PHILIPPINE CARABAO CENTER | 2nd Issue, September 2011

R&D Highlights

2011 OUTSTANDING YOUNG SCIENTIST (OYS). Dr. Claro N. Mingala of the PCC Animal Health Laboratory gives PCC another laurel as the national lead agency for livestock biotechnology R&D when he was adjudged as one of the OYS awardees by the Department of Science and Technology - National Academy of Science and Technology (DOST-NAST).

PCC stays focused as excellent institution for livestock R&D

By Rowena G. Bumanlag

Efforts of the Philippine Carabao Center (PCC) along its research and development (R&D) agenda are continuously strengthened and refined with the overall objective of improving productivity and efficiency in the carabao industry and consequently the lives of thousands of smallhold farming families.

This is evident in its sustained focus to address issues pertinent to the agency's operations and to bridge gaps in the industry using strategies such as the annual in-house R&D review.

R&D is one of the critical components in PCC's program management. It is on this premise that scientific papers were reviewed to ensure that areas of research are consistently focused on and aligned with the R&D thrust of PCC.

The in-house review, conducted last May 23-25 at the PCC national headquarters, specifically aimed to assess ongoing research activities, achieve a systematic R&D management system through understanding and appreciation of the

continued on page 2

CONTENTS

EDITORIAL STAFF

Editor-in-Chief Rowena Galang-Bumanlag
Editors Eric P. Palacpac • Anselmo S. Roque
Technical Editors Eufrocina P. Atabay • Claro N. Mingala • Danilda H. Duran • Arnel N. del Barrio • Glen P. Bajenting • Thelma A. Saludes • Rosalina M. Lapitan
Managing Editor/Layout Joahna G. Goyagoy
Writers Rowena G. Bumanlag • Joahna G. Goyagoy • Khrizie Evert M. Marcelo
Editorial Adviser Libertado C. Cruz

Through its sustained efforts on R&D, PCC recognizes the inevitable need to improve the level of productivity for meat and milk while reducing the cost of production with the objective of protecting the interest of thousands of smallhold farming families who depend on carabao raising as a means of livelihood.

- Dr. Eric P. Palacpac, PCC R&D Coordinator

PCC stays focused...

(From page 1)

technologies for verification and transfer to farmers, and motivate researchers to strengthen their interest in conducting researches along the agency's R&D agenda.

Scientists and researchers from the office of the executive director and from the PCC regional centers participated in the in-house review. Student researchers, hosted by PCC, were also invited to present the results of their scientific studies.

Thirty three research papers were presented for evaluation. These studies focused on priority thematic areas, such as animal health, reproductive biotechnology, reproductive physiology, improving forage and pasture, increasing milk production, increasing calf production, reducing calf mortality, production management, meat products, socio-economics, animal nutrition, and breeding and genetics.

Research papers on reproductive biotechnology and meat products titled "Effect of All-trans Retinoic Acid during In-vitro Maturation on the Development, Carbohydrate Uptake and Midkine Expression in Water Buffalo Oocyte" by Lilibeth Cajuday, Annabelle Herrera and Danilda Duran and "Carcass Yield of Native and Crossbred Buffaloes Slaughtered at Two Years of Age" by Rosalina Lapitan, Arnel del Barrio, Jesus Rommel Herrera, and Thelma Canaria won this year's "Best Paper", non-operational and operational research categories, respectively.

Animal nutrition expert Dr. Daniel Aquino was named "Best Presenter" for his presentation on "Augmented Feeding with By-pass Amino Acids and Slow Release Non-protein Nitrogen (NPN) Supplements for Dairy Buffaloes".

Each of the awardees received certificate and cash prizes.

The panel of evaluators was composed of seasoned veterinarian Dr. Jose Arceo Bautista of the Animal and Dairy Sciences Cluster of the University of the Philippines (UP) at Los Baños, animal scientist Dr. Synan Baguio of the Livestock Research Division of the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development; scientist Dr. Windell Rivera of the UP System, and developmentalist and economist Dr. Luzviminda Galang of the College of Agriculture of the Central Luzon State University. Dr. Bautista chaired the panel of evaluators.

Following the review of research papers was the PCC R&D Management review facilitated by national R&D coordinator Dr. Eric Palacpac.

The position of R&D in the agency's program management was reiterated emphasizing on its functional interrelationship with other critical components of implementation, such as planning, monitoring and evaluation, and applied communication.

A quick overview of the R&D process was also presented for better appreciation of a systematic research management.

The presentation was highlighted with the review of the agency's R&D agenda.

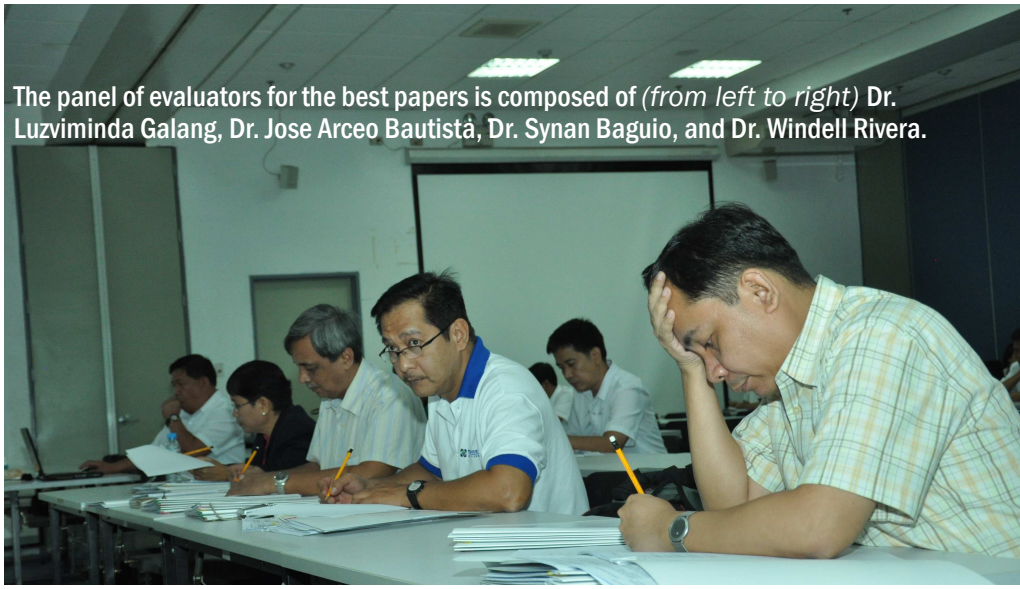
Through its sustained efforts on R&D, Dr. Palacpac said, PCC recognizes the inevitable need to improve the level of productivity for meat and milk while reducing the cost of production with the objective of protecting the interest of thousands of smallhold farming families who depend on carabao raising as a means of livelihood.

