PHILIPPINE CARABAO CENTER

Annual Report 2015

TRANSCENDING BOUNDARIES FOR INCLUSIVE DEVELOPMENT


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Annual Report

2015

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PHILIPPINE CARABAO CENTER

The Philippine Carabao Center (PCC) operates as an attached agency of the Department of Agriculture (DA). PCC is mandated under Republic Act No. 7307 or the Philippine Carabao Act of 1992 to conserve, propagate and promote the carabao as a source of draft animal power, meat, milk and hide to benefit the rural farmers.

Per DA Administrative Order No. 9, series of 2008, PCC likewise is the lead Institution in Livestock Biotechnology research and development.

VISION

To become a premier institution promoting profitable and sustainable carabao-based enterprises designed to improve the income and nutrition of rural farming communities.

MISSION

Improve the general well-being of rural farming communities through carabao genetic improvement, technology development and dissemination, and establishment of carabao-based enterprises, thus ensuring higher income and better nutrition.

POWERS AND FUNCTIONS

RA 7307, which was signed on March 27, 1992 and operationalized on April 1, 1993, provides that PCC's powers and functions are:

- Conserve, propagate and promote the Philippine carabao as a source of draft animal power, meat, milk and hide;
- Enable the farmers, particularly smallholder-farmers and CARP beneficiaries, to avail themselves of good quality carabao stocks at all times and at reasonable prices through an organized program of production, breeding, training, and dispersal;
- Undertake training programs for farmers, particularly smallholder-farmers and CARP beneficiaries, designed to transfer technology on the proper care and reproduction of the carabao and the processing of its meat and milk;
- Encourage backyard dairy development in rural areas by raising carabaos so as to meet the nutritional needs of the smallholder-farmers and their families and reduce dependence on imported milk by-products;
- Undertake research activities in all disciplines that lead to the improvement of the overall productivity of the Philippine carabao;
- Increase the existing annual population growth of the Philippine carabao to keep pace with human population growth;
- Enter into memoranda of agreement and receive donations through the Department of Agriculture from local and foreign sources. Upon the recommendation of the PCC Advisory Board, the individual carabao centers may enter into agreements directly with funding agencies through their respective board of regents or head of agency.

GENETIC IMPROVEMENT PROGRAM

As of December 2015, the NGP facility maintains 498 purebred dairy buffaloes (416 Bulgarian, 76 Brazilian, one Italian-Meditteranean) and five crossbred buffaloes for genetic evaluation. Some 259 of these are female breeders with average conception rate of 44.80%, average calving interval of 15.9 months, and calving rate of 64.59% (a marked improvement over the past year).

Purebred and Crossbred Dairy Buffaloes

National Gene Pool. The PCC's National Gene Pool (NGP), operates as an "open nucleus herd", i.e., it allows entry of breeding stocks into a herd of purebred (riverine) dairy buffaloes where systematic breeding, selection, and genetic evaluation procedures are being carried out. The purpose of which is to eventually produce an elite herd of dairy buffaloes that would be sources of superior germplasm for future generations. The NGP is nestled on a two-hectare facility and is supported by around nine hectares of improved forage.

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Regional Centers. Institutional herds of purebred riverine buffaloes numbering to 1,153 (6 Murrah, 914 Bulgarian, 39 American, 112 Brazilian, and 82 Italian-Mediterranean) and 296 crossbred buffaloes are also maintained at the PCC's 13 regional centers. Performance or production data from these buffaloes are also registered in the PCC-wide recording system for genetic evaluation and selection.

Infusion of Italian-Meditteranean Buffaloes (IMD). From the earlier importation of IMBs, 336 more were entrusted to 17 qualified cooperatives, associations, and families with 156 farmer-trustees located within the impact zones of the PCC regional centers hosted by USM, CMU, VSU, CSU and USF in 2015.

National and Regional Impact Zones. Purebred dairy buffaloes were also entrusted to farmer-cooperators in various cities and municipalities in Nueva Ecija, tagged as the "National Impact Zone" or NIZ for dairy buffalo development, and in the "Regional Impact Zones" (RIZs) being stewarded by the PCC's regional centers. Current inventory of purebred dairy buffaloes in these impact areas is 8,002 (Table 1), which represents an increase of 46.69% from the previous year.

Table 1 Purebred dairy buffalo inventory in the NIZ and RIZs.

Category	NIZ	RIZ	Total
Pregnant	373	317	690
Nonpregnant	1,810	1,323	3,133
Female Calves	189	181	370
Male Calves	232	155	387
Junior/Adult Bulls	545	330	875
Total	3,149	2,306	5,455

Philippine Native (Swamp) Buffaloes

The PCC's regional centers also raise and maintain Philippine native carabaos in their institutional facilities (ex situ) for purpose of conservation, propagation, and selection within breed. As of 2015, a total of 242 native carabaos are raised in the PCC's regional centers, most of which are found in PCC at USF (n=105) and PCC at CSU (n=90).

Breed development

Dairy Buffalo Breeding Program

In 2015, the Genetic Improvement Program Laboratory (GIPL) implemented for the first time the use of multi-trait random regression test day model (MT-RRM) for breeding value estimation (EBV) in Philippine dairy buffaloes. This is a refinement in genetic evaluation model from a research on estimation of genetic parameters. In 2015, the same model was used for genetic evaluation. Based on the new model, MT-RRM, 136 bulls (55 of which are island born breeding bull) and 1,656 cows were reported with breeding values for milk, fat and protein yields. Top performing centers, cows and bulls based on EBVs were reported to the concerned Center last May 2015 during the GIP Coordinator's meeting (see report below). The genetic trend for milk yield is positive, indicating genetic progress. Eight semen donor young bulls were identified for progeny testing and another eight were identified for training to become semen donor bulls. The actual number of bulls to become semen donor will depend on these bulls passing the semen quality evaluation.

Establishment of performance recording for dairy buffaloes in the various cooperatives of Nueva Ecija and selected Dairy buffalo multiplier is continuous. The Javier Dairy Farm and Italian Riverside multiplier farms have started milk test day recording along with another cooperative enrolled in DHI. Thus, with the enrollment of another cooperative in 2015, there are now seven (7) cooperatives/associations undergoing milk test day recording with 136 newly calved cows added to the previous years' number.

Swamp Buffalo Breeding Program

The genetic parameters and phenotypic trend for growth traits of the gene pool for swamp buffaloes in PCC at CSU was also estimated and analyzed. There was a substantial increase in average weight and average daily gain across different age category and a very positive phenotypic trend across the years. The genetic parameters were also within the range of values as reported for bovine species for the same traits. Result of the analysis was presented at the PSAS conference in October 2015.

Molecular Genetics Laboratory Researches

Activities at the MolGen in 2015 lab focused mainly on the newly approved research project, "Genotyping the Philippine water buffaloes using medium density 90K buffalo SNP panel". Implementation of the research project commenced in February 2015 and so far, 960 buffalo DNA samples were sent for genotyping and analysed. The target number of buffaloes to be genotyped for the year one (1) implementation of the project has been achieved. Genotypes results of 960 buffaloes have been given by Affymetrix Inc. to PCC and as such, genotype quality control analyses have been done. Current activity is now towards creating the dataset needed for genome-wide association analysis (GWAS). This involves combining the genotype dataset containing the genotype calls of 123,040 probe set for 90,000 SNP markers of each buffalo with its phenotype (milk yield, fat and protein yields, fat% and protein%). Genotype metrics obtained were comparatively similar to the result from Italian buffaloes as reported by Dr. John Williams during the World Buffalo Congress held in Phuket Thailand on May 6–8, 2013. Table 2 summarizes the result of genotyping for all samples submitted and on a per breed basis. Out of the 960 DNA samples submitted that passed minimum dsDNA concentration, 911 samples (95%) passed quality control procedures with an average call rate of 99.5% for those samples that passed QC and an average reproducibility of 99.86. Of the 90,000 SNPs in the panel, 74.3% are polymorphic and informative or usable (PolyhighResolution) while Dr. Williams reported 74% for the Italian buffaloes. These SNPs are suitable for linkage disequilibrium (LD), genome wide association studies (GWAS) and population stratification studies.

On a per breed basis, the percentage of samples passing quality control measures and the average call rate for passing markers were the same as the all-breed average. The percentage of polymorphic markers was less than the percentage obtained from running the all-breed samples. The number of polymorphic markers apparently increased with the number of samples probably because the likelihood of markers with rare alleles being sampled more than two times increases with more samples. However, for the swamp buffaloes, the percentage of polymorphic markers is substantially lower than the crossbreds and the riverine breeds such that even with higher number of samples, it may not approximate the all-breed average. Nevertheless, the total number of polymorphic markers is large enough for the markers to be informative.

The results of genotyping metrics from the combined samples of all breeds and on a per breed basis indicated that the buffalo genotyping array can be used on the various buffalo breeds present in the Philippines.

Table 2. Quality control metrics across seven (7) buffalo populations in the Philippines using the Affymetrix Axiom Analysis Suite Software.

Measures	Breed						
	SP	CB	USMB	BrMB	ItMB	BMB	All breeds
Genotyping metrics							
Number of samples	21	43	45	59	75	712	960
Samples that pass QC (%)	20 (95.24)	42 (97.7)	44 (97.8)	57 (96.6)	74 (97.3)	675 (94.8)	911 (94.9)
Ave. QC CR for passing samples	98.89	99.4	99.4	99.6	99.7	99.5	99.5
SNP Summary							
Poly High Resolution (%)	38720 (43)	60406 (67.1)	61645 (68.5)	63046 (70.1)	64,081 (71.2)	66,499 (73.9)	66,845 (74.3)
Other (%)	14262 (15.8)	11690 (13.0)	12054 (13.4)	11125 (12.4)	10,478 (11.6)	10,563 (11.7)	10,538 (11.7)
Mono High Resolution (%)	7457 (8.3)	6461 (7.2)	6028 (6.7)	6531 (7.3)	7126 (7.9)	6,805 (7.6)	6,624 (7.4)
No Minor Hom (%)	22232 (24.7)	7385 (8.2)	5602 (6.2)	4501 (5.0)	4796 (5.3)	1,117 (1.2)	830 (0.92)
OTV (%)	1860 (2.1)	908 (1.0)	971 (1.1)	831 (0.92)	818 (0.91)	680 (0.76)	772 (0.86)
Call Rate Below Threshold	5457 (6.1)	3138 (3.5)	3688 (4.1)	3954 (4.4)	2689 (3.0)	4,324 (4.8)	4,379 (4.9)
Hemizygous (%)	12 (0.01)	12 (0.01)	12 (0.01)	12 (0.01)	12 (0.01)	12 (0.01)	12 (0.01)

SP- swamp buffalo, CB- crossbred, USMB- American murrah buffalo, BrMB-Brazilian murrah buffalo, BMB-Bulgarian murrah buffalo, ItMB-Italian murrah buffalo

Substantial delay in sending the DNA samples for genotyping was encountered due to the required high concentration of double stranded DNA for hybridization. On the average, the dsDNA concentration required is 25 times higher than normally used for sequencing as measured using Nanodrop. Thus, those samples that did not meet the cut-off had to be subjected to a re-concentrator to increase the DNA concentration prior to re-submission.

Dataset preparation for genome-wide association studies is now being done. A small data set of phenotype was prepared and analysis done to test the suitability of the genotypes for GWAS. The power of detecting significant association between phenotype and genotype becomes greater with more animals in the dataset. Nevertheless, even with a small dataset of less than 100 cows, significant SNP markers associated with milk production have been observed.

There were 64,844 female animals examined, out of which, 63,547 heads were artificially inseminated covering 6,800 barangays in 875 municipalities and cities in 73 provinces of the 16 regions of the country as of December 2015. These AI services were carried out by village-based AI technicians or VBAITs (n=349), LGU AI Technicians (n=491), and PCC AI Technicians (n=58).

National Crossbreeding Program

The aim of the PCC's crossbreeding program is to ultimately develop a Philippine dairy breed adaptable under local conditions. The production of crossbred buffaloes is done in two ways: (1) artificial insemination (AI), and (2) natural mating through the Bull Loan Program.

Artificial Insemination (AI). There were 64,844 female animals examined, out of which, 63,547 heads were artificially inseminated covering 6,800 barangays in 875 municipalities and cities in 73 provinces of the 16 regions of the country as of December 2015. These AI services were carried out by village-based AI technicians or VBAITs (n=349), LGU AI Technicians (n=491), and PCC AI Technicians (n=58).

An additional 128 AI technicians (VBAIT and LGU) were trained this year in the five PCC training centers (PCC at CLSU, PCC at CMU, PCC at CSU, PCC at UPLB, and PCC at USF), which added to the pool of trained AI Technicians in the country.

As of December 2015 report, there were 14,125 monitored calves on the ground based on the 2014 AI services.

Frozen semen production and distribution. The agency produced a total of 367,921 doses of frozen semen at its semen processing facilities managed by PCC at CLSU (n= 284,482 doses) and PCC at UPLB (n=83,439 doses), which were deposited in the PCC's semen bank. Of this total, 262,316 doses were distributed to the PCC regional centers and other partner agencies and individuals for the conduct of nationwide AI for water buffaloes. The remaining doses were stored for reference and for future research work. To maintain the quality and viability of the frozen semen for AI, the PCC distributed a total of 2,606 dewars of liquid nitrogen to its regional centers and partner-agencies nationwide.

Natural Mating via Bull Loan Program. In support of the AI services and in areas where AI services were not accessible, farmers availed of the bull loan program. As of December 2015, a total of 156 bulls were loaned out to farmers. These add up to the 904 existing purebred breeding bulls in the villages around the country. Out of these bulls, 400 are active breeders with 4,039 services and benefitted more than 1,775 carabao raisers (owners of the female carabaos naturally serviced and bull handlers).

As of December 2015, there were 1,554 monitored calves on the ground from the 2014 services of the active bulls.

CARABAO-BASED **ENTERPRISE DEVELOPMENT (CBED)**

The dairy buffalo sector, as stewarded by the PCC, contributed a total of 2,204,105.60 kg of raw milk to the national dairy industry. The milk comes from the Regional Impact Zones, the National Impact Zone, and the PCC's institutional herd. The total value of raw milk traded was Php141,609,802.64.

Newly Created Carabao-Based Modules

In order to expand the development reach of the carabao-based enterprises (CBE), the PCC mobilized and helped organize more farmers, particularly the owners of crossbreds produced out of AI and bull loan programs in the RIZ. The CBED program aims at creating more income-generating opportunities for the smallholder carabao raisers. There were 13 newly organized cooperatives or associations in 12 regions of the country.

