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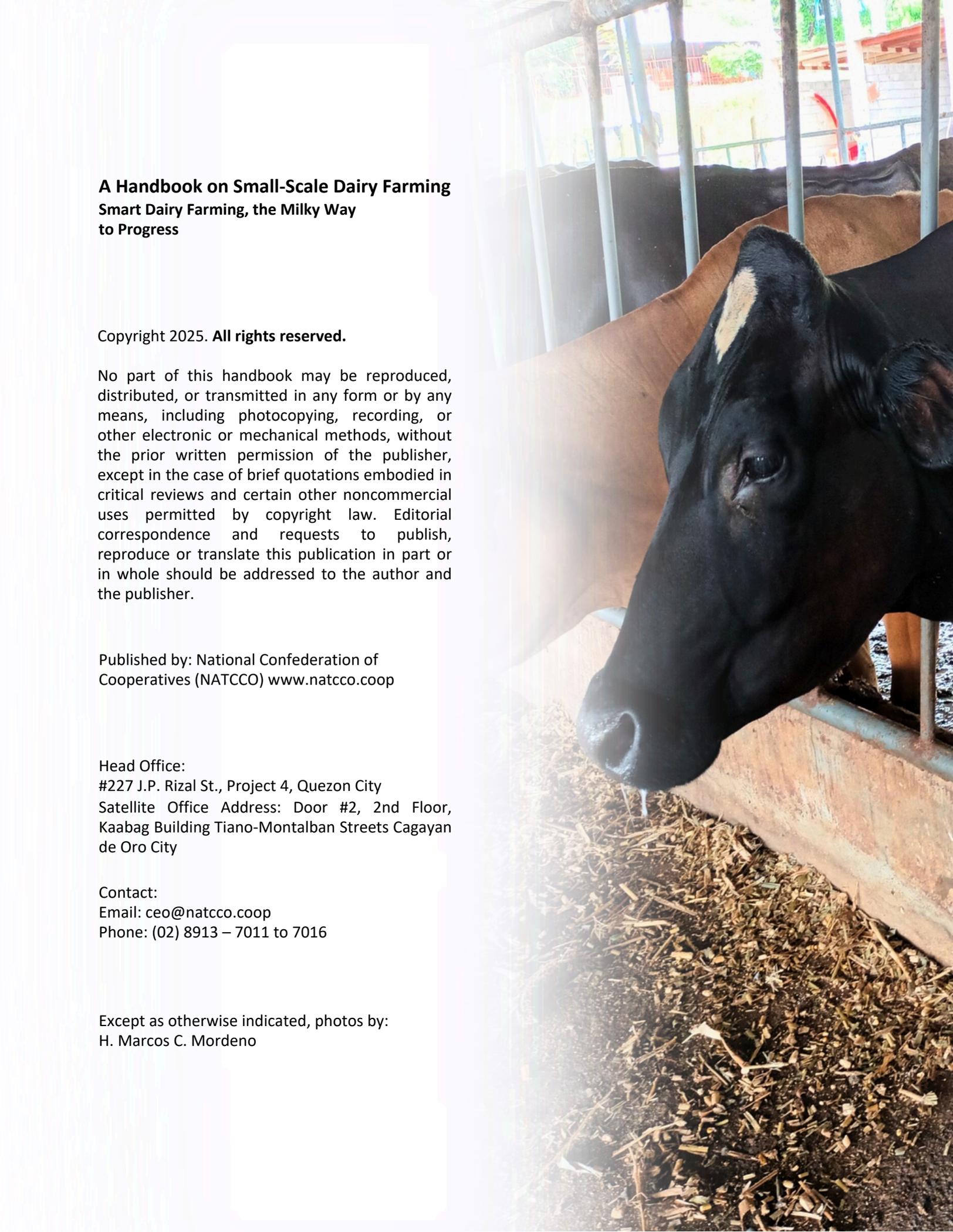


A HANDBOOK ON

SMALL-SCALE DAIRY FARMING

SMART DAIRY FARMING, THE MILKY WAY TO PROGRESS





A Handbook on Small-Scale Dairy Farming
Smart Dairy Farming, the Milky Way
to Progress

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Head Office:
#227 J.P. Rizal St., Project 4, Quezon City
Satellite Office Address: Door #2, 2nd Floor,
Kaabag Building Tiano-Montalban Streets Cagayan
de Oro City

Contact:
Email: ceo@natcco.coop
Phone: (02) 8913 – 7011 to 7016

Except as otherwise indicated, photos by:
H. Marcos C. Mordeno



A Handbook on Small-Scale Dairy Farming
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Technical Team

Writer:

H.Marcos C. Mordeno

Layout Artist:

Xenia Nichole D. Porras

Coordinator:

Engr. Susano B. Balais III
Agricultural and Biosystems Engineer
Cooperative Technical Specialist on Dairy, CAFÉ-DAIRY Project

National Confederation of Cooperatives CAFÉ-DAIRY Project:

Sylvia Okinlay-Paraguay,
Chief Executive Officer

Alejandro G. Almendral
Project Manager (November 2022-September 2024)

Maribel G. Isidro
Project Manager (April 2025-October 2025)

Sheila Marie D. Satur
Cooperative Training and Knowledge Management

Hazel F. Salaum
Agribusiness Development Officer (June 2023-March 2025)

Timmy Rei A. Allocod
Agribusiness Development Officer (April-October 2025)

Noel Z. Almera
Central Bookkeeper

Irish Queen Saway-Baoy
Coop Technical Specialist - Coffee

Amorele A. Rejas
Monitoring & Evaluation Officer

Melojean M. Francisco
Administrative Staff

GIZ SPADe MinPAD RISE Project:

Lyndon J. Arbes
Senior Advisor

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ACRONYMS AND ABBREVIATIONS

AI	Artificial Insemination
AMIA	Adaptation and Mitigation Initiative in Agriculture
AU	Animal Unit
BMPC	Baclay Multi-Purpose Cooperative
CAFÉ-DAIRY	Cooperative Assistance and Farm Extension to Develop Agri-enterprises of Indigenous Peoples and Rural Youth
CMU	Central Mindanao University
CP	Crude Protein
DA	Department of Agriculture
DMDC	Dalwangan Multi-purpose Dairy Cooperative
DM/I	Dry Matter/Intake
EBV	Estimated Breeding Value
FDA	Food and Drug Administration
GAHP	Good Animal Husbandry Practices
GIZ	German Ministry of Economic Cooperation and Development
GMP	Good Manufacturing Practices
LGU	Local Government Unit
MinPAD RISE	Mindanao Peace and Development Program
NATCCO	National Confederation of Cooperatives
NC II	National Certification II
NDA	National Dairy Authority
OSHS	Occupational Safety and Health Standards
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCC	Philippine Carabao Center
PCIC	Philippine Crop Insurance Corporation
PDC	Philippine Dairy Corporation
SCC	Somatic Cell Count
SPADe	Strengthening the Implementation of Regional and Local Peace Development Agendas in Mindanao
SSOP	Standard Sanitation Operating Procedures
TDN	Total Digestible Nutrients
TESDA	Technical Education and Skills Development Authority
UMMB	Urea Molasses Mineral Block

Message from the CHIEF EXECUTIVE OFFICER (CEO)

The National Confederation of Cooperatives (NATCCO) exists to help ordinary Filipinos build extraordinary futures together. This handbook born from the CAFÉ-DAIRY Project embodies that mission. It gathers the lessons, field-tested practices, and cooperative wisdom that our mentors, farmers, and partner cooperatives refined through real work in real barns, during seasons of risk and resilience.

CAFÉ-DAIRY set out to strengthen local dairy value chains so that families, especially Indigenous Peoples, women, and youth, could find dignified income close to home. Along the way, we learned that productivity follows when three things come together: good husbandry and hygiene, sound enterprise management, and a culture of cooperation. This handbook weaves all three – showing how better forage, breeding, and animal health translate into safer milk, stronger margins, and more confident cooperatives.

This knowledge product was made possible through the partnership and trust of many. We thank our co-funders – the European Union and the German Federal Ministry for Economic Cooperation and Development – implemented by GIZ under SPADe/MinPAD RISE. We acknowledge our government and academic partners, federations, and primary cooperatives who opened their facilities, shared data, and co-designed solutions. To our Dairy Mentors and farmer-members: your discipline at milking time, your patience in record-keeping, and your courage to try new practices gave this handbook its credibility.

What you hold is not just a manual of techniques – It is a roadmap for cooperative-led rural development. Use it to set heard health targets, embed GMP and SSOP in daily routines, plan pastures, cost your operations, and design services that keep more value within your communities. Adapt it, translate it, re-echo it. In the cooperative movement, knowledge grows when it is shared.

NATCCO reaffirms three commitments:

1. **Continuity:** We will keep strengthening post-project support-mentor networks, peer learning, and market facilitation – so gains become habits and habits become standards.
2. **Inclusion:** We will continue to elevate the roles of women and youth in the dairy value chain, from farm management to enterprise leadership.
3. **Quality and Safety:** We will champion practices that protect consumers and enhance trust in locally produced milk.

On behalf of NATCCO's Board, Management, and our entire network, thank you for the work behind these pages and the work that will flow from them. May this handbook help every cooperative produce cleaner milk, earn better incomes, and build a more inclusive rural economy – one healthy herd, one ethical enterprise, one community at a time.



Sylvia O. Paraguya

Chief Executive Officer
National Confederation of
Cooperatives (NATCCO)

Message from the PROJECT MANAGER

When we established the Cooperative Assistance and farm Extension to Develop Agri-enterprise (CAFÉ-DAIRY) in November 2022, our goal was clear: to help build peace through agriculture – one cooperative, one farmer, and one liter of milk at a time. This manual is the concrete result of that journey. It distills two years of fieldwork, mentoring, and collaborative problem-solving into a practical guide that dairy mentors, smallholder farmers, and cooperative leaders can apply on the next milking day.

CAFÉ-DAIRY concentrated on boosting the dairy and coffee value chains in Regions IX and X to assist Indigenous Peoples, women, and youth. We collaborated with the Northern Mindanao Federation of Dairy Cooperatives and primary cooperatives, such as Oro Integrated Cooperative, Paglaum Multipurpose Cooperative, and Baclay Multipurpose Cooperative, as well as the government's feeding programs, to secure stable, mission-aligned markets for fresh milk. Along with production, we invested in people. We equipped mentors with the Dairy Mentors Development Program and seven focused training modules to re-echo technical know-how, manage learning sites, and assist farmers in adopting climate-smart, sanitary, and financially sound practices.

The chapters here reflect the real difficulties that modern farmers face: adjusting to climate change, developing forages and pastures, getting nutrition, breeding, calving, and herd health correct, incorporating GMP and SSOP into everyday routines, and understanding farm economics to make informed decisions. More crucially, the guidebook offers real-life field stories that demonstrated how science, local knowledge, and cooperative solidarity may work together to make progress.

This knowledge product was made possible by the unwavering support of our co-funders, the European Union and the German federal Ministry for Economic Cooperation and Development (implemented by GIZ) through SPADe/MinPAD RISE, as well as the leadership of NATCCO and the invaluable contributions of our technical partners from academia and government. Thank you to our dairy mentors, cooperative officers, and farmer members for opening your farms, sharing data, testing new approaches, and most importantly, staying the course.

On behalf of the CAFÉ-DAIRY team and NATCCO, I invite you to treat these pages not as endpoint but as a living guide to better herds, safer milk, stronger enterprises, and more inclusive local economies.



Maribel Gulay-Isidro

Project Manager CAFÉ-
DAIRY Project-NATCCO

Message from the Principal Advisor

Mabuhay!

My heartfelt congratulations to the Cooperative Dairy Mentors Development Program under the CAFÉ-DAIRY Project of the National Confederation of Cooperatives (NATCCO) Network. This inspiring initiative nurtures agri entrepreneurs, uplifts Indigenous Peoples, and empowers rural youth to build more resilient and sustainable livelihoods.

This program came to life through the steadfast support of the project “Strengthening the Implementation of Regional and Local Peace and Development Agendas” (SPADe) — commissioned and financed by the German Federal Ministry for Economic Cooperation and Development (BMZ), co-financed by the European Union (EU), and implemented by GIZ.

As part of the broader Mindanao Peace and Development Programme (MinPAD RISE), SPADe is proud to have contributed to the conceptualization and enabling of this meaningful endeavor.

Across the Philippines, small-scale dairy farmers form the backbone of our dairy sector. Yet they continue to face formidable challenges: water scarcity, low forage yields, reproductive health issues, limited technical know-how, and constrained access to finance. These difficulties have long hindered productivity and income, despite the farmers’ resilience and willingness to combine traditional wisdom with modern practices.

This handbook was created as a companion and guide — to strengthen farmers’ knowledge in dairy science and farm management, and to encourage innovation and confidence in every step of their journey. Beyond technical guidance, it captures the real-life stories of dairy mentors who participated in the training — stories of courage, perseverance, and transformation that remind us all that progress begins with passion and persistence.

We invite you to take these lessons to heart, to experiment boldly, and to share what you learn with others. Every improvement in your herds, your farms, and your communities contributes to a larger story of growth, peace, and sustainability.

On behalf of the SPADe team, I extend our deepest appreciation to NATCCO, to all implementing partners, and above all, to the dairy farmers and mentors whose dedication made this initiative possible. May this handbook continue to inspire creativity, collaboration, and a shared commitment to shaping a brighter, more sustainable future for the Philippine dairy industry.



Peter Hinn

Principal Advisor
SPADe / MinPAD RISE

PREFACE

The National Confederation of Cooperatives (NATCCO) implemented the Cooperative Assistance and Farm Extension to Develop Agri-enterprises of Indigenous Peoples and Rural Youth (CAFÉ-DAIRY) Project starting in November 2022. CAFÉ-DAIRY aims to promote peace through agriculture development using the value chain approach in dairy and coffee industries in Regions 9 and 10 to benefit 1,800 farmers including Indigenous Peoples, women and youth.

Co-funded by the European Union and the German Ministry of Economic Cooperation and Development (BMZ), the project is part of the “Strengthening the Implementation of Regional and Local Peace Development Agendas in Mindanao (SPADe),” under the broader “Mindanao Peace and Development Program (MinPAD RISE)” implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Of the federation’s nearly 900 members comprising multipurpose and credit cooperatives, at least 20 percent are engaged in agricultural enterprises. NATCCO selected dairy and coffee as priority agricultural commodities based on the findings and recommendations of a GIZ initiated study conducted by the Philippine Family Farmers’ Fishery Forestry Cooperatives Federation (AgriCooPh). The study found that aside from addressing development issues, the participation of the target cooperatives engaged in dairy and coffee production can significantly contribute to the industry and to the achievement of peace and development in the regions.

For the dairy side of the project, NATCCO partnered with the Northern Mindanao Federation of Dairy Cooperatives, and three primary cooperatives, namely: Oro Integrated Cooperative, Paglaum Multi-purpose Cooperative, and Baclay Multi-purpose Cooperative. These cooperatives have existing dairy processing facilities and are engaged in dairy production. The partnership with the feeding program of the government is a major opportunity for these cooperatives, which are supported either by the Philippine Carabao Center or the National Dairy Authority.

Since improving the milk yield of the dairy farmers is the project’s major challenge, the project needed to design an appropriate business model that integrates cow nutrition and reproductive efficiency, two elements that highly affect milk production. This would require the partner cooperatives to develop their own dairy technicians or mentors and their farms as learning sites for their farmer members.

To achieve this, the project implemented the Dairy Mentors Development Program, a capacity-building for 30 target mentors whose task is to re-echo their knowledge and provide technical guidance to other members. They will also take the lead in managing the learning sites identified by the cooperatives.

Aside from the cooperatives, the project also partnered with the Department of Agriculture, CJ Philippines, and Central Mindanao University Department of Agriculture, particularly its experts in Animal Science and related fields who served as resource persons in the seven-module training for the dairy mentors.

This handbook is a product of these partnerships. As a consolidated version of the knowledge imparted to them during the training, it is meant to serve as a guide for the participants in their task as dairy mentors. It is also hoped that this material can be of help to other dairy farmers and those who may be planning to take the less traveled road of dairy farming.

ACKNOWLEDGMENT

The publisher wishes to thank the following individuals whose lecture materials that were used during the training activities under the Dairy Mentors Development Program of CAFÉ-DAIRY project serve as the main references for the topics presented in this handbook:

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- **Mr. Mario Jaraula**
- **Ms. Marilou Lumanta**
- **Ms. Cherrylene Luntap**
- **Datu Rolando Melendez**
- **Mr. Andre Paulo Paraguay**
- **Mr. Jhon Paul Peczon**

Assistance from and supervision by **Engr. Susano Balais III**, NATCCO Technical Specialist, greatly helped in accessing the reference materials.

Finally, this handbook would not have been possible without the support of the project “Strengthening the Implementation of Regional and Local Peace and Development Agendas in Mindanao (SPADe)” co-funded by the European Union and the German Federal Ministry for Economic Cooperation and Development, and implemented by Deutsche Gessellschaft fur Internationale Zusammenarbeit (GIZ). SPADe is part of the broader “Mindanao Peace and Development Programme (MinPAD RISE).

INTRODUCTION

Small-scale dairy farmers, or those with five to ten cows in their herds, comprise the majority of the dairy sector of the Philippines. Their raw milk mainly go to cooperatives that do the collection, processing, and redistribution of their product.

The dairy sector is facing challenges such as water scarcity, low forage production, low reproduction rate, lack of technical skills, and poor access to financing, among others. These have resulted in low production – only about 2 percent – forcing the country to import the bulk of its dairy needs. The low level of production also means low income for dairy farmers, who are combining traditional practices with modern innovations.

This handbook has been developed to help address these challenges by contributing to the improvement of the farmers' understanding of dairy science and management to enable them to increase their milk production and, consequently, to improve their income. The objective is not only to provide technical knowledge but also to encourage best practices that enhance productivity, ensure food safety, and promote environmental stewardship.