These efforts, he said, will be popularized and translated into tangible outputs and will be "communicated for purpose of innovation" at the level of PCC's primary clientele, the farmers.

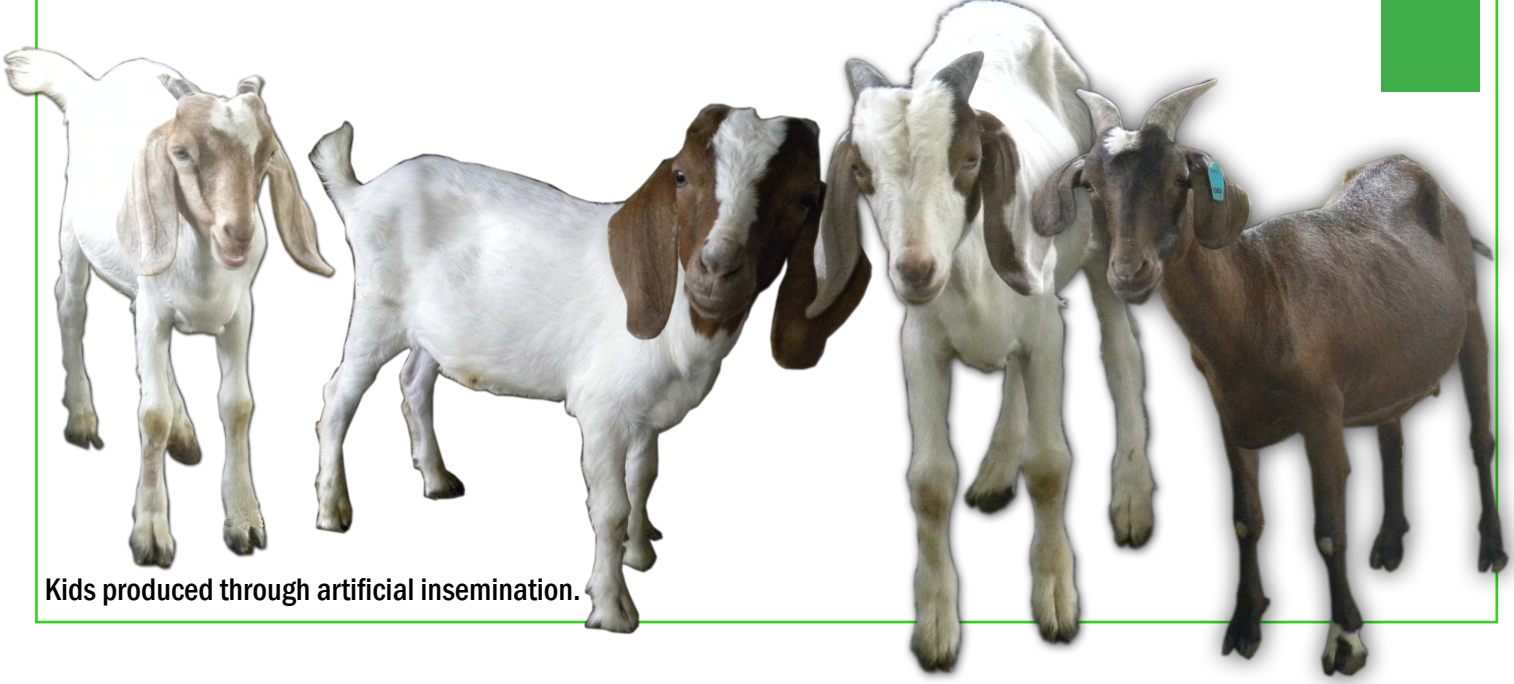
Dr. Palacpac presented that, since 1997, PCC takes on a focused R&D program direction, such as: improving carabao productivity for milk and meat, increasing calf crop in water buffaloes in the villages, developing buffalo-derived products, developing sustainable village-based dairy enterprises, assessing the socio-economics aspect, and assisting in policy formulation.

A workshop followed after the presentation where concerns relevant to a sound R&D program implementation at the centers' level were discussed.

Among the apparent issues that called for the immediate formulation of policies from the PCC's program management committee were on motivating and bringing out the best asset of researchers, improving the technical capability of researchers to conduct researches that are aligned to the PCC R&D agenda, mentoring young researchers and retooling those who have not been back to research work for some time, strengthening linkage with SUCs hosting the regional centers, strengthening of logistical and technical support for PCC researchers, and enhancing focus among researchers to carve time solely for conducting research out of their busy day-to-day routines.



The panel of evaluators for the best papers is composed of *(from left to right)* Dr. Luzviminda Galang, Dr. Jose Arceo Bautista, Dr. Synan Baguio, and Dr. Windell Rivera.



Kids produced through artificial insemination.

Optimized extender for semen cryopreservation offers big potential for wide-scale AI in goats

By Joahna G. Goyagoy

Wider scale application of artificial insemination (AI) in goats is now possible through the development of a more efficient extender for goat semen cryopreservation.

Mixed with semen, an extender is a liquid diluent that preserves the latter's fertilizing ability and ensures the livability and efficiency for successful AI activities. Cryopreservation diluents, on the other hand, supply the sperm cells with sources of energy, protect the cells from temperature-related damage, and maintain a suitable environment for the spermatozoa to survive temporarily.

Research studies conducted by a team from the Philippine Carabao Center (PCC) and Tarlac College of Agriculture (TAC) showed that the incorporation of egg yolk at a lower level can work wonder as extender.

Studies have shown that even though there are many similarities in semen processing techniques in goat's and other domestic animals, such as the types of cryopreservation media, cryoprotectants, freezing and thawing procedures, goat semen requires extra attention to maximize its post-thaw motility and fertilizing ability.

Due to limited studies done on cryopreservation of goat semen, the research team, led by Dr. Eufrocina P. Atabay of PCC and Dr. Ma. Asuncion G. Beltran of TAC, embarked on determining an efficient extender for the cryopreservation of goat semen to be used for AI, particularly with the kind of non-permeating components of the extender using goat serum, Bovine Albumin Serum (BSA), and egg yolk.

The three non-permeating components were tested at various levels using semen samples from three healthy bucks (Anglo-Nubian, Boer, Saanen), ages 1.5 to 3, from the Small Ruminant Center (SRC) at Central Luzon State University in the Science City of Muñoz, Nueva Ecija.

The collected semen samples were brought to the Reproductive Biotechnology Laboratory of PCC and were evaluated for its volume, color, consistency, pH concentration, pre and post-thaw motility, morphology, and acrosome integrity.

