss in Dairy Buffaloes. RB20004-RC.

The study concluded that the CIDR-hCG protocol (T2) demonstrated comparable pregnancy rates to natural estrus (T1) but with a significant advantage of lower embryonic loss. The PGF2 protocol (T3), however, was less effective, showing the lowest pregnancy rates and highest embryonic loss. Additionally, larger follicle size (≥12 mm) was associated with improved pregnancy outcomes, characterized by higher pregnancy rates and reduced embryonic loss.

Furthermore, insemination during cooler months (January-March and October-December) resulted in more favorable reproductive outcomes, highlighting the importance of both protocol choice and seasonal timing in optimizing fertility.

Professional in Animal Science Extension Awardee.

The PSAS is a non-profit organization of veterinarians and animal scientists conducting relevant research in animal science. Its annual seminar and convention facilitate knowledge-sharing through presentations and discussions on industry challenges.

2024 PSAS INDIVIDUAL AWARDEES

CITATION

Palacpac, E.P., Galang, R.S., Canute, R.C., Jacang, R.T., Daganos, D.Y.D., Ruba, R.M.B., Mariano, M.C.I., and de Gracia, C. (2023). Effectiveness of KBGAN Learning Videos on Improving the Knowledge, Attitude, and Practices of Dairy Carapreneurs. SE22002-RC.

KBGAN
KNOWLEDGE BROKERAGE, GUIDANCE, AND ADVISORY NETWORK
LEARNING VIDEO SERIES

Feeding Management.....3:36
Health Management.....5:22
Hygienic Milking.....4:25
Calf Management.....6:09
Silage.....4:27
CBED.....5:01
Benepisyo ng Gatas.....5:24
Wastong Pagsusuri sa Kalidad ng Gatas.....10:48
Vermicomposting.....5:10
AI and FTAI.....7:35

The results of using KBGAN learning videos to train carapreneurs

By Ronaline C. Canute

The Knowledge Management Division (KMD), in partnership with the Grameen Foundation Philippines, produced five sets of learning videos in 2019 under the Knowledge, Brokerage, Guidance, and Advisory Network (KBGAN). These KBGAN learning videos feature the best practices of the agency on Silage Making, Calf Management, Hygienic Milking, Feeding Management, and Health Management.

These learning videos were shared publicly through DA-PCC's official website, Knowledge Portal, Facebook page, and Youtube. Despite substantial viewership, no empirical evaluation has been conducted to measure their effectiveness.

In this regard, the Applied Communication Section of KMD conducted a study titled, "Effectiveness of KBGAN Learning Vidoes on Improving the Knowledge, Attitude, and Practices of Dairy Carapreneurs." The study was conducted at five sites under the Carabao-Based Business Improvement Network (CBIN), particularly in the provinces of Bataan, Pangasinan, South Cotabato, Isabela, and Iloilo.

To measure the KAPs of the participants, they were divided into three groups: the video only group (participants watched the KBGAN learning videos twice with minimal supervision and no traditional lectures or demonstrations); the video plus demo group (participants watched the videos followed by an open forum and actual demonstrations); and traditional lecture with demo (the participants received traditional lecture with demonstration conducted by a community-based trainer, aided by a PowerPoint presentation).

Statistical analysis methods included Paired Sample T-Tests, Repeated Measures ANOVA, Kruskal-Wallis H, and McNemar's Tests to assess changes in KAPs across instructional modalities.

The result showed that Traditional Lecture plus demonstration yielded the most significant knowledge gains in calf management, while videos combined with demonstrations were effective or feeding management.

However, there were no significant changes in health management and silage making across all instructional methods. Attitudes remained largely unchanged post-training and while traditional methods improved some practices, video-only methods negatively impacted others like mastitis management.

This study won the Best Paper Award under the Socioeconomics category during the 61st Philippine Society of Animal Science Scientific Meeting and Annual Convention.

DA-PCC showcases 32 studies...

(From page 2)

presented would be implemented at the industry level to enhance carabao profitability and productivity. Meanwhile, Deputy Executive Director for Production and Research Dr. Claro N. Mingala emphasized the significance of the event in highlighting DA-PCC's research efforts, noting that the agency could evolve into a national livestock research institute with a broader focus beyond water buffalo.

The panel of reviewers for the research papers included experts from the University of the Philippines (UP) Diliman (UPD), UP Los Baños (UPLB), and Central Luzon State University (CLSU) including Dr. April Shayne Lobaton Sulabo, Dr. Ian Kendrich C. Fontanilla, Dr. Rommel C. Sulabo, Dr. Joice V. San Andres, and Dr. Maria Excelsis M. Orden.

The annual external review is part of DA-PCC's preparation for major scientific conventions, such as those organized by the Philippine Society of Animal Science (PSAS) and the Department of Science and Technology-Philippine Council for Health Research and Development (DOST-PCHRD). The review also tracks the progress and impact of DA-PCC's livestock studies, providing valuable insights for stakeholders and partner agencies.

Newly-formulated Karabun can last for 7-8 days

By France Joseph O. Pascual & Patrizia Camille O. Saturno

As of 2024, the Philippines continues to grow its population to 115 million people, where 31.71 million are schoolchildren aged 5-17, meaning we would need more food to sustain everyone. Programs like the School-Based Feeding Program of the Department of Education (DepEd) aims to address undernutrition, and it requires a sustainable approach to food production that can extend the shelf-life of the food it serves, including the Karabun.

Recently, researchers from the DA-Philippine Carabao Center (DA-PCC) have formulated a bread recipe that extends its shelf-life from 4-5 days to 7-8 days, which can enhance marketability, reduce economic losses due to spoilage, and support wider bread distribution.