Existing Carabao-Based Modules

There were 170 cooperatives or associations composed of 9,067 carabao owners engaged in CBEs, which were mostly located in the RIZs of Luzon and the Visayas. The most notable dairy cooperatives are based in Cavite, Batangas, Bulacan, Cagayan, Laguna, Rizal, Leyte, Isabela, Pampanga, and Bohol, which contributed 729,977.05 kg of milk to the dairy industry.

At the NIZ, there were 54 dairy cooperatives consisting of 990 smallholder-farmer members handling a total population of 3,504 head dairy buffaloes of all ages and sexes. These cooperatives constitute the Nueva Ecija Federation of Dairy Carabao Cooperatives (NEFEDCCO).

Milk Production and Marketing

The NEFEDCCO contributed a total of 833,216.35 kg of raw milk to the milk pool and portion of which was sold to local processors while the rest was sold as processed milk products (basically, pastillas, kesong puti and flavored milk) to the local market. In addition, 116,807.35 kg of total raw milk produced from NEFEDCCO and other dairy cooperatives was sold to the PCC's Centralized Milk Processing Plant (CMPP) for processing and subsequent marketing.

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Dairy Buffalo Multiplier Farm (DBMF)

The PCC continued partnering with qualified farmers and/or private individuals who have the capacity to manage a commercial dairy farm. The DBMF was initiated in order to improve the efficiency in multiplying good quality genetics and to establish a viable commercial buffalo-based dairy farm. In 2015, the PCC entrusted 282 heads of Italian Mediterranean buffaloes to seven DBMF Operators in the coverage areas of PCCs at CLSU, CSU, USF, VSU and the NIZ.

The Department of Trade and Industry (DTI) granted a total of Php3.5 million in the form of milk collection equipment that included 18 units of milking machine, chest type freezers, refrigerators, and 36 units of 40-liter capacity milk cans to the 12 dairy cooperatives in the NIZ under the Shared Service Facilities (SSF) program of DTI.

Post-Production Support

The Department of Trade and Industry (DTI) granted a total of Php3.5 million in the form of milk collection equipment that included 18 units of milking machine, chest type freezers, refrigerators, and 36 units of 40-liter capacity milk cans to the 12 dairy cooperatives in the NIZ under the Shared Service Facilities (SSF) program of DTI. The project started in 2014 and completed on the second quarter of 2015. The following cooperatives were benefited from the SSF: NEFEDCCO, Eastern PMPC, Simula ng Panibagong Bukas PMPC, PBDS, Dimasalang PMPC, San Vicente PMPC, and Casile Dairy Producers Cooperative.

The Provincial Office of the Department of Agrarian Reform (DAR) also granted Php100,000 each to Eastern Primary Multi-Purpose Cooperative in San Jose City and the Catalanacan Multipurpose Cooperative in the Science City of Muñoz, both in Nueva Ecija, as support fund for the enhancement of their respective village-level processing centers.

Capability Building and Strengthening Support to the Farmer-Clients and Other Stakeholders

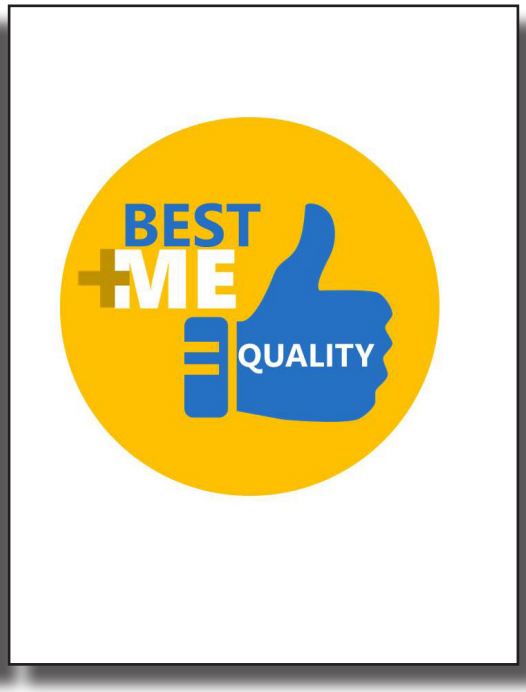
The PCC's regional centers conducted 120 trainings in support of the assisted cooperatives and associations. Some 3,807 participants from Luzon, Visayas and Mindanao participated in such trainings (Appendix 1).

Likewise, the PCC's NIZ Coordinating unit conducted 15 trainings for the farmer-trustees of cooperatives and associations in Nueva Ecija, which were attended by 614 participants (Appendix 2).

Operationalization of the "Dairy Box": a coop-led business model

The PCC's Business Development and Commercialization Unit (BDCU) spearheaded the operationalization of the Dairy Box, a One-Stop-Dairy-Delicatessen-Shop. After series of meetings with the Catalanacan Multi-Purpose Cooperative (CAMPC), the BDCU had finalized an agreement, which encompasses product references and restrictions, consignment regulations, and lease terms. The BDCU then drafted the Memorandum of Agreement, which stipulates the above specified areas. The BDCU is also the mind behind the shop's exterior and interior designs and even the shop's name itself. In close coordination with the CAMPC and other PCC units, the BDCU spearheaded the Soft Opening on July 13, 2015 and finally its Grand Opening on July 31, 2015.

The Business Enhancement Training Series (BEST) Program aimed to continuously elevate the cooperative's practices and their offerings.



'BEST' Lecture Series

As one of the BDCU's directives to provide dairy farmers with capabilities in business operations and enterprise development for the agency's clients, the unit conducted a program comprising a series of trainings and workshops to equip the farmers and its members involved in dairy processing. The program includes varied activities to elevate the dairy processors' techniques and practices in plant operation, production standardization, and store management.

Initial activities lined up in the program targeted to address difficulties faced by farmers as they upscale their production and distribution, such as inconsistencies, spoilage, stock-outs, communications failures and misunderstandings. The activities culminated in a series of training workshop that encourages overall quality consciousness and continuous improvement that aims to effectively integrate and sustain the knowledge gained from the program. The Business Enhancement Training Series (BEST) Program aimed to continuously elevate the cooperative's practices and their offerings. The pioneering groups that underwent the proposed program are Catalanacan Multi-Purpose Cooperative, Eastern Primary Multi-Purpose Cooperative and Milka Krem.

Business Talk

The BDCU conceptualized and conducted the 1st PCC Business Talk on December 9-11, 2015 to jumpstart infusing real business principles in our business models. Creatively designed, the Business Talk is meant to formally introduce the BDCU team to the regional center business module, to discuss basic and relevant business principles, to present the results of the review done for the regional centers, to start making the FS for 2015 using the proposed templates, to agree with business-related targets for the Institutional Herds and for the Processing and Marketing Outlet for 2016, and to cascade and fully discuss the new template for recording of financial data and reporting of financial statements for 2016. The BDCU is currently monitoring the 2015 FS of these models under the new template, which is agreed to be submitted on January 15, 2016. This will be the basis for business target setting for 2016.

RESEARCH FOR **DEVELOPMENT**

Research for Development is one of the major thrusts of the Philippine Carabao Center (PCC). It helps propel the agency to work towards a better understanding of the foundation and dynamics of genetic improvement, animal health and nutrition, buffalo-based enterprises, and the underlying socio-economic issues related to program implementation.

Completed and Ongoing Researches

The PCC has continued conducting researches in various disciplines and particular thematic areas as determined under the agency's R4D Agenda. Many of the researches have applied the concepts and methodologies in biotechnology. This is in keeping with the designation of PCC by the Department of Agriculture as its lead agency for livestock biotechnology R&D. The latter is complemented by relevant researches that explore and address problems or issues that are being encountered in the course of the agency's implementation of the Carabao Development Program (CDP).

In 2015, 17 researches were completed while another 30 were still being conducted (Table 3 and Appendices 3a and 3b). These researches were also presented in the agency's Pre-In House and Annual R4D In-House Reviews held at the PCC National Headquarters.

Table 3. Type, number, and status of researches.

R4D Thematic Area	Completed	Ongoing
Production Management System	4	5
Biosafety	6	6
Product Development	2	3
Genetic Improvement (Breeding and Genetic Evaluation)	1	5
Genetic Improvement (Reproductive Biotechnology)	3	8
Socioeconomic Dimensions of CDP Implementation	1	3
TOTAL	17	30

Appendix 4 presents the abstracts of some completed researches in 2015.

R4D Annual In-House Review

Research for Development is one of the major thrusts of the Philippine Carabao Center (PCC). It helps propel the agency to work towards a better understanding of the foundation and dynamics of genetic improvement, animal health and nutrition, buffalo-based enterprises, and the underlying socio-economic issues related to program implementation. The R&D agenda has been drafted and laid down since the initial operation of the Center in 1993. Revisions and refinement were regularly injected and in 2004, the concept of operational research evolved. The PCC's R&D has been shifted into its new paradigm, the R4D or research for Development. The PCC is moving into a non-traditional, problem-oriented, and focused Research for Development, which has more relevance to the industry's stake holders.

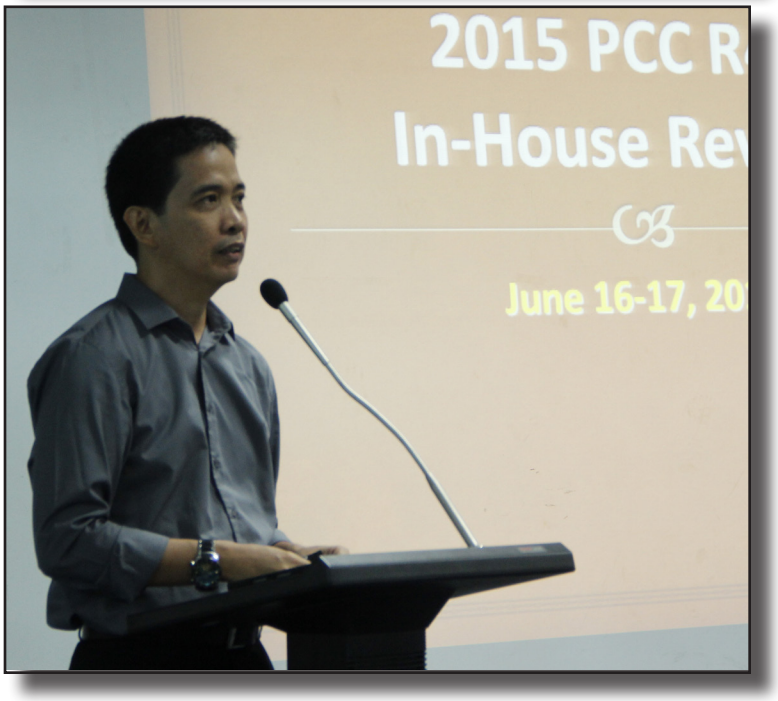
Along this line the PCC's R4D pre-in-house and in-house reviews were organized as a monitoring and evaluation tool that ensures alignment of R4D efforts with the R4D Agenda. It is a continuing activity that demonstrates and recognizes the PCC's research

initiatives. Likewise, it helps create opportunities for researchers and scientists to present their notable accomplishments, and more importantly, to interact and share learning with one another.

There were 26 research studies presented during the in-house review held on June 16-17, 2015 at the PCC National Headquarters. Seven of which are completed while 19 are on-going researches. Completed and on-going researches also included undergraduate thesis along the thematic areas of biosafety, genetic improvement-reproductive biotechnology, genetic improvement–animal genomics, socio-economics, production management system, and product development. Moderators for the paper presentations were Dr. Michelle M. Balbin, Dr. Jesus Rommel Herrera, Ms. Patrizia Camille O. Saturno, Ms. Phobe Llantada, Ms. Excel Rio S. Maylem and Mr. Alvin V. David, all from PCC.

Dr. Jezie A. Acorda, Professor from the UPLB College of Veterinary Medicine, Mr. Peter James Icalia, Instructor from MMSU's Department of Biological Sciences and Dr. Rosalina M. Lapitan, Product Development expert of PCC at UPLB served as external evaluators.

Out of 26 research studies presented, a completed research study titled "The Kinetics of Sperm Penetration and Embryo Development as Predictors of Fertility of Frozen Buffalo Semen" presented by Ms. Excel Rio S. Maylem, won the best paper award. The study titled "Biological Control Efficacy of Nemathophagous Fungi Duddingtonia flagrans in Common Strongyle Roundworms and Fasciola sp. of Swamp Buffaloes (Bubalus bubalis) authored and presented by Ms. Toni Rose Barroga of UPLB won the awards for best undergraduate student research and best presenter.



Conference Presentations and Journal Publications

Consistent with the norm of sharing R&D outputs to wider research and scientific communities, the PCC researchers have actively participated in local and international scientific conferences (see portion of Appendix 5). Likewise, 21 papers were published in refereed journals (Appendix 6).

Technical Seminars Conducted and/or Facilitated

The PCC has also conducted or facilitated a series of Technical Seminars at its National Headquarters on various topics (Table 4). The aim is to improve and sustain awareness of PCC staff and other invited researchers and students from the academe and government institutions on technical matters and issues relevant to the livestock industry in general and PCC operations in particular.

Table 4. List of Technical Caucus and Symposia conducted for CY 2015.

Date (2015)	Title and/or Topic Presented	Resource Speaker
13 January	Chemical Composition and In-vitro Digestibility of locally Available Feed Resource in the Philippines	Dr. Yoshiaki Hayashi
17 March	Direct and Indirect Biological Control of Livestock Disease Vector on the Texas-Mexico Border"	Dr. John Goolsby and Dr. Alex Racelis
19 March	Scientific Writing for Journal Publication	Dr. Jezie A. Acorda
26 March	Seminar on Nutrition and Management of Buffaloes	Dr. Robert Salazar, Paul Christian Ver Manzano, Felomino Mamuad Jr. and Donnan Rey Canoy
15 May	Screening for Genetic Defects in Domestic Animals	Dr. Ming Che-Wu
16-17 June	PCC R4D In-house Review	Dr. Jezie Acorda, Dr. Rosalina Lapitan and Mr. Peter James Icalia
17 September	Gene Editing: Accelerating Livestock Breeding for Agriculture in Asia-Pacific	Dr. Andrew Roberts

The International Training on Reproductive Biotechnology practically dealt with wide aspects of reproductive biotechnologies such as Ovum Pick-up /IVEP, oocyte and embryo cryopreservation, Multiple Ovulation and Embryo Transfer, and Ultrasonography.

International Training on Reproductive Biotechnology

The PCC through its Reproductive Biotechnology Unit spearheaded an international training on Reproductive Biotechnology jointly organized by Food and Fertilizer Training Center (FFTC), Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD), and PCC on July 13 to 22, 2015 at the PCC National Headquarters. The training practically dealt with wide aspects of reproductive biotechnologies such as Ovum Pick-up /IVEP, oocyte and embryo cryopreservation, Multiple Ovulation and Embryo Transfer, and Ultrasonography. The resource speakers were known technical experts in the field conducting the lectures, laboratory demonstration and field activities wherein the participants actively and enthusiastically engaged. There were 15 participants representing the following countries: Taiwan, Thailand, Pakistan, Vietnam, Ecuador, Philippines, and Indonesia. This FFTC and DOST-PCAARRD-organized training was their third of the series in the country.