Results indicated that using lower level of egg yolk (5%) in the diluent demonstrated the highest post-thaw motility, sperm motility, and percentage of live sperm in cryopreserved goat semen. Low egg yolk level also resulted in the lowest sperm abnormality.

These observations were comparable with previous research findings recommending the use of low (1.5%) egg yolk level on the basis that higher concentration can decrease the post-thaw viability of buck's semen samples. It was reported that goat semen plasma contains egg yolk coagulating enzyme (EYCE) which causes the egg yolk media to coagulate which induces death of sperm.

Using frozen-thawed semen cryopreserved with 5% egg yolk, 23 naturally in-heat does (female goats) in the first batch were inseminated, 16 of which were confirmed pregnant thereafter. In the second batch, five does were also confirmed pregnant out of the seven that were artificially inseminated. The result indicated a 70.50% overall pregnancy rate.

In sum, the study demonstrated the development of a simple and economical protocol for the goat semen cryopreservation involving extender with lower concentration of egg yolk and the use of a simple freezing device applicable for wide-scale field use.

Recommending for further research and additional field trials, the research initially concluded that the findings present a huge potential for application to the goat production system, in particular, and livestock industry, in general.

Dairy buffalo module proves dairying is a viable business venture for farmers

By Rowena G. Bumanlag

A five-cow dairy module can provide a profitable business enterprise to a smallhold farming family, a PCC case study declared.

From five dairy buffaloes, a farmer can earn a monthly income of Php9,018.52, concluded a study conducted by the PCC at University of the Philippines-Los Baños (PCC-UPLB) station.

The cash inflow, with a 97.4% return of investment (ROI) value, was proof enough for the viability of the dairy enterprise, the study revealed.

The study, which covered the period 2001 to 2007, indicated that net incomes from year one to year seven, ranging from Php82,209.37 to Php197,838.64, were realized from the farmer's module. The main source of the income was from milk sales based on a selling price of Php55 per liter, a relatively higher price compared with the buying price in Sta. Cruz, Laguna which is at Php40 a liter.

The cumulative net income, though, showed negative values in the first two years but turned positive in the third up to the seventh year at Php757,556.04. The average annual net income was computed at Php108,222.29 or Php9,018.52 monthly.

The measure of profitability of the dairy operation, expressed in its high ROI value, was based on the cumulative net income over total costs.

Subject of the study was farmer-trustee Pablo Remulla of Dasmariñas, Cavite. His module consisted of three- to eight-month pregnant purebred Bulgarian Murrah buffaloes.

The total capital investment, valued at Php199,000, covered the cost of breeder stocks pegged at Php30,000 per head which is the prevailing market price of a pregnant heifer, animal housing with calf pen and milking parlor, and 1-ha pasture area. As per provisions in the trusteeship contract, the PCC provided the pregnant heifers while the farmer-recipient was required to put up the facility.

Parameters

Parameters for economic analysis, such as milk production, lactation period, calving and calving interval (CI), and animal inventory, were recorded monthly.

Remulla also kept records of production and operation costs including, among others, feeds, infrastructure, pasture development, and labor to determine the total costs incurred for the dairy operation.

All the animals gave birth in the first year of operation but only four were milked because of the death of one cow due to complete uterine prolapse after calving.

Using natural breeding with a Murrah bull loaned out by PCC, a total of 22 calves were produced in seven years. The CI was 16.2 months.

With an average lactation period of 251.4 days, the total milk production was recorded at 1,205.2 liters.

In the duration of the study, with the initial introduction of five dairy buffaloes, the herd size increased to 13 head then leveled-off from six to seven head in 2005 to 2006. A 22.7 percent calf mortality was also documented in the course of the study.

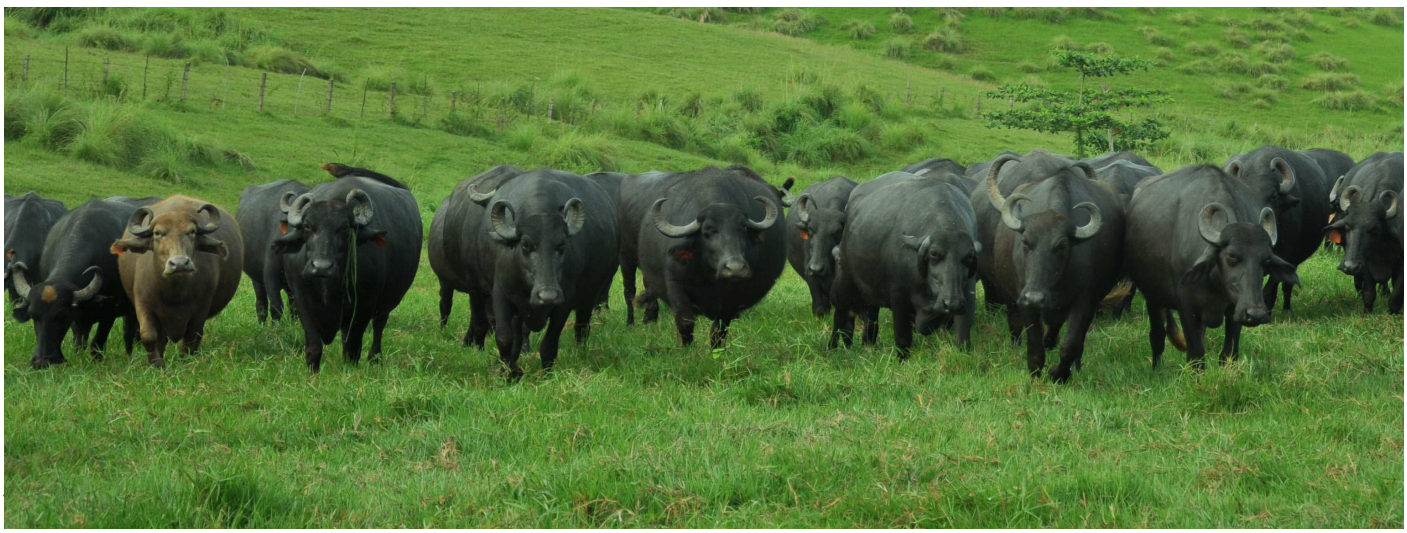
Likewise, eight yearling cows, four males and four females, were given to PCC.

Remulla employed a cut-and-carry system of feeding. He fed his animals ad libitum with Napier grass, rice straw, and sugarcane tops. He also gave them a ration of concentrates: 0.2 kg/day for calves in 300 days, 0.5 kg/day for yearlings, and 1 kg/day for breeder cows in 365 days.

Remulla's records also showed that lactating cows were fed with 2 kg of wet concentrates per day at the time of milking. He milked his cows twice a day.