The topics covered by this material are spread across seven chapters, and include climate-smart agriculture, ruminant production and management, animal nutrition, silage production, pest and disease prevention and control (including biosecurity), milking hygiene, and dairy farm economics and financial management.

The content of this handbook is mainly based on the lecture materials prepared by the resource persons who shared their expertise to the participants of the seven-module training under the Cooperative Dairy Mentors Development Program of the Cooperative Assistance and Farm Extension to Develop Agri-Entrepreneurs, Indigenous Peoples and Rural Youth (CAFÉ-DAIRY) project. Additional inputs were obtained from online references.

The seven chapters in this handbook are titled after the topics covered by the training: Toward A Climate-Smart Dairy Industry; Ruminant Production NC II and Pasture Establishment; Dairy Animal Nutrition and Feeding Management; Dairy Animal Breeding, Reproduction, and Proper Farm Recording; Dairy Animal Calving, Calf Rearing, and Calf Management; Good Manufacturing Practices and Standard Sanitation Operating Procedures; and Dairy Farm Economic and Financial Management.

In addition to the technical content, this handbook features stories about firsthand experiences of the dairy mentors who participated in the training. These are narratives of their struggles, resilience, hope, and resourcefulness that may serve as an inspiration for other dairy farmers.

CHAPTER ONE

TOWARD A CLIMATE-SMART DAIRY INDUSTRY

“The challenges for the dairy sector include bringing milk to the consumer at competitive prices when dairy production is subject to changing weather patterns, changing market dynamics and dairy prices. At the same time, there is a growing emphasis on sustainability. People are concerned about the environment, animal welfare, and the quality of their food.” *FAO Report, 2019*



Dairy farm at Central Mindanao University with Mount Kalayo in the background.

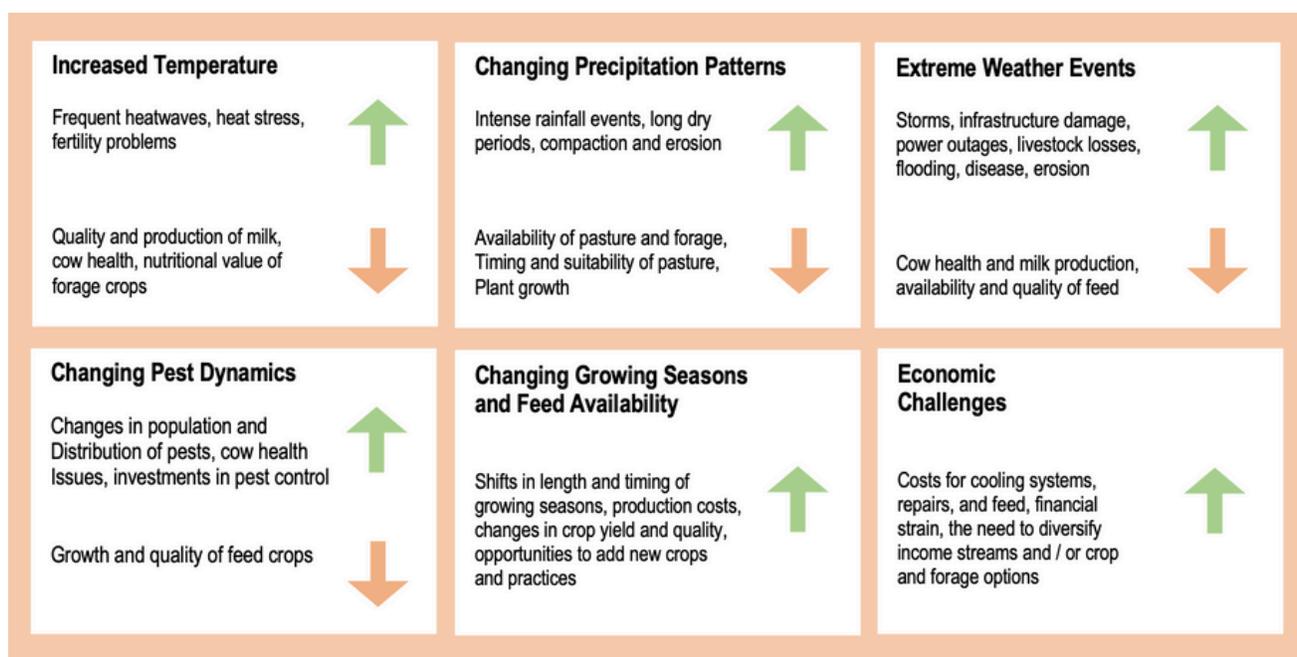
Climate Change and the Dairy Industry

A 2019 report by the Food and Agriculture Organization (Climate Change and the Global Dairy Cattle Sector) projects the global demand for food to double by 2050, and the world population to reach 9.8 billion in the same year. The agriculture sector will have to produce more food for this growing population. This growth, the report says, will provide opportunities and challenges for the dairy sector, particularly the challenge to feed the global population with food that is both healthy, nutritious and sustainably produced.

In the Philippines, where smallholder dairy farmers run around 80 percent of the local dairy business, the relatively high farmgate and retail milk prices make fresh milk unaffordable for many people. Low productivity, inadequate supply chain, and lack of facilities and support services also limit the industry, according to a December 2020 report by the Australian Center for International Agricultural Research. The country currently imports 99 percent of its dairy needs, primarily from the US and New Zealand, The Dairy News said in a report on July 1, 2024. The Philippine Genome Center (2017) cited that one of the reasons for low productivity is the country’s lack of a “national breeding strategy for the development and supply of productive local dairy animals, resulting in the cyclical importation of Sahiwal-Holstein cattle.”

Moreover, climate change has brought in another challenge – reducing and/or mitigating environmental impacts while striving to enhance production to meet growing needs. As the FAO report emphasizes: “The challenges for the dairy sector include bringing milk to the consumer at competitive prices when dairy production is subject to changing weather patterns, changing market dynamics and dairy prices. At the same time, there is a growing emphasis on sustainability. People are concerned about the environment, animal welfare and the quality of their food.”

There is an urgent need for dairy farmers to know and understand these challenges, some of which are presented below, and equip themselves with appropriate adaptation and mitigation strategies.



How Climate Change Impacts Dairy Farming

Dairying requires unique environmental conditions for optimum production. Climate change, however, poses hazards to the industry which, if not addressed through mitigation and adaptation measures, will impact the dairy producers and the communities that depend on them.

Climate change is defined as a change in climatic parameters including temperature, rainfall, relative humidity, and wind patterns over time. These shifts may be natural, but since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas, as well as agricultural practices, deforestation, and intensive farming and livestock production, the impacts of which threaten the sustainability of rural livelihood systems.

Among the effects of climate change are intense droughts, water scarcity, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity. The Philippines' archipelagic formation makes it vulnerable to climate change. Besides, the agriculture and fisheries sectors, the lifeblood of the country's poor, bear the brunt of this phenomenon.

The challenge, therefore, is how to build climate-resilient livelihoods or enhancing adaptive capacity vis-à-vis climate change. It deals with questions like how to sustain operations amid extreme weather occurrences like El Niño and La Niña, or, if affected, how to recover from the losses. It is essential to improve efficiency and productivity in agriculture, including livestock farming, to maintain environmental sustainability and economic prosperity, as well as ensure food security and human health.

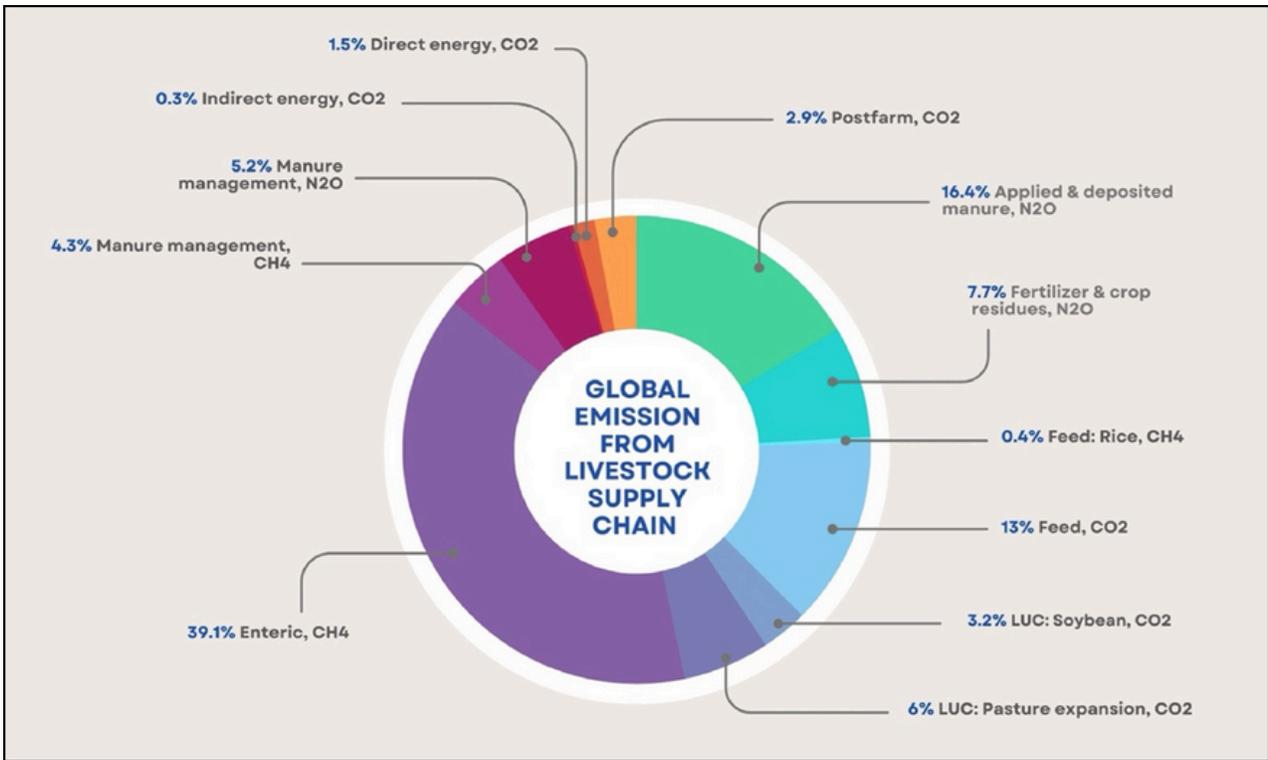
The livestock industry is one of the most important agriculture sectors. It plays a major role in providing nutritious food to people globally, and accounts for 40 percent of the world's agriculture gross domestic product. At the same time, however, it is a major contributor of greenhouse gas (GHG) emissions that increase atmospheric temperature.

In turn, climate change impacts dairy production, as it affects the cows' environment, behavior and health, the third one having adverse effects on their estrus behavior and milk yield.

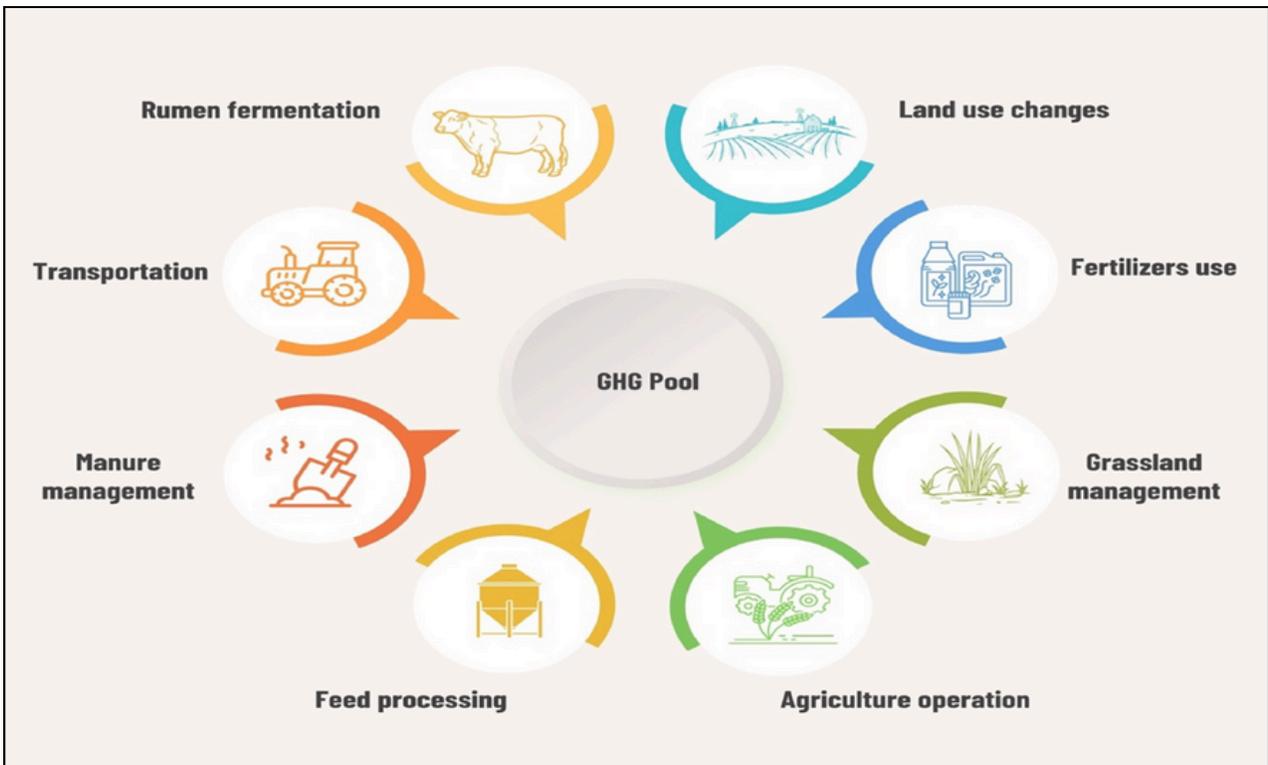
For example, when there is a rise in temperature, some of the cows' energy is used in sweating/panting, and their feed intake is reduced, lowering milk production. This leads to less milk yield, lower protein, and fat concentrations. This further results in declining immunity, susceptibility to infections, and affects udder health. Ultimately, it means high economic loss.

Insufficient rainfall over a period of time and changes in temperature can impact pasture growth and reduce the amount and quality of feed, and make some lands unsuitable for particular forage crops. This will oblige farmers to buy supplemental feed to keep milk production going or dry off (stop milking) stock earlier than planned.

Climate change may also affect the health and welfare of animals, especially those that live outdoors and risk exposure to extreme weather and/or rising temperatures. Moreover, warmer temperatures may bring about biosecurity risks with the possible emergence of new exotic pests, weeds and diseases.



The impact of the livestock supply chain on world emissions.



The role of the livestock industry in the greenhouse gas emissions pool

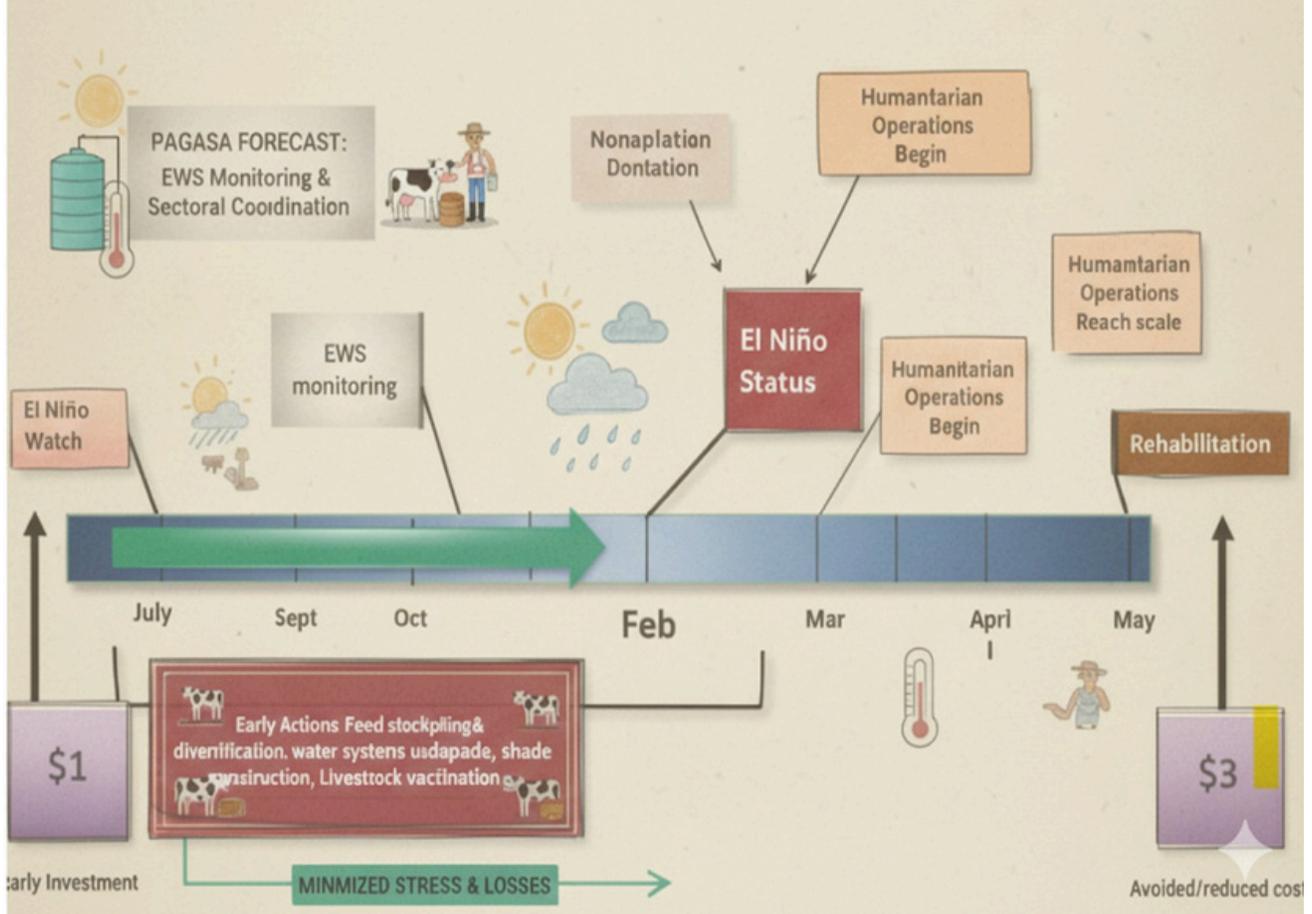
How Dairy and Livestock Farmers Mitigate and Adapt to Climate Change: Strategies for Climate-Resilient Farming

Climate-smart adaptation and mitigation technologies and practices can be grouped under specific “smart” criteria: weather- and knowledge-smart, water-smart, nutrient/carbon-smart, seed/breed-smart, and institution/market-smart (CCAFS, 2016). These categories, as shown in the table below, provide a framework for building resilience and reducing vulnerabilities in dairy and livestock systems.