Awards and Recognitions

The PCC staff members continued to gain recognition from various award-giving bodies in 2015 (Table 5a). Several PCC researchers were also cited in their paper or poster presentations in scientific conferences (Table 5b).

President Aquino personally presented awards to the winners in the Civil Service Commission's 2015 Search for Outstanding Public Officials and Employees. The awarding rites was held November 9 at Malacanang's Rizal Hall. The Philippine Carabao Center at Don Mariano Marcos Memorial State University (PCC-DMMMSU) Center Director Gloria M. Dela Cruz (1st row, 4th from right) was one of the recipients of this year's National Civil Service Commission Pagasa Award.

Table 5a. Recognitions received by PCC staff members.

Awardee	Title of Recognition	Award-Giving Body
Dr. Edwin C. Atabay	2015 Distinguished Researcher in Veterinary Science Award	PSAS-Bounty Agro Ventures
Dr. Julius V. Abela	2015 Outstanding Animal Farm Manager	PSAS
Dr. Claro N. Mingala	Gregorio Y. Zayra Award for Applied Science Research	Philippine Association for the Advancement of Science and Technology
Ms. Gloria M. De La Cruz	2015 Honor Award for Outstanding Work Performance	Civil Service Commission

Table 5b. Citations for PCC staff members who presented papers or posters in scientific conferences.

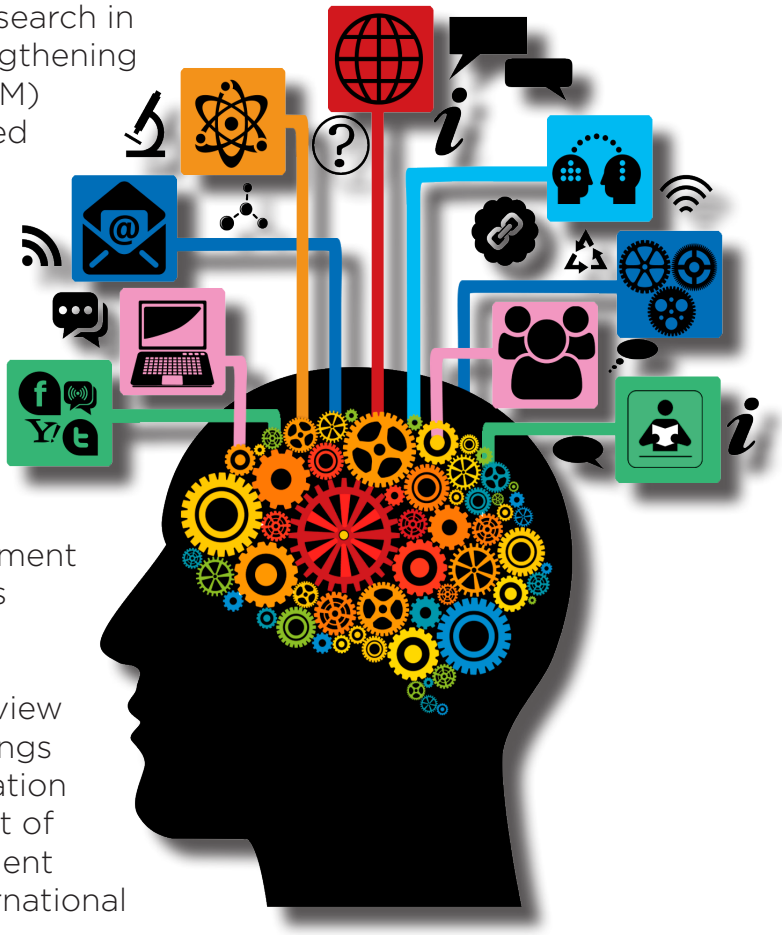
Awardee	Title of Recognition	Award-Giving Body
Dr. Edwin C. Atabay	2015 Distinguished Researcher in Veterinary Science Award	PSAS-Bounty Agro Ventures
Dr. Julius V. Abela	2015 Outstanding Animal Farm Manager	PSAS

KNOWLEDGE MANAGEMENT

The agency's Knowledge Management Division (KMD) leads the information dissemination activities of PCC and plays a significant role in promoting the institution in general and its programs in particular. Recent undertakings emanating from the PCC's R&D activities, including scientific collaborations and other related events, were made available to the public through sustained efforts on information dissemination. These matured and verified information about its activities and technologies were packaged, relayed and disseminated using mixed media approaches.

Knowledge Management

The PCC engaged the services of the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) to facilitate the strengthening of the agency's Knowledge Management (KM) strategy and program under the project titled "Building Capacity and Strengthening Partnerships for Carabao Development Program". The SEARCA in turn engaged the expertise of Dr. Serafin Talisayon, KM Policy and Planning Specialist, along with Dr. Alexander Flor, professor and dean of the U.P. Open University's Faculty of Information and Communication Studies.



Initial activities included meetings and discussions with the PCC's top management and unit heads, inventory and audit of PCC's knowledge assets and resources, interviews and focus group discussions with the PCC executives and staff, consolidation of KM review of PCC, presentation and discussion of findings and recommendations for validation, finalization of KM review and proposed KM plan, roll-out of the KM plan, and preparation and management of learning events such as national and international conferences. The project continues in 2016.

Production and Distribution of Information, Education, and Communication (IEC) Materials

The agency's Knowledge Management Division (KMD) leads the information dissemination activities of PCC and plays a significant role in promoting the institution in general and its programs in particular. Recent undertakings emanating from the PCC's R&D activities, including scientific collaborations and other related events, were made available to the public through sustained efforts on information dissemination. These matured and verified information about its activities and technologies were packaged, relayed and disseminated using mixed media approaches.

Consistent with its goal of image-building and program promotion, the KMD has also used audio-visual and web-based publications utilizing the advancements in information communication technology (ICT) in promoting the agency's accomplishments in narrative and creative content.

Publications and Productions

Six issues of "NIZ Balitaan" were produced. Written in Filipino, it utilizes the tabloid format. With farmers as the specific intended readers, it is produced and released monthly focusing on the PCC's National Impact Zone. The NIZ Balitaan publishes significant news and feature stories about people and technologies involved in buffalo-raising by smallhold dairy farmers in Nueva Ecija and NIZ-related undertakings of PCC. It seeks to inspire and empower dairy farmers as well as current and future program partners, and ultimately contribute to the improvement of the Philippine dairy industry.

Four issues of the PCC Newsletter were produced in 2015. The other regular publications that were circulated to the general public were two issues of the PCC Balita and one issue of R4D Highlights. Various comics, namely Artificial Insemination sa Kalabaw, Pagpapahiram ng Bulugan, Mapa-Wow sa Kabuhayan mula sa Kalabaw and Pagpapanatili ng Kalidad ng Gatas ng Kalabaw were also updated and translated into four dialects: Cebuano, Hiligaynon, Ilonggo and Ilocano. Four other IEC materials were produced, such as: updated corporate brochure, annual report, souvenir program and farmer's calendar.

A total of 97,130 copies of these IEC materials were dispatched to regional centers and were distributed to 35, 543 identified PCC stakeholders, visitors, and partner institutions.

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Five training videos were produced in support of the Dairy Herd Improvement Program entitled, estrous detection, bloat and prolapse, calf rearing, forage production, proper milking and milk handling.

Benefitting from Other Media Forms

In 2015, continued effort was made to introduce the Carabao Development Program of PCC to different media outlets. To maintain regular media exposure, two media fora were organized and held during the PCC 22nd Anniversary "Pistang Kalabaw" event and the 1st National Carabao Conference, respectively.

The PCC gained better media mileage thru 20 television and radio interviews and guesting this year. Major TV networks such as ABS-CBN, GMA7, PTV4, UNTV, TV48, TV5, Studio 23 and CNTV, covered various activities of PCC that highlighted PCC's programs, services and dairy

products. Guesting in radio stations were also monitored in Radyo ng Bayan, Radio Vision, DWNE, DWIC, DWAY and DZRH.

The agency also gained exposure through regular news releases in the Philippine Daily Inquirer, Central Newsweek and Pampanga-based local newspaper Punto! Central Luzon. Other write-ups from different broadsheet newspapers like Philippine Star, Manila Bulletin, The Daily Guardian and Sunstar Baguio were monitored. PCC was also featured in magazines, such as Food Obsession and PhilSCAT magazines and in Rappler, an online news network.

The PCC's website with URL www.pcc.gov.ph serves as a venue to publicize articles about the current undertakings of the agency. A total of 44 web articles were uploaded while 91 scoured press releases related to PCC were monitored. The PCC online and print press releases recorded totaled 171 this year.

Regular placements of PCC advertorials in souvenir programs of various entities were published in 12 advertisements. Aside from the use of the traditional and digital media, the PCC co-sponsored several trade fairs and exhibits that served as venues for program and product promotion. Such were the Dairy Con and Expo 2015, NAST ASM Meeting, PSAS, MMSU Foundation Week Trade Fair, Laoag City Fiesta 2015 Trade Fair, 4th Karabag o Festival, Wow Carabao, Sinigayan Festival, Pontevedra Carabao Festival, MMSU Farmers day, Panaad Festival, Pasalamat Festival, Kasadyahan Festival in Aleosan, Cotabato, Madrid Fusion, Farmers' Festival CSU Farmers' Day, Sandugo Trade Fair, OPA Agro-Fair, Livestock 2015 Philippine Expo, Health and Wellness and Gatas ng Kalabaw Festival

Prioritizing Customers' Satisfaction

A total of 5,183 scheduled and walk-in visitors were received, oriented, and toured to the PCC facilities in 2015 following the standards of the Integrated Management Systems. A majority of the visitors were students and farmers, the others were either government officials or employees and researchers.

With the purpose of continually improving its systems in receiving visitors, the ACS conducts a Visitors Satisfaction Survey quarterly. In 2015, the Visitors Bureau, which is composed of the ACS staff members and security guards, were able to sustain its good rating. The bureau earned a satisfaction rating of 4.54 (very good to excellent), which is above the agency's Quality Management Systems (QMS) target rating of 4.25 percent.

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Currently, the KRMC has total collection of 4,100 bibliographic entries of books, e-books, journals, thesis and multimedia on its web-based Electronic Integrated Library System (EILS), active subscription to ScienceDirect and linkages with 15 external journal databases that can be accessed through an Online Public Access Catalog (OPAC) for ease of locating and retrieving the needed library materials.

Scientific Library Services

The PCC's Knowledge Resources Management Center (KRMC) or Scientific Library is now introducing the electronic book (e-book) system to provide more accessible reference resources and maximize the use of its library collection. It is also continuously strengthening its collections of references in the Animal Sciences to include Livestock Biotechnology, Cryopreservation, Genomics and Bioinformatics, Animal Health and Nutrition, Biosafety, Reproductive Biotechnology and Physiology, Veterinary Science and Medicine, and Social Sciences. The library in-charge is proactively encouraging the participation of the agency's scientists and researchers to recommend titles of books, references, international refereed journals/articles, and multimedia materials that they use frequently in the course of their research. This will beef-up selection and acquisition function of the library.

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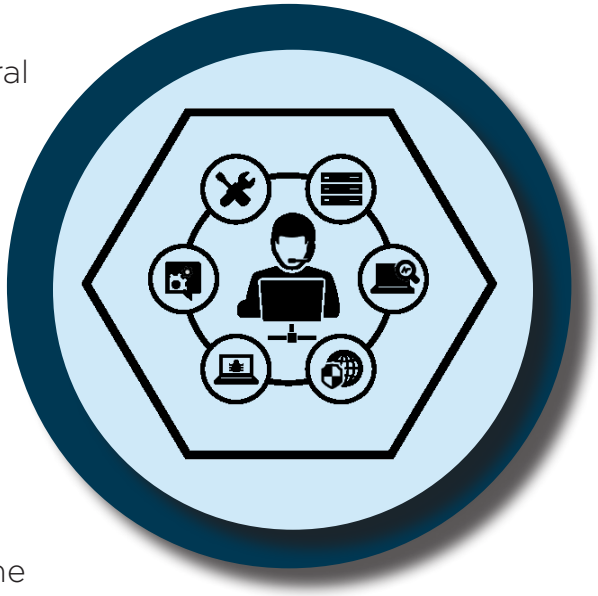
The KRMC also facilitates the publication of research papers of PCC's researchers and scientists in appropriate scientific journals. Likewise, it assists in the renewal of their memberships in various international scientific societies and associations.

The KRMC manages and maintains the database of the International Buffalo Knowledge Resource Service (IBKRS), a web-based hub for research literatures in buffalo. To date, the IBKRS has total of 10,000 e-journal articles in full-text and abstracts from different refereed journals, which are accessible thru URL: www.ibkrs.net.

KRMC is also been managing the web administration of the agency's website that can be accessed thru URL: www.pcc.gov.ph.

Information Management System

The Information and Communication Technologies Section (ICTS) assisted in the deployment and maintenance of the newly enhanced Information System of the Electronic National Government Accounting System (e-NGAS) v2.01 to the PCC headquarters and regional centers and the introduction of the COA-led Budget System v1.0. The section continuously improved the Human Resource Management Information System (HRMIS) and Document Tracking System. The section conducted geotagging to its existing Geographic Information System use and map generation to 34 dairy cooperatives in the National Impact Zone. Likewise, training and knowledge sharing to several staff in the regional centers on the geotagging technology was conducted. The section performed regular maintenance and check-up of PCC and IBKRS websites and the newly created National Carabao Conference web page to ensure they are secured online 24/7.



The ICTS continuously enhanced and upgraded several Central Processing Units (CPUs) and laptops at the PCC operating units/section and its regional centers with the assistance of the Medium-Term Information and Communications Technology Harmonization Initiative (MITHI) fund. The upgrading has ensured making workstations up-to-date. Continuous maintenance and patch upgrading of Windows Server Enterprise 2008 R2 edition Operating System, and Microsoft Forefront Threat Management Gateway, regular maintenance of Microsoft Windows 7 32 and 64-bit Operating System and Microsoft Office 2013 was also achieved.

The section created and installed a Split Domain Name System (DNS) making a secure web gateway that provides comprehensive protection against web-based threats and hacks. Regular updating of Symantec End Point Protection Server and Client-based anti-virus were conducted to ensure a virus-free Local Area Network (LAN). This also ensures protection to all computer units joined in the LAN- Active Directory from any fortuitous computer viruses. Improving the intranet and the introduction of LAN messenger ensures communication to be swift and acted upon by staff concerned.