As the lead agency to take on carabao upgrading through genetic improvement, PCC is keen on establishing dairy buffalo-based enterprises that will provide additional income to marginalized farming families.

Realized through the organized crossbreeding program, carabao upgrading is complemented with the provision of superior breeding animals to farmers, of which the five-cow dairy buffalo module is a component.



Buffalo meat shows big promise in high-end meat products processing

By Khrizie Evert M. Marcelo

Have you tasted buffalo meat? If you did, it is most likely that you mistook it for cattle beef.

According to researchers, buffalo meat, is comparable to beef with its physiochemical, nutritional and palatable characteristics.

This is proven in the use and acceptability of buffalo meat in the meat processing industry. In fact, more manufacturers now prefer using buffalo meat in processing high-end meat products such as meat loaf, corned beef and sausages.

Nutritional quality

Buffalo meat, experts said, became popular of late among beef lovers because of its healthy values. The reason given is that it contains 40% less cholesterol and 55% less calories while it has 11% more protein and 10% more mineral compared to beef.

Alternative livestock for meat

Studies revealed that meat derived from properly fed carabaos aged 18 to 24 months is equivalent to beef in terms of tenderness and juiciness. Studies also show that buffaloes that are slaughtered at the end of their working life result in dark, coarse, and tough meat.

Buffalo carcass has rounder ribs, a higher proportion of muscle and a lower proportion of bone and fat than beef. These make buffalo meat very good for processing into numerous meat products similarly produced from cattle meat.

In a study led by Dr. Rosalina M. Lapitan, supervising science research specialist of the Philippine Carabao Center at the University of the Philippines-Los Baños, the carcass yield of native and crossbred buffaloes slaughtered at two years of age were compared.

The carcass yield or dressing percentage is the proportion of the animal's live weight salvaged at carcass point.

Specifically, the team's study was aimed at determining the carcass yield and characteristics of native and crossbred buffaloes and the income from processing the carcass into high-end processed meat products.

Five healthy two-year-old native and 13 crossbred male buffaloes properly fed with Napier or para grass and concentrates during the growing period were used in the study.

The animals were slaughtered following the standard procedures in slaughtering cattle. The live weight was measured using a digital livestock scale. Slaughter weights, hot carcass weight and the weights of the by-products and organs of the animals were measured. Its dressing percentage was computed based on the hot and chilled carcass weight.

The carcass weight after chilling was also measured to determine the chilling loss. The individual weights of the wholesale and retail cuts from the chilled carcass were also recorded.

The average slaughter weight of the native carabaos, according to the study was 288.80 kilograms (at 26 months) while the crossbred buffaloes, 339.08 kilograms (at 22.4 months).

Results showed that the live weight, hot and chilled weight and the dressing yield were significantly lower in native carabaos than in crossbred buffaloes.

In terms of percent of live weight, the values obtained from chuck and briskets were found higher in crossbred buffaloes than in native carabaos. Values from foreshank, ribs, and plate were similar. Conversely, the percent of chilled weight showed that the yields of chuck, ribs, plate and foreshank except for brisket were higher in native than in crossbred buffaloes.

By comparison, the chilled carcass yield in the forequarter of the native and crossbred buffalo contributed about 57.74 % and 51.92% respectively, the study said.

The forequarter of an animal carcass includes the forelimb.

continued on page 6

Buffalo meat shows big potential...

(From page 5)

As far as the chilled carcass yield of the hindquarter was concerned, the native carabao had 55.90%, which was higher than the crossbred buffaloes with only 49.53%.

It also showed that when expressed as a percentage of live weight, the wholesale cut yields of a crossbred buffalo that include the round, loin, and flank parts, were heavier than those of the native's. Similar values were also observed for round and loin when expressed in percent chilled carcass weight.

The team observed that yield in terms of retail cuts were heavier in crossbred buffaloes than in the natives. These retail cuts were particularly heavier in the o-bone and brisket stew in the forequarter. The same value was found in the round steak, heel of round, t-bone, club, and sirloin steak from the loin, flank steak and flank stew of the hindquarter.

The researchers opted to process only the meat from the crossbred buffaloes into different meat products.

Processing was done at the Animal Products Development Center (APDC) of the Bureau of Animal Industry (BAI) in Marulas, Metro Manila.

Thirty-eight percent or 56.84 kg of the carcass from crossbred buffalo was used to produce different kinds of sausages and to determine the possible income that can be derived from it. The different sausages processed include beerwurst, bratwurst, hungarian and italian sausages, mortadella, schublig, kabanosy, summer sausage, and salametti.

After deducting all the expenses such as transport, processing fee, ingredients and other related costs, an added income of Php7,856.49 was generated per animal, 46.87% higher than the profits made when the carcass was sold fresh.

The researchers concluded that male crossbred buffaloes, owing to its higher dressing percentage and lean cuts yield, have more potential in the meat processing enterprise, thus have a place in the market for high-end meat products.

Retinoic acid can improve embryo development in water buffaloes

By Joahna G. Goyagoy

Dr. Duran (back) and Dr. Cajuday incorporates retinoic acid to the buffalo oocyte maturation medium.

Retinoic acid (RA), a vitamin A metabolite, increases the possibility of embryo development after in-vitro fertilization in water buffaloes.

This result was drawn from the study "Effect of All-Trans Retinoic Acid during in Vitro Maturation on the Development, Carbohydrate Uptake, and Midkine Expression in Water Buffalo Oocyte" by Lilibeth Cajuday of the University of the Philippines-Diliman which was done in collaboration with the Reproductive Biotechnology Laboratory of the Philippine Carabao Center.

Aside from the very low number of available and retrievable buffalo oocytes from slaughterhouse-derived materials and ovum pick-up from genetically superior females, studies showed that buffalo oocyte has low embryo development efficiency mainly due to its inherently low fertility.

Researches on cattle, on the other hand, have shown that RA has greatly influenced the development of embryo because it contains vitamin A (retinol) vital to cellular growth and development, embryonic morphogenesis, and differentiation.

These findings led the UP researcher to undertake this study and validate the efficiency of RA incorporation to the maturation medium of buffalo oocyte on the developmental competence of water buffalo oocytes in-vitro.

In vitro fertilization is a reproductive biotechnology ensuring a higher rate of fertilization through the fertilization of egg outside the animal's womb. It is also commonly known as the test-tube system.

To determine the effects of all-trans RA in the overall development of water buffalo oocyte, the research, as for its objectives, focused on three several studies. The first was on determining the desired concentration and effects of all-trans RA by examining its action on cumulus expansion, nuclear maturation, embryo development, and quality after in vitro fertilization. The second assessed the carbohydrate consumption of oocytes,

continued on page 9

Cryotop, SSV methods prove effective for buffalo oocyte cryopreservation

By Joahna G. Goyagoy

Oocyte (egg cell) cryopreservation, remains an open challenge in most mammalian species due to the extreme sensitivity of this gamete to chilling injuries.

