GENETIC IMPROVEMENT PROGRAM IN CARABAOS: The PCC Experience

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Ruminants are with the Small Holders

2012 Population

- Carabao: 2.91M, 99.58%, commercial
- Cattle: 2.5M, 93.00%, commercial
- Goat: 3.69M, 98.24%, commercial

Improving Ruminant Production in the Philippines is a **SOCIAL AGENDA**

- Achieving growth and food security
- Reducing rural-urban income disparities and rural poverty
WHAT IS CARABAO DEVELOPMENT PROGRAM?

- A continuous and organized effort to increase the genetic potential of the native carabao for meat, milk and draft that would result to the development of buffalo-based and related enterprises aimed at increasing income and nutritional status of the farming communities.

- A very important socio-economic program that addresses the national concerns on poverty alleviation, nutritional improvement, income equity/distribution and people empowerment.
1. GENETIC IMPROVEMENT
   - GENE POOL
     - Riverine Buffalo
     - Swamp Buffalo
   - UPGRADING
     - Bull Loan
     - Artificial Insemination

II. Carabao Based Enterprise
   - Cooperative Development
   - Credit
   - Market Assistance

III. Research and Development
   - Technology Development
   - Technical Training
   - Policy

GASS

SUPPORT TO OPERATIONS
   - Human Resource Development
   - Information Dissemination
   - Planning, Monitoring & Evaluation
   - Project Development

AFMA Class

Goal

Production Support

Improving Productivity

Capability Building

Improving Income/
Empowerment

Post Harvest

R and D

Policy

Information Support

Improving Productivity
The CDP is carried out nationwide through a network of 13 PCC regional centers linking with DA RFUs, LGUs, SUCs, NGOs, other NAs with agriculture concerns, private entrepreneurs and entities.
NETWORK OF CENTERS
National Headquarters and Gene Pool
CLSU Compound, Muñoz, Nueva Ecija
Tel.: 044-456-0731-34
Fax: 044-456-0730
Email: pcc-om@morcom.com

1. PCC at Mariano Marcos Memorial State University, Batac Ilocos Norte
   Tel./Fax: 077-792-2187
   Cell: 0917-410-1527
   Email: gmnrecta@yahoo.com

2. PCC at Cagayan State University, Piat, Cagayan
   Tel./Fax: 078-844-6345
   Cell: 0916-471-7916/0916-752-850
   Email: frellin078@yahoo.com

3. PCC at Dan Mariano Marcos Memorial State University, Rosario, La Union
   Tel./Fax: 072-712-0118
   Cell: 0919-867-9963 / 0919-242-181
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4. PCC at Central Luzon State University, Science City Of Muñoz, Nueva Ecija
   Tel.: 044-456-3323/39
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5. PCC at University of the Philippines at Los Baños, Los Baños, Laguna
   Tel./Fax: 049-576-2729
   Cell: 0917-791-3105
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   Tel.: 053-335-2648
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7. PCC at West Visayas State University, Calinog, Iloilo
   Tel./Fax: 043-320-2245
   Cell: 0916-930-5957
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8. PCC at La Carlota Stock Farm La Granja, La Carlota City
   Tel./Fax: 038-735-0123
   Cell: 0919-411-2587
   Email: pccsfsf@yahoo.com

9. PCC at Ubay Stock Farm, Ubay, Bohol
   Tel./Fax: 038-516-5596
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10. PCC at Mindanao Livestock Production Complex, Kalamit, Zamboanga del Norte
    Tel.: 066-312-2626
    Fax: 066-333-2537 (WESMARC)
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11. PCC at Central Mindanao University, Musulan, Bukidnon
    Tel.: 088-390-1800
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    Email: lawencedinoe@yahoo.com

12. PCC at Mindanao State University, Marawi City
    Tel.: 063-352-1002
    Cell: 0918-809-9765/0920-221-2805

13. PCC at University Of Southern Mindanao, Kabacan, North Cotabato
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Organized crossing breeding of swamp and riverine buffaloes – from draft to milk & meat