Upgrading of internet services from 4 Mbps to 6 Mbps to PLDT and Globe Communications was provided to the PCC personnel in line with their research and collaborative activities with international and local agencies. The ICTS also maintains wireless internet connectivity at the PCC Hostel, Training Halls, Gene Pool, Dairy Processing Plant, Milka Krem, Main and Annex buildings.

Capacity building of staff in terms of knowledge and applications on Information Technology (IT) was conducted as ICTS staff members attended Training Seminars at the DOST-Information and Communications Technology Office (ICTO) on IT Procurement.

PLANNING AND INSTITUTIONAL DEVELOPMENT

Through the concerted efforts of the PCC workforce in its national headquarters and regional centers, the agency's MARC for 2015 shows an overall average physical accomplishment of 120% and fund utilization of 97% (Appendix 9).

MARC-OPCR-IPCR Congruence System

The MFO Accountability Report Card (MARC) is a snapshot presentation of the overall performance of an agency subscribed as one of the good governance drivers of the Result-Based Performance Management System (RBPMS). It is one of the official reporting instruments of the agency's performance that summarizes performance indicators for each major accomplishment.

To ensure that PCC complies with the RPBMS and achieve set targets for its MARC, a congruence system was crafted and operationalized to systematically align the Office Performance Commitment and Review (OPCR) accomplishment to the agency's MFO and the employees' Individual Performance Commitment and Review (IPCR). A series of MARC-OPCR-IPCR Congruence workshops was held to reach out to all operating units and employees across the PCC Network (Table 6).

Table 6. MARC-OPCR-IPCR Congruence System Workshops.

Cluster	Host	Venue	Date (2015)
Mindanao	PCC at USM	Davao City	March 9-13
Visayas	PCC at USF	Bohol	April 5-9
Luzon	PCC at CSU	Nueva Viscaya	April 14-17

Through the concerted efforts of the PCC workforce in its national headquarters and regional centers, the agency's MARC for 2015 shows an overall average physical accomplishment of 120% and fund utilization of 97% (Appendix 9).

Institutional Linkages

International Institutional Benchmarking on Livestock Research and Development

The PCC participated in a series of overseas study mission, which was coordinated and administered by SEARCA.

The mission aimed to benchmark the institutional capability of the PCC with similarly situated institutions in other countries for purposes of drawing lessons and best practices in livestock research, development, and management. It also explored possible collaboration with the said institutions in the fields of molecular biology, animal health, animal breeding, bioinformatics, vaccine production, and transformation of knowledge into something that is acceptable to the farmers. Table 7 presents the members of the study mission and the research institutions visited.

Philippine Carabao Center (PCC) Acting Executive Director Dr. Arnel N. Del Barrio (2nd from right), along with PCC at Ubay Stock Farm Center Director Caro B. Salces (3rd from left), visited C.P. Meiji in Nong Khae, Saraburi, Thailand as part of a week-long series of briefings and discussions on matters related to the Thai dairy industry. With them are other delegates from the National Dairy Authority and Dairy Confederation of the Philippines as well as C.P. Meiji representatives.

Table 7. International Institutional Benchmarking on Livestock Research and Development.

Participants	Country Visited	Institutions Visited	Date of Visit (2015)
1.Liza Battad 2.Arn Granada 3.Jose Canaria 4.Bonifacia Granada 5.Jeffrey Rabanal 6.Jonel Donato 7.Wilma del Rosario 8.Honorato Baltazar 9.Vilma Gagni	Thailand	(1) Pakthongchai R&D Dairy Farm-R&D arm of Charoen Pokphand Foods Public Company (2) Khamtalesor Cooperative (3) Pakchong Dairy Cooperative's "Pakchong Plantation" (4) TMR Plant owned by Thai Milk Cooperative (5) Farm Chokchai (6) CP Meiji Milk Company (7) CPF Feed Mill Plant (8) Royal Thai Chang Hua Mun Project (9) Mini Murrah Farm	September 20-26
1.Felomino Mamuad 2.Ariel Abaquita 3.Rommel Carag 4.Elma Abay-Abay 5.Fe Venturina 6.Anna Reylene Montes 7.Joy Paman 8.Janice Cuaresma	Thailand	(1) "Chiralada" Royal Research Demonstrations Projects (2) Pakthongchai Dairy Farm (3) Kham Thale So Dairy Cooperative, Kham Thale So, Nakhon Ratchasima (4) Nakhon Ratchasima Animal Nutrition Research and Dev't Center, Pak Chong, Nakhon Ratchasima (5) Chokchai Farm tour, Nakhon Ratchasima (6) CP Meiji, Saraburi (7) B.P. Feedmill, Nongkhae, Saraburi (8) Mini Murrah, Chachaengsao	November 22-28

1.Eric Palacpac 2.Ester Flores 3.Annabelle Sarabia 4.Edwin Atabay 5.Jeffrey Jerome Balaoing	India	(1) Indian Agricultural Research Institute (2) National Agricultural Science Museum (3) National Dairy Research Institute (4) National Bureau of Animal Genetic Resources (5) Central Institute for Research on Buffaloes (6) Lala Lajpat Rai University of Veterinary and Animal Sciences (7) National Dairy Development Board (8) Mother Dairy Plant	October 26 - Nov. 2
1.Arnel del Barrio 2.Caro Salces 3.Daniel Aquino 4.Lowell Paraguas 5.Cyril Baltazar 6.Saturno Dayanan 7.Ivy Fe Lopez	Vietnam	(1) International Livestock Research Institute (2) International Cooperation Department, Ministry of Agriculture and Rural Development (MARD) (3) Northern Mountainous Livestock Research and Dev't Center (4) THMilk Food Joint Stock Company (5) National Agricultural Extension Center (6) Vietnam National University of Agriculture	September 27-October 3
1.Liza Battad 2.Cecelio Velez 3.Grace Marjorie Recta 4.Thelma Saludes 5.Gloria dela Cruz 6.Benjamin Basilio 7.Cesar Arevalo	Vietnam	(1) Institute of Animal Sciences for Southern Vietnam (2) Ruminant Research Dev't Center, Institute of Animal Sciences for Southern Vietnam (3) Nong Lam University (4) Cu Chi Tunnel (5) Dairy Farm and Center for Research and Technology Transfer	November 29 - Dec. 4

Partnerships and Collaborations

The PCC has established new partnerships and collaborations during the year while maintaining existing ones with various institutions for purposes of research, development, technical cooperation, and capability building (Appendix 7).

Likewise, the PCC has sustained its partnerships with state colleges and institutions that host its regional centers and with the local government units, farmer-cooperatives, and private entities nationwide for the sustained implementation of the CDP.

Integrated Management Sytem

The PCC through its Integrated Management Audit Section (IMAS) ensured that the established Integrated Management System (IMS) that has been certified to ISO 9001 (Quality Management System); ISO 14001 (Environmental Management System); and OHSAS 18001 (Occupational Health and Safety Management System) is maintained and effectively carried out. During the first quarter of 2015, Re-certification audit for the second cycle was conducted by TUV SUD. The activity culminated with the confirmation of the continuing validity of IMS Certification for PCC National Headquarters and Gene Pool.

To ensure sustained effective implementation of the IMS, two batches of Internal Audits covering all areas at the National Headquarters and gene pool were conducted. The audits were done purposely to check on the operating unit's compliance not only to the requirements of the three standards but to applicable legal, regulatory and other requirements (LOR) without compromising customer requirements.

To warrant efficient conduct of internal audits, two sessions were conducted to improve the Internal Auditors' skills. One was an in-house session that was focused on the specific requirements for each process. Another is an offsite session on the mastery of the requirements of the three Standards.

Training on Philippine Quality Awards (PQA) was participated in by two (2) personnel to further enhance the implementation of Quality Management System (QMS).

Involvement of the newly hired employees in the maintenance of IMS was ensured by conducting three orientation seminars.

Apart from overseeing the maintenance of IMS at the National Headquarters, the IMAS also assisted the PCC regional centers in both their quests and maintenance of certification. The following were accomplished in 2015:

- Assisted in the conduct of surveillance audits at PCC at Cagayan State University (CSU) and PCC at University of Southern Mindanao (USM);
- Conducted refresher training on Internal Quality Auditing at PCC at Mariano Marcos State University (MMSU);
- Conducted training-workshop on "Problem Identification, Root Cause Analysis and Management of Corrective/Preventive Action (CAPA)".

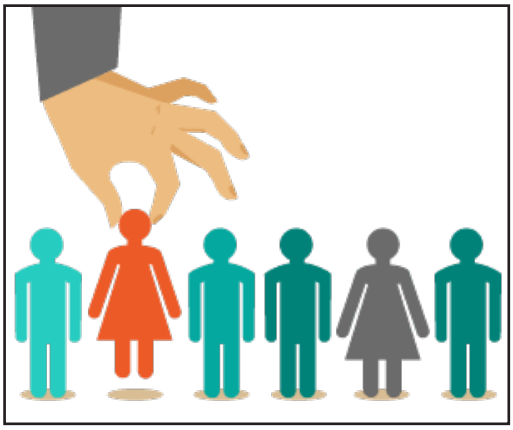
Human Resources Management

The HRMS CY2015 accomplishments were anchored on the challenges encountered in CY2014 while in the course of fulfilling the HRMS' mission and achieving set targets through a system/process of recruiting, developing, rewarding, motivating and retaining employees who are contributing to the attainment of agency's MARC through aligned MFO aligned target outputs of its programs, projects, and development priorities.

The major accomplishments of the section were summed up in terms of implementation and continual improvement of the Strategic Performance Management System, realization of the agency Strategic HR Plan, improved and continues updating of the Human Resource Management Information System (HRMIS) and the appropriate nurturing of teams for the institutionalization of PCC Core values (EPICS) and facilitating the provision of favorable environment for promotion of employees' productivity. These major accomplishments were the results of HRMS responses to the support activities required by concerned offices (units/sections/divisions) as well as those of individual employees.

Consequently, these accomplishments as well as challenges encountered resulting to under-achievement serve as bases for continual improvement and setting target for the succeeding year.

Recruitment, Selection, and Staffing



During the year, the HRMS performed the following:

- Accepted and screened one hundred thirty three (133) application documents for different Job Order positions.
- Administered Proficiency Tests to ninety four (94) applicants for various available Job Order positions.
- Facilitated scheduling and conduct interview to Fifty one (51) applicants who passed the proficiency test for various Job Order positions available positions.
- Piloted administration of Psychometric Exams for the use of a more competitive process of hiring/ selection of PCC staff.
- The Personnel Unit served as Secretariat of the Selection and Promotion Board.
  1. Facilitated the posting and publication of twenty one (21) vacant and newly created positions for filing up.
  2. Set deadline of submission of applications for PCC vacant and newly created positions for filing up.
  3. Received and evaluated forty six (46) application documents for vacant/newly created plantilla positions
  4. Facilitated the interview of the forty two (42) applicants (OED & Regional Centers)
  5. Administered psychosocial tests to forty two (42) applicants
- Facilitated the hiring of Fifty one (51) additional Job Order (J.O.) staff for different Division/Section/Units/ Projects.

As of December 31, 2015, the PCC has a workforce comprised of 184 regular personnel and 339 individuals on job orders (Tables 8a and 8b).

Table 8a. Distribution of PCC Plantilla(Regular) Personnel, CY 2015.

Office/Center	Technical Staff	Non-Technical Support Staff	Administrative Staff	Total
Office of the Executive Director	36	7	11	54
PCC at CLSU	21		2	23
PCC at UPLB	21		2	23
PCC at CSU	9		1	10
PCC at MMSU	8		1	9
PCC at DMMMSU	6		1	7
PCC at USF	7		1	8
PCC at VSU	5		1	6
PCC at WVSU	8		1	9
PCC at LCSF	5		1	6
PCC at CMU	14		1	15
PCC at USM	5		1	6
PCC at MSU	2			2
PCC at MLPC	5		1	6
Total	152	7	25	184

Table 8b. Distribution of PCC Plantilla(Regular) Personnel, CY 2015.

Office/Center	Technical Staff	Non-Technical Support Staff	Administrative Staff	Total
Office of the Executive Director	24	30	21	75
PCC at CLSU	11	22	7	40
PCC at UPLB	5	17	4	26
PCC at CSU	17		7	24
PCC at MMSU	2	10		12
PCC at DMMMSU	1	5	2	8
PCC at USF	11	23	10	44
PCC at VSU	3	12	15	30
PCC at WVSU	3	6	3	12
PCC at LCSF		10	4	14
PCC at CMU	2			2
PCC at USM	6	17	4	27
PCC at MSU		4	2	6
PCC at MLPC	2	12	5	19
Total	87	168	84	339

Budget and Finance Management

The PCC financial management system has fully adopted the e-budget system and the enhanced e-ngas accounting system across the network. This is consistent with the public financial management reform roadmap of the government to harmonize budgetary and accounting systems that are compliant with the Philippine Public Sector Accounting Standards, Revised Chart of Accounts, and Unified Accounts Code Structure.

Likewise, the PCC has complied with all mandatory financial accountability reports as prescribed by regulating and coordinating agencies such as the Commission on Audit, Department of Budget and Management, and the Department of Agriculture. Budgetary requirements of the operating units of the center were provided on time and in accordance with the approved plans. Appropriate administrative policies, procedures and processes were also issued and implemented to enhance transparency of operation and minimize lead time in processing financial claims and administrative services.

The FY 2015 PCC expenditures were focused on setting programs and activities to meet the mandate of the newly rationalized Philippine Carabao Center as Research for Development agency.

Highlights of FY 2015 Budgetary Expenditures

The FY 2015 PCC expenditures were focused on setting programs and activities to meet the mandate of the newly rationalized Philippine Carabao Center as Research for Development agency. The major functional shift of the agency's configuration of expenditures is the intensified research and development that emphasize biotechnology. Likewise, extension activities have been limited to extension research, and on capacitating the RFU and LGUs and other partners. Major expenditures for FY 2015 supported the activities of laying the foundation for the long term carabao genetic improvement program, technology development, and development of models for viable and competitive carabao-based enterprises. Specifically, the usage of funds is channelled to meet the requirements for the expansion of R&D implementation on three areas:

a. Genetic Improvement Program (GIP). This program focuses in the improvement of genetic potential of carabaos for milk and meat thru organized breeding & selection (artificial insemination and natural mating) and conduct of R&D and related production support activities. In 2015, expenditures were focused on technology development, DNA based selection for disease resistance, selection of best genetics through bio-informatics & genomics to include the expansion of the GIP system in water buffaloes.

b. Cryobanking of Animal Genetic Resources. Conservation of genetic materials of important livestock species/breeds is the main thrust of this sub-program component.