With this challenge at hand, a team of research scientists from the Philippine Carabao Center (PCC) led by Dr. Eufrocina Atabay, conducted a study to determine which technique could be best used to curb chilling injuries of oocytes using vitrification method.

Earlier study indicated that vitrification method is a more effective method in buffalo oocytes cryopreservation than slow freezing.

Vitrification process involves high concentration of cryoprotective agents which can cause chemical toxicity and osmotic effects to which a very rapid cooling rate was found to be critical for successful vitrification.

Following this research work, the team focused on determining the efficiency of the so-called minimum volume vitrification using Cryotop (CTP) and Solid Surface Vitrification (SSV) methods. Employing the same type of equilibration, vitrification, and diluent solutions for the two methods, the study aimed at determining the survival and subsequent development of in-vitro matured (IVM) buffalo oocytes after fertilization. Moreover, the effect of the presence or absence of cumulus cells around the oocyte cryopreservation was also studied.

The results indicated that minimum volume methods, CTP and SSV, projected high survival rates and development of the vitrified-thawed buffalo oocyte after IVF which could be due to high rates of cooling and warming.

Cryodevices

The CTP and SSV devices hold common features of a containerless system and using small sample size that allow rapid cooling-warming rates leading to a succesful vitrification. The CTP involves the use of a thin plastic sheet on which oocytes/embryos are placed in a minimum amount of vitrification solutions before they are placed in liquid nitrogen (LN2). The SSV method, on the other hand, achieves a high cooling rate by using a combination of microdrops and improved heat exchange by direct contact with a dry metal surface cooled by LN2.

Dr. Eufrocina Atabay vitrifies oocytes using the Cryotop method.

Furthermore, the study also found out that the presence of cumulus cells around the oocytes prior to freezing is beneficial in the fertilizability of the vitrified oocyte.

It was verified that the absence of cumulus cells severely reduced the proportion of oocytes that cleaved following vitrification by both CTP and SSV methods.

Previous works also reported that the removal of cumulus cells represents one of the factors that may contribute to the failure of fertilization rates following IVF of the non-treated oocytes. In addition, the results indicated that the presence of cumulus cells could minimize the zona hardening effect of the vitrification process, thus allowing fertilization.

These results, taken together, indicated that SSV and CTP vitrification methods are equally effective and suitable and are thus recommended for vitrification of buffalo oocytes. The choice between the two methods, however, may depend on the advantage and purpose of each method.

The SSV is a very cheap method that enables preservation of several microdrops of vitrification solutions within a short period of time, each containing a large number of oocytes. With the use of SSV, around 10-15 oocytes or more per drop can be vitrified while less than 10 oocytes can be loaded in CTP cryosheet.

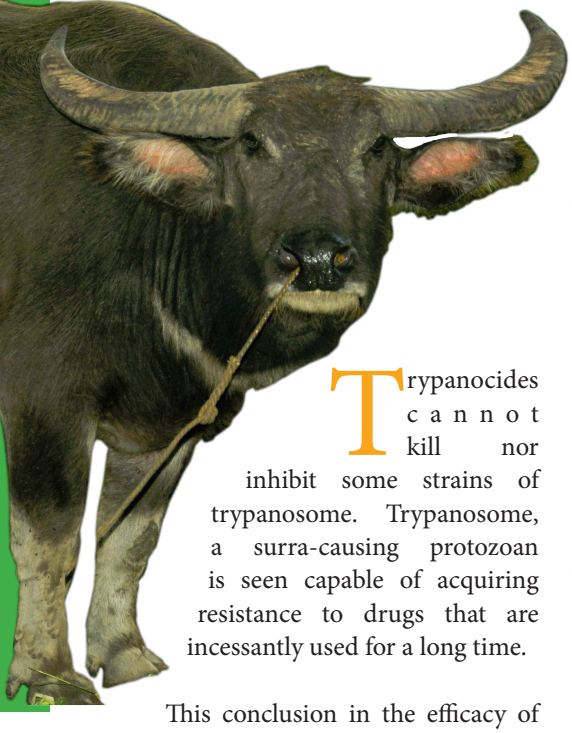
The SSV method is found more suitable for rapid cryopreservation of large quantities of oocytes, especially in cases where there is an abundant genetic resource available for mass production of cryopreserved buffalo oocytes. On the other hand, Cryotop is recommended for few but genetically superior in vivo-derived (OPU) oocytes.

The overall efficiency of oocyte vitrification is lower compared with embryos making vitrification of buffalo oocytes still a challenging area of research.

If perfected, the research team posited, cryopreservation of oocytes offers huge prospects in animal production as vitrified oocytes serve as valuable germplasms for in-vitro embryo production and other assisted reproductive technologies for the genetic improvement and conservation of livestock.

The study was funded jointly by the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development of the Department of Science and Technology (PCAARRD-DOST) and the PCC under the project "Cloning by Somatic Cell Nuclear Transfer as a Tool for Genetic Improvement in Water Buffaloes".

Effects of Surra drugs vary against *T. evansi* isolates from water buffaloes in PH islands



By Rowena G. Bumanlag

Trypanocides cannot kill nor inhibit some strains of trypanosome. Trypanosome, a surra-causing protozoan is seen capable of acquiring resistance to drugs that are incessantly used for a long time.

This conclusion in the efficacy of trypanocidal drugs was backed up by the results of a scientific research titled "Comparative Effects of Trypanocidal Drugs Against *Trypanosoma evansi* (T. *evansi*) Isolated from Philippine Water Buffaloes (Bubalus bubalis) Using Murine Model".

The study was conducted jointly by the Central Luzon State University's College of Veterinary Science and Medicine (CLSU-CVSM) and the Philippine Carabao Center's Animal Health Laboratory (PCC-AHL).

Results of the study showed that the three commonly used drugs in controlling surra disease, Diminazene diaceturate, Isometamidium chloride, and Quinapyramine sulphate and chloride, varied in effectiveness against the *T. evansi* isolates in Luzon, Visayas, and Mindanao. Luzon trypanosome isolates were found to be sensitive to a dose rate of 5 mg/kg of Diminazene diaceturate and those in Visayas, 3 mg/kg Quinapyramine sulphate, and those in Mindanao, 3 mg/kg of either Diminazene diaceturate or Quinapyramine sulphate and chloride.

The study further showed that the sensitivity of the trypanosome isolates to specific dosage rates determines the potency of the trypanocidal drug in the treatment of *T. evansi* infection.

Isolates were obtained from infected water buffaloes that did not receive trypanocidal treatment.