Climate Smart Technology Options for anticipated Extreme Dry and Wet Conditions

Climate-Smart Criteria	Before Extreme Dry Condition	Before Extreme Wet Condition
Weather- & Knowledge-Smart	<ul style="list-style-type: none"> • Monitor PAGASA/DA-AMIA climate outlooks (6-month) and 10-day forecasts to anticipate El Niño risks to dairy and livestock. • Use early warning systems for droughts, heatwaves, and heavy rains, if available • Prepare anticipatory action plans based on forecasts, deciding on water, breed, feed, and market strategies before hazards occur (see illustration below). • Develop contingency measures such as forage budgeting and emergency feed reserves 	<ul style="list-style-type: none"> • Monitor PAGASA/DA-AMIA climate outlooks (6-month) and 10-day forecasts to anticipate La Niña risks to dairy and livestock. • Prepare anticipatory action plans based on forecasts • Prepare evacuation or relocation plans for animals.
Water-Smart	<p>Ensuring sufficient water supply for dairy animals and planted forage in preparation for dry season such as:</p> <ul style="list-style-type: none"> • Construction of rainwater harvesting/catchment, solar, drip irrigation and storage tanks. • Use solar-powered pumps for reliable water supply. • Adopt water-efficient troughs. • Practice silvopasture to provide shade and conserve soil moisture. 	<ul style="list-style-type: none"> • Construct improved drainage in barns and paddocks. • Provide raised watering points to ensure clean supply. • Elevate housing in flood-prone areas.
Nutrient- & Carbon-Smart	<ul style="list-style-type: none"> • Plant drought-tolerant forage (Napier hybrids, sorghum, legumes). • Preserve feed through silage, haylage, feed blocks. • Manage manure via composting and biogas digesters. 	<ul style="list-style-type: none"> • Apply controlled grazing to avoid pasture degradation. • Use supplements (probiotics, urea-molasses blocks). • Secure dry storage for feed and forage.
Seed- & Breed-Smart	<ul style="list-style-type: none"> • Introduce heat-tolerant and tick-resistant breeds. • Promote crossbreeds adapted to tropical climates. • Use artificial insemination for resilient genetics. 	<ul style="list-style-type: none"> • Select breeds resistant to waterborne diseases. • Regular vaccination and deworming. • Rotate grazing to limit exposure to wet-soil pathogens.
Institution- & Market-Smart	<ul style="list-style-type: none"> • Establish feed and fodder/silage banks (cooperatives, LGUs). • Organize collective fodder production and bulk feed purchases. • Strengthen market linkages for livestock products. • Avail livestock insurance for drought risks. 	<ul style="list-style-type: none"> • Provide milk cooling/storage resilient to power loss. • Strengthen cooperative networks for emergency response. • Link farmers to recovery and relief programs • Avail insurance for flood-related damages.

Anticipatory Action Plan for Dairy and Livestock



Adopted from UNFAO Early Warning Early Action project

Since livestock production is one of the causes of climate change, there is a need for the dairy business to adopt mitigation measures, like in managing manure, which produces the GHGs methane and nitrous oxide. Another measure is to anticipate and analyze potential hazards and plan six months ahead of the forecast climate scenario and choose what options are applicable. For immediate scenarios like floods forecast and other disasters, develop protocols on what measures to undertake like securing livestock to protect their health and ensure feed supply. There are global as well as locally adaptable strategies to reduce GHG emissions from livestock.

Strategies to manage limitations may also be employed. These include reducing the exposure of cows, reducing their sensitivity, and increasing their adaptive capacity, for example, using cow breeds that are more adaptable to local environmental conditions.

One of the best ways to improve agricultural sustainability is by developing and using effective ruminant livestock grazing systems. Land areas that are not suited for crop production can become productive when used for ruminant grazing. Besides, ruminant livestock production also complements crop production, because ruminants can use the byproducts of crop systems not in demand for human use or consumption.

Global strategies include the following:

Nutritional Intervention	Planting Secondary Metabolites*	Use of Chemical Inhibitors**	Use of Genetic Technologies	Immunization
Reducing about 10% less protein content of the diet (e.g., feed more maize silage) will result in 15% less ammonia	Tannins, saponins and phenolic compounds exhibit methanogenic bacteria or bacteria that produce methane as a metabolic by-product (source: legumes, shrubs, trees)	Chloral hydrate, amichloral, bromochloro-methane, nitroethane, and 2-nitropropanol	Radio Frequency Identification (RFID)	Vaccine against specific methanogens
Feeding young grass reduces up to 30% less ammonia, and reduced nitrogen in the rest of cow's diet		Exhibit methanogenic bacteria	Genetic breeding	<p><i>* Metabolites are organic compounds produced by living organisms that are not directly involved in their growth, development, or reproduction.</i></p> <p><i>** The chemical inhibitors may not be used locally.</i></p>
Reduction of enteric methane (gas produced by ruminants like cattle and sheep)				

Dairy farmers must go beyond traditional methods and embrace climate-smart strategies in both production and business. By doing so, they not only adapt to climate change but also enhance resilience, sustainability, and long-term competitiveness.

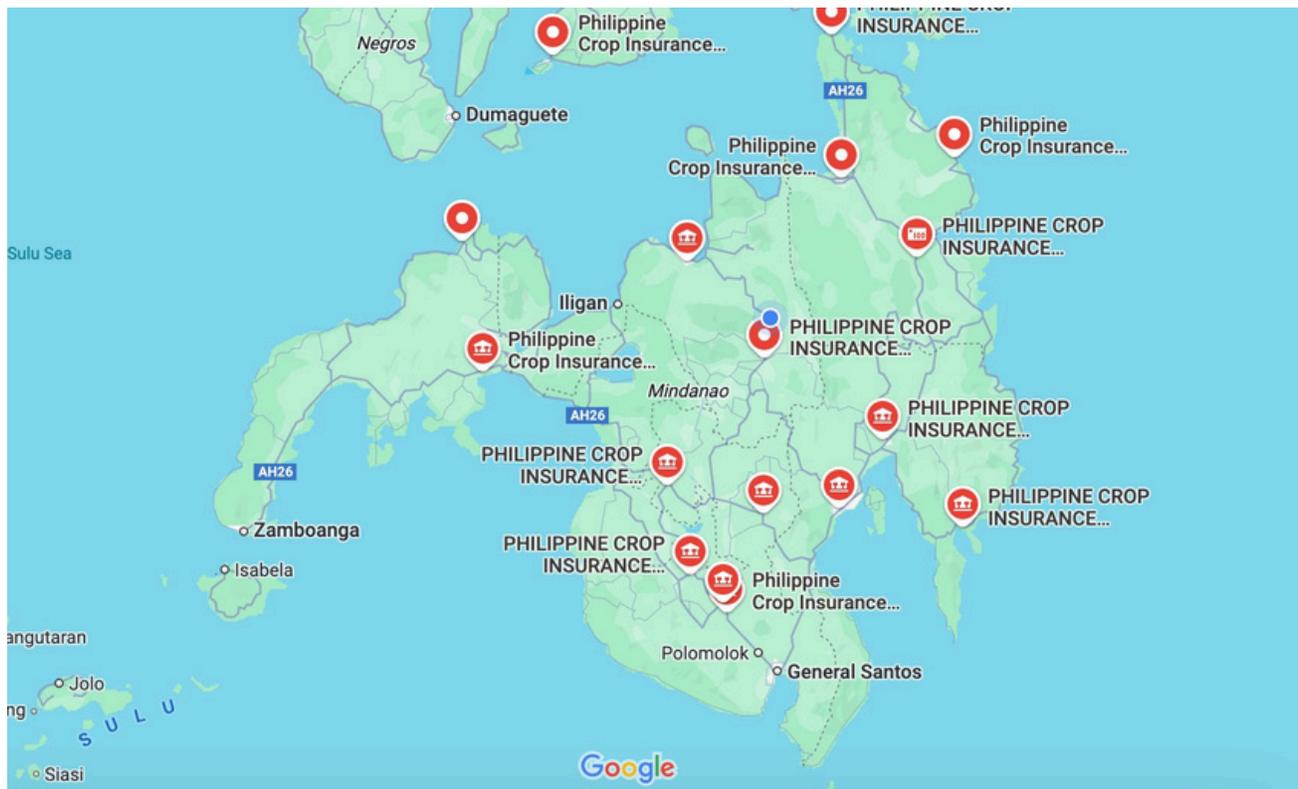
Livestock Insurance Program

Climate change has caused extreme weather and climatic events such as stronger typhoons, El Niño and La Niña occurrences, creating more risks in agriculture in general and dairy farming in particular. For example, a prolonged drought threatens the sustainability of forage supply for animals as well as their health due to heat stress. These disasters would mean financial and material losses for the farmers from which they may find it difficult to recover.

For dairy farmers, one way to cover losses caused by natural events is to insure their animals with either State-run or private insurance firms.

Philippine Crop Insurance Corporation

One of these entities is the Philippine Crop Insurance Corporation (PCIC), a government corporation attached to the Department of Agriculture (DA). It is the implementing agency of the government's crop insurance program focusing on small farmers. It offers insurance protection in case of damage or loss to palay and corn, livestock, fisheries, high-value crops, as well as non-crop, credit and life term insurance.



Locations of PCIC offices in Mindanao. Map courtesy of Google

PCIC's livestock insurance covers loss of carabao, goat, cattle, swine, sheep, and poultry by accidental death or diseases, including animals under livestock dispersal programs. Any type of animals may be covered.

Livestock insurance has no cost for members of the Registry System for Basic Sectors in Agriculture, a DA program, but there is a limit on the amount of indemnity for each animal. It also limits the number of animals that may be insured per household. For cattle and carabaos, two to 10 heads can be insured per farmer under the non-commercial mortality insurance cover, and at least 10 per farmer under the commercial mortality insurance cover.

The following causes of animal mortality are exempted from payment: avian flu (poultry), destruction of the animals by government administrative order, theft, negligence, diseases already existing at the start of insurance, and force majeure, although major volcanic eruptions may be considered.

In general, the waiting period or the time elapsed between effectivity of the coverage and the occurrence of the disease within which no compensation shall be paid is 21 days. However, the waiting period for cattle, carabao, goat, horse and swine is three months.

In case of death of the insured animal, a notice of loss shall be sent within days from the time of death containing the following information: name of the animal raiser, address, policy number, livestock insured, cause of death, date of the occurrence of death. The notice of loss may be written or in the form of an email or SMS.

Within 30 days after the death of the insured animal, the farmer shall submit to PCIC the following documents: signed claim for indemnity, veterinary disease report signed by a veterinarian or local government unit livestock inspector, proof of ownership of large cattle, livestock death certificate, photos of the animal showing the identifying marks like brand or tattoo.

Payment for the loss shall be 100 percent of the value of the animal at the time of death (except for fattening and breeding goats, which is 90 percent) less 10 percent deductible and salvage value. Salvage value applies to animals that are either sold or butchered because the owners consider them as still edible.



***Dairy Mentors Training Module 1: Climate-Smart Agriculture for Dairy Production
Koronadal City, 3-5 September 2024***



Communal farm of BMPC

Baclay Multi-Purpose Cooperative: Walking Toward Progress

Baclay Multi-Purpose Cooperative (BMPC) started a dairy enterprise in 2020 with 60 heads of female buffaloes from the Philippine Carabao Center (PCC), for dispersal to farmer-members. The arrangement is that after the buffaloes give birth, they would either give the calves to the PCC for dispersal to other farmers or keep them under their (members) care.

As of June 2025, sixty dams have been distributed, 30 in Dumalinao and another 30 in Tukuran, Zamboanga del Sur, where BMPC is based. More than 50 remain at the cooperative's communal farm in Barangay Tawagan Norte in neighboring Labangan town.

With assistance not just from PCC but also from the National Dairy Authority and NATCCO, the dairy business – selling milk and milk products – eventually became BMPC's main source of revenue. The cooperative obtained a contract with the Department of Education related to the agency's school feeding program, covering the Zamboanga Peninsula and some areas in Lanao del Norte, Misamis Occidental, and even as far as Bukidnon.

It was no ordinary feat for a group that started as a coconut farmers association, a consumer store and credit and savings enterprise for five years, registered as a cooperative in 1993, until it became an affiliate of NATCCO in 2013.

Nonetheless, BMPC's dairy venture has had known rough times, from having problems with feeds to caracows that are incapable of giving high milk yield.

Farm workers mainly relied on "pangumpay" (cut-and-carry method), although a chopper was already available. According to Solomon Honor, the cooperative's swine manager, there were times they would run out of stock due to frequent rains. At times, the machine would break down.

Ernesto Buce, of BMPC's animal monitoring and breeding section, said lactating buffalos need the right amount of feeds. He narrated that two of their member-farmers experimented with "precision nutrition" using feeds from a Bukidnon-based company. They did see an increase in the milk yield of their caracows, but they decided to stop because the harvest seemed just enough to cover the cost [of the feeds].

Buce said that based on experience there's no need for "precision feeds" because the animals would give enough milk if they are taken care of well. He said a pure breed (Murrah) can produce six liters a day, although he admitted that on the average, the buffalos they have can only give two to four liters. He clarified though that they are now only using artificial insemination to ensure breed purity.

Jhon Paul Peczon, the person in charge of feeding at the communal farm, said the buffalos will produce more milk if given concentrate. "If there's no concentrate, it's difficult to get two liters."

He, however, added that breed is also a factor. "Depende pod sa breed. Ang uban five liters. Pero ang Bisaya na halos, bisan pag daghan bahog, gamay ra gyud [It also depends on the breed. Some can produce five liters. But those who are almost entirely Bisaya (read native), even if you give them plenty of feeds, can only give a little]. The pure breed can give a lot even without concentrate."

John Paul said they are using total mixed ration as taught during the training organized by NATCCO. But he affirmed Solomon's statement that the machine would sometimes conk out, forcing them to resort to the cut-and-carry method. They need at least twenty-five kilos of feeds per day for their lactating line.

For now, BMPC continues to believe that there's always room for improvement. One lesson they have learned is to do silage-making only during the dry months or weeks. In addition, it is seeking to improve the nutrition of its carabaos through a feeding trial with assistance from researchers at the Animal Science Department of Central Mindanao University, who are conducting a feeding milk sampling and soil test as well.

CHAPTER TWO

RUMINANT PRODUCTION NC II AND PASTURE ESTABLISHMENT

An animal's breeding value (estimated breeding value or EBV) can be defined as its genetic merit for each trait. While it is not possible to determine an animal's true EBV, it is possible to estimate it. Determine the traits you want from certain breeds, including those for bulls. Some reproductive traits are lowly heritable. Medium heritable traits include milk production of which nutrition is a factor.



A dairy farm in Maramag, Bukidnon.

Training Regulations on Ruminant Production NC II

Competencies Based on Training Regulations

There are three units of competencies namely, Basic, Common and Core.

Basic competency means an individual is able to: participate in workplace communication; work in a team environment; practice career professionalism; and practice occupational health and safety procedures.

Common competency is the ability to: apply safety measures in farm operations (machineries); use farm tools and equipment; perform estimation and calculations; and process farm wastes.

Core competency refers to the ability to: maintain housing, farm implements and surrounding areas; provide forage; perform breeding of ruminants; raise dairy-type animals; and raise meat-type animals.

Maintaining housing, farm implements and surrounding areas includes: preparing for farm maintenance activities (disinfection, equipment, tools, materials and facilities); maintaining farm and housing facilities (OHS, environmental management standards); applying biosecurity measures; and performing work to completion (recordkeeping of silage production and maintenance).

Providing forage entails: preparing area for forage plantation (tools, materials, equipment and clearing); planting forage species (grass and legumes); maintaining forage plants (pest control measures, fencing to ward off other animals, fertilizer application and other maintenance practice, GAHP and OSHS); producing silage (ensiling, commercial silage additives); and performing work to completion.

Raising meat-type animals includes: providing assistance in management of meat-type animals such as pre-selection using body condition scoring; selection; culling and GAHP to minimize production cost; feeding animals (confined, grazing or both), applying basic health care such as sick animal management, medication/vaccination program, OSHS; and performing work to completion (record keeping, marketing).

A person who has achieved this qualification is competent to be: a livestock raiser/farmer; cattle farm worker (specialist); goat raiser/farmer; and dairy raiser/farmer.

Having an NC II gives individuals more edge in a workplace, as it may land them in a management job. To qualify, trainees must be: able to read and write; possess good moral character; able to communicate through oral and written means; and physically and mentally fit.

The nominal training duration for animal production (ruminants) NC II is 18 hours for basic competencies, 48 hours for common competencies, and 240 hours for core competencies, or a total of 306 hours.