This would include characterization of indigenous and introduced breeds. In 2015, PCC sustained and expanded the implementation of the in-vitro conservation of animal genetic materials needed for long term breeding requirements and in response to changing global environment.

c. Intensified Research and Development. A good portion of the budget supported the efforts towards the development of DNA-based technologies applicable across species. R&D efforts supported the conduct of the development of DNA-based biotechnologies, improving rumen functions – probiotics and microbial manipulations, Improvement in reproductive biotechniques, modeling of carabao enterprises, and other livestock policy studies.

Sources and Usage of Funds

The agency main sources of funds to support its operation are provided by the national government through the General Appropriation Act (GAA). Table 9 details the fund allotment and utilization.

Table 9. PCC Sources and Utilization of Funds as of December 31, 2015 (Php M).

Fund Source	Authorized Allotment	Usage	% Utilization
GAA-Current & Continuing	444.56	427.43	96
Personnel Services	85.82	85.80	100
Maintenance & Other Operating Expenses	306.29	289.79	95
Capital Outlay	52.45	51.84	99
Revolving Fund- Dairy Business Module	84.05	60.68	72
Locally funded special projects/ research funds	41.31	19.09	46
Foreign Assisted Projects	30.44	7.17	24
TOTAL	600.36	514.37	86

Special projects fund are the receipt of research funds from various government agencies and institutions. Project funds utilization is mainly on the maintenance and operating requirements of the project.

PCC's Financial Condition

The PCC's total assets as of December 31, 2015 are valued at Php 2,653.11 million comprising mainly of the agency Property, Plant & Equipment (PPE) and Biological assets. The disposal of various unserviceable and obsolete properties causes the significant decrease in the other assets account of the agency, while the decrease in biological assets account is the dropping of dead animals (with granted request for relief from property accountability) from the books account. The causes of death of the said animal are within the acceptable rate of mortality.

Total liabilities posted Php 130.74 million and total accumulated surplus reached Php 2,522.37 million. The decrease in liabilities represents liquidation of various special projects funds to the respective funding agencies.

Table 10 presents the PCC's Statement of Financial Position at the end of FY 2015 .

Table 10. Statement of Financial Position as of December 31 (Php M).

Particulars	FY 2015	FY 2014	% Change
Assets			
Current Assets	452.68	428.95	6
Property, Plant & Equipment	1,021.03	1,001.70	2
Biological assets	1,172.15	1,226.45	-4
Other assets	7.25	18.08	-60
Total Assets	2,653.11	2,675.19	-1
Liabilities	130.74	124.85	5
Accumulated Surplus	2,522.37	2,550.34	-1
Total Liabilities & Gov. Equity	2,653.11	2,675.19	1

Table 11 presents the PCC's Statement of Financial Performance for the year end FY 2015.

The PCC's total income for the year reached Php 525.54 million comprising mainly of the subsidy from the national government. The business income represents the sales of milk, meat, live animals, and other by-products as a consequence of the operation of the institutional dairy business module of the regional centers.

Personnel services expenses posted Php 87.28 million, while total maintenance and other operating expenses including non-cash expenses is Php 413.39 million giving a net income or surplus from operation of Php 24.87 million. The decrease in personnel services is due to the initial implementation of the rationalized manpower complement of the agency. The decrease in net income for FY 2015 is attributed to the decrease in subsidy from the national government due to the decrease in the budget for non-recurring expenditures such as infrastructure projects.

Table 11. Statement of Financial Performance for the period ending of December 31 (Php M)

Particulars	FY 2015	FY 2014	% Change
Income			
Subsidy Income	433.14	590.18	-27
Business Income	92.40	79.34	16
Other Income	0.00	0.35	100
Total Income	525.54	669.87	-22
Expenses			
Personnel Services	87.28	103.85	16
Maintenance & Other Operating Expenses	332.75	340.51	2
Non-cash expenses	80.64	58.43	38
Total Expenses	500.67	502.79	0
Net Income	24.87	167.08	-85

Appendices

Appendix 1. CY 2015 Trainings Conducted by PCC and Number of Participants.

No.	Title of Training Conducted	No. of Participants	Month (2015)	Center
1	Consultation and Workshop on Dairy Program Dispersal Final List	7	January	USF
2	Milk Soap Processing and Costing	16	January	USF
3	Training on Good Manufacturing Practices (GMP)/Food Safety	1	January	UPLB
4	Business Planning Workshop in Ubay Northwestern Dairy Breeder's Association (UNDABRA)	21	January	USF
5	CBSTF	1	January	VSU
6	AI Technology Information Promotion Workshop	38	January	USF
7	Basic Entrepreneurship and Overview of Small Business	11	January	USF
8	Orientation on CUP and Animal-Related Consultations	9	January	VSU
9	Pagsasanay sa Pangangalaga at Pangangasiwa ng Gatasang Kalabaw	55	January	UPLB
10	Training on Processing of Different Dairy Products	38	January	UPLB
11	Training on Milk Quality Testing	32	January	UPLB
12	AI Technology Information Promotion/ Workshop	75	February	USF
13	Basic Training Course on AI and PD in Large Ruminants	14	February	USF
14	Dairy Buffalo Production and Management	30	February	DMMMSU
15	Hands-on Demo on White Cheese Processing	3	February	CSU
16	Hands-on Training on Milk Handling and Processing	6	February	MMSU
17	Hands-on Training on Processing Lactojuice and Kesong Puti	1	February	CLSU
18	Lecture on Pregnancy Diagnosis	22	February	CLSU
19	Milk Handling and Processing	3	February	USF

20	Organizational Development of Carabao Owners	34	February	USF
21	Pangangalaga ng Gatasang Buffalo	16	February	UPLB
22	Practical Training on Recording	7	February	UPLB
23	Training on Dairy Processing (starter culture preparation, yogurt, yogurt drink, yogurt ice cream and mozzarella cheese)	5	February	UPLB
24	Training on Mozzarella Cheese Production	4	February	UPLB
25	Training/Seminar/Workshop	66	February	VSU
26	Workshop on Module Development for the Farmer Livestock School on Dairy Buffalo Production	16	February	PCC-OED
27	Basic Training Course on AI and PD	11	March-April	CMU
28	Bull Handlers Training	22	March	CMU
29	AI Technology Information Promotion Workshop	128	March	USF
30	Basic Training Course on AI and PD in Large Ruminants	9	March	UPLB
31	Buffalo Bull Recipients Meeting	37	March	CSU
32	Dairy Buffalo Production and Management	40	March	DMMMSU
33	Milk Feeding Activity	458	March	MLPC
34	Practice Milking	8	March	USF
35	Refresher Course on Handling of Frozen Semen and AI Equipment	37	March	CLSU
36	Social Preparation Training	31	March	USM
37	Training on Carabao Production and Management	116	March	WVSU
38	Training on Milk Processing	18	March	WVSU
39	AI Technology Information Promotion Workshop	1	April	USF
40	Carabao-Based Enterprise Development Technical Training	34	April	CMU
41	Cascading the CDP Strategic Shift-Luzon Cluster	5	April	MMSU

42	Practical Training on Recording	1	April	UPLB
43	Refresher Course on Handling of Frozen Semen and AI Equipment	15	April	CLSU
44	Social Preparation Training	34	April	CSU
45	Social Preparation Training	31	April	MLPC
46	Training on Internal Quality Audit (ISO 9001:2008)	9	April	MMSU
47	AS Laboratory-Milk Collection and Handling	59	May	VSU
48	Social Preparation Training	50	May	CSU
49	Social Preparation Training	32	May	CMU
50	Students' Farm Practice	39	May	LCSF
51	Silage Making	5	May	DMMMSU
52	Silage Making, UMMB Making, and UTRS	27	May	USM
53	Training Course on Dairy Buffalo Management, Milk Collection, Processing, and Marketing	22	May	CSU
54	Training on Dairy Processing	18	May	UPLB
55	Training/Seminar/Workshop	75	May	VSU
56	Milk Handling and Processing	5	May	USF
57	Animal Management, Breeding, Milking and Housing; Practical Training on Feeding, Forage Production and Silage Making	228	June	MLPC
58	Basic Training Course on AI and PD in Large Ruminants	13	June-July	UPLB
59	Carabao Dairy Production and Health Management	26	June	VSU
60	Hands-on Training on Dairy Buffalo Management	3	June-July	UPLB
61	Housing and Facilities in PCC-VSU Dairy Farm	132	June	VSU
62	Basic Training Course on Buffalo Bull Management	20	June	CSU
63	Training for Women/Housewives on Carabao Milking and Dairy Products Processing	36	June	LCSF

64	Training on Dairy Buffalo Management	28	June	UPLB
65	Training on Cheese Making	30	June	WVSU
66	Training on Silage Making	19	June	UPLB
67	Training on UMMB and Silage Making	46	June	WVSU
68	Workshop on Module Development for the FLS-DBP	19	September-October	OED
69	Advances in Animal Health Management for Large Ruminants	10	July	UPLB
70	Consultation and Training Workshop on Dairy Buffalo Management, Milking, and Milk Processing	55	July	LCSF
71	Hands-on Training on Milk Processing	32	July	CLSU
72	HR Diagnostic Test	16	July	USF
73	Training for Women/Housewives on Carabao Milking and Dairy Products Processing	69	July	LCSF
74	Training on Dairy Processing	27	July	UPLB
75	Training on How to Process Chocobar	8	July	USF
76	Training on How to Process Chocomilk	4	July	USF
77	Training on Milk Collection	8	July	USF
78	Training on Milk handling and Quality Control	6	July	UPLB
79	Training on Milk Quality Testing	24	July	UPLB
80	Training on Silage Making and UMMB	44	July	WVSU
81	Basic Training Course on AI and PD	15	August	USF
82	Pastillas Making	17	August	DMMMSU
83	Seminar on Fire Drill and Earthquake Drill	30	August	USF
84	Training on Milk Collection	5	August	USF

85	Training Workshop on Formulation on the Operations Manual for the Enterprise	36	August	USF
86	Processing of Dairy Products	6	September-October	MLPC
87	Carabao Dairy Production and Management	25	September	DMMMSU
88	Choco/Lacto Juice Processing	10	September	DMMMSU
89	Dairy Buffalo Production and Management	43	September	CMU
90	Dairy Processing	28	September	LCSF
91	Farmers Training (Milk Handling & Processing, Feeding Management, Bull Management, etc.)	15	September	CLSU
92	Milk Collection and Milk Handling	26	September	MLPC
93	Processing of Dairy Products	20	September	MLPC
94	Social Preparation Training	25	September	DMMMSU
95	Technical Traning on Dairy and Milk Processing	21	September	CMU
96	Learning Workshop on FLS-DBP	15	September	OED
97	Basic Training Course on AI and PD	2	October-November	DMMMSU
98	Hands-on Demo on Yogurt and Cheese Processing	6	October	CSU
99	Hands-on Demo on Silage Production	10	October	USF
100	Hands-on Seminar on Processing of Milk and Milk Products	81	October	MMSU
101	Social Preparation Training	30	October	CSU
102	STCBF on Cassava Foliage Breeding for Dairy Buffaloes in Bohol	172	October	USF
103	Training on Animal Slaughter and Fabrication	6	October	UPLB
104	Good House Keeping and Basic Accounting	15	October	DMMMSU
105	Basic Training Course on AI and PD in Large Ruminants	22	November-December	UPLB
106	Basic Training Course on AI and PD	12	November	CSU

107	Basic Training Course on AI and PD in Water Buffaloes	13	November-December	CMU
108	Basic Training Course on Buffalo Bull Management	12	November	CSU
109	Dairy Buffalo Production and Management	31	November	DMMMSU
110	Dairy Production and Management	30	November	CMU
111	Laboratory Immersion of Science Teachers	24	November	MMSU
112	Occupational Internship/On-the-Job Training for Undergraduate Students	6	November-December	MMSU
113	Social Preparation Training	36	November	DMMMSU
114	Training on GMP and Food Safety for Baryo Froyo Owners and Staff	6	November	UPLB
115	Training on Good Animal Husbandry Practices	38	November	CSU
116	Training on Milk Handling and Quality Control	35	November	UPLB
117	Training on Milk Processing	35	November	UPLB
118	Training on Milk Processing and Quality Control	30	November	UPLB
119	Occupational Internship Program on Dairy Buffalo Management and Milk Handling and Processing	6	December	MMSU
120	Tutorial Training on Processing of Milk and Milk Products	1	December	MMSU
	TOTAL	3,807		

Appendix 2. CY 2015 Trainings Conducted for the National Impact Zone (Nueva Ecija).

No.	Trainings/Seminars/Forums Conducted	Date (2015)	No. of Participants
1	Basic Buffalo Management Training	January 13-14	36
2	Basic Buffalo Management Training	August 12-13	12
3	Business Enhancement Series Training (BEST)	August 25	
3	Basic Buffalo Management Training	November 12-13	46
4	Product Costing and Pricing	March 25	26
5	Maintenance of Milking Machine	May 26	22
6	Prolapse Management, Bloat Management and Forage Establishment	March 27	138
7	Record Keeping Through MS Excel	September 11; October 5; November 10-11	21
8	Milk Handling and Processing	October 9	21
9	Bull Management Training	November 19-21	6
10	Social Preparation Training	October 27; October 30	25
11	Social Preparation Training	November 5-6	22
12	Bull Handlers' Forum	November 3	37
13	Farmers' Forum	November 4	45
14	CDP Stakeholders Integration Forum	September 3	97
15	Cooperative Chairmen's Forum	December 14	60
	TOTAL		614

Appendix 3a. List of Completed Researches, CY 2015.

Research Area	Title	Researchers
Biosafety	Undergraduate Thesis	
	1. Tetracycline and Sulphonamide-Resistance Genes in Respiratory and Gastrointestinal Bacterial Isolates from Pig, Small and Large Ruminants	AEFrancia, KBCostales, GGGarcia and CNMigala
	2. Molecular Characterization of Tim-3 and Gal-9 in Swamp and Riverine Buffaloes	PLHDuran, RBPadiernos, EBAbella and CNMingala
	3. Biological Control Efficacy of the Nematophagous Fungi Duddingtonia flagrans in Common Strongyle Roundworms and Fasciola sp. Of Swamp Buffaloes (Bubalus bubalis)	TRMBarroga and CNMingala
Product Development	Undergraduate Thesis	
	1. Utilization of Whey as Substrate for Vinegar Production	CJCallaga, RDPerez, MPVeneracion, JRustia and MPAbella
Production Management System	1. Preliminary Trials on Production Performance of Buffaloes on Different Feed Supplement : Effects of Concentrate Mixture and Rumen Buffer on Dairy Milk Production and Composition	RMLabindao, ASalazar, JMartin, PDCFlorendo and ECAtabay
	2. Morphological and Physiochemical Characterization of Rumen Fungi in Sweet Sorghum Hydrolysis Using Carabao (Bubalus bubalis) Rumen Fluid	APeralta, MFandialan and PDCFlorendo
	Graduate Thesis	
	1.Raw Milk Physico-Chemical Characteristics of Moringa Leaf Meal (MoLM) Fed with Crossbred Water Buffaloes	NTadeoJr., RVega, ARayos, RSulabo, RBaconguis, ANDel Barrio and TSaludes
Genetic Improvement - Reproductive and Cryopreservation Biotechniques	1. The Kinetics of Sperm Penetration and Embryo Development as Predictors of Fertility of Frozen Buffalo Semen	ERSMaylem
Society & Social Relationships (Social Dynamics in CDP Implementation)	1. Characterizing the Progressive Dairy Buffalo Farmers in Nueva Ecija	EPPalacpac, EValiente, RTJacang

Appendix 3b. List of Ongoing Researches, CY 2015.