Four treatments in varying levels of vinegar, bread improver, and calcium propionate were used based on flour weight. Also, the study evaluated the bread samples on physicochemical characteristics, microbial quality, sensory evaluation, and shelf-life analysis, including water activity, moisture content, and sensory properties during storage.

Tests on the sensory evaluation and physicochemical characteristics indicated a decreasing trend in terms of water activity, moisture content, and sensory attributes of samples during storage but showed no significant differences among treatments. On the other hand, results on microbial quality showed visible molds on Day 5 on the T1 (original Karabun) and T2, while T3 and T4 exhibited mold growth on Day 8 and 9, respectively. This apparent spoilage has something to do with the use of calcium propionate, a food additive commonly used to prevent rope bacteria and mold growth without disrupting the leavening process, which further prolongs the shelf-life of any baked goods.

Aside from its microbial stability, Treatment 4 has the lowest microbial count in terms of aerobic plate, coliform, E. coli, yeast, and molds throughout the storage period compared to the original formulation.

Computation on the formulation cost was also considered in the study with T4 showing the highest at PHP 8.83 per 80g. T1, meanwhile, had the lowest cost at PHP 8.75 bun since it did not contain bread improver and calcium propionate, followed by T2 at PHP 8.78.

T4 demonstrated the most extended shelf-life of eight days, improving marketability and reducing spoilage. Though the suggested formulation is at a higher cost compared to the original recipe, profit is more at stake since longer shelf-life means reduced economic loss due to spoilage. Recommendations include developing additional variants of nutritional milk bread for broader market appeal.

Karabun—a bread to go at any time, all the time. And now, for a longer time.

CITATION

Saturno, P.C.O., Salazar, J.D.C., Soliven, J.J., dela Cruz, R.R., and Baltazar, T.M. (2023). Extension of Shelf-Life of Nutritional Carabao Milk Bread. PD 22004-RC.

Carabeef Jerky yields potential as new source of protein

By France Joseph O. Pascual & Renelyn M. Labindao

Diet became a global concern, especially as people around the world now have access to a wide range of food options, including those rich in protein. This essential nutrient plays a crucial role in tissue repair, hormone regulation, immune function, energy supply, and muscle maintenance. By incorporating a variety of protein sources, such as beef jerky, individuals can ensure they receive the necessary amino acids for optimal health.

Carabao, as a source of meat, can rival beef because it contains less fat, cholesterol, and calorie content. It also has superior processing characteristics, suitable for developing value-added meat products. Jerky, on the other hand, involves meat that is marinated, seasoned, and dried to create a chewy, flavorful, and long-lasting snack.

By developing carabeef jerky as a nutritious, low-fat, and high-protein snack, the study also addresses the growing demand for convenient, shelf-stable meat products that do not require refrigeration. Additionally, the study uses advanced sensory evaluation techniques, microbial analysis, and nutritional profiling to ensure product safety, quality, and consumer acceptability.

While cost analysis shows profitability, the jerky production and sensory acceptability tests are still in progress, making such a promising source of protein out of carabao's meat suitable for health-conscious consumers.

CITATION

Labindao, R.M., Conde, R.M., Geminiano, M.A., Dalusong Jr., D., Mamuad, F.V.L., and dela Cruz, E. (2024). Development and Evaluation of Carabeef Jerky Snacker. PD 22003-ROG.

Expanding Horizons: Uniting for Livestock R&D Innovation

ERIC P. PALACPAC, PhD
PCC-OIC National R4D Coordinator

As we look back on the past year, the Research and Development Division (RDD) has made remarkable strides in driving innovation and excellence within the DA-PCC. These accomplishments are not just milestones; they are testaments to the power of teamwork and the synergy of our efforts. Every breakthrough and milestone achieved by the RDD's various sections reflects the seamless interfacing within our division, collaboration with other divisions of the agency, and the proactive engagement of our regional centers. Together, we have transformed challenges into opportunities and ideas into impactful initiatives that serve not only the carabao industry but also the broader livestock sector.

This collective effort underscores an essential truth: that the heart of research and development lies in collaboration. Our ability to work across boundaries—whether disciplinary, geographical, or institutional—has been instrumental in implementing innovative R&D projects. These initiatives do more than address the present needs of the carabao industry; they also pave the way for a more resilient and competitive livestock sector as a whole.

As DA-PCC continues to evolve into the Department of Agriculture's premier R&D arm for livestock, we are called to expand our horizons. While carabao remains central to our mission, the agency must also prepare to engage with other livestock commodities, including cattle, goats, swine, and poultry. This is not merely a shift in focus but an opportunity to position ourselves as leaders in research excellence across the livestock spectrum.

In this transition, it is crucial to recognize that our greatest asset is not solely the products we develop—milk, meat, or leather goods—but the knowledge workers who create, innovate, and sustain these efforts. Our researchers and development workers are the true engines of change. Their expertise, dedication, and drive are what enable DA-PCC to generate solutions, develop technologies, and shape the future of livestock research in the Philippines.

To my colleagues in DA-PCC, I extend my deepest appreciation for your commitment to excellence and innovation. Let us continue to foster a culture of collaboration, where every idea is valued, every contribution matters, and every challenge is met with determination. Together, we will not only achieve our goals but exceed them, leaving an indelible mark on the livestock industry and the communities we serve.

Let us move forward with purpose, knowing that our work today will shape the future of the livestock industry—an industry that is not just about producing goods but about transforming lives through science, innovation, and the dedication of a united team.

R4D *Highlights*©

R4D Highlights, an annual publication of the DA-Philippine Carabao Center, publishes in popularized form the agency's researches presented in its annual R&D Review. This publication reaches out to a wide scope of readers both in the science and non-science professions as well as the general public.

For comments and suggestions, please write to the Editors-in-Chief in this mailing address:

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