Those who pass the assessment will attain Full Qualification as Animal Production (Ruminant) NC II holders. Those who fail the assessment will be given a Certificate of Competency, meaning they have the core competency to perform the following: maintain housing, farm implements and surrounding areas; provide forage; perform breeding of ruminants; raise dairy-type animals; and raise meat-type animals.

The assessment and certification is open to graduates of formal, non-formal and informal education, including enterprise-based training programs, and experienced workers (employed or self-employed). They must submit the following requirements: training certificate on animal production (ruminant); equivalent training/transcript of record (BS Agriculture); photocopy of Philippine Statistics Authority birth certificate; two passport sized photos (white background, polo/blouse with collar); and self-assessment guide.

The assessment for NC II covers not just written and oral means but also practical application in the field, including lassoing of cows, injecting, administration of vitamins, and restraining animals.

Assessment is done at the provincial offices or assessment centers of the Technical Education and Skills Authority (TESDA), with at least 10 applications for each assessment day. Applicants must check “yes” for all the questions in the self-assessment or they won’t be assessed. Checking even just one “no” will be interpreted by the assessor as unpreparedness to undergo the assessment.

In Northern Mindanao, the accredited assessment centers for ruminant production are the Lanao del Norte National Agro-Industrial School (Tubod), Kinoguitan National Agricultural School (Misamis Oriental), and Oroquieta Agro-Industrial School (Misamis Occidental).

Core Competencies

This section covers the following topics: Raise Meat and Dairy Type Animals and Perform Breeding of Animals.

Some Key Terms

- Estrus is the period when the female will accept service by the male, and occurs every 21 days and lasts from 10 to 30 hours. Local cow breeds have longer estrus periods.
- Lactation is the period that the animal is producing milk. Every year, cows go through 300 days of lactation, the remaining two months are allotted as rest period before another calving. The farmer must know when a cow gets pregnant.
- Calving interval is the time between one calving and the next for individual cows, which is 14 months.
- Dry period is the time between the end of one lactation and the start of the next, which is two months.

Dairy cattle breeds

The commonly used breeds are Holstein and Jersey. In the Philippines, farmers are using Frieswal cows, a cross between Friesian and Sahiwal, for their dairy production capacity and adaptability to the local climate. Island-born cows are more adapted to local climate and show high milk yield. For example, there is a farm in Siquijor where the cows can produce up to 13 liters of milk daily. Kiwi Cross, a mix of Holstein Friesian (a good milk producer) and Jersey, can produce 21 liters a day. The NDA is also importing Australian-Friesian-Sahiwal cattle, but most likely for meat production.

Dairy Goat Breeds

The table below shows the eight dairy goat breeds that an individual who wants to undergo assessment by TESDA needs to be familiar with:

Alpine	Alpine does are at least 30 inches tall and weigh around 135 pounds. They have erect ears and come in many color combinations and known as a hardy breed and can thrive in any climate.
Lamancha	Lamancha does are at least 28 inches tall and weigh around 130 pounds. They have very short ears and come in any color and any color combination. They are known for their calm nature and do well in a variety of climates.
Nigerian Dwarf	Nigerian Dwarf does are at least 17 inches tall and average around 75 pounds. They have erect ears and come in any color combination. Even though they are small, they are known to produce a proportionate quantity of milk with high butterfat content.
Nubian	Nubian does are at least 30 inches tall and weigh around 135 pounds. Their ears are large and hang down, flaring out at the bottom. They may be any color and can come solid or patterned. They are also known for high butterfat and protein content.
Oberhasli	Oberhasli does are at least 28 inches tall and weigh around 120 pounds. They come in the distinctive color called "Bay", but range in light to deep red bay with black markings. They have erect ears and are known for having calm dispositions.
Saanen	Saanen does are at least 30 inches tall and weigh around 135 pounds. They are distinctly white and they have erect ears. They are a favorite for commercial dairies due to the high volume of milk they produce and their calm temperament.
Sable	Sable does are at least 30 inches tall and weigh around 135 pounds. They are of any color combination and have erect ears. Sables have high milk production and calm temperament, similar to the Saanen.
Toggenburg	Toggenburg does measure at least 26 inches tall and weigh around 120 pounds. They have erect ears and carry forward. Their colors range from light fawn to dark chocolate with white or cream markings. They are one of the first purebred dairy goats to be imported into the United States and registered.

Below is a chart showing the range the breed can produce in pounds and the percent of butterfat and protein per pounds of milk:

Doe Breed	Range (lbs./year)	Butterfat %/lbs	Protein %/lbs
Alpine	750-5750	3.3/89	2.9/78
Lamancha	830-4120	3.7/85	3.2/72
Nigerian Dwarf	220-2110	6.4/51	4.4/35
Nubian	510-3840	4.9/99	3.8/77
Oberhasli	1120-3050	3.7/73	3.0/60
Saanen	920-4870	3.3/89	2.9/79
Sable	1540-3120	3.3/79	2.9/68
Toggenburg	1090-3840	3.1/70	2.9/64

Buffalo breeds

There are nine buffalo breeds from India namely, Murrah, Nili-Ravi, Bhadwari, Meshana, Surti, Nagpuri, Jafarabadi, Chilika and Banni. There are also buffalo breeds from other countries – Romanian, Cambodian, Carabao (Philippines), Anatolian, and Australian. The Philippine carabao is mainly for draft purposes and has low milk production.

Perform Breeding of Ruminant

Estrus cycle

The estrus cycle occurs after every 21 days while the estrus period (heat) lasts 3-30 hours with ovulation occurring 2-22 hours after heat. The timing of ovulation should be known since the egg cell has a shorter lifespan compared to the sperm cell. Moreover, a successful mating program ensures the availability of enough young animals as replacements. Workers should be trained in performing artificial insemination (AI).

Early Heat	Standing Heat	After Heat
Increased nervousness/ restlessness	Standing to be mounted	Dried mucus on the tail
Mounting other cows	Clear mucus discharge	Roughened tail head
Swollen vulva	Sharp decline in milk production	The animal refuses to be mounted
Licking other cows	Tail bent away from vulva	Streaks of saliva or signs of leaking on her flanks
Sniffing other cows and being sniffed	The animal may stop eating	
Reduced feed intake		
Early signs: watch the cows closely	Best signs: take the cow for service	Late signs: keep record

Estrus Detection

- Observation- Observe at least three times a day especially during the evening.
- Record keeping - monitoring of the cows' reproductive activity; if the cow shows signs of heat in the morning, have it bred in the afternoon. Natural mating is best at a cool temperature so as not to cause stress on the animals.
- Presence of bull - A bull may be placed near the cows.
- Heat mount detector - This is placed at the back of the cow. When the cow is mounted the paint capsule will burst and the heat mount detector changes color.
- Activity meter - The activity of the cow increases around estrus and this can therefore be measured.
- Estrus control or synchronization - PRID or prostaglandin F2a to induce estrus

When To Mate the Cows?

Observe the AM-PM Rule, i.e., if estrus is observed in the morning, mate in the evening; if estrus is observed in the evening, mate in the morning. The best time to inseminate is 4-16 hours after estrus is observed.

Pregnancy rate is the number of cows pregnant as a proportion of cows served, which should be 94 percent. A lower rate may be caused by these reasons: calving to service interval, mineral deficiencies, timing of service, weight loss, and lack of crude protein in diet.

To maintain a good pregnancy rate, weight loss should not be more than .5 kg per day. Crude protein should be 12-16 percent of the diet, although cows may have different requirements at different stages of pregnancy. Remember the AM-PM Rule. Ensure that cows do not suffer from a deficiency in magnesium, calcium and phosphorous, and observe a calving to service interval of 42 days as practiced in other countries.

There are instances of cows getting pregnant without the farmers knowing it. This is due to bull breeding in pasture and absence of any record for monitoring. It is important to examine cows that do not show signs of heat 60 days or more after calving and those with unknown mating history. Cows that are not given rest would not be able to produce colostrum, leading to calf mortality.

In dairy animals, confirmation of the stage of pregnancy is important so drying period could be scheduled at 60 days before calving. Determination of stage of pregnancy is essential for calving dates, precautions and preparations for a successful parturition.

To avoid or minimize chances of inseminating pregnant cows, technicians should first examine the animal for pregnancy before the insemination. Signs of pregnancy include increase in weight, increase in size of abdomen, drop in milk yield, and detection of fetus by palpation on the right flank during the last stage of pregnancy.

NOTE: Dairy farmers need to be aware that the Animal Welfare Act (Republic Act No. 8485) of 1998, as amended, provides for five freedoms namely:	freedom from thirst, hunger and malnutrition
	freedom from discomfort
	freedom from injury, pain and disease
	freedom to express normal behavior
	freedom from stress and fear

Recordkeeping

Recordkeeping is a necessary element of a good livestock business management. It involves various aspects of operations, including animal information, production record, breeding and reproduction records, health and disease records, and mortality and disposal records.

Importance of Recordkeeping:

- Improved management – Accurate records allow for better decision-making regarding breeding, feeding, and health management.
- Enhanced productivity – By monitoring health production and identifying areas for improvement, farmers can increase herd productivity.
- Disease prevention – Records of health disease can help to identify and prevent disease.
- Compliance with regulations - Any dairy farms are subject to regulations that require record keeping practices.
- Financial management – Accurate financial records are essential for managing the farm's finances and making business decisions.

For diseased animals, administer medication while waiting for the veterinarian if you happen to have some knowledge of how to do it and what medicines may be applied. The idea is to prevent the illness from getting worse while waiting for professional intervention.

Recordkeeping should include, among other information, the breeding, health, and milk production record of cows. It is important to record the date when the cows became pregnant to determine the dry period for the production of colostrum and the date of possible calving. Recordkeeping also allows the farmers to know which cows are good milkers.

In somatic cell count, a higher SCC means bacterial contamination. A high SCC, 400 or higher, means the milk has mastitis or possibly contaminated. Bovine mastitis is an inflammation of the mammary gland caused from trauma or an infection, leading to abnormal and decreased milk production.

Breeding Program

Define the production system – This includes shed in pasture area, fencing, what is existing and what the plans are. It depends on the owner's intention, e.g., if he/she wants to prevent parasites, choose cut-and-carry. Consider the number of cattle and the possibility of electric fencing.

Define the breeding goal – milk production, replacement, or both, but replacement is secondary

Collection of information – phenotypes (physical attributes like color), family relationship (if the mother cow is a good dairy producer, the offspring is also likely to produce well), genotypes (the breeds you want to use); milk production average, lactation

Determining selection criteria (how replacements are chosen) – genetic model and EBV. An animal's breeding value (estimated breeding value or EBV) can be defined as its genetic merit for each trait. While it is not possible to determine an animal's true breeding value, it is possible to estimate it. Determine the traits you want from certain breeds, including those for bulls. Some reproductive traits are lowly heritable. Medium heritable traits include milk production of which nutrition is a factor.

Selection and mating – not yet in a stage to cull based on unmet productivity expectations; you would not have the luxury of choosing females if there are only a few to choose from.

Structuring of the breeding program – Avoid inbreeding; for AI, ask for sire number to avoid inbreeding; breeding siblings is the weakest, as the offspring are prone to several defects; program should be for five years; consider a five-percent mortality rate.

Evaluation – for genetic improvement and genetic diversity; this is done after about five years. Once you have achieved the desired standard, you may stay on a plateau or an equilibrium and maintain it.

Forage and Pasture Establishment

Pasture is defined as a plant or plants for grazing, including those growing wild. It could also be a lot or land purposely used for grazing animals. Pastures are either [1] native or those with natural vegetation like cogon and carabao grass, which has low productivity in that they can only carry 0.5 to 1 animal unit (AU), or [2] improved, or those that are established and planted with improved species like Napier (which has more dry matter) and Mombasa, and with high productivity or a capacity of as much as 8 AU.

Pasture productivity is measured in terms of dry matter (primary) and milk produced (secondary). A 300-kg cow for each hectare of pasture is considered low productivity. AU is the amount of dry matter that an adult ruminant (200-300 kg body weight) could consume daily, which is 1.5 to three percent of body weight.

An improved pasture involves land preparation, soil fertilization, irrigation (in New Zealand, not the Philippines), and weed control, to enable it to carry eight animal units per hectare.

Application of AU

Computing the consumption of a cattle with a body weight of 300 kg:

If feeding forage corn or Napier, dry matter should be 3% of body weight, thus $300\text{kg} \times 0.03\% = 9\text{kg}$ dry matter. If dry matter or forage corn is 22%, then fresh forage corn is $9\text{kg} / .22 = 40.91\text{kg}$ per day. It is 3% or 9kg per day because corn and Napier digest faster.

If feeding low quality feed like rice straw, the formula is $300\text{kg} \times 0.015\% = 4.5$ kg dry matter, assuming %DM rice straw is 30%, then the amount fresh rice straw = $4.5 \text{ kg} / .3 = 15$ kg per day. Low quality feeds like rice straw (protein 3%) has low digestibility and 30% dry matter.

If you have 10 heads of cattle for fattening, you will need $40.91 \text{ kg} \times 10 \text{ heads} = 409.10$ fresh forage corn per day. This gives an idea how wide the pasture area should be. CMU is allotting 1 hectare per paddock for easy management.

Projecting the amount of forage need

Based on the computation above of 409.10kg fresh forage corn/day for 10 heads of cattle, the annual consumption would be: $409.10 \text{ kg} \times 365 \text{ days} = 148,321.5 \text{ kgs}/1000 \text{ kg per ton} = 148.32 \text{ tons per year}$.

Assuming you will establish Napier grass that produces 40 tons DM/year, how many hectares will you need to guarantee a year-round supply of forage for your 10 heads cattle?

- $9 \text{ kg DM per head per day} \times 10 \text{ heads} \times 365 \text{ days} = 32,850 \text{ kg}/1000 \text{ kg per ton} = 32.85 \text{ tons DM}$
- $\text{Area needed} = 32.85 \text{ tons DM required}/40 \text{ tons DM Napier} = 0.82125 \text{ hectares (cut-and-carry)}$

Potentials of selected forages DM

Forage	Description/DM	Means of Propagation
Napier – <i>Pennisetum purpureum</i>	As hay, yields up to 43 MT/ha 29–48 T green herbage 2 to 3 cuttings	Cane, nodes
Mombasa – <i>Megathyrsus maximus</i> cv. <i>Mombasa</i> (formerly <i>Panicum maximum</i>) otherwise known as Maramais	8 – 10 %CP, 28% DM, 60%TDN 15 – 20 T DM/ha/year (in poor soils) 8- 10 T green herbage, 5 to 6 cuttings per annum	Seeds, rootstocks (200 rootstocks = 500 pesos)
Mulato (Molato) – <i>Urochloa ruziziensis</i> x <i>U. decumbens</i> x <i>U. brizantha</i> ; a triple cross	Cut and carry at 40 -45 days (wet season), 60-70 days (dry season); 14 – 17 tons DM/ha/yr, 35 T (China)	11-18% CP 55-60 TDN
Paragrass – <i>Brachiaria mutica</i> (Forsk.), otherwise known as Buffalo grass	Highly palatable and nutritious; 10.2% CP, 23.6 % DM; 1 st cut at 70-80 DAP; fresh forage yields of 130 – 140 T/ha	Stolons, cuttings
Signal Grass – <i>Brachiaria decumbens</i>	30 T DM / ha (fertile soils) N fertilizer is provided; average of 10 T DM, 4 T DM (no fertilizer); 2.61 T DM (50% leaves) in Western Brazil	Stolons, seeds
Indigo – <i>Indigofera zollingeriana</i>	1 -1.5 M cutting every 60 days, 27 – 31 % CP, tannin – 0.09 to 0.65%, 1,17% Ca,0.26% P Presence of indospicine (indigofera intoxication) 40% indigo in pellet for dairy goats; 8 months harvest fresh weight 50 T/ha	Seeds; scarification should be done like hot water treatment before sowing
Star grass - <i>Cynodon plectostachyus</i>	10 % CP but could go as high as 18% if fertilized	Stolons
Ipil – ipil - <i>Leucaena leucocephala</i>	120 T/ha/year, cut back every two months	Seeds, seedlings
Madre de Agua/Nacedero – <i>Tricanthera gigantea</i>	Harvest at 8-10 months after planting, 1 st yield could be 15 T DM/ha, next harvest every 3 months with 17 T fresh harvest	Ipil – ipil - <i>Leucaena leucocephala</i>

Additional Notes

Mombasa yields high dry matter even in poor soils.

Mulato is advisable for cut-and-carry or zero grazing.

Madre de agua is an indicator of water nearby as observed in Colombia. It is not classified as a legume but is good for dairy cows due to high protein content.

Consider forages as cash crops. Corn that do not produce cobs can be sold since it is highly used in forage production as water-soluble carbohydrates.

Paragrass is palatable especially for goats; plant it at onslaught of the rainy season.

Star grass may be given to goats if it comes with salt.

For legumes, Indigo is preferred by goats. Indigo, however, has tannins, which are reported to be a cause for decrease in food intake, growth rate, feed efficiency and protein digestibility.

Wait until 10 a.m. to graze animals in wet areas planted to paragrass to avoid hila-hila (slugs) that cause liver fluke. These slugs would go down to the ground once the temperature rises.

Microorganisms in signal grass and mulato can cause photosensitization in calves.

Misamis grass is high in nitrogen, while cogon is highly acidic.

Processes for pasture establishment

Here is a quick general checklist for pasture establishment:

- Plan ahead. Have the land prepared well before the expected planting date.
- Plant during the time of year when rainfall is plentiful and temperatures are appropriate for the forage crop being planted.
- Use high-quality seed or planting material.
- Prepare a smooth, level, weed-free, and firm seedbed.
- Always plant into a seedbed with good soil moisture.
- Place seed or planting material at the appropriate depth.
- Firm soil around the seed or planting material to ensure soil-to-seed contact.
- Use appropriate establishment fertilizer and weed control methods.