Research Area	Title	Researchers
Biosafety	Undergraduate thesis	
	1. Gene Marker Identification Targeting Toll-Like Receptor 4 (TLR4), Breast cancer 1 (BRCA1) and Adenosine Triphosphate 1 Alpha 1 (ATPA1) Genes: Assessing their Association with Subclinical Mastitis in Dairy Water Buffaloes (Bubalus bubalis)	CCBlendima, MRUy and CNMingala
	2. Anthelmintic Potential of Pochonia chlamydosporia Against Fasciola sp. In water Buffaloes (Bubalus bubalis)	SCRamos and VSalting
Genetic Improvement - Reproductive and Cryopreservation Biotechniques	1. Improving Artificial Insemination Efficiencies Using Fertility Indexed Bulls Selected by Fourier Harmonic Analysis and Screened from Environmental Instabilities	PGDuran, DHDuran, MDPeralta, and HVenturina
	2. Epididymal Sperm Cryopreservation as a Potential Tool for Breed Conservation In-Vitro of Indigenous Livestock and/or Endangered Wildlife in the Country: Prospects for Animal Genetic Resource (AnGR) Cryobanking	LCOcampo, EPAtabay, ECAtabay, MBOcampo, FPAquino, and ESMaylem
	3. Optimizing Artificial Reproductive Technologies (Art) in Water Buffaloes Through the Regulation of Ovarian Function	EPAtabay, ECAtabay, MBOcampo, LCOcampo, FPAquino, and ESMaylem
	4. Genetic Propagation of Girolando Dairy Cattle by Reproductive Techniques	EPAtabay, ECAtabay, MBOcampo, LCOcampo, FPAquino and ESMaylem
	5. Production of Genetically Superior Goat/ Sheep and Germplasm Cryopreservation Through Assisted Reproductive Techniques	MBOcampo, LCOcampo, EPAtabay, FPAquino, and ESMaylem
	6. Screening for Sperm-factor (Phospholipase C-zeta) by Molecular Technique as a Novel Biomarker of Bull Fertility for Genetic Improvement in Water Buffaloes	EPAtabay, ECAtabay, EVVenturina, CNMingala, and RAFissore

	Graduate/Undergraduate Student Thesis	
	1. Motion Kinematics of Goat (Capra hircus) Spermatozoa as Influenced by Penetrating Cryoprotectants Under Various Stages of the Cryopreservation Process	ASGalamgam, EMCruz, EPAtabay, FPAquino, LCOcampo, and ESMaylem
Genetic Improvement – Animal Genomics	1. Private-Public Partnership in the Application of Animal Genomics to Increase Productivity and Improve Efficiency of the Philippine Swine Industry: Project 1. Development and application of genetic markers in selecting genes for prolificacy and other positive traits of swine	JRHerrera, LMLabonite, SMatias, and HCruz
	2. Genotyping the Philippine Water Buffaloes Using Medium Density 90K Buffalo SNP Panel	EBFlores
Production Management System	1. Establishment of Tropical Feed Library Utilizing Locally Available Feed Resources for Ruminant Production in the Philippines	DLAquino, TFujihara, and JSantos
	2. S&T Community Based Farm (STCBF) On Cassava Foliage Feeding For Dairy Buffaloes In Bohol	CBSalces, GPBajenting, EJEscala, and MVAbela
	3. Community-based S&T Project on the Preparation & Utilization of Urea-Treated Rice Straw (URTS) as Fodder for Dairy Buffaloes	DLAquino, JPSantos, DKDomingo and TFujihara
	4. Commercialization of Grass/Forage Corn Silage for Dairy Buffaloes in Lupao, Nueva Ecija Through Technomart	EPPalacpac, Dr. DLAquino, TFujihara, HBaltazar, and CICastillo
Social Research and Socio-Economics	1. Profiling the Modalities of Carabao-Based Enterprises Led by the Philippine Carabao Center and Its Partner Institutions	
	2. Extension Methods for Technology Adoption for Dairy Buffalo in Selected Barangays in Nueva Ecija and in Ilocos Norte	EPPalacpac, MGFHonoio, EMValiente, and RTJacang
Product Development	Production and Commercialization of Nutri-Rice Milk	MPAbella and MRomero
	Undergraduate Thesis	
	Evaluation of Probiotic Properties of Lactobacillus from Yogurt	CNCallejo, MPAbella, AMParayno, and FGPineda
	Production of Sports Drink Using Delactosed Whey	MLLeano, JDMalig, GLMartin, MPAbella, and VCQuines

Appendix 4. Abstracts of some completed researches (CY 2015).

Research Title	Researchers	Abstract
1. The Kinetics of Sperm Penetration and Embryo Development as Predictors of Fertility of Frozen Buffalo Semen (ERMaylem)	ERMaylem	The conventional method of semen quality assessment by motility grading is considerably subjective. This study was conducted to investigate the motility characteristics of buffalo sperm using a computer-assisted sperm analyzer (CASA) which evaluates motility objectively. Semen samples from six bulls were collected, analyzed and cryopreserved. Fresh and frozen semen were analyzed with the CASA kinematic parameters as follows: average path velocity, curvilinear velocity, straight line velocity, amplitude of lateral head displacement, beat cross frequency, straightness, linearity and wobble. Results revealed that sperm motility population was initially classified into Progressively Motile, Motile and Static. Based on these, the six bulls were qualified as semen donors. The sperm population was then further categorized based on speed of movement into Rapid, Medium and Slow and found out high and comparable frequencies of sperm population among bulls, which again made them qualify as semen donors. Finally, when the eight default CASA kinematic parameters were applied, the superiority of four bulls has been elucidated, while the two bulls were detected as undesirable semen donors. The study highlighted the features, functions of CASA, and more importantly its capacity and sensitivity in screening semen donors which can enhance AI efficiency in water buffaloes and other livestock species.
2. Biological Control Efficacy of the Nematophagous Fungi Duddingtonia flagrans in Common Strongyle Roundworms and Fasciola sp. Of Swamp Buffaloes (Bubalus bubalis)	TRBarroga and CNMingala	Gastrointestinal nematode is a major problem in grazing animals. Control is achieved through usage of anthlemintics, however, because of indiscriminate use there have been increased reports of anthelmintic resistance. This study determined the efficacy of Duddingtonia flagrans (in vivo and in vitro) as a biological control against common strongyle roundworms of buffaloes. Using corn meal agar (CMA) assay, strongyle infective larvae were treated with and without D. flagrans. Results showed that D. flagrans treated group had significantly lower larvae counts than non-treated groups. The chlamydospore/gram (CG) assay tested a dose-dependent treatment wherein feces with 2,100 eggs/gram (EPG) strongyles were treated with increasing doses of chlamydospores/g feces (100,000, 250,000, 500,000). Results showed an 84.39% larval reduction after treatment with 500,000 chlamydospores/g. The chlamydspore/egg (CE) assay evaluated varying ratios (1:100, 1:500, 1:1000) using the 2,100 EPG feces.

		The ratio 1:500 received the highest percent larval reduction (78.88%). D. flagrans was directly fed to buffaloes at varying concentrations (50,000, 150,000, 250,000 chlamydospores/ kg BW). A 78.77% larval reduction was observed at 50,000 chlamydospore/kg BW oral administration for 5 days. This study showed the efficacy of D. flagrans as a potential alternative for anthelmintics in Philippine setting.
4. Comparative Gene Expression of Swine Leukocyte Antigen in Diarrheic and Non-Diarrheic Cases in Native Pigs at Pre-weaning and Post-Weaning Using Real Time PCR	JPAquino and JFSampang, MRUy and SRamos	The gene expression of 2 types of swine leukocyte antigen (SLA-1 and SLA-2) as an immune response of swine to diarrhea was undertaken with the use of real-time polymerase chain reaction (RT-PCR). A total of 20-head, 6-to 8-wk old post-weaned piglets were used in the study. Ten (10) of the animals were diarrheic post-weaned piglets were which composed of five (5) native breeds and five (5) Large White. Ten (10) non-diarrheic post-weaned piglets which were represented by five (5) native breeds and five (5) Large White breed served as negative control. Samples for RNA extraction of SLA-1 and SLA-2 genes were obtained from the blood of diarrheic and non-diarrheic post-weaned piglets. RNA samples were reversely transcribed into cDNAs (complementary cDNA) before amplification that applied the primer SLA-1*13XX (which targets the SLA-1 gene with a 217 bp) and SLA-2*w08XX (which recognizes the SLA-2 gene with a 126 bp). Amplified products were analyzed by real-time polymerase chain reaction (RT-PCR). Gene expression levels were computed based on cycle threshold (ΔCT). Gene expression levels were statistically compared using 2x2 Factorial in complete randomized design. Results showed that the expression levels of SLA-1 in post-weaned piglets were slightly expressed in piglets experiencing diarrhea, however, the statistical result showed no significant differences. In SLA-2 genotype, the expression levels between diarrheic and non-diarrheic post-weaned piglets had also no significant differences. These findings implied that both genes have no direct influence on the activation of immune responses mediated by either SLA-1 or SLA-2 of post-weaned pigs to an impending case of diarrhea.

5.Molecular Characterization of Tim-3 and Gal-9 in Swamp and Riverine Buffaloes	PLHDuran, RB-Padiernos and CNMingala	Molecular characterization of TIM-3 and GAL-9 genes of swamp- and riverine-type water buffaloes were conducted to compare these genes with other species, determine the unique characteristic specific in water buffalo, and provide baseline information for the assessment of disease progression in buffalo species. TIM-3 and GAL-9 genes were amplified, purified, sequenced and characterized. The sequence result of TIM-3 in both types of water buffaloes contained 843 nucleotides encoding to 280 amino acids while GAL-9 of swamp-type and riverine-type water buffaloes contained 1023 and 972 nucleotides encoding to 340 and 323 amino acids, respectively. Meanwhile, nucleotide and amino sequence of TIM-3 in water buffalo were 83-98% and 94-97% identical with other artiodactyl species, respectively. On the other hand, GAL-9 nucleotide and amino acid sequence in water buffalo were 85-98% and 76-96% identical with other artiodactyl species. The tyrosine-kinase phosphorylation motif and potential glycosylation sites were conserved within the tribe Bovinae. It is imperative to have further studies in assessment of the role of these genes in disease progression in water buffalo during chronic infection. The study is the first report that describes the genetic characteristic of TIM-3 and GAL-9 genes in water buffalo.
6. Utilization of Whey as Substrate for Vinegar Production	CJCallaga, RDPerez, MPVeneracion, JRustia and MPAbella	The utilization of whey as substrate for vinegar production was assessed in this study. Specifically, the study aimed to determine the rate of ethanol production as affected by the whey used for fermentation; to evaluate the effect of different starters for acetic acid production; and aeration on the rate of acetification and quality of the whey vinegar; to determine the physicochemical and sensory properties of vinegar from whey and compare it with commercial vinegar; and to compute the cost of producing whey vinegar. This research was conducted to determine the potential of sweet whey and medium acid whey for commercial vinegar production. The established vinegar production process developed consisted of (a.) pasteurization (b.) alcoholic fermentation by a strain of Saccharomyces cerevisae, and (c.) acetic acid fermentation. Effect of two different starters (pure culture of Acetobacter aceti and unpasteurized vinegar) and aeration on rate of vinegar production and quality evaluated.

		Results showed that Treatment 4 which is sweet whey, with mother vinegar and aerated; and Treatment 8 which is medium acid whey with mother vinegar and aerated, are the prominent treatments. Treatments 4 and 8 have the acidity of 3.51% and 3.55% respectively. Treatment 8 obtained the highest score on the overall acceptability and even in the other vinegar attributes evaluated. All the attributes of Treatment 4 and Treatment 8 were "Just About Right" according to 50 panelists. For the rank test, Treatment 8 was ranked first, followed by Treatment 4 and lastly, the commercial vinegar. Cost analysis revealed that it is economically feasible to produce whey vinegar. Practically of this process is the use of whey from the increasing number of dairy product processing in our country.
7. Evaluation of Probiotic Properties of Lactobacillus from Yogurt	CCallejo, APArayno and MPAbella	The objective of this study was to evaluate the probiotic properties of Lactobacillus isolated from plain, unsweetened buffalo milk yoghurt samples. A maximum of 10 potential bacterial strains were isolated, purified and subjected to confirmatory tests for lactic acid bacteria. All of the isolated strains were found to be gram positive and catalase negative Lactobacillus spp. In the evaluation of its probiotic properties, two parameters were used in screening the isolates namely: acid tolerance test and detection of antibacterial activity. Of the 10 isolated bacterial strains, all (100%) were able to survive at pH 3.0, 40% at pH 2.5 and 30% at pH 2.0. The isolated Lactobacillus, however, did not show inhibitory effect on E. coli and S. aureus.
8. Production of Sports Drink from Delactosed Whey	MLLeano, JDMalig, GMartin and VQuines	A study was conducted to optimize the formulation of a sports drink utilizing fermented whey. Acid whey (3.32 % lactose) was fermented using cultures of Lactobacillus bulgaricus, and Streptococcus thermophiles. The resulting fermented whey (2.84% lactose) was used as main raw material in the preparation of sports drinks with varying levels of stabilizer (T1= no stabilizer added, T2= 0.1%, T3= 0.125% and T4=0.15%). . Physico-chemical analysis, microbial analysis, sensory evaluation and proximate analysis were conducted to determine the quality, acceptability and storage life of the sports drink. Results showed that the drinks progressively became more viscous with increasing levels of stabilizer. Results also show that levels of stabilizer did not affect the pH and TSS of the drinks however; pH and TSS values significantly fluctuated during storage.Total Aerobic Plate Count revealed that all treatments

		with the exception of T1 would not be hazardous to health up to the 30th day of storage. Across the 30 day storage the yeast and mold (YMC) and coliform counts of all the treatments were <10 estimated APC which is at microbiologically acceptable level. Sensory evaluation revealed that T3, which contains 0.125% stabilizer (6.58) was the most liked sample, although its difference with the 3 other treatments was not significant. Also the 4 treatments of sports drinks and Gatorade were statistically indistinguishable in terms of their mean liking scores for color, aroma, taste and mouth-feel. JAR results revealed that T2, T3 and T4 had too much orange flavor. For purchase T3 got the highest mean (3.72) score. Proximate analysis of T3 revealed that it contained 22.1% carbohydrates thus it could be accordingly classified as 'hypertonic sports drink'.
9. Raw Milk Physico-Chemical Characteristics of Moringa Leaf Meal (MoLM) Fed	NTadeo, Jr., RSAVega, A Rayos, RSulabo, RBaconguis, ADel Barrio, and TSaludes	The study aimed to analyze the nutrient content (protein, lactose, solid-not-fat (SNF) and total solid (TS) of raw milk from MoLM fed buffaloes; and compare the effects of MoLM in terms of color, aroma, appearance, flavor and consistency, milk pH, temperature, sweetness, specific gravity and total titratable acid (lactic acid) of raw milk. A total of 8 lactating buffaloes were used as experimental animals for the duration of 63 days feeding trial. Treatment 1 includes concentrate with 1.25 urea (T1) and concentrates with 30% Moringa oleifera Leaf Meal (T2). A total of 60 containers of milk samples were used for milk composition analysis and sensory evaluation. Collected milk analyzed by PCC using MilkoScan FT-1 and Fossomatic Minor milk analyzer. Sensory evaluation was performed by PCC using their milk standard. All the data were analyzed using t-test to compare the two treatments. The results of raw milk analysis from both treatments showed comparative results having a progressive increase in fat, protein, lactose, solid-not-fat (SNF) and total solid (TS) contents from the initial up to the 4th collection of milk. Both treatments have the comparable color, aroma, appearance, flavor and consistency. Slight difference of milk pH, temperature, sweetness, specific gravity and total titratable acid (lactic acid) values were obtained. Statistical analysis showed no significant differences among the treatments observed.