Using murine model as a cost-effective technique of investigating the efficacy of the three trypanocidal drugs against the trypanosome isolates, the researchers used 270 inbred Balb/c mice from the stock bred at the PCC-AHL.

For easier calculation of values, the mice were divided into three groups according to the three trypanocidal drugs: 7% Diminazene diaceturate phenazone, 2% Isometamidium chloride, and 16.7% Quinapyramine sulphate and chloride.

Using an observation period of 60 days, parasitemia or the degree of infection was estimated based on the standards on blood parasite examination of the PCC-AHL.

The statistical significance of results was analyzed using t-test while the effects of the drugs to the mice were evaluated using bioassay graphical analysis.

Specifically, the study determined the onset or duration of trypanocidal drug efficacy using effective dosage (ED) and the drug dosage that showed relapse or reoccurrence of infection and death using curative dosage (CD).

The drug's efficacy was based on septicemia or negative presence of blood parasite.

ED 80 and 100 indicated the efficacy of the drug dosage when at 100 percent or at least 80 percent of the test population was cleared with infection after 60 days. It proved otherwise when the percentage is lower.

CD 80 and 100 indicated an effective drug dosage when at least 80 percent of the mice were cured after 60 days. Lower percentage showed the resistance of the isolates to the treatment.

Results of the experiments showed that the recommended dosages were comparative to surra treatment used among large animals.

Many earlier studies showed, however, that trypanocidal drugs vary in their modes of action, influencing the drug's potency to eliminate or restrain *T. evansi*. All three trypanocidal drugs used in the study target the kinetoplast of the organism. Not all strains of *T. evansi*, though, have kinetoplast.

These dyskinetoplastic forms, some studies explained, can be found in wild strains that have undergone mutation in animals that received trypanocidal treatments.

Some trypanocidal drugs, then, become ineffective because they were not able to aim at the kinetoplast, causing relapse of the infection or death to the infected animal.

Frequent usage of a particular trypanocidal drug also causes resistance of the trypanosome strain, studies revealed. In Mindanao, Isometamidium is the most commonly used drug for the treatment of surra. Prolonged usage thus resulted in the drug to require the highest dosage of 20 mg/kg to react against trypanosome isolates from the island.

Another cause of reinfection is the inability of the drug to penetrate organs of the host, such as the brain, where the trypanosomes are lodged.

Researchers Bryan Macaraeg and Jonathan Lazaro of the CLSU-CVSM, in collaboration with the animal health scientists of PCC led by Dr. Claro Mingala, recommended that while using murine model determined the efficacy of the trypanocidal drugs against the trypanosome isolates in Luzon, Visayas, and Mindanao, testing of the effect of these drugs should also be done in large animals.

PCC ups efforts on zoonosis control

By Joahna G. Goyagoy

As the national lead agency on livestock biotechnology undertakings, the Philippine Carabao Center (PCC) aims to intensify its efforts on animal health control, particularly on zoonosis.

Relative to this, the agency embarked on extensive researches and collaborations to ensure that the livestock industry is free from this disease.

Zoonosis is any infectious disease in animals that can be transmitted to humans and vice versa. Ruminants, particularly carabaos, have certain diseases that can be transmitted to humans like bovine tuberculosis.

Although bovine tuberculosis is a chronic bacterial disease in cattle, it was reported to affect many domesticated and non-domesticated animals. This disease, according to research studies, can spread to humans through the inhalation of bacteria in aerosols droplets or ingestion of infected unpasteurized milk (major mode of transmission), and consumption of raw or undercooked meat.

Bovine tuberculosis is still common in less developed countries. Because of the slow progression of the disease, the undetected infected cattle/buffalo persistently spread the disease to many other herd mates before it begins to manifest a clinical sign, which is why early detection is very important. "Test and slaughter" is the standard control measure for this disease causing severe economic losses to farms with positive test results.

According to the World Organization for Animal Health (OIE), around 10% of human tuberculosis case is caused by bovine tuberculosis. At risk of contracting the disease are farmers, milkers, farm workers, and veterinarians.

Aware of the need to expertly address zoonosis, the PCC picked out one of its veterinarians to specialize on the studies and effective control of the disease. Dr. Marvin Villanueva of the PCC Animal Health Unit (PCC-AHU) is currently undertaking an advanced training course on zoonosis control in Japan which is spearheaded by the Global Center of Excellence (COE) Program under the "Establishments of International Collaboration Center for Zoonosis Control".

The primary objective of the program, attended by Dr. Villanueva, is to contribute to the development of human resources who will be involved in education, research, and diagnosis toward the control of zoonosis by providing basic and advanced knowledge and introducing related technologies.

The training is currently ongoing at the Research Center for Zoonosis Control, Hokkaido University in Sapporo, Japan. Started on July 29, the training will end on November 25, 2011.

Meanwhile, Dr. Charito Gutierrez of the PCC-AHU, attended a two-week training course on genotyping *Mycobacterium bovis*, the causative agent of bovine tuberculosis, from September 5 to 18 in the same university.

Dr. Gutierrez brought organ samples (liver and lung) from carabaos collected from the slaughter houses of Batangas and Pangasinan to determine the specific species. Dr. Villanueva later extracted the DNA from the samples, brought by Dr. Guttierez, using gel electrophoresis and sequencing.

From the extracted DNA, Dr. Villanueva and Dr. Gutierrez found out that the liver sample contains *Mycobacterium arupense*, a non-tuberculous, potentially pathogenic species rarely associated with humans. On the other hand, the lung sample has *Corynebacterium spp*. which can either be pathogenic and non-pathogenic.

After learning the basic and advanced techniques in the diagnosis of zoonotic disease, particularly on bovine tuberculosis, Dr. Villanueva is expected to be a vital resource person in the field of veterinary medicine on the control and prevention of zoonosis in the country.

Retinoic acid can improve...

(From page 6)

and the third analysed the midkine (MK) expression of the cultured oocytes to depict the physiological effect of RA.

A total of 564 (grades A and B) oocytes derived from 686 ovaries was subjected to evaluation. They have exhibited cumulus expansion, nuclear maturation, development of the oocyte to metaphase II evidenced by positive cleavage and blastocyst development, and improvement of the quality after in vitro fertilization.

The study further showed positive results in the RA-treated cumulus-oocyte complex (COC), the fully grown oocyte, wherein the oocytes demonstrated higher uptake of glucose and pyruvate compared to those not treated with RA. Glucose and pyruvate, the study explained, are essential substrates for many cellular functions during oocyte maturation, including regulation of nuclear maturation.