1. Soil testing and correcting soil nutrient deficiencies

- Soil sampling – Get soil samples following a Z pattern, and submit the samples to the nearest soil testing laboratory.
- Apply lime at a rate of 1 – 2 T/ha (a month before the planting of vegetative part or seed).
- Apply fertilizer based on the result of the soil analysis.
- If using manure for fertilizer, have it analyzed.

- Most of the pastures in the Philippines especially in hilly areas are acidic, thus the need for lime. Nutrient availability, root growth and nitrogen fixation of legumes are highly affected by soil acidity.
- Rejuvenation of soil that has been used by plantations is a long process. The grass that will grow will not be productive. It needs soil analysis and liming. Use manure first to fertilize and plow under to let decomposed vegetation help in restoring soil fertility.
- Dairy farmers in New Zealand use shit spreader after plowing.

2. Selecting species adapted to a specific area – A knowledge of the different forage species and its environmental adaptation is a must. For example, Napier needs open space and direct sunlight, paragrass prefers swampy or water-logged areas, signal grass thrives in shady areas, while molato tolerates poor or less fertile soils.

3. Ruminants are classified into distinct feeding types based on the diets they prefer. Know the grazing preferences and adaptations among ruminant livestock species to help in planning grazing systems for each individual species and for multiple species grazed together or on the same acreage.

- Cattle, buffalos and sheep are called grass/roughage eaters (bulk and roughage eaters) because they depend on diets of grasses and other fibrous plant material. They prefer diets of fresh grasses over legumes but can adequately manage rapidly fermenting feedstuffs.
- Goats are classified as intermediate types and prefer forbs and browse such as woody, shrubby type plants. This group of ruminants has adaptations of both concentrate selectors and grass/roughage eaters. They have a fair though limited capacity to digest cellulose in plant cell walls.
- Sheep are grazers (they eat anything green) while goats are intelligent browsers (choosy).

4. Implementing the correct planting (seeding, vegetative) method and rate

- non tilled (burning or use of chemicals; plowed/harrowed soil (land preparation)

Methods of planting:

- Broadcasting (uneven distribution of seeds) – Increase the recommended seeding rate by 20%.
- Drilling/direct sowing – Cut a thin furrow in the soil and deposit the seeds at a minimum depth of one inch.
- For seedlings and vegetative materials, be aware of the distance between plants.
- If planting seeds, soil must be well prepared to assure good seed germination. There is no need to till if the area is hilly; just apply judicious burning using fire breaks to control the fire.
- Soil radiation poses a problem to using seeds in the Philippines as means of propagation, thus using rootstock is more advisable.
- Use seedlings in general in propagating ipil-ipil.

5. Implement a weed control program – types of weed control program: mechanical (use of machines), chemical (using chemical substance like 2,4 D), natural (use of other plants)

Having a weed control program assures the newly emerged forage better growth in the absence of weed that competes with it for the external factors like sunlight, water and others.

6. Proper management to maintain a productive stand:

- Do not allow grazing in new stands of forages too early or frequently. Allow plants to become well established. When plants are 8-12 inches tall, mow lightly.
- Do not introduce sheep to newly planted pastures. Wait for the pasture to produce seeds then introduced sheep to allow new (seeds) to be introduced to the pasture. Allow for colonization of pasture.
- Minimum height of planted forages should be maintained at 3-4 inches.
- Maintain proper grazing height to trigger new plants to produce runners or stolons (shoots that grow along the ground and produce roots at its nodes).
- Hagonoy should be eliminated because it kills other plants with a chemical or when it creates a canopy once it grows tall. It can also cause abortion in cows and goats.
- Amor seco is an indicator of overgrazing and of the need to renovate (reestablishment).

Systems of grazing:

Proper pasture management involves the prevention of undergrazing and overgrazing. The following are systems of grazing:

- Continuous grazing – The animals stay in the pasture year in-year out, and this happens in native pasture. This system results in both overgrazing and undergrazing of forages.
- Rotational grazing – Animals are rotated in the different paddocks within the whole pasture area, thus the need to establish paddocks. Cost is a disadvantage (corner post, gate assembly, etc.) but in the long run it will pay off. The system gives an opportunity for forage plants to rest so that they can regrow more quickly as well as the opportunity to move livestock based on forage growth, promote better pasture forage utilization, and extend the grazing season.
- Strip grazing – This is similar to rotational grazing but the area of a paddock is smaller (strips), and animals stay in the strip for two to three days. This is advisable for small areas.
- Alternate grazing – The area is bigger compared to strip grazing but not as large as rotational grazing. Electric fence may be used.
- Cut-and-carry (zero grazing) – It is an efficient use of pasture and animals have no contact with soil but entails high labor cost.

If using rotational grazing system, determine how many paddocks are needed using the following steps:

[1] know the total animal units in your herd; [2] convert your herd into animal units, for example:

Class	Body Weight (kg)	Number	AU	Total AU
Buck	30	3	0.1	0.3
Doe	25	75	0.08	6.0
Buckling/doeling	20	60	0.07	4.2
Kids (male, female)	10	68	0.04	2.72
Total AU				13.22

- Assumptions: 1 AU = 300 kg BW
- kidding rate of does (1st kidding) = 80%
- kidding rate of does (2nd kidding) = 90%
- Pasture to establish = paragrass, 10 tons/ha/year
- goats grazing at 10 am, brought back to the house at 2pm
- supplementation with UMMB and 12 % CP concentrate

Computation for number of paddocks:

- Total area needed = total AU/DM production
= 13.22 AU/ 10 T DM/ha /yr = 1.322 ha or 1.5 ha
- Assuming that grazing /resting scheme is 5/15 (5 days grazing/15 days resting); number of paddocks needed = resting/grazing + 1
= 15days resting/5 days grazing +1 = 3 +1 = 4 paddocks
- Area per paddock = Total area needed / number of paddocks
= 1.5 ha/ 4 = 0.375 ha /paddock

Concentrate supplements

As shown in the computations below, using soya meal in preparing the supplements costs higher than using copra meal:

Using soya meal and rice bran

18% crude protein (CP) desired

Soya meal, 43.10% CP and rice bran d1 (tikitiki), 12.5% CP

$$43.10 - 18 = 25.10$$

$$18 - 12.5 = 5.50$$

$$25.10 + 5.50 = 30.60$$

$$\% \text{ soya meal} = 5.50/30.60 \times 100 = 17.97\%$$

$$\% \text{ rice bran (tikitiki)} = 25.50/30.60 \times 100 = 82.03\%$$

If mixing 20 kg:

$$\text{Amount soya} = .1797 \times 20 \text{ kg} = 3.59 \text{ kg}$$

$$\text{Amount RBD1} = .8203 \times 20 \text{ kg} = 16.41 \text{ kg}$$

Using copra meal and rice bran

18% crude protein (CP) desired

Copra meal, 20% CP and rice bran d1 (tikitiki) 12.5% CP

$$20 - 18 = 2$$

$$18 - 12.50 = 5.50$$

$$2 + 5.50 = 7.50$$

$$\% \text{ copra meal} = 5.50/7.50 \times 100 = 73.34\%$$

$$\% \text{ rice bran} = 2/7.50 \times 100 = 26.66\%$$

If mixing 20 kg:

$$\text{Amount copra meal} = .7334 \times 20 \text{ kg} = 14.67 \text{ kg}$$

$$\text{Amount RBD1} = .2666 \times 20 \text{ kg} = 5.33 \text{ kg}$$

Minimum level of crude protein needed is 7-8%, but for higher productivity, make it 12%.

Silage ensures steady supply of feed. You need silo for storage, grass and starter (source of water- soluble carbohydrate from sugar, which is broken down into lactic acid by lactic acid bacteria found in grass). Chop the grass and put the starter.

Making UMMB (Urea Molasses Mineral Block)

UMMB or Urea Molasses Mineral Block is a type of supplemental block used in feeding ruminants like goats and cattle to provide essential nutrients and improve their overall nutrition. It is more nutritious compared to salt block.

Molasses is the main ingredient of UMMB as an energy source. RBD1 is a filler. Cement, another ingredient, is burnt lime meaning it is calcium oxide. Urea, which is about 45% nitrogen, aids in the breakdown of complex carbohydrates in the rumen, improving their digestibility and nutrient utilization. It cannot poison the ruminants because of microbes called urolithic bacteria that destroys the urea structure to increase its population. These bacteria then join the microbial pool. However, you can only put a maximum of 10% of urea into the UMMB.

To create a 5-kg UMMB, prepare the following ingredients: 2-kg molasses, 400 g urea plus 100 ml water, 100 g salt, 50 g cecical, 400 g cement, and 2 kg rice bran (RBD1). Add 100 ml water to the cement, salt and cecical, and 10 kg Napier for a 1:2 UMMB-silage ratio. The following equipment are also needed: a mixing container, a weighing scale, mixing utensils, and molds or vessels for shaping the blocks.

Measure and Weigh the Ingredients: Measure and weigh each ingredient using the given proportions. Adjust the quantities accordingly based on the desired batch size.

Mix the Ingredients. In a mixing container, dissolve the urea with 100 ml water, then combine it with salt and cecical, and add 100 ml water to help dissolve the salts. Mix well until the urea, salt and cecical are dissolved. Gradually add the molasses to the mixture. Continuously mix the ingredients to ensure thorough distribution. Once the molasses is well-incorporated, add the cement. Continue mixing the ingredients to achieve a homogeneous mixture. Finally, add the rice bran to the mixture. Ensure that all the ingredients are thoroughly combined to create a consistent blend.

Formation of UMMB Blocks: Once the ingredients are well-mixed, transfer the mixture into molds where the Napier has been placed. Press the mixture firmly into the molds to remove any air pockets and ensure the blocks have a uniform shape, either rectangular or cylindrical based on preference and availability.

Cure and Dry: After shaping the blocks, allow them to cure and dry. Place the blocks in a well-ventilated area away from direct sunlight. Curing is crucial for the blocks to gain strength and stability. Regularly check the blocks for any signs of spoilage or undesirable odors during the curing process.

Storage and Usage: Once the UMMB blocks are fully cured and dried, they are ready for storage and usage. Store the blocks in a cool, dry place to prevent spoilage. Ensure they are protected from moisture, as excessive dampness can cause the blocks to deteriorate. Place the UMMB blocks in areas where livestock can easily access them.

Lactic acid is anaerobic. Fermentation process takes 21 days. It must be done by layer to prevent exposure to air, which will kill the lactic acid. Long storage of silage is not advisable.

Silos need not be made of concrete. Containers like sacks can be used for storage. In India the farmers are using areas for charcoal-making to store silage. The important thing to remember is that it can prevent the entry of air.

PRECAUTIONS

The daily recommended dosage of UMMB is 500 grams for adult ruminants. Others would limit it to 350 grams.

It is not advisable for calves whose stomachs are sterile and incapable of producing urolithic bacteria because they only consume milk.

It should not also be fed to pregnant cows, as it may cause abortion and even death.

Avoid giving UMMB to animals when they are hungry or when there is no drinking water available.

Animals should have access to their regular feed and fresh water before consuming UMMB, to ensure a balanced diet and adequate hydration.

Watch for poisoning symptoms, which may include excessive salivation, breathing difficulty, bloating, or other abnormal behavior.

Electric Fence Establishment

Cattle farms in Australia previously used barbed wire as fence. However, flies would attack animals that had wounds caused by the wire, leading to the use of electric fence. They would install up to eight layers of high-voltage polywire (6,000-8000 volts) at 10-inch intervals because aside from preventing the cattle from going out, the fence also serves to ward off foxes that prey on the calves. In the Philippines, where there are no foxes, two layers of wire would be enough.

Five-foot long metal or wooden posts can be used. After putting up the posts, place the insulators (attached to the holes on the posts), polywire, ground, and energizer in that order. The energizer is connected to the battery power which is attached to a solar instrument to maintain power supply. Use a roller in installing the wire to prevent it from getting entangled. Leave a space for the bungee gate (also a wire). Electricity along the bungee gate automatically goes off once it is removed to allow the animals to pass through.

Metal posts are shaped as angle bars. How deep the lower part of the post should be buried depends on the hardness of the soil. Corner posts should be sturdy. For a three-hectare area, the fencing would cost around 100,000 pesos. In Australia, it is required by law to put warning signs every 30 meters around the fence.

The wire will not trip off even if grounded, although the voltage would decrease. Such a decrease in voltage can be detected by the tester, and the device will point the direction to the grounded part of the wire. Moreover, the wire is of high-tension quality; it won't break even if cattle or buffalos ram it, which is unlikely as the current will push them back upon contact. The animals can detect the electric current through its vibration.

Steps in Installing Electric Fence

All electric fences consist of three equally important parts:

- The Fence (posts, wires, insulators, gates)
- The Electronics (fence charger, insulated cable, switches)
- The Ground System (ground rods, clamps, wiring)

Step 1: Decide whether you want to build a temporary or a permanent electric fence.



Use a roller to install the wire to prevent it from being entangled.

Temporary electric fences are used to control animals inside a permanent fence, usually consisting of one or two wires attached to plastic or metal rod posts. They are easy to install, move, and take down.

Permanent electric fences are used to fence animals inside a property, fence out predators, and separate breeding animals. A permanent fence usually consists of multiple wires attached to steel “T” posts or wood posts.

Step 2: Materials

The type of animals to be controlled will determine material selection. Buy the most powerful fence charger (energizer) you can afford. Use the appropriate designed insulator, specific to the fencing material being electrified. Cheap insulators and incorrect installation are a major cause of electric fence problems. Use insulated cable designed for electric fencing.

Most temporary fences use small gauge (14 to 17 gauge) steel wire, or polywire or polytape. Metal rod or plastic posts are usually spaced 20 feet to 30 feet apart. Making the fence visible is important but not necessary. If using steel wire, flag the fence with colorful tape if desired.



A fence charger or energizer

Step 3: Installation

Install the fence, fence charger and ground system.

- Install an effective ground system with three six foot long ground rods, spaced ten feet apart. Use ground rod clamps and galvanized wire or insulated cable to connect ground rods to each other and to the fence charger. Without a good ground system your animals won't get shocked when they touch the fence.
- Install the fence charger (energizer) under cover, several feet above the ground. Install solar-powered fence chargers in an open area facing south (northern hemisphere). Use insulated cable, rated up to 20,000 volts, to connect the fence charger to the fence. Install cut-off switches to isolate sections of your electric fence if desired.
- Test your ground system

Step 4: Test the fence

Before connecting the fence charger to the fence and ground system, turn it on and check the voltage with your digital voltmeter. It should read 5,000 volts +. Now connect the fence and ground system and check the voltage again. If the voltage drops more than 2,000 volts then you have a problem in the fence or your fence charger isn't powerful enough. Models DE 20, DE 60 and DE 80 will register only 2,000+ on a clean fence.

Check your fence at the farthest point from the fence charger. Touch probe on top of the tester to an electrified wire and touch the other lead to the ground. This will tell you how much voltage, which is the speed the energy is being delivered to your animals. A minimum of 2,000 – 3,000 volts is necessary to contain most animals. A properly constructed electric fence will have 5,000 to 8,000 volts, depending on your Fence Charger. That might sound like a lot but electric fences emit an extremely short electric pulse that is harmless for animals and people of all ages, but will get your attention.

Step 5: Introduce animals to the fence

Electric fence works because animals are afraid to touch it, but they must learn that touching the fence will shock them. Put animals behind a new electric fence during daylight hours, giving them a chance to see it. If necessary put some hay or grain under the fence to speed up the "learning" process. It can take up to three days to train animals to your fence.

NOTE: It's best not to turn off an electric fence if animals are behind it.



***Dairy Mentors Training Module 2: Ruminant Production NC II and Pasture Establishment
Central Mindanao University, 1-4 October 2024***



Datu Rolando Melendez at his forage area

Datu Lando: Blending Tradition and Technology

For Datu Rolando G. Melendez, becoming a dairy farmer wasn't a personal choice at the start. Credit goes to the owner of the cows that he took care of in the early 1980s.

He recalled that in 1983, the Philippine Dairy Corporation (PDC) brought imported cows to Barangay Dalwangan, Malaybalay City. However, almost all of the animals later died. Some of the calves, which were island-born and hence already acclimatized, were given to the care of PDC workers.

"I had no interest in dairy farming. But my employer who saw that dairy cows can thrive in Kibuwa entrusted me with two cows. He assured me I would not be liable in the event that the animals died. All he told me was just to take care of them," he said.

Kibuwa is a farming village of Barangay Impalutao in Impasugong, Bukidnon where Datu Lando currently resides. It is around five kilometers from Dalwangan.

"I was a farm worker earning 180 pesos per day. I didn't expect to earn from dairy cows. My house only had 12 iron sheets for roofing. But my employer assured me, 'This house of yours will become bigger, and you'll be able to give your children one motorcycle each'," Datu Lando recalled with amusement.

He said that with the price of raw milk at only 10 pesos in 2010, he had doubts that his employer's words would come true. It was his employer who bought the milk and processed it. "I harvested 16 to 18 liters per day. But if he could not come to get the milk, I had to discard it because I have no means of transport to deliver it to him."

"Since the price was only 10 pesos per liter, I didn't collect the payment for three months until it reached 15,000 pesos. It was a big amount at that time. My wife exclaimed, 'Hala, kwarta na man na (Hey, that's money already)' and told me we should go into the merchandizing business."

It was then that he realized that dairy farming can help a Lumad like him. He said it has helped him send his children to school. Two of them are presently in college. “And, I have four motorcycles now,” he said, recalling what his employer had told him.

As regards feeding techniques, Datu Lando said he is using a combination of what he has been applying since starting 16 years ago as a dairy farmer and what he has learned from trainings. He said the dairy mentors training and the assistance from Central Mindanao University have expanded his knowledge about the proper way to feed milking cows.

“I can get 20 liters from each of my cows with healthy forage and by giving them enough water even if there’s no commercial feeds. I would advise my fellow dairy farmers to take care of their forage so they can get high milk production. The amount of feed is useless if the forage is not healthy or overmature,” he said.