		Milk produced from MoLM fed buffaloes are ideal for the production of any or all dairy products based on the standard set by the PCC and 30% of MoLM can be a good cheap source of protein ingredient for dairy buffaloes.
10. Correlation of Infrared Tympanic and Rectal Body Temperatures in Lactating Bulgarian Murrah Buffaloes in the Philippines	APYbanez, V Mutya, and JVAbela	Determining body temperatures in a convenient, fast and less stressful method, like the infrared thermometry, is advantageous in the animal health industry. In this study, infrared thermometry and traditional methods (using mercury-in-glass and digital thermometers) in assessing tympanic and rectal (core body) temperatures in lactating Bulgarian Murrah were evaluated, respectively. A total of 9 animals in the Philippine Carabao Center at the Visayas State University, Baybay City, Leyte, Philippines were monitored twice daily (morning and afternoon) for 14 consecutive days within the warm season (May 2014). The procedure was repeated during the cool season (November 2014). Mean body temperatures were found higher in the warm season, and during afternoons. Ambient temperature readings using beechwood and infrared thermometers revealed no significant difference, and were found not strongly correlated with body temperature measures. Although infrared tympanic temperatures (ITT) were found significantly higher than rectal temperatures, the temperature readings were found moderately correlated. This indicates the reliability of the ITT as an alternative in assessing body temperatures. However, the study proposes that ITT and rectal temperature should not be interpreted as the same, and that normal range for ITT under different field conditions should be established. While infrared thermometry has been explored in several other livestock animals, this study is the first report in Bulgarian Murrah buffaloes in the Philippines.

Appendix 5. List of Externally Funded and Collaborative R&D Projects, CY 2015.

Title	Proponent	Funding/Collaborating Agency
Genetic Diversity of the Philippine Carabao using mtDNA (COI) and microsatellite markers (FAO STRs)	L. Villamor and E.B. Flores	DA-Biotech
Screening for Sperm-factor (Phospholipase C-zeta) by Molecular Technique as a Novel Biomarker of Bull Fertility for Genetic Improvement in Water Buffaloes	E. P. Atabay, E. C. Atabay, C. N. Mingala, E. Venturina	DA-Biotech
Detection of Heat Shock Protein 70 in Buffalo at Various Seasons and Its Correlation with Semen Quality and Fertility Following Artificial Insemination	E. S. Maylem, E. P. Atabay, E. C. Atabay, E. Venturina	DA-Biotech
Improving Artificial Insemination Efficiencies Using Fertility Indexed Bulls Selected by Fourier Harmonic Analysis and Screened from Environmental Instabilities	P. G. Duran, D.H. Duran, M.D. Peralta, and H. Venturina	DA-Biotech
Evaluation of the ovicidal function of nematode predacious fungus Pochinia chlamydosporia against Fasciolan spp. in water buffaloes (Bubalus bubalis)	S. Ramos	DA-Biotech
Development of Loop-Mediated Isothermal Amplification (LAMP) Assay Based Test Kit for the Detection/Screening of Caprine Arthritis Encephalitis Virus (CAEV)	M. Balbin	DA-Biotech
Application and development of molecular-based tools for the diagnosis and characterization of reproductive infectious diseases causing abortion in livestock	G. Garcia, C.N. Mingala	DA-Biotech

Bovine Vaccine Trial of Schistosoma japonicum Paramyosin	M.S. L. Jiz, C.N. Mingala	Research Institute for Tropical Medicine
Investigation on the Extent of Leptospira Infection Among Different Water Buffaloes in the Philippines	M.A. Villanueva, C.N. Mingala, C. Nakajima, Ysuzuki and N. Koizumi	Hokkaido University
Sero-surveillance and Isolation of Bovine Viral Diarrhea Virus, Parainfluenza Virus, and Herpes Virus in the Philippines affecting Large Ruminants	M. Onuma, F. Saito, C.N. Mingala	Consortium for Japanese Veterinary Medicinal Products Manufacturers
Genetic assessment of Trypanosoma spp. towards vaccine development	C. Soloma, C.N. Mingala, N.S. Abes, M.R. Uy, M. Miguel	PL480, NIMBB
Epididymal Sperm Cryopreservation as a Potential Tool for Breed Conservation in-Vitro of Indigenous Livestock and/ or Endangered Wildlife in the Country: Prospects for Animal Genetic Resource	L. C. Ocampo	DA-BAR
Enhancing milk production of water buffaloes through S&T interventions	E.C. Atabay, E.P. Atabay, D.L. Aquino, M. Balbin, M. Abella	
A.S. Sarabia, H. Baltazar	PCAARRD-DOST	
Private-public partnership in the application of animal genomics to increase productivity and improve efficiency of the Philippine swine industry	J.R. Herrera and C.N. Mingala	PCAARRD-DOST
Genotyping the Philippine water buffaloes using medium density 90K buffalo SNP panel	E.B. Flores	PCAARRD-DOST
Community Based STBF on the Preparation and Utilization of Urea-Treated Rice Straw (UTRS) as Fodder for Dairy Buffaloes in Llanera, N.E	D.L. Aquino	PCAARRD-DOST
Commercialization of Grass/ Forage Corn Silage for Dairy Buffaloes in Lupao, N.E. through TechnoMart	E.P. Palacpac	PCAARRD-DOST

Appendix 6. Conferences, Seminars, Symposia, Workshops, and Trainings Participated in by PCC Personnel, CY 2015.

Title	Venue	Date (2015)	No. of PCC participants
International (Abroad)			
Armidale Animal Breeding Summer Course 2015	Armidale, New South Wales, Australia	January 28-February 6	2
8th Asian Buffalo Congress	Istanbul, Turkey	April 21-25	3
22nd Session of the CODEX Committee on Drug Residues of Veterinary Drugs in Foods	San Jose, Costa Rica	April 27-May 1	1
Certification System for Genetic Products in Animal Industry	Taiwan	June 1-7	4
Training Course on the Use of Near Infrared (NIR) equipment	Hamburg and Hainburg, Germany	June 27-July 5	1
Production and Distribution System of Animal Products	Kunpo & Yemsung, South Korea	September 21 - October 4	1
Workshop on the Benefits of Advanced Greenhouse-Gas Emissions Inventories for the Livestock Sector	Bangkok, Thailand	September 22-26	1
Regional Workshop on Improvement of Emission Factors for Enteric Fermentation	Bogor, Indonesia	December 7-11	1
Training workshop on Oocyte and Embryo Vitrification, November 24, and Primordial Germ Cells Isolation, Vitrification, and Transplantation	Hanoi, Vietnam	November 24	6
12th Annual Conference of the Asian Reproductive Biotechnology Society (ARBS)	Hanoi, Vietnam	November 26-29	6

International Conference on Integrated Science and Technology for Sustainable Development	Hanoi, Vietnam	November 27-28	6
Short Course on Market Access for Food Security	Wageningen University-Centre for Development Innovation WUC-CDI, The Netherlands	November 29-December 22	1
National			
ISO 9001 MGT Systems Standards Transition Training Overview	El Cielito Hotel, Baguio City	January 16	2
Philippine Quality Awarrd PQA Applicatuion Development Course	DAP Building, San Miguel Avenue, Pasig	February 24-27	2
Basic Techniques in Isolation and Purification of Rumen Microorganisms for Probiotic and Enzyme Production	UPLB Biotech	Februay 16-27	2
Basic Life Support & SFA, AED	Red Cross, Cabanatuan City	March 2-6	9
Orientation on Records Inventory Management	ITCAF Director's Conference Room, DA	March 11-12	1
Managing Social Media Records	Iloilo City	March 17-19	2
7th Annual National Convention EUC. INC. Surfing the Tide of Asian Financial Integration	Crown Regency Resort & Convention Center, Boat Station 2, Main Road, Boracay Island, Aklan	March 17-20	5
Training/Workshop on the DA Enterprise Architecture	Antipolo Rizal	April 8-10	1
GACPA Leads, Excels and Adheres to Professional Standards	SMX Convention Center, Lanang, Davao City	April 15-18	5
Accounting for Non-Accountants	Hotel Veniz, Baguio City	April 21-24	2
Government Procurement-Comprehensive Updates on R.A. 9184	Cagayan de Oro City	April 22-25	3
Values Restoration Program Trainers' Training	Hotel Supreme Convention Center Baguio City	April 21-24	1

Training Course on Environment Laws, Rules & Regulations for Managing Heads	Holiday Inn, Pampanga	April 21	1
Philippine Bidding Documents	Subic International Hotel	May 5-8	3
Government Procurement-Comprehensive Updates on R.A. 9184	Subic International Hotel	May 6-9	1
GIP Coordinators Meeting and Training on the Application of Fixed Time AI in Genetic Improvement and Young Bull Testing Program of PCC	PCC National Headquarters, Science City of Muñoz, Nueva Ecija	May 11-15	16
International Conference in Nature Studies and Innovations for the Environment	Hotel Stotsenberg, Clark Pampanga	May 26-30	1
2015 Conference on the Philippines Society for the Study of Nature	Hotel Stotsenberg, Clark Pampanga	May 26-30	1
Handling and Manipulating Results from Affymetrix Laboratory	PCC National Headquarters, Science City of Muñoz, Nueva Ecija	June 2	4
Livestock Expo Philippines 2015	SMX Convention Center, Pasay City, MM	June 24-26	10
ASEAN Food Conference 2015	SMX Convention Center	June 24-26	10
Property and Supply Management System-National/Corporate	COA, Rawis, Legaspi City	July 21-24	2
Seminar/Workshop on ICT Resource-acquisition-terms of reference	ICT Office-Diliman Q.C.	July 6-10	3
PICPA Seminars for CPA	PICPA Building, Metro Manila	July 1 & 22-24	1
International Training Course on Reproductive Biotechnologies	PCC National Headquarters, Science City of Muñoz, Nueva Ecija	July 13-22	17
Statistical Data Mgt. and Analysis using MS Excel	Manila	July 20-24	2
2nd Postgraduate Course in Diagnostic Mycology for the Practicing Veterinarian	UP Manila	July 27-31	1

Training on the Development of Antimicrobial Resistance Surveillance and Antimicobial Use Monitoring Program for Livestock	Subic International Hotel, Olongapo City	July 28-31	2
Appraisal & Disposal of Government Properties		July 28-30	1
Capacity Development Program on KM-Phase II		July 7-9	1
37th NAST Annual Scientific Meeting	Manila Hotel	July 8-9	6
Basic MS Excel and Advance MS Excel	PTTC, Pasay City	August 14 & 20-21	1
Social Media Development		August 6-7	1
Workshop on Research Proposal Writing on Livestock & Fisheries Biotechnology LBC, FBC, ASU, NRCP	Aklan State University	August 26-29	1
Evolve or Die save your ISO Transition to 2015 Version	Intercontinental Manila	August 28	4
Appraisal & Disposal of Government Properties		October 26-27	1
Basic Meat Processing Course	BAI-APDC Compound, Valenzuela City		1
NCC Capacity Building Programs on Government E-Service	Xenia Hotel, Clark Freeport Zone	September 2	4
Government Procurement-Comprehensive Updates on R.A. 9184	Bayview Park Hotel, Manila	September 16-19	1
Government Procurement-Comprehensive Updates on R.A. 9184	Bayview Park Hotel, Manila	September 16-19	2
Tools & Techniques for Internal Auditing	Hotel Kimberly, Manila	September 2-4	1
Tools & Techniques for Internal Auditing	Manila	September 2-4	1
Basic Productivity and Quality P+Q Foundation Course	Development Academy of the Philippines	September 15-18	1

Retooling of Veterinarians and Animal Health Coordinators of PCC	PCC National Headquarters and Gene Pool, Science City of Muñoz, Nueva Ecija	September 21-25	20
Core Competencies for HRMOs	Cagayan de Oro City	September 22-25	1
Developing Customer Satisfaction CSS	Cagayan de Oro City	September 22-25	1
LPD Matters: Updates on the CPO Rules & Regulations	UP Diliman	September 22	1
The Future of Agribusiness & Coopeerative Enterprise	Waterfront Insular, Davao City	October 14-17	4
Basic Training on AI / PD	Digdig, Carranglan	October 19 - November 12	2
52nd PSAS Scientific Seminar and Annual Convention	Puerto Princesa City, Palawan	October 21-24	21
50th PAEDA Biennial convention	Legaspi City, Albay	October 22-23	2
Seminar on Food Safety Initiative	Hotel Pampanga, San Fernando, Pampanga	October 27	1
Laws and Rules in Govenrment Expenditures		November 2-4	2
5th Luzon Convention of Human Resource Management Practioners	CAP Trade & Convention Center, Camp John hay, Baguio city	December 1-3	1
Workshop on the Development of TR and CATs in Dairy Processing	PCAF Conference Room, Apacible Hall, DA, Q.C.	October 13-14	1
42nd Annual Convention Philippine Society of Biochemistry and Mollecular Biology	Centro Escolar Universitry, Manila	December 3-4	4
PCC 1st Business Talk	Las Casas Filipinas de Acuzar, Bataan	December 9-11	35
Effective Management of Corrective Actions	Richmonde Hotel, Ortigas Center	December 7	3

Appendix 7. Research articles published in refereed journals, CY 2015.