3 times more milk

2 times growth rate

Double farmers’ income

The income derived from milk of crossbred is comparable with that derived from 1 ha of rice. Income from milk increases with the increase in milk yield resulting from backcrossing with dairy breed.
Total AI services, 1993-2012: 466,680
No. of AI Technicians trained, 1983-2012: 1,642
Active AI Technician, 2012: 991 (servicing water buffaloes only)
Expanded AI Program

Goal
• Seeks to expand the coverage of the AI program, improve its efficiency and the ultimate goal of privatizing the AI services

Objectives
• Train, equip and mobilize new private village-based, coop-based and LGU-based technicians
• Install an efficient liquid nitrogen support and distribution system
• Ensure sustained and adequate supply of high genetics and good quality buffalo frozen semen
• Harness trained but inactive LGU AI technicians in support of the wide scale AI service
Program Components

- Strengthening of the semen processing laboratory
- Improvement of the bull testing facilities
- Improvement of liquid nitrogen distribution
- Training of private village-based technicians
Implementing Partners

- PCC – Provision of the following:
  - Technical training on AI and PD
  - Field tanks & AI Kits
  - Provide frozen buffalo semen
  - Coordinate and conduct crossbreeding for CBED in the villages
  - Assist in the conduct of monitoring and evaluation

- DA-RFU – Coordination, technical assistance, provision of supplies, logistics and funds, monitoring and evaluation (M&E)

- LGU-Province - Assist in selection process, endorsement, monitoring and evaluation and provision of funds.
Implementing Partners

- LGU-Municipal – Prepare livestock development plan, allocate funds, recommend, submit reports to province and monitoring & evaluation.

- VBAIT – Conduct AI, PD and monitoring, submit reports to PCC/DA and LGU; handle and pay at cost (after 2 years) frozen semen, AI tanks and supplies; reimburse the training expenses incurred by PCC amounting to P30,000.00, and surrender the loaned AI equipment to PCC in termination of contract as in the case of inactivity
Two Existing Bull Farms and Semen Processing Laboratories:

- National Buffalo Bull Farm and Semen Processing Laboratory at Digdig, Caranglan, Nueva Ecija – can accommodate 100 mature bulls

- Buffalo Bull Farm and Semen Processing Laboratory at PCC-UPLB, College, Laguna – an extension bull farm, which can accommodate 30 mature bulls

An expansion of the Buffalo Bull Farm and Semen Processing Laboratory in Mindanao is currently constructed at PCC-CMU, Musuan, Maramag, Bukidnon – can accommodate 50 mature bulls
Density/Distribution of Breeding Bulls of Dairy Buffaloes, by Province, Philippines, 2012

Total Dairy Buffalo Bulls Loaned, 2012: 2,407 hds
Breeding Program for dairy buffaloes

- **Breeding objective**
  - Production of medium sized riverine buffaloes (Philippine Dairy Buffaloes) with improved milk production potential that are performance tested under Philippine conditions
    - Milk yield
    - Milk fat and Milk protein yield
    - Linear type traits
Strategies

- PCC is implementing an organized breeding program for dairy buffaloes to increase milk production potential
  - Pedigree and milk production performance records of buffaloes from nucleus herds are recorded and evaluated
    - Individual cows and bulls with daughters have estimated breeding values (EBVs)
  - Source of frozen semen and breeder animals
    - Young bulls sired by AI sires from outstanding cows are selected to become semen donor
    - Good genetics is passed on to dairy farmers
Genetic improvement in the dairy buffalo population is carried on by the recorded herds. Improved genetics is brought down to the cooperatives through frozen semen, live animals. Crossbred cows/heifers are produced and Crossbred cows with high riverine blood join the dairy cow population.
Backcrossing Scheme: Development of the Philippine Dairy buffalo breed

Heat Detection
Synchronization
Rectal Palpation

GP

BMB
Semen

Bull selection
Semen Collection
Semen Processing

Heat Detection
Synchronization
Rectal Palpation

AI

PC

F₁(50/50)

Monitoring (PD)

F₁

75/25

Monitoring (PD)