[Datu Lando is right in saying that overmature forage should not be given to animals. Forage maturation is associated with a decrease in the nutrient content, digestibility, and subsequent nutritional value. As a plant matures the contents of water, protein, nonstructural carbohydrates (i.e., energy), minerals, and vitamins decrease.]

He said farming has become easier with technology such as silage-making. He, however, advised that farmers should not abandon traditional cow-rearing practices that have proven to be effective such as giving healthy forage.

CHAPTER THREE

DAIRY ANIMAL NUTRITION AND FEEDING MANAGEMENT

The high producing dairy cow requires a diet that supplies the nutrient needs for high milk production. Carbohydrates, amino acids, fatty acids, minerals, vitamins, and water are all nutrients required by the lactating dairy cow to meet the demand by the mammary gland to produce milk and milk components.



A dairy farm in Maramag, Bukidnon.

Animal Nutrition

Animal nutrition deals with the nutritional needs of food-producing, companion, or service animals. It is the science of preparation or formulation of feed for animals that produce food (e.g., meat, milk) or nonfood materials (e.g., wool). It is also an integrative science, as it deals with the different steps by which the animal assimilates feed, or food, and uses it for its growth, health, and performance (e.g., meat, milk, and egg production and service).

Feed intake and feed efficiency are key metrics for monitoring a cow's nutrition. Feed intake can be limited, especially for cows in early lactation. Moreover, rations should be balanced to meet the cow's nutrient needs at each stage of lactation.

If the animal's body is lean, simply increase its food intake. Aside from nutrition, genetics plays an important role in improving the milk production of dairy animals, which means a huge surplus for the farmers.

Dairy Nutrition

The high producing dairy cow requires a diet that supplies the nutrient needs for high milk production. Carbohydrates, amino acids, fatty acids, minerals, vitamins, and water are all nutrients required by the lactating dairy cow to meet the demand by the mammary gland to produce milk and milk components.

Amino acids break down proteins. **Carbohydrates** are the major source of dietary energy, and also function in building macromolecules, sparing protein, and assisting in lipid metabolism. **Fatty acids** function in providing energy, being components in the plasma membrane of all cells, being carriers for fat-soluble vitamins, and providing insulation and lubrication.

Vitamins are the foundation of balanced animal nutrition. They are essential, irreplaceable micronutrients that are required for normal physiological functions including growth, body development and reproduction, as well as animal well-being and general health status.

Minerals are inorganic elements that are essential for the animal body's physiological functions and metabolic processes.

Macronutrients (amino acids, carbohydrates, fatty acids) are needed by animals in large quantities, while micronutrients (minerals and vitamins) are needed by them in small quantities. That's why in UMMB there is more bran than cecal.

However, developing the cow that will produce a high milk yield begins with the nutrition of the calf and heifer.

Nutrients and Sources

Cows undergo physiological stages during which they need food materials that perform specific functions to meet the diet required to attain high milk production. These food materials include the following:

- Forage - High-quality forage should be the basis of a cow's diet. Forages are the main source of structural carbohydrates for dairy cows. Concentrates are supplemental feeds for cows.

- Carbohydrates - The primary source of energy for dairy cows, carbohydrates should make up 60% – 70% of their diet.
- Protein - The protein density and sources should be adjusted based on the cow's milk production level. Young animals need more protein than adults, and lactating animals need more protein than non-lactating animals.
- Fat - Fat is especially important for high-performance dairy cows. However, added fat should not exceed 7% of the ration's dry matter.
- Minerals and vitamins - Cows need minerals and vitamins to meet their needs. Ruminants produce some water-soluble vitamins, but dairy cows may benefit from supplementation.
- Dry matter is the source of the five nutrients previously mentioned (vitamins, minerals, carbohydrates, fats, proteins).
- Water - Cows need access to enough clean, fresh water. Water makes up 87% of milk composition.

Understanding the Dairy Animal's Digestive System

The anatomy of the ruminant digestive system includes the mouth, tongue, salivary glands (producing saliva for buffering rumen pH), esophagus, four-compartment stomach (rumen, reticulum, omasum, and abomasum), pancreas, gall bladder, small intestine (duodenum, jejunum, and ileum), and large intestine (cecum, colon, and rectum). The four compartments of a ruminant's stomach are not evenly distributed in terms of size.

On its first week, the calf's stomach is monogastric and, like other animals, cannot digest forage, but the four compartments are already present. Its rumen is 25% of its stomach, while the reticulum is 5%, omasum 10%, and abomasum 60%. At this stage, the rumen does not function that's why there are feeds that mature cows can digest that calves cannot. After 3-4 weeks, the rumen grows to 65%, while the abomasum shrinks to 20% due to changing diet. At this stage the omasum stays at 10%, while the reticulum remains at 5%.

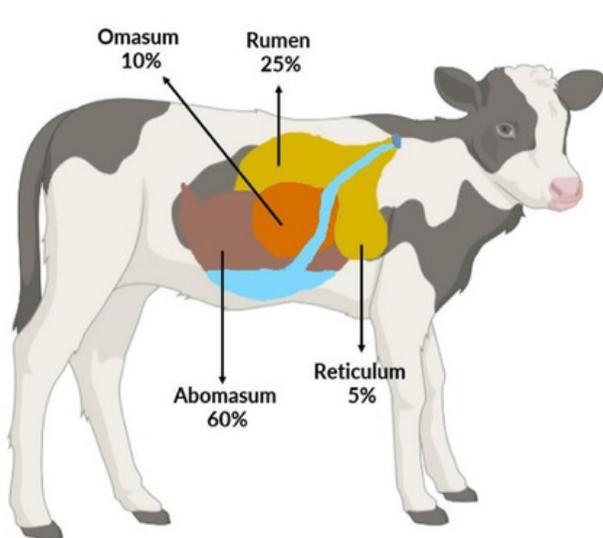


Photo credit: A. Pfau

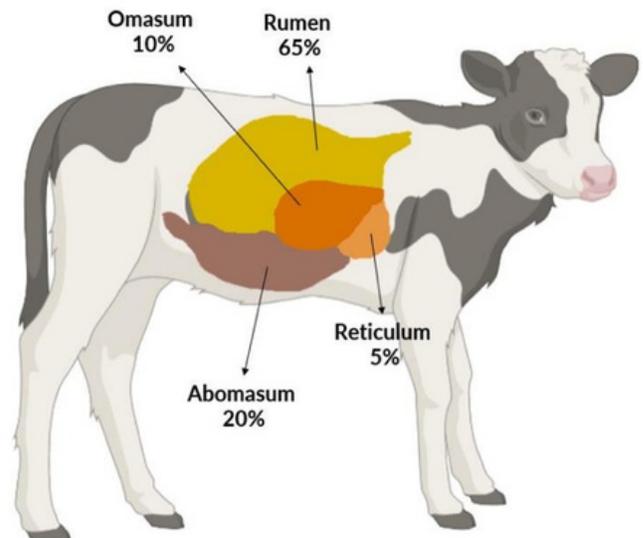


Photo credit: A. Pfau

The stomach of a 1-week old calf (left) and a 3- to 4-week old calf (right)

The rumen acts as a fermentation vat by hosting microbial fermentation, and digests about 50 to 65 percent of starch and soluble sugar consumed by the animal.

The reticulum mainly collects smaller digesta particles and move them into the omasum, while the larger particles remain in the rumen for further digestion. Heavy or dense feed and metal objects eaten by the cow drop into this compartment and may cause “hardware disease” which, if left untreated, may lead to infection and possible death.

Water absorption occurs in the omasum. It has several folds that increase the surface area that absorbs nutrients from feed and water.

The abomasum produces hydrochloric acid and digestive enzymes, such as pepsin (breaks down proteins), and receives digestive enzymes secreted from the pancreas, such as pancreatic lipase (breaks down fats). These secretions help prepare proteins for absorption in the intestines.

The esophageal groove bypasses the milk from the mouth to the abomasum. Reflex action (e.g. when the calf nurses) closes the groove to form a tube-like structure. This prevents milk or milk replacer from entering the rumen. If the calf drinks milk rapidly, some may overflow into the rumen. Milk must not pass through the rumen because its quality will be damaged by fermentation, causing the calf to fall ill, or worse, die. Milk should remain at a temperature of 30-41°C.

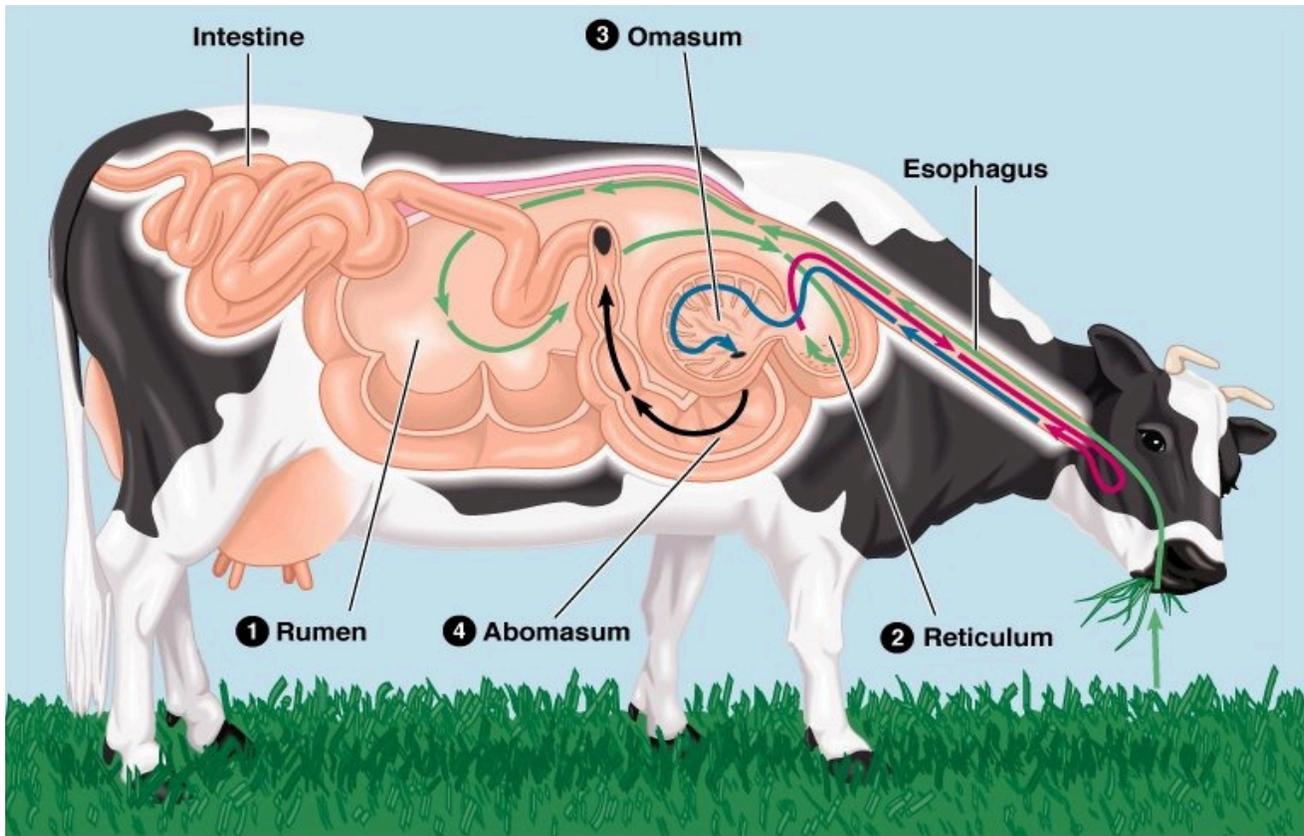
In other countries, calves are deprived of milk for 120 days. This is called creep feeding or slowly feeding solid food (high quality forage) to the calves. Temperate countries use conserved forage, silage and hay, while tropical countries like the Philippines use fresh silage. Grazing is common in both temperate and tropical countries.

Solid food develops the rumen and thus calves are gradually weaned off from milk to make them not fully dependent on it. Weaning is done on the presumption that calves are slowly introduced to solids.

The rumen will remain undeveloped as long as the calf stays on milk. Once the calf begins eating grain and forage, a microbial population will develop in the rumen and reticulum. The end products from microbial fermentation are responsible for developing the rumen.

Feeding grain with or without forage during the first few weeks of life will result in larger and heavier papillae growth in the rumen. Thus, the rumen will begin functioning like the adult’s when the calf is three months old.

In adult cows the rumen, combined with the reticulum, is the largest compartment of the stomach (84%) where the solid food undergoes fermentation. Rumen has good microbes that contain enzymes that break down fiber. Its surface area must be favorable to microorganisms to enable bacteria to penetrate the grass. This is why the cow is chewing (rumination), further masticates by regurgitation or controlled vomiting, which happens when the rumen and reticulum contract to allow food to go out and be masticated again through re-salivation.



How digestion works in an adult dairy cow

Re-deglutition is a process that moves food from the oral cavity into the esophagus before entering the stomach.

Grass is fermented to produce volatile fatty acids, mainly acetate-energy plus milk-fat synthesis, propionate, and butyrate, which are absorbed by cows as source of energy through the rumen.

Forage facilitates the production of acetate, which increases milk fat synthesis in lactating cows.

Rumen-degradable protein is digested by microorganisms in the stomach and small intestine. It is protein that is easily degraded in the rumen making the nitrogen available for the microbes in the rumen. This is necessary so the microbes can initiate digestion in the rumen. It is mostly from forage.

Rumen-undegradable protein is not digested by the microbes in the rumen but by the other compartments of the stomach and is available for the ruminant animal itself for tissue growth or lactation. This has also been called escape protein, bypass protein, or undegradable intake protein. It is usually from soybeans, fish meal, among others, and increases the microorganism population.

A symbiotic relationship exists between the cow (house, food) and microorganisms (energy, proteins). This is different from that with parasites that give nothing to the hosts.

The small intestine has three sections – duodenum, jejunum, ileum. The duodenum is where bile from the gall bladder is secreted to aid in digestion.

Nutrients not digested by the abomasum go through the accessory organ called pancreas. The pancreas has two main functions: an endocrine function that regulates glucose levels, and an exocrine function that helps in digestion by releasing enzymes to the duodenum.

The jejunum absorbs water and the five nutrients (vitamins, minerals, carbohydrates, fats, proteins) from food so they can be used by the body.

Ileum, the last part of the small intestine, connects to the cecum (first part of the large intestine). It helps to further digest food coming from the stomach and other parts of the small intestine. Food not digested in the small intestine goes to the large intestine to become excreta.

The large intestine absorbs water from material passing through it and then excretes the remaining material as feces from the rectum. The cecum is a large blind pouch at the beginning of the large intestine, approximately 3 feet long with a 2-gallon capacity in the mature cow. The cecum serves little function in a ruminant, unlike its role in horses. The colon is the site of most of the water absorption in the large intestine.

Feedstuffs:

- Roughage - refers to a plant-based feedstuff with a higher fiber content forage. The terms forage and herbage are often used interchangeably with roughage.
- Types of roughage: grass hays, legume hays, and mixtures of grasses and legumes are all types of roughage. Legume hays are generally higher in protein, energy, calcium, and phosphorus than grass hays
- Concentrates - Concentrates are a type of animal feed that are high in energy and low in fiber, and are often used to supplement the nutritional needs of animals.
- Examples of concentrates: cereal grains and their by-products, such as barley, corn, oats, rye, and wheat; high-protein oil meals or cakes, such as soybean, canola, cottonseed, and peanut; by-products from processing sugar beets, sugarcane, animals, and fish

Grass contains around 80% moisture; thus, 1 kl is reduced to only 200 g after drying. There are different moisture contents for each forage.

Pasture and forage crops:

- Pasture refers to a land with herbage or forage crops for grazing animals. It can either be native forage or improved forage. Native forage like cogon may be offered but it is poor in nutrition, thus, the need to introduce high-quality ones.
- Weeds are undesirable grass that have little nutrients and compete with Napier.
- Napier and paragrass must not be grown together in one paddock.
- Conserve forage through silage and hay. The best silage is from corn.
- Grasses, as sources of energy, must be given at higher percentage to prevent bloating. Legumes, on the other hand, are the sources of protein.
- Grass must be ensiled 24 hours after cutting, and must be flipped over to prevent heating that will invite harmful microbes. Silage needs to be stored in anaerobic conditions. In other countries, labor for ensiling is contracted to reduce cost.
- For corn, inspect the milk line (a whitish line where the liquid and solid portions of the kernel meet). A 50% moisture content will give enough dry matter. It can be ensiled right away without drying.

- In times of drought, grain residues and rice straw may still be available, but these are poor in nutrients needed for milk production, thus, the need to conserve forage.
- Ferment silage for 21 days before feeding it to the cows for best milk production and feed intake. Well-conserved forage lasts for six years.
- Things to watch out for:
 - Fungi produce micro toxins that harm the liver.
 - Silage pH must remain at 4.2 or lower.
 - Hay exposed to air will generate heat and heat-resistant molds; throw away silage with molds.

Computing feed intake:

- Body weight is the basis of computation; dry matter (DM) intake of adult animals is 3% of their body weight.
- An average body weight of 450 kg multiplied by 3% means 13.5 KG DM. Since Napier has 80% moisture content and 20% DM, dividing 13.5 kg by 20% means 6.75 kg DM, which is for beef production.
- For dairy cows, satisfy the body maintenance and production needs, say, 15 liters of milk. For the body, it means using the 2.5% of body weight formula and 10% for production needs. Thus:
 - $450 \text{ kg} \times 0.025\% = 11.25 \text{ kg}$
 - $15 \text{ liters} \times .10\% = 1.5 \text{ kg}$
 - $11.25 \text{ kg} + 1.5 \text{ kg} = 12.75 \text{ kg}$
 - $12.75 \text{ kg} / 0.20 = 6.35 \text{ kg}$
- Nutrient requirements depend on age (adult or calf) and physiological state (lactating or dry period); cow must not become too fat, which causes difficulty in getting pregnant. Give more fiber to make her feel always full.
- Feedstuff must be locally available and contain enough dry matter and the five nutrients. Aside from being economical, the feed formulated must be a palatable ration or acceptable to animals.