No.	Authors	Title of Paper	Title of Journal
1	Virginia M. Venturina, Ma. Antonette F. Alejandro, Cyril P. Baltazar, Nancy S. Abes, and Claro N. Mingala	Evidence of Fasciola spp. resistance to albendazole, triclabendazole and bromofenofos inn water buffaloes (Bubalus bubalis)	Annals of Parasitology, 2015, 61(4), 283-289
2	Hirohisa Mekata, Shiro Murat, Claro N. Mingala, Kazuhiko Ohashi, and Satoru Konnai	Expression of regulatory dendritic cell-related cytokines in cattle experimentally infected with Trypanosoma evansi	Journal of Veterinary Medical Science
3	Perry Loraine H. Duran, Ryan Bismark C. Padiernos, Evaristo A. Abella , Satoru Konnai and Claro N. Mingala	Molecular characterization of T-cell immunoglobulin mucin domain-3 and Galectin-9 of swamp and riverine-type water buffaloes	International Journal of Immunogenetics
4	Gemerlyn Garcia, Lawrence P. Belotindos, and Claro N. Mingala	Evaluation of treatment alternatives against Respiratory Bacterial Pathogens of Small and Large Ruminants	Advances in Environmental Biology, 2015,9(8):149-155
5	Nyamsuren Ochirkhuu, Satoru Konnai, Claro N. Mingala, Tomohiro Okagawa, Marvin Villanueava, Flor Marie Immanuelle R. Pilapil, Shiro Murata and Kazuhiko Ohashi	Molecular epidemiological survey and genetic analysis of vector-borne infections of cattle in Luzon Island, the Philippines	Veterinary Parasitology, 2015 Sep 15;212(3-4):161-7
6	Sannny Barbera and Claro N. Mingala	Conservation of Exotic and endangered animals through biotechnology	Global Journal of Bio-Science and Biotechnology 2015, 4(2):220-223.
7	Ryan Bismark C. Padiernos, Michelle M. Balbin, Arman Parayao and Claro N. Mingala	Molecular Characterization of gag gene of caprine arthritis encephalitis virus from goats in the Philippines	Archives of Virology 2015, 160:969-978
8	Eric P. Palacpac, Moses Gil F. Honorio, Erwin M. Valiente, Rovelyn T. Jacang	Common Characteristics of Progressive Dairy Buffalo Farmers in Nueva Ecija, Philippines	Philippine Journal of Veterinary and Animal Sciences 2015, 41(2): 109-118
9	Marlon B. Ocampo and Lerma C. Ocampo	A protocol for the in vitro production of bubaline embryos: The Philippine experience.	Intl J. Agric Tech., 11(8): 2343-2357

10	Marlon B. Ocampo and Lerma C. Ocampo	Strategies to improve the developmental competence of water buffalo oocytes in vitro	Intl J Agric Tech., 11(8): 2309-2323
11	KM Tawatao, FV Manaois II, LC Ocampo, and MB Ocampo	Folic acid supplementation for bovine oocyte maturation in vitro	Intl J Agric Tech., 11(8):2401-2409
12	JD Sumeldan, LC Ocampo, EP Atabay, EF Celestino, JV Lazaro, and MB Ocampo	Comparison on the efficiency of estrus synchronization methods for artificial insemination in goats	Intl J Agric Tech., 11(8):2489-2497
14	LM Aquino, FV Manaois II, LC Ocampo, and MB Ocampo	Evaluation of bioassay using in vitro matured water buffalo oocytes in predicting bull sperm fertility	Intl J Agric Tech., 11(8): 2531-2538
15	EJP Valete, ERS Maylem, MB Ocampo, EA Abella, and LC Ocampo	Post mortem viability of epididymal sperm from Philippine native water buffalo	Intl J Agric Tech., 11(8): 2283-2294
16	MB Ocampo, JA Manuel, RP Soriano, and LC Ocampo	Chromosome complement and developmental competence of swamp buffalo oocytes matured and fertilized in vitro	Intl J Agric Tech., 11(1):57-68
17	Marlon B. Ocampo and Lerma C. Ocampo	Improved developmental potential of porcine blastocyst by L-carnitine supplementation.	Intl J Dev Res., 5 (7): 5029-5033
18	PCJ Manzano, MB Ocampo, LC Ocampo, ERS Maylem, and JV Lazaro	Improved bovine blastocyst developmental potential by L-carnitine supplementation	Intl J Sci Res Knowledge, 3(1):21-29
19	LC Ocampo LC and MB Ocampo	Improved developmental competence of swamp buffalo oocytes matured in the presence of cysteamine	Intl J Agric Tech., 11(1):31-40
20	VB Salting, FP Aquino, MEDC Leoveras, LC Ocampo, EP Atabay and AM De Leon	Comparison of quality of spermatozoa from the excurrent ducts of Philippine local chicken retrieved by swim-up or mincing methods	Journal of Biological Engineering Research and Review, 2016; 3(1): 01-05
21	DG Antalan III, FP Aquino, MEDC Leoveras, LC Ocampo, EP Atabay and AM De Leon	The effect of semen extender and storage time on the quality of spermatozoa collected from the excurrent duct of Philippine local chicken	Journal of Biological Engineering Research and Review, 2015; 2(2): 18-20

Appendix 8. List of partner-institutions, CY 2015.

Partner Institution	Nature of Linkage
New	
International Livestock Research Institute, Kenya	R&D
RIKEN (Institute of Physical and Chemical Research), Japan	R&D
Kyoritsu Seisaku (KS), Japan	R&D
National Institute of Agrobiological Sciences, Japan	R&D
National Institute of Animal Health, Japan	R&D
Kyoto University, Japan	R&D
Agricultural Business Research Institute, Australia	R&D
Animal Genetics and Breeding Unit, Australia	R&D
University of Wisconsin-Madison, USA	R&D; Technical Cooperation
Taiwan Livestock Research Institute, Taiwan, ROC	R&D; Technical Cooperation
Philippine Rice Research Institute	R&D
Bureau of Fisheries and Aquatic Research	R&D
University of the Philippines Los Baños	R&D
Southeast Asian Regional Center for Graduate Study and Research in Agriculture	R&D; Capability Building
Existing	
International Committee for Animal Recording (ICAR), Italy	R&D; Technical cooperation
Laboratory of Plant and Animal Science Experimental Farm, Meijo University, Japan	R&D; Technical Cooperation
BUDHI ng Pilipinas Foundation, Inc.; Tulong Dairy Farmers Association (Tulong DFA); SHAHANI GATAS ng KALABAW Products Inc. (SGKP)	Capability building
Laboratory of Infectious Diseases, School of Veterinary Medicine, Hokkaido University, Japan	R&D; Technical Cooperation
Hokkaido University Research Center for Zoonosis Control, Japan	R&D; Technical Cooperation
Consortium for Japanese Veterinary Medicinal Products Manufacturers, Japan	R&D
Korea International Cooperation Agency	Technical Cooperation
Sunchon National University, South Korea	Capability Building
Hankyong National University, South Korea	Capability Building
Korea Institute for Animal Products Quality Evaluation, South Korea	R&D; Technical Cooperation
Japan International Cooperation Agency, Japan	Capability Building
Rajamangala University of Technology Thanyaburi, Thailand	Technical Cooperation

Rajamangala University of Technology Tawan-ok, Thailand	Capability building
National Genetic Resources Preservation, USDA, Agricultural Research Service, Fort Collins, Colorado, USA	Technical Cooperation
Colorado State University, USA	Capability Building
Department of Veterinary and Animal Science, University of Massachusetts, USA	Capability Building
Manila Economic and Cultural Office-Taiwan Economic and Cultural Office	Technical Cooperation
Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development-Department of Science and Technology	R&D; Technology commercialization
National Academy of Science and Technology	R&D
Research Institute for Tropical Medicine-Department of Health	R&D
Central Luzon State University-College of Veterinary Science and Medicine	R&D
Central Luzon State University-Small Ruminants Center	R&D
Department of Biology-University of the Philippines Manila	R&D
Department of Biology-College of Science-University of the Philippines Baguio	R&D
Molecular Protozoology Laboratory, Natural Sciences Research Institute, University of the Philippines Diliman	R&D
National Institute of Molecular Biology and Biotechnology, University of the Philippines Diliman	R&D
Bureau of Animal Industry	R&D
Bureau of Agricultural Research	R&D
National Dairy Authority	Development
Philippine Statistics Authority	R&D
Department of Agriculture Biotech Program	R&D
Department of Agriculture-National Agricultural and Fishery Council	R&D
Accredited Swine Breeders Association of the Philippines	R&D
Cooperative Development Authority	Development; Capability Building
Department of Trade and Industry	Development; Capability Building
Public Law (PL) 480	R&D; Capability Building
Kennedy Round (KR) 2	Development

Appendix 9. PCC's MFO Accountability Report Card (MARC) as of December 31, 2015

MFO/PI		2014 Actual Accomplishment	2015			
			TARGET	ACCOMPLISHMENT	% Accomplished	Remarks
MFO 1: Technical Support Services						
PI set 1	**1.1 Production Support Services**					
	Improvement of genetic potential of carabaos for milk and meat thru organized breeding & selection (artificial insemination, natural mating) and conduct of R&D and related production support activities					
Quantity:	1.1.1 **Clients** directly provided with support services	124,739	170,000	111,101 clients served		
	Production Support provided to clients	129,306	170,000	1170,880	101%	
Quantity:	1.1.2 Calves produced	16,344	17,161	16,307	95%	
Cost	Actual Budget Utilization		345,522,000.00	337,372,332.63	98%	
Timeliness	% of farmers[1] requests for technical assistance responded to within 3 days	85%	90%	93%	103%	
PI set 2	**1.2 Market Development Services**					
Quantity:	1.2.1 No. of organized groups provided with market development services	174	180	172	96%	
Quality:	1.2.2 Volume of milk production traded (kgs)	924,590.00	1,109,508.00	1,798,907.73	162%	
	1.2.3 Value of milk production traded	75,000,000.00	90,000,000.00	141,609,801.57	157%	
Timeliness	*1.2.4 Percent of clients that rated market support services as satisfactory or better*					
Cost	Actual Budget Utilization		12,211,000.00	11,878,314.07	97%	
PI set 3	**1.3 Extension Support, Education and Training Services**					
	Enhance the skills of clients to elicit their active participation in the program					
	1.3.1 No. of clients of IEC services	49,500	51,975	66,131	127%	
	1.3.2 No. Individuals trained	11,064	12,170	12,120	100%	
Quality:	*1.3.3 Percent of clients that rated ESETS as satisfactory or better*	85%	90%	93%	103%	
Timeliness	within 2015 (monthly, quarterly)					
Cost	Actual Budget Utilization		14,191,000	12,683,015.90	89%	
	AVERAGE		**Physical Accomplishment**		**120%**	
			Fund Utilization		**97%**	

[1] – *supported by list of clients (name, address, and/or contact details)*
[2] – *90% compliance to target, DBM Circular AO 25 RBPMS*

Appendix 10

PCC Advisory Board Members

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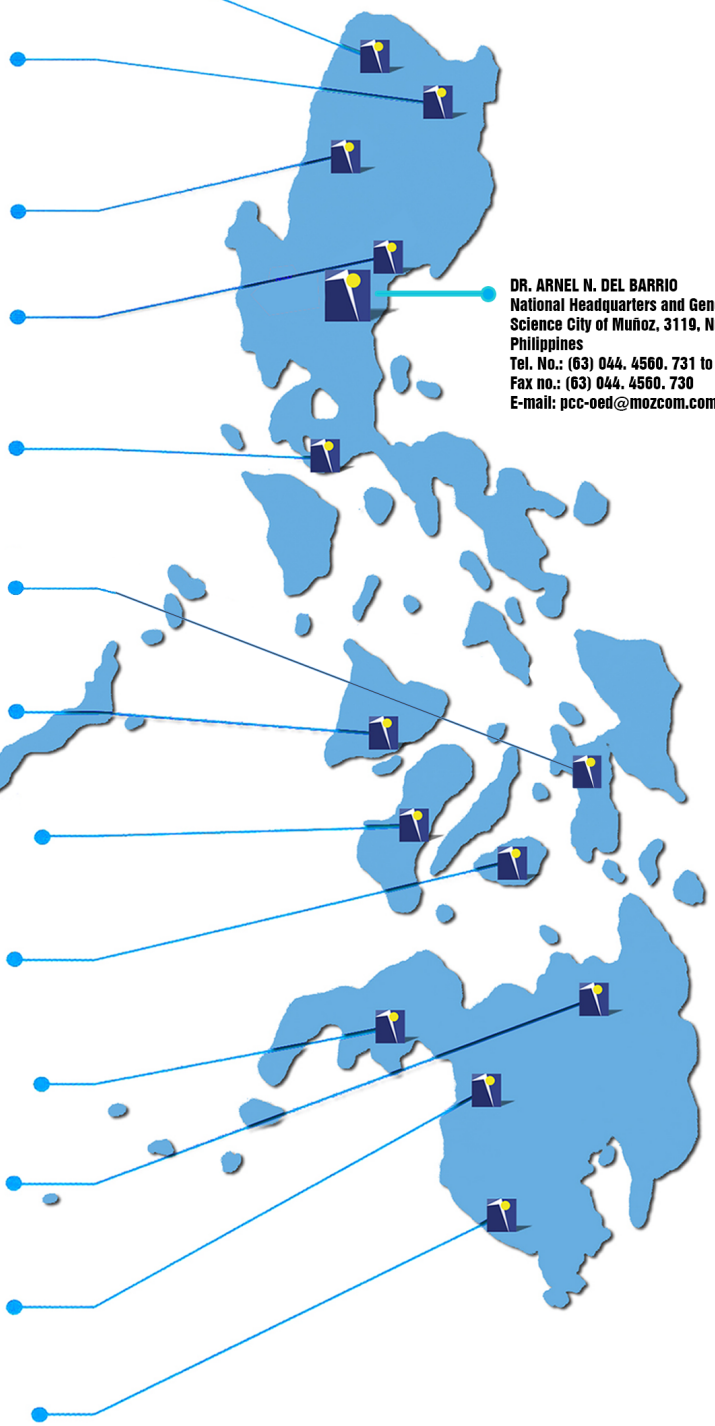
Science City of Muñoz, Nueva Ecija

Appendix 11

PCC DIRECTORY



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