F₁

75/25

F₁

87.5
Bull Loan
- clean up bull/natural mating
Herd Build Up and Improving Productivity

Technology today is research yesterday

Export
- Traceability (DNA-based)

Infusion
- Screening for Genetic defects
  - e.g. scrapie - goat
  - BLAD - cattle
  - PPS - swine

Internal Growth
- reproduction
- mortality
- diagnosis
- production
- potential

R & D (DNA Test Screening)

Nutrition

Extension
II. Buffalo Based Enterprise

- Cooperative Development
- Credit
- Market Assistance

CDP is a social agenda that addresses the national concerns on poverty alleviation, nutritional improvement, income equity/distribution and people empowerment. CDP is the framework of the Philippine Carabao Center’s operation.
amidst these exciting possibilities

The vision of transforming multitudes of native carabaos across the country will only lend meaning to its full realization if these technological advancements are translated into tangible benefits for the economically-deprived small-holder families in the villages.
creating village-based enterprises
capacity building
buffalo-based dairying
small hold entrepreneurship
III. Research and Development

- Technology Development
- Technical Training
- Policy

NATIONAL RESEARCH & DEVELOPMENT AGENDA 2007-2020

Philippine Carabao Center
(Livestock Biotechnology Center)
RESEARCH PRIORITIES

PRIORITY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
- Need to expand and sustain efforts to conserve the indigenous genetic materials and to improve the genetic potentials of existing stocks

RESEARCH THEMATIC AREAS/SUB THEMES:
- Genetic Resources Conservation & Improvement

RESEARCHABLE AREAS:
- In vitro genetic conservation of indigenous and important livestock species
- Identification of genetic and molecular markers of indigenous and important livestock species and identification of Quantitative Trait Loci (QTL).
- Testing and evaluation of genetic merits of various livestock species/Marker Assisted Selection (MAS)
RESEARCH PRIORITIES (con’t.)

PRIORITY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
- Need to enhance the genetic improvement, since the traditional breeding system requires relatively long period. Also there is a need to develop measures to improve reproduction among the currently existing livestock resources.

RESEARCH THEMATIC AREAS/SUB THEMES:
- Genetic Resources Improvement and Biotechnology

RESEARCHABLE AREAS:
- Development/refinement of biotechnologies for harnessing the potentials of superior male animals
  - Semen cryopreservation, Sperm sexing, Refining AI techniques
- Development/refinement of biotechnologies for harnessing the potentials of superior female animals
  - Control of ovarian function, Superovulation, In vitro maturation/In-vitro fertilization, Embryo transfer, Embryo sexing, Ovum pick-up, Nuclear transfer
- Use of transgenic technologies to hasten incorporation of specific traits and development of novel products using animals as bioreactors
RESEARCH PRIORITIES (con’t.)

PRIORITTY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
- Limited attention on development of feeding and production system for efficient and cost effective production of food from domestic animals

RESEARCH THEMATIC AREAS/SUB THEMES:
- Animal Nutrition & Digestion Physiology

RESEARCHABLE AREAS:
- Improving rumen function and nutrient utilization
- Improving nutritive value of locally available feedstuff
- Establishing nutrient standards and feed libraries
- Improving animal production system for smallhold
RESEARCH PRIORITIES (con’t.)

PRIORITY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
- There is a growing concern on the environmental impact of intensive livestock production. Likewise, issues on risk/safety for consumption of animal products from animal biotechnology

RESEARCH THEMATIC AREAS/SUB THEMES:
- Production System/Environment

RESEARCHABLE AREAS:
- Environment risk reduction measures in livestock commercial establishment
- Minimizing livestock production-related stress factors
- Organic livestock farming system’s development
- Environmental impact assessment of in vitro/artificially/genetically modified products
RESEARCH PRIORITIES (con’t.)

PRIORITY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
❖ Need for measures that will improve income of producers from livestock

RESEARCH THEMATIC AREAS/SUB THEMES:
❖ Value Adding

RESEARCHABLE AREAS:
● Enhancing milk and meat quality through biotechnology applications
● Animal-derived non-food products development and improvement
RESEARCH PRIORITIES (con’t.)