Nutrient management: 200kg heifer

Heifer	DMI (kg)	TDN (kg)	CP (g)	Ca (g)	P (g)
	5.4	3.2	622	21	15

Feedstuff	Nutrient Composition				
	DM	TDN	CP	Ca	P
Napier grass	2.2	55	9.5	0.42	0.39
RBd1	91.9	77.7	12.4	0.07	0.23
Soya meal	90	74	43.10	0.45	0.19

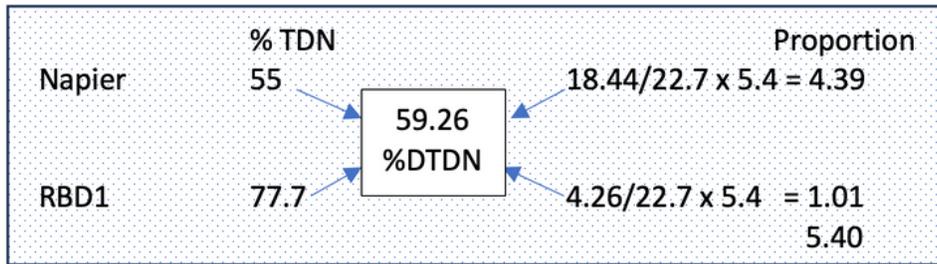
1. Check if Napier alone can satisfy the TDN requirement of the heifer:

Napier: $5.4 \times 0.55 = 2.97$ TDN, which is lacking, so, we need to add another ingredient.

2. Check if Napier and RBD1 can satisfy the TDN requirement of the heifer. Determine the proportion of

Napier and RBD1 in the mixture: % DTDN: $3.2 / 5.4 \times 100\% = 59.26\%$

Using the Pearson Square:



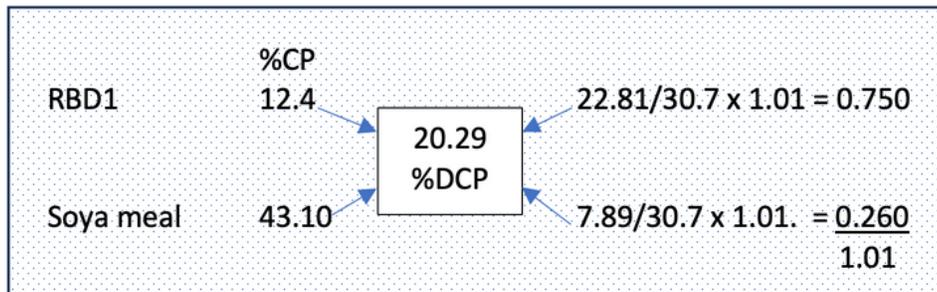
3. Check if Napier and RBD1 will satisfy the TDN requirement:

Feedstuff	DMI(kg)	TDN (kg)	CP (g)	Ca (g)	P (g)
Napier	4.39x.55	2.41	417.05		
RBD1	0.750x.777	0.58	93		
Soya meal	0.260x.74	0.19	112.06		
			622		

4. Determine the proportion of RBD1 and soya meal in the mix:

$$\%DCP = 622 - 417.05 = 204.95g / 1,010 \times 100 = 20.29\%$$

Using the Pearson Square:



5. Compute the cost:

Napier	4.39/0.22	= 19.95 x Ph2/kg	=	39.9	12.3	15.95
RBD1	0.750/0.919	= 0.82 x Ph15/kg	=	68.15/21.06 = Ph3.24/kg		
Soyameal	0.260/0.90	= 0.29 x Ph55/kg	=	_____		
		21.06				

$$200 \text{ kg (heifer body weight)} \times 0.03\% = 6 \text{ kg DM}$$

$$6 \text{ kg} / 0.22 = 27.27 \text{ kg (bigger amount than the previous calculation using Pearson Square).}$$

We might give an amount of feed that is heavier than the required amount.

Energy sources are grains, cereals and root crops, which are rich in carbohydrates but the protein content is below 20%.

Protein can be obtained from feed ingredients, legumes, marine animals. Non-protein nitrogen like urea can be fed to ruminants in small amounts.



***Dairy Mentors Training Module 3: Dairy Animal Nutrition and Feeding Management
Central Mindanao University, 21-23 November 2024***



Joy Angcod at his pasture area

Earning from Milk's Steady Flow

Two of these dairy farmers from Barangay Dalwangan in Malaybalay City only have two milking cows each, while another one from Kibuwa in Barangay Impalutao, Impasugong, Bukidnon has three. Yet, no matter how few, these animals have given them a constant source of daily income.

Cherrylene Luntap, currently the treasurer of Dalwangan Multi-purpose Dairy Cooperative (DMDC), said her husband was already a dairy farmer when they got married. Sometime later, they went into producing high-value crops.

However, prices of vegetables are unpredictable, making them incur losses several times. Those “failures,” as farmers in Bukidnon would call the instances of drastic drops in crop prices during harvest, made them decide to return to dairy farming.

“Unlike milk, you can never be sure of the prices of crops. There’s no failure in dairy farming, you wake up every morning to money from milk.

“We only have two milking cows now, producing 23 liters a day. We milk them once daily. We’re earning around 20,000 pesos a month. This is our only livelihood apart from selling forage planting materials to the National Dairy Authority (NDA),” Cherrylene said.

Charles Jomines Lunap, of Dalwangan, also said he is earning at least 20,000 pesos a month from raw milk sales. He said his cows would produce 18 liters of milk, although this would decrease to 11 liters at the later stage of lactation.

He earns, too, from selling forage planting materials to the NDA. He is planning to expand his forage area for more income and additional stock for his cows. “There are times that I have to tether the cows because I have run out of grass.”

But if there's something Charles wants to improve on, it's his knowledge about artificial insemination. He attended NATCCO's trainings on total mixed ratio and AI under the CAFÉ-DAIRY project, and was planning to join another session in Claveria, Misamis Oriental during the interview with him.

"It would be a waste if we could not respond to a cow's heat because we don't know how to do AI," he said.

Joy Angcod, of Kibuwa, had his share of "failures" as a vegetable producer before returning to dairy farming. "I started as a dairy farmer, then turned to vegetable farming, and went back to dairy production."

After five years since his return to dairy farming, Joy has three cows, which were all pregnant during the interview. That means if they will all deliver female calves his milking line will increase to six.

He averages at least 12,000 pesos from raw milk sales. He admitted though that his production fluctuates between 13 liters and 18 liters, attributing the lower output to insufficient total mixed ratio at times. Buying molasses for the UMMB is costly for him. "Instead of molasses, I'd use salt and water because my money isn't enough."

Nonetheless, he is glad that milk has provided him with a steady source of income, and has enabled him to send his children to school. Selling forage planting materials to the NDA serves to augment his earnings.

Cherrylene, Charles, and Joy are selling their raw milk to their own cooperative, DMDC, which maintains a station in Dalwangan.

CHAPTER FOUR

DAIRY ANIMAL BREEDING, REPRODUCTION AND PROPER FARM RECORDING

Attaining optimum reproductive performance in dairy farms requires detecting cows in heat in a timely and accurate manner. Poor heat detection means long calving intervals, which is economically bad to the dairy business.



The dairy farm at Central Mindanao University in Maramag, Bukidnon.

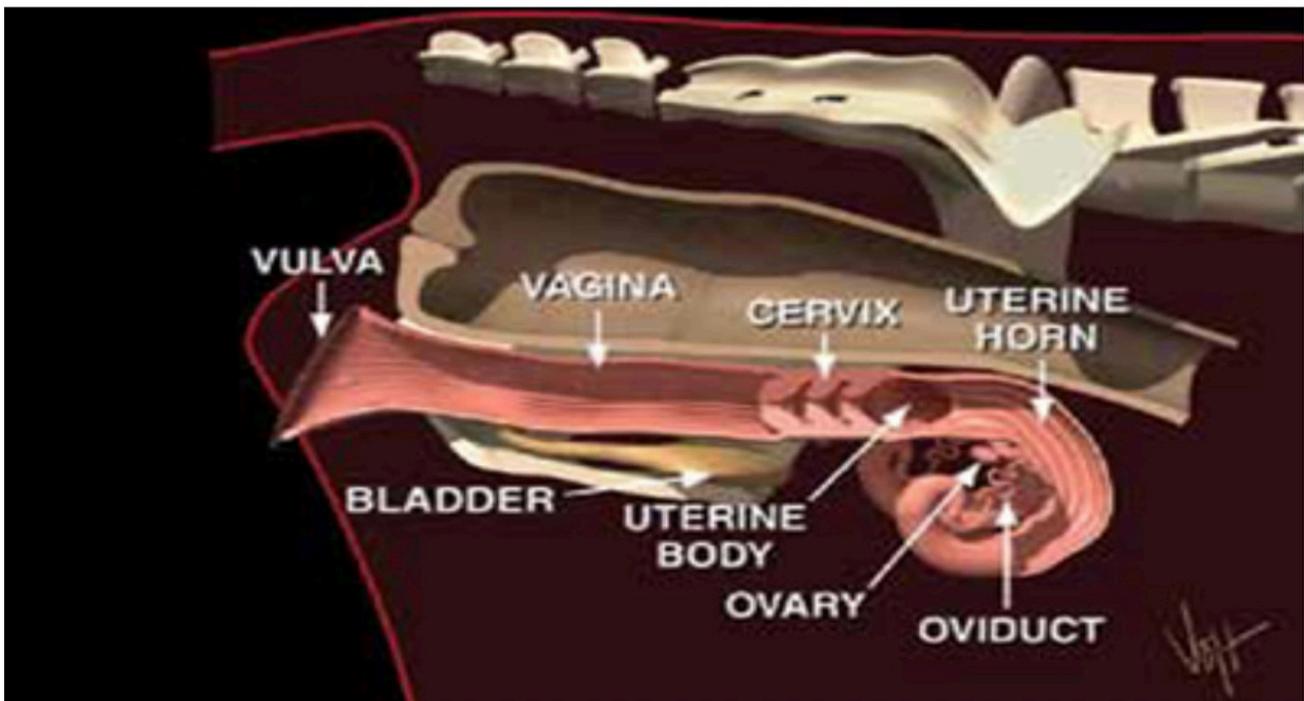
Overview of Dairy Animal

This section covers: Anatomy and Physiology; Reproductive Cycle; Estrus Cycle and Heat Detection; Ideal Breeding and Calving Age; Fetal Development and Calving; Different Breeding Methods (Natural Service and Artificial Insemination); Pregnancy Determination; and Various Technologies in Animal Breeding.

Anatomy and Physiology

The Cow Reproductive Tract

The reproductive tract of a cow comprises the vulva, vagina, cervix, uterus, two uterine horns, two oviducts and two ovaries. The rectum is located above the reproductive system and the urinary bladder is found below it.



- **Vulva** – the external opening to the reproductive system, it has three main functions: the passage of urine, the opening for mating and serves as part of the birth canal. Included in this structure are the lips and clitoris. The vulva lips are located at the sides of the opening and appear wrinkled and dry when the cow is not in estrus. As the animal approaches estrus, the vulva will usually begin to swell and develop a moist red appearance.
- **Vagina** – found immediately inside the vulva. It is where semen is deposited when a cow is bred naturally by a bull, and serves as the birth canal at calving. The vagina is acidic due to mucus.
- **Cervix** – a dense connective tissue that connects the vagina and uterus.
- **Uterus** – consists of a body and two horns. Its main function is to provide an appropriate environment for fetal development. This is where semen should be deposited when a cow is artificially inseminated.
- **Oviducts** – Also known as fallopian tubes, these are located at the end of each uterine horn and, as their name implies, carry ova, the cow's eggs. The egg cell just waits for the sperm cell for about seven hours at the oviduct where fertilization takes place.

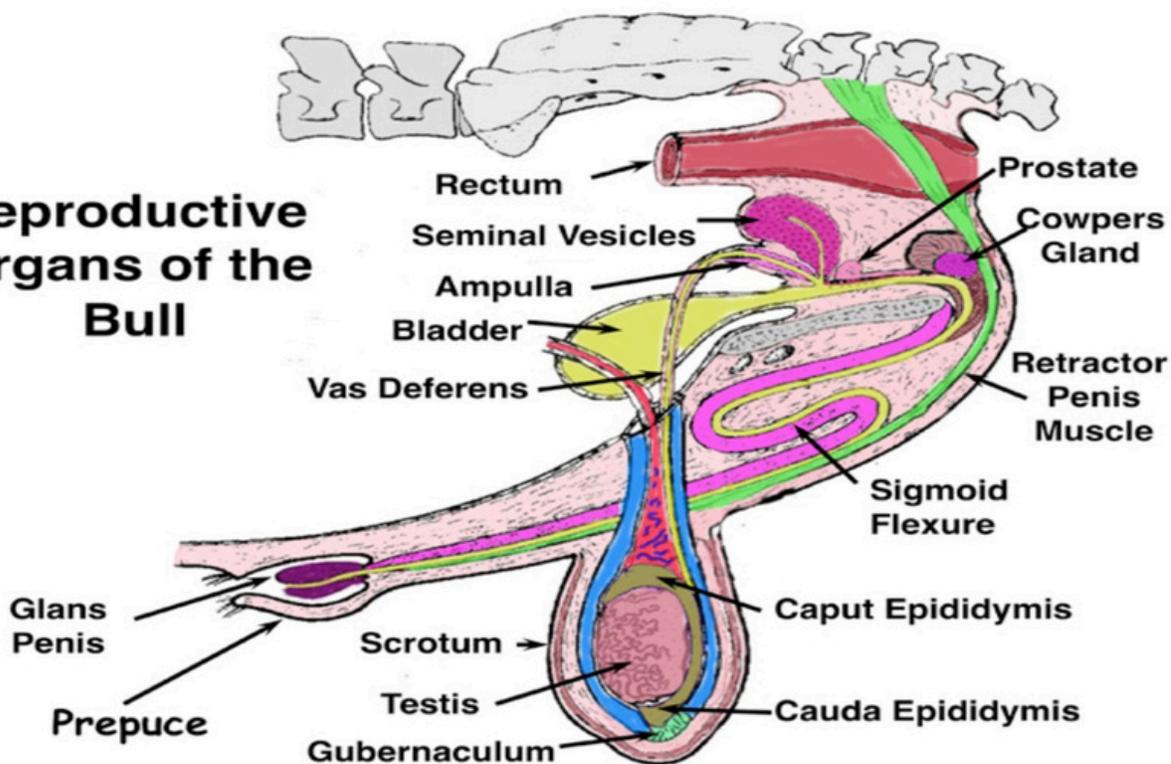
- **Ovaries** – extending just beyond the oviducts, ovaries are the primary organs in a cow’s reproductive tract. They have two functions: produce eggs and produce hormones, estrogen and progesterone, throughout the stages of the estrus cycle.
- Ovaries have follicles that house the egg cells. Follicles are the fluid-filled, blister-like structures containing the developing egg. A corpus luteum develops after the follicle ruptures and is ovulated.
- If the egg is not successfully fertilized, the cow won’t become pregnant and the corpus luteum will degenerate, and the cycle repeats itself.
- Once fertilization happens at the oviduct, the egg cell and sperm cell fuse to become an embryo, moves to the uterine horn and then the uterine body in five to seven days. If not, ectopic pregnancy occurs.
- A developed embryo (zygote) stays inside the uterus for nine months. The cervix closes during this period as a way to prevent infection.
- The calf exits through the cervix.
- Rectal palpation is done by inserting the hand into the rectum.
- Vagina can’t be seen from the outside, only the vulva.
- Vagina has varied pH (acidity). When sperms enter it, there are many mortalities, that’s why pH is sometimes controlled.
- Unlike humans, the cervix of an animal only opens if it is in heat.
- Estrogen decreases when an animal is pregnant. Progesterone takes over to help produce placenta, a temporary organ useful for nutrient exchange during pregnancy; stress affects pregnancy.

The Bull Reproductive Tract

Bulls become fertile at about seven months of age. A bull’s reproductive tract consists of the testicles, secondary sex organs epididymis, vas deferens and penis), and accessory sex glands (seminal vesicles, prostate and bulbourethral gland, also called the Cowper’s gland).

- **Testicles** – There are two testicles located outside the body cavity in an external sac called the scrotum. Their function is to produce sperm and testosterone. The testosterone travels to the epididymis where it is temporarily stored and matures (two to three days). An immature sperm has a small chance to fertilize. The amounts of sperm vary depending on the frequency of release.
- **Scrotum** – protects the testicles and regulates the temperature for optimum sperm development. The temperature should not exceed 2°C or the sperm will die. The sperm cell should remain milky.
- **Vas deferens** – a tube where mature sperm passes through from the epididymis. It unites into a single tube called the urethra, the channel that passes through the penis and is the passageway for semen and urine.
- **Accessory glands** – found in the area where the vas deferens becomes the urethra. Secretions from these glands make up the liquid portion of semen.
- **Semen** – consists of sperm and fluids and has nutrients and higher protein content
- **Glans penis** – the most sensitive part and connected to the penis
- **Penis** – the organ of insemination, which is held inside a sheath, except during service.

Reproductive Organs of the Bull



The Cow Reproductive Cycle

Estrous Cycle

The estrous cycle repeats every 18-21 days, or up to 23 days in lactating cows. It is caused by changes in hormone levels that trigger a series of events within the cow's reproductive system. The cycle begins on Day 0, when a cow is in estrus or standing heat. It is also on Day 0 that one ovary has a dominant, large follicle with an egg that is ready to be released and ovulated. The cells lining the follicle produce the hormone estrogen, which is responsible for all visible signs of heat.

On Day 1, the follicle ruptures and releases the egg in what is called ovulation. Over the next five to six days, the corpus luteum forms at the site where the egg was released from the ovary, producing progesterone. After ovulation, the estrogen level decreases to stop the cow from showing signs of heat.

On Day 16, if fertilization occurs, progesterone takes over to prepare the uterus for implantation of embryo and prevents the cow from returning to estrus by regulating the release of hormones by her brain. If no embryo is detected from Days 16 to 18, the uterus produces prostaglandin, which destroys the corpus luteum to stop the release of progesterone. Prostaglandin increases the secretion of luteinizing hormone, stimulates the dominant follicle to produce estrogen, and brings back the cow into heat.

Note: The term **cycle** refers to days, while **period** refers to hours. The latter is used for the observation of heat, which lasts from 18 to 24 hours, as opposed to the estrus cycle that starts from Day 0 to Day 20.

Heat Detection: Know the Signs of Heat

Signs of Heat	
Standing still when mounted*	Loss of appetite
Mounts other cows	Bellowing
Swelling/moistness/redness of vulva	Erect ears
Clear mucus discharge from the vulva	Smelling other cows and licking
Nervousness, restlessness	Decreased milk production**
Frequent urination	Unusually friendly
Increase in body temperature	Roughed up hair on tail, head or rump

* A cow standing still for an average of four to six seconds at a time when mounted is the most reliable sign of heat. She will accept service from a bull or by a technician (artificial insemination).

** Dry off the cow once milk production goes down to 8-10 liters. Forced dry-off can be done by feeding only hay (no nutrition).

There are factors affecting estrus detection efficiency. These include management factors such as heat detection protocols, estrus detection aids, and controlled breeding programs, all of which can be controlled. Physiological factors, particularly, estrus behavior in lactating cows, cannot be controlled.

Estrus detection protocols

- Check for heat a minimum of 3 to 4 twenty-minute periods evenly spaced throughout the day
- Move the cows to a dirt lot or exercise area with good footing for heat detection. Cows that are on dirt experience heat quicker than those that are staying on floor/concrete surfaces. Mounting activity is 15 times greater for the former.
- One person should be in charge of heat detection.
- Don't combine heat detection with other activities such as feeding, milking or scraping.

Estrus detection aids

- Heat monitoring through Radio Frequency Identification (RFID)
- After undergoing AI, a cow's tail is painted and inspected after 21 days. If the paint is erased, it means she is again in heat and is subjected to another round of AI. (A cleanup bull would be used for beef-type cows.)
- Visual observation plus heat detection aids equals better estrus detection efficiency.
- Pedometry: possibility of detecting heat in cows through the sounds they make. This is based on South Korea's experience in pigs.
- Pressure-sensitive heat mount – applied with glue and placed on the rump between the hip and pin bones, and are activated after four to five seconds of continuous pressure such as a cow mounting another cow's rump. The pressure causes the detector to change colors so dairymen can identify cows that have already been ridden and are likely in standing heat.

- Tailhead chalk or paint – applied to a cow’s tailhead, in a strip about 12 inches long and two inches wide. Tailhead markings must be touched up daily for a consistent look and easy detection of changes.
- Pedometers in legs, collars – measure steps cows take throughout the day; also detect animal body condition; monitors every two hours for one month (baseline); can monitor cow activities like rumination; tells when AI may be administered; not practical for small farms due to high cost; collars expire after five years
- Teaser bull

Ideal breeding and calving age

Breed	Birth Weight (lbs.)	Breeding		Calving		Average Daily Gain (lbs.)	Adult Weight (lbs.)
		Weight (lbs.)	Age (mo.)	Weight (lbs.)	Age (mo.)		
Holstein, Brown Swiss	88 – 100	793 – 881	14 – 16	1199 – 1366	23 – 25	1	1433 – 1598
Guernsey, Ayrshire	77 – 88	606 – 683	13 – 15	992 – 1102	22 – 24	1	1157 – 1278
Jersey	55 – 66	496 – 573	13 – 15	793 – 936	22 – 24	1	936 – 1102

There are cows called **silent heaters** or those that do not manifest outward signs that they are in heat. They should be culled along with those that don’t get pregnant in one year, to save on feed expenses. The aim is for a cow to produce one calf per year.

Productivity is just one of the factors for culling. The others are health and reproduction (failure to conceive).

Breeding Methods

- Natural service – traditional method of breeding where a male and female animals mate naturally; less reliable than using AI sire because fewer daughters of the bull have been observed; also, keeping mature bulls can be dangerous and they can introduce venereal disease into a herd.
- AI – manually depositing semen into the female’s reproductive tract at the time of heat. Its advantages include access to thousands of sires; faster genetic progress; intense selection for genetic merit; rule of thumb on the AM:PM protocol since ovulation occurs 16 hours post standard heat.
- AI is simple but difficult to learn, and requires practice before proficiency is acquired.
- Don’t use animals with records of low production.
- In choosing bulls, look into the milk production performance of the mother and sibling cow.

AI or natural service?

There are some disadvantages of natural service. For one, when several cows are in heat but there is only one bull, it translates into higher cost of feeding since you have to wait again for some weeks for the estrus to recur among the cows that were not serviced. Moreover, senior bulls tend to be dominant, and infections could happen through natural mating.

When to mate/inseminate the cows

- Observe the AM-PM rule: If estrus is observed in the morning, mate in the evening; if it is observed in the evening, mate in the morning.
- For AI, the same protocol applies: If estrus is detected in the morning, do AI in the evening; if detected in the evening, do AI in the morning.
- The best time to inseminate is 4-16 hours after estrus is observed.

Fixed AI/ Synchronization	Sexed Semen	Multiple Ovulation Embryo Transfer	In Vitro Fertilization
Giving cows hormone injections over a specific period of time	Done to increase numbers of dairy female replacements born and to reduce the number of dairy bull calves born	Removing fertilized eggs from a cow or heifer and transferring those eggs into recipient animals	A process where unfertilized eggs (oocytes) are collected from the cow's ovary and placed in a maturation media in a petri dish that will help them mature
Useful if you want to breed a group of cows at the same time, are planning to perform embryo transfer work or if you have a cow that is not cycling normally	90-percent accurate and allows producers to increase the number of heifer calves while lowering calving difficulty	Allows owners to produce more offspring from an elite female than would be possible through normal calving	The petri dish is then placed in an incubator for 18 to 24 hours after which the sperm are added the next day so fertilization may occur
	For this procedure, heifers are preferred in managed/controlled farms		

Enhanced AI (PGF2a-based Estrus Synchronization)

- Observe for 72 hours for heat manifestation before giving AI.
- PG injection will cause abortion if the cow is already pregnant.
- Don't force giving hormones; some cows tend to look mature even if they're still juvenile due to their huge bodies.

Conception Rate Vs Pregnancy Rate

- Conception rate refers to how many cows that undergo AI get pregnant.
- Pregnancy rate is the total number of cows that undergo AI multiplied by the number of those that get pregnant.
- As an example, take a dairy herd with 100 cows eligible to breed:
Heat detection rate = 60/100 or 60%
Of the 60 cows inseminated, 30 became pregnant.
Conception rate = 30/60 = 50%
Pregnancy rate = 60% x 50% = 30%
- Conception rate depends on semen handling and the cow's physiological and nutritional status, and whether it has experienced stress or not. This applies to both local and imported semen. § Even if the semen is imported, it can adapt to the local environment. It is more costly but has a good pedigree.

Threshold of Managing Cows

- Nutrition is key. Malnourished cows won't experience heat. Dairy cows need not be fat, a body scoring must be around 5 for quicker pregnancy. Increase the quantity of feeds only after they get pregnant.
- If cows experience heat stress, their egg cells will be wrapped by cuticle, and it would be hard for the sperm to penetrate. Imported cattle ideally thrive at 18°C. In the Philippines where the climate is hot, the more they eat, the more heat they get, so they lose appetite. These cattle are not designed for pasturing in the Philippines, although their offspring may survive because they have adapted to the local environment.
- Site-specific selection of breeds should be observed in the Philippines due to its environmental conditions. It is better to develop island-born breeds suited to local conditions.
- It is all right to import breeds as long as correct management is applied. If there's already a stock in a particular area that can produce an average of 20 liters, then we should get our stocks from there. We can develop a breed that can be a source of stocks.

Artificial Insemination

Preparations for Insemination and Sanitation

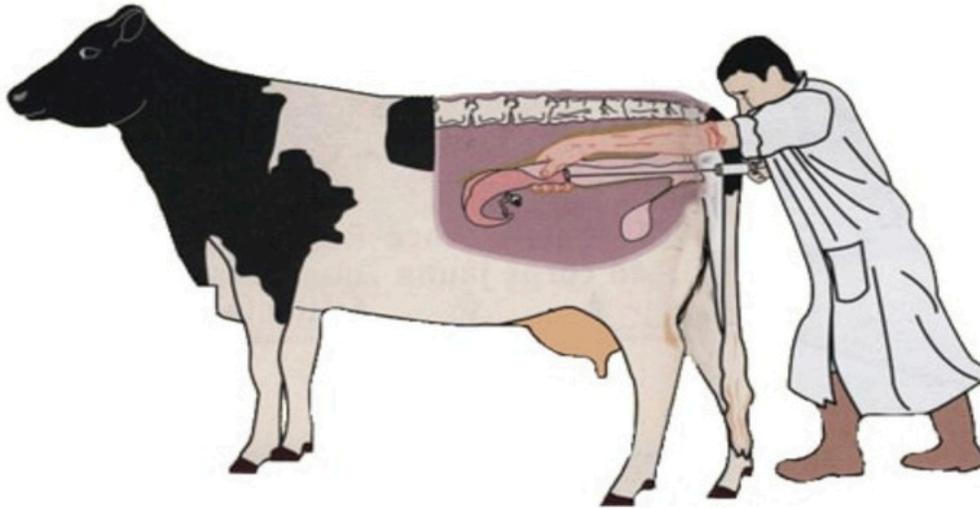
- Ensure that the cow to be bred is truly in heat. Past research studies have indicated that as many as 20 percent of the cattle inseminated are not in heat.
- Restrain the cow first, do pregnancy diagnosis, and then thaw the semen to 35-36°C up to 10 seconds using a thawing jar and a thermometer. The restraint area should be familiar to the cow and free of stressful conditions. Unnecessary excitement may interfere with physiological mechanisms important to achieving a good conception rate.
- Use clean cutter/scissors for the semen (which is frozen).
- Develop good sanitary procedures and insemination practices. It is easier to learn good habits than to break bad habits.
- Insemination supplies should be kept dry and clean at all times. Breeding sheaths should be stored in the original package until used.
- Once the insemination device is assembled, it must be protected from contamination and cold shock temperatures.
- Materials used to lubricate the rectum should not come in contact with the vulva region. Lubricants are generally spermicidal. Avoid using products that are irritating.
- Use one hand glove for each animal to prevent zoonotic diseases that can inflict humans.



Tools and Materials Needed: Liquid nitrogen tank, long gloves, insemination rod, paper towels, straw cutter, sheath, semen straw, warm water bath, thermometer, rubbing alcohol, clock, record books

Key AI Techniques/Tips

For insemination to be done, hygiene should be practiced; the outside tract of the cow should be washed to remove manure and contaminants to the reproductive tract of the cow. The straws will be cut and fitted into the sheath, then it is fitted into the insemination rod. The gloved arm grasps the cervix and the insemination rod is inserted then inseminated to the vagina of the cow. The whole process should be done within less than 15 minutes.



- Be careful in doing rectal palpation. Let the cow know that you are there as you approach her from behind.
- Form a cone with the fingers of your gloved hand when inserting it into the anus.
- When cleaning the rectum, don't fully remove your hand (to prevent entry of air).
- Clean the vulva with clean paper towel.
- Enter vagina at 45-degree angle with the AI gun, to avoid hitting the bladder.
- Make sure the AI gun is in the body of the uterus to ensure it won't fall even if no longer held.
- Gently squeeze the end of the cervix and guide in the gun.
- Manipulate the cervix to move the gun past the cervical folds and rings.
- Move the tip of the AI gun forward until you can feel the tip with your middle finger.
- Slowly deposit the semen. You have five seconds to inject, then remove.
- If the animal moves during AI, wait until movement stops and reposition the AI gun. If there is bleeding, stop and reposition the gun.
- After depositing the semen, slowly remove the AI gun. Check the tip of the AI gun for blood, which means the uterine lining is possibly damaged and the cow won't conceive. A pus on the tip means a possible infection. Make sure the straw and sheath are still intact.
- Observe the AM/PM rule, i.e., if estrus is detected in the morning, do AI in the evening; if detected in the evening, do AI in the morning.
- Infection of the uterus needs to heal first for AI to succeed, otherwise, no pregnancy could occur.
- Nutrition is the key; changing a cow's diet after AI can cause stress.
- Carabaos experience heat usually during the night; heat detection should be done before and after 6 p.m. so AI can be done at the right time.

Semen handling

The semen is kept at a temperature of -196°C by storing it in a tank containing liquid nitrogen. The semen in storage is called straws. The tank where it is stored has to be insulated to control temperature changes, and must be kept clean, dry and well-ventilated. Avoid moving the semen as this will tamper with its quality.

- Wear gloves and safety glasses as protection from liquid nitrogen.
- Handle straws with tweezers.
- Thaw straw in a warm water thermos – $35\text{-}37^{\circ}\text{C}$ in 10-30 seconds.
- Semen should be placed into the cow within 15 minutes after removal from the tank. If AI is not done within this time period, return the semen to the cannister so it won't die.
- Warm the gun if it is cold outside.
- Be sanitary.

Semen tank storage

- Semen tank should be visible all the time.
- Keep the tank off concrete flooring.

Dairy Breeding Plan

A plan is a projection or estimation. In the case of dairy breeding, it should cover five years and ideally use Holstein-Sahiwal that's already well-adjusted to Philippine conditions. But in its absence, what's existing in the farm may be used.

The plan should have a title and the name of the farm implementing it, and should carry one objective at a time, e.g., to improve milk production (specific amount of increase which is at least 10 percent, although 15 percent is the standard); fertility (cull it out if poor performance is genetic in nature); longevity and reproductive performance. Also observe record-keeping.

Attaining optimum reproductive performance in dairy farms requires detecting cows in heat in a timely and accurate manner. Poor heat detection means long calving intervals, which is economically bad to the dairy business.

Selection of breeding stock

- Select sires with pedigree record in terms of milk yield (pedigree record); health; fertility and calving ease; high genetic reliability; temperament (docile); tests (e.g., diseases). One caveat is that phenotype, or a set of observable traits, is not always reliable.
- Select dams based on milk production record, fertility performance, udder and teat appearance, disease resistance (tests), and temperament.

Breeding strategy

- Breeding methods – AI or natural
- Mating system – selective breeding, crossbreeding
- Breeding season – year-round AI with heat detection and synchronization
- Calving interval (from one pregnancy to the next) – 365-400 days; 9 months gestation period; to restore nutrition to the cow for a well-nourished fetus during the next pregnancy; it depends on farm practices

Heat detection and reproductive management

- Heat detection methods – heat detection patches, activity monitors
- Pregnancy diagnosis – estrus synchronization; rectal palpation
- Culling policy – remove cows with repeat breeding issues, e.g., unsuccessful AI; consider factors like availability of replacements, genetics, feeds, government support

Estrus synchronization is the process of manipulating the estrus cycle that results in standing estrus (heat) in the majority of animals in a short time. It is effective in increasing the number of animals bred at a particular breeding season. It has several systems, each requiring one or more hormones with a specific schedule of treatment and dosage the use of which needs consultation with a veterinarian. In developing countries, however, the use of this system is limited to intensively managed farms or smaller farms with links to farmers organizations that routinely use AI.

Genetic improvement plan

- Performance recording – milk composition (especially fat which can be homogenized if high), conception rate; fertility metrics; milk composition; cooperatives should maintain data
- Culling and replacement strategy – Remove cows with low milk production, poor fertility and health issues; retain and raise top 20-50 percent of heifers as replacement.

Nutritional support for breeding success

- Pre-breeding diet – high energy protein-rich diet for large animals
- During pregnancy – balanced minerals and vitamins to support fetal growth
- Post-calving nutrition – no immediate isolation of calves to prevent stress

Performance evaluation

- Quarter/annual review of herd performance – monitor milk production trends; assess breeding efficiency (conception rate, culling and replacement rates)
- Adjust sire selection – rotate bulls every 3-4 years to prevent inbreeding (for stay-in bulls)
- Full sibling mating – effects

Expected outcomes

- Increased milk yield
- Improved fertility and calving ease
- Reduced disease incidence (mastitis, metritis and metabolic diseases like ketosis or lack of carbohydrates)
- Higher probability through efficient breeding

Record-keeping In Dairy Farm Management

Records serve as future reference, thus farmers need to document their farm activities using computerized or manual means, although most farmers in the Philippines are not using digital technology yet. Farmers keep no records of their activities because they have no appreciation of its benefits, e.g., knowing the cost that will enable them to go beyond the breakeven mindset.

The farm activities that should be recorded include:

- Daily milk production, including sales – recorded monthly and should be placed within the milking parlor
- Milk distribution
- Breeding calendar
- Dairy breeding register – date of pregnancy diagnosis, date AI was done, cow ID, semen used
- Dairy health – diagnosis, treatments, names of technicians, daily health record
- Dairy services – dehorning, deworming, deticking
- Record of farm implements and equipment – includes chopper, milking machine, grass cutter
- Financial transactions/purchases – fuel, feeds, utilities, labor, veterinary services, repairs, equipment
- Sales records – milk, manure, forage
- Methods of identification – mechanical (branding, tattooing, ear tags); biometrics (RFID); electronic methods



***Dairy Mentors Training Module 4: Dairy Animal Breeding, Reproduction, and