Further, the effect of all-trans RA on midkine (MK) expression of oocytes stimulated cumulus expansion and the overall developmental competence of the water buffalo oocytes. The MK is the product of a retinoic acid responsive gene that suppresses IVM-induced apoptosis that spontaneously occur in the COCs during in vitro maturation.

Moreover, the study showed that the positive effects of all-trans RA was due to its role as a developmental morphogen in regulating the expression of midkine protein during in vitro culture for maturation of water buffalo oocytes.

Taken together, the results of the study validated previous studies which indicated that the action of RA enhances embryonic development in the oocyte maturation medium in vitro.

The researchers recommended supplementary studies to determine the viability of the blastocysts produced and their vitality for improving the success rate of embryo transfer technology.

The researchers further recommended that results of this study be used in determining its significance in intra-cytoplasmic sperm injection (ICSI) and cloning technology.

PCC experts cite economic gains in using milk replacer

By Khrizie Evert M. Marcelo

Raising calves to become profitable involves knowledge, skills, capital investment, and long hours of hard work for the raisers.

After birth, the calves are faced with common health problems. There is a need, therefore, to detect and prevent onslaught of disease by providing them proper nutrition.

Giving special attention to feeding management and good health practices for the calves is also very essential.

At birth, the calves must be fed with colostrum which is the first milk produced by the dam.

According to the experts, colostrum provides immunoglobulins or antibodies that the calf needs to fight off infections. It has twice the solids, three times the minerals, and five times the protein of whole milk.

The calf must be allowed access to liquid's milk up to the weaning period of 90 days.

Milk Replacer

One practice adopted in dairy operation is the use of milk replacer. Although its preparation is time-consuming and laborious, it helps in the early weaning of the calf. It is also economical and convenient to use and aids in reducing the risks of calf diseases occurrence.

According to studies, milk replacer, which is usually in powder form, are by-products of the milk manufacturing industry. Whey, a by-product of cheese manufacturing, is the principal protein source of the milk replacers. It is much cheaper than other sources of milk protein like casein and skimmed milk.

Artificial feeding of calf

The use of milk replacer for buffalo calves is a new technology for farmers in the country. Some trials were conducted in the institutional herds of PCC to prove that it can be used as a replacement for buffalo's milk without significantly affecting the body weight and survival rates of buffalo calves.

A research team, led by Dr. Thelma A. Saludes of the Philippine Carabao Center at University of the Philippines-Los Baños, conducted a study using commercially available milk replacers as calf feed. The team monitored the growth and mortality rates of the calf, computed the economic benefits of using milk replacer over buffalo milk, and packaged the technology for the smallhold dairy farmers.

Saludes and her co-researchers utilized 40 purebred and crossbred Murrah buffalo calves born from January 2009 to December 2010. They were observed over a 90-day feeding period.

At birth, calves were immediately separated from the dam and transferred to clean individual pens with beddings of hay. Birth weights of the newly born calves were measured immediately (within 24 hours) after birth. They were fed with colostrum from birth to five days old. Gradual addition of milk replacer was given from the 6th up to the 14th day. On the 15th day, the calves were given pure milk replacer until they reached 90 days old.

Using a clean pail, 180 g of milk replacer was dissolved in 1 liter of clean warm water of about 50 °C. Desired amount was transferred to clean feeding bottles. The calves were guided at first in the use of the feeding bottle. Soon after, they became accustomed to it. After their use, the feeding bottle, nipple and pail were cleaned, disinfected and dried.

Each morning after milk feeding, the calves were allowed to graze in a mixed pasture area for two hours with free access to calf starter ration and forage. Fresh water and mineral blocks were also made accessible to them all the time.

Deworming was done twice using Ivermectin injectable at seven and 90 days old.

Monthly weights, daily milk consumption, average daily gain (ADG), incidence of diarrhea, mortality, and economic benefits of milk replacer were measured over a 90-day period.

Results showed that artificial feeding can generate savings of Php8,251.46 per calf compared to the traditional feeding of the calf with buffalo's milk alone. In addition, during this period, 332.72 liters of the dam's milk was used for processing.

Total savings realized for feeding the 40 calves with milk replacer in 90 days was Php330,058.40.

The average colostrum consumption was only 3.76 liters which was lower than the recommended 4 liters. The total milk consumption per calf was 357.79 liters from birth up to 90 days which explained the lower ADG of 419 compared to the target of 500 g.

The mortality rate was at 7.5%. Six of the calves had scouring, when they were 15-30 days old, but three of them recovered. Those which died were given supportive treatment of fluid therapy, vitamins, minerals and antibiotic but to no avail.

Calf scouring or calf diarrhea is a frequent discharge of more fluid than normal from the bowel, which can result in rapid dehydration of the calf.

The high incidence of scouring may be due to an increase in rainfall that caused high moisture content in fresh roughage that the young calves had easy access to during the time they were let loose.

No cases of aspiration pneumonia from calves were noted. The calves, it was noted, were easyily trained to feed on milk replacer.

Upon completion of the study, a package of technology for the farmers was developed using the actual modeling of the materials and methods used in the study.

Postpartum uterine flushing can shorten calving intervals

By Khrizie Evert M. Marcelo

Uterine flushing immediately after calving can help shorten the calving interval of dairy buffaloes, results of a study showed.

This finding was based on an operations research carried out by Dr. Caro Salces and his team at the Philippine Carabao Center at Ubay Stock Farm (PCC-USF) from 2009 to April 2011.

Their study focused on developing management protocol for breeding and artificial insemination (AI) of dairy buffaloes highlighting the use of uterine flushing and teaser bull.

It was recommended that uterine flushing be administered to the dam within 48 hours after giving birth. A mixture of 200ml of 10% betadine solution with 800ml of water should be flushed into the uterus and reproductive tract of the mother to cleanse the organ and prepare it for the next cycle.

Results of the study showed that with these interventions, the first service pregnancy in the second quarter of 2009 was improved to 41.17% or 14 pregnant out of 34 inseminated animals compared to 15% or 3 pregnant out of 20 inseminated animals without flushing and teaser bull in the first period of that same year.

It was recorded the following year that the first service pregnancy rate was at 48.14% or 26 out of 54 animals.

Overall, the study indicated that pregnancy rate was recorded highest in 2010 with 83% or 50 out of 60. Out of the 50 animals, 33 (66%) were pregnant due to AI, while 17 (34%) were pregnant by natural mating.

Interventions

Prior to the interventions, the PCC-USF dairy herd, which is being raised under a ranch production system, has exhibited relatively poor reproduction performance. The center used to adopt natural breeding procedure for reproduction which resulted in average calving interval of 24 months.

In 2009, under the PCC-Genetic Improvement Program, the regional centers were advised to use artificial insemination as a priority mating system. In support of the above program, PCC-USF used uterine flushing to ensure the protection of an un-involuted postpartum uterus from infection and lessen the delay of successive occurrence of heat postpartum.

With the help of a teaser bull in heat detection, the center was able to establish that buffaloes come in heat between 4 a.m. and 6 a.m. (before morning milking) and between 5 p.m. and 7 p.m. (after afternoon milking).

Based on the study, the highest success rate of AI was attained when 73.2% or 63 out of 86 animals showed signs of estrus during the first heat occurrence.

The study noted that with the use of uterine flushing combined with teaser bull in 86 animals, the average days from calving to first AI service was reduced from initial 181.8 days (without flushing) to 62.32 days in 2009. In 2010, an average of 49.20 days to first service, was observed.

Teaser bulls

Two vasectomized American murrah bulls were used as teaser bulls in the research. One teaser bull was assigned to the milking cow while the other one was assigned to the dry cows. One teaser bull for every 25-30 cows in a herd was the standard system used.

These bulls were observed if they would mount on other cows, sniff the vulva, muzzle-up and bellow and/or will always tail on other cows.

They were allowed to graze freely at day time in their assigned herd and put back in their corral at nighttime.

To confirm if the cow was in estrus, rectal palpation was performed. AI was administered once signs of estrus were spotted.

The researchers recommended that dairy cows in PCC-USF which exhibit signs of estrus in the afternoon should be artificially inseminated immediately. A follow up AI should be done in the morning after milking while the animals observed in heat at night should also be inseminated in the morning and after milking as a follow up.

The animals are to be placed in the barn to prevent heat stress, the researchers said. If the cows failed to conceive after three attempts of AI, it should be exposed to active bulls, the researchers said. They also said that pregnancy diagnosis should be performed one month before the actual bull exposure.

The pregnant dry cows should be placed in the pregnant herd while the open dry cows should remain with the active bull.

The cows that are producing less than 2 kg of milk a day should be placed at "dry off" status even if the "Days in Milk" (DIM) is less than 300 days.

Monitoring

For purposes of monitoring, proper feeding and management, the expectant dams from the pregnant herd should be separated and placed in the individual maternity stall with rice hull beddings two to three weeks before calving.

After giving birth, it is advised that the cow be examined for any vulva lacerations including checking of the condition of the udder and teats. The newborn calf's birth weight should be measured while the umbilical cord is disinfected with 10% Iodine solution.

The calf is fed with colostrum for five days and then transferred to its individual pen for milk feeding, the researchers said.

These results showed that with the implementation of good management protocol, the reproductive performance of the dairy animals of PCC-USF has improved, hence, it is recommended as a good management practice for dairy buffalo production.

OPINION

The need for pursuing a more meaningful, pragmatic R&D

By Eric P. Palacpac, PhD
PCC National R&D Coordinator

For almost two decades now, the Philippine Carabao Center (PCC) engaged in numerous researches across various disciplines of animal science.

These are in the areas of reproduction and reproductive biotechnologies, breeding and genetics, nutrition, forage production, and feed supplementation, and meat and milk products processing. Most of these were novel efforts that contributed to the advancement of knowledge in buffalo production.

These initiatives won for PCC and its researchers numerous awards and recognition. The most prestigious of them was the Tanglaw Award bestowed by the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development in 2009, a solid testimony to the agency's stature as an institution of excellence in livestock R&D.

The recent designation of the PCC by the Department of Agriculture as a National Livestock Biotechnology Center provided an even stronger emphasis to such a formidable reputation.

In the midst of all of these accolades, though, is the nagging question: "To what extent are the PCC's R&D outputs applied or utilized by the society, in general, and by the agency's primary stakeholders, such as farmers, in particular?"

That poses a **difficult question** to answer. The reason is that much of what PCC accomplished and has been doing in its years of existence fall under a "Mode-1 Knowledge Production" system (as discussed by the seminal work of Gibbons, Limoges, Nowotny, Schwartzman, Scott and Trow in 1994 titled "The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies").

Essentially, "Mode-1 Knowledge" portrays the traditional science carried out in a context governed by academic interests, such as in universities, and is characterized as being disciplinary and homogeneous, organizationally hierarchical tending to preserve its form, and whose quality control is more related to the discipline (e.g., institutional communication, peer-review journals, and professional conferences).

Does it sound familiar?

Now, there is nothing wrong with "Mode-1 Knowledge" for it is something that is basic and has a specific purpose, that is, "production of knowledge for science's sake". But for the PCC to become more relevant to societal concerns, it has to move from Mode-1 to Mode-2.

What is "Mode-2 Knowledge" then?

According to Gibbons, et al. (1994), "Mode-2 Knowledge" is carried out in the context of application in the wider social domain and is characterized as being transdisciplinary, heterogeneous or involving multiple actors, organizationally heterarchical and transient, and with quality control that is more socially accountable and reflexive.

In other words, while "Mode-1 Knowledge" is researcher-initiated and discipline-based, "Mode-2 Knowledge" is **problem-focused** and participated in by a team of researchers from various disciplines who closely communicate with one another. In the familiar words of PCC executive director Dr. Libertado C. Cruz, "Mode-2 Knowledge" is akin to "Operations Research", that is, the R&D interventions to address the problems that the agency or its operating units encounter in the course of implementing the Carabao Development Program.


Dr. Palacpac

Since 2003, this has been the constant call of the top management, but, somehow, many researchers at PCC find it difficult to "switch modes". Quite understandably, this is because of "paradigms" that are really stubborn and the tough act of getting "out of the box".

Nonetheless, shifting perspectives is not impossible especially if a researcher encounters an "anomaly" or a challenge in his/her otherwise routinary "Mode-1 Knowledge" production activities. For example, a "progressive" researcher cannot be complacent or satisfied with his/her research work if it does not have any pragmatic and meaningful application. There is no other recourse but to evolve a more socially robust knowledge, production of which necessitates close interaction among researchers from various disciplines and involving the non-scientist members of the society, such as farmers, as well.

At PCC, there is a need for all its researchers to revisit their roles beyond the traditional undertakings of a scientist. Their focus may instead be directed to problems that beset the industry in general and the carabao farmers in particular. This may mean going beyond individualistic research approach that caters self-promotion. Instead, as "Mode-2 Knowledge" suggests, there is a need to cooperate, to work as a team, to involve the farmers who are the eventual users of research outputs, and to co-produce a knowledge that is practical, contextual, and adaptable.

Department of Agriculture
PHILIPPINE CARABAO CENTER
ISO 9001:2008

R&D *Highlights*©

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

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

Philippine Carabao Center
National Headquarters and Gene Pool
Science City of Muñoz, Nueva Ecija, Philippines
or email at pcc-oed@mozcom.com.