PRIORITY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
- Need for measures that will improve income of producers from livestock

RESEARCH THEMATIC AREAS/SUB THEMES:
- Socio-Economics

RESEARCHABLE AREAS:
- Continuing livestock industry analysis
- Impact assessment of various livestock programs, policies and technologies
- Market research
RESEARCH PRIORITIES (con’t.)

PRIORITY COMMODITIES: Animal Biotechnology

PROBLEMS/CONCERNS:
- Need to seriously establish models for smallholder livestock entrepreneurs and to continuously assess related policies and progress to attain sustained industry growth

RESEARCH THEMATIC AREAS/SUB THEMES:
- Cross-Cutting/Enterprise Development

RESEARCHABLE AREAS:
- Livestock enterprise modeling
- Development of effective/efficient technology delivery system for smallholders livestock producers
With PCC’s emerging new role as the Animal Biotechnology Center, what are its immediate plans?
Laid the foundation for sustainable genetic improvement of carabao towards milk & meat

GIP (for milk & meat)
- Gene Pool
  - Purebred: 6,380 hd
  - Indigenous: 300 hd
- Progeny testing system
- Crossbreeding system
  - AI: 466,680 hd
  - Bull Loan: 2,407 hd

Carabao-based Enterprise
- Primary Coops; Federation
  - National Impact Zones (NIZ);
  - Regional Impact Zones (RIZ)

Research & Development
- Reproductive Biotech
  - IVM/IVF, OPU, SO, ICSI, NT
- DNA-based Techniques
  - Breed ID, Parentage, MAS

Institutional Development
- IMS Certified: ISO 9001, 14001 & 18001
- Central Research Facilities and Regional Centers
- Human Resource Capacitation

Livestock & Biotechnology Research Institute (LBRI)
(Rationalized PCC) 2014 and on

Harnessing Biotechnology, Multicommodity

GIP (for ruminants & others)
- Expand to other commodities
- CDMU
- Genetic Board
- Sperm Sexing (for dairy)
- AI training to privatization

Production System R & D
- Reproductive Biotechnologies
- Nutrition and Management
- Product Development R & D
- Social Studies and Policy

DNA-based R & D
- Traceability
- MAS
- Genetic Defects Screening
- Diagnostics

Cryobanking
- Long-term breeding needs
- Climate Change
PRIORITY FOCUS

Genetic Improvement Program (across species)

- Genetic Board (Setting breeding direction)
- Strengthening breed associations for breed improvement
- Setting-up Animal Registry (for check and balance of animal pedigree)
- Central Data Mgmt Unit (CDMU) (data analysis & feedback)
- Expand Semen Laboratories (to target 300,000 AI/yr)
- Establish Sperm Sexing Facility (for enhancing dairy development)
- Strengthen Training Facilities for AI — (towards privatization)
Cryobanking (AnGR)
addressing long-term breeding requirements
and climate change

Semen
Oocytes
Embryos
Somatic Cells
DNA
Enhancing dairy/meat based enterprises (buffalo, cattle and goat)

REPRODUCTIVE BIOTECHNIQUES

1. Artificial Insemination
   a). Cryopreservation of semen
      (improving semen quality (carabao, goat and cattle))
   b). Estrus synchronization
      (enable breeding many females at pre-determined time)
   c). Sperm sexing – (predetermined sex)

2. Embryo Technologies
   a). Embryo Transfer (goat & cattle) for faster multiplication of superior stocks
   b). IVM/IVF & OPU (dairy cattle & dairy buffalo)
For production of elite purebred stocks
DNA-Based Technologies

**DNA Marker Assisted Selection** significantly shorter the time and improve accuracy to select best animals

**DNA-based screening for genetic defects**
- BLAD in cattle (poor reproduction)
- PPS for swine (poor quality pork)
- SCRAPIE for goat (high mortality)

**DNA-based traceability**
- For Export of Product

**DNA-based diagnostics** for FMD, mastitis, etc. to reduce risks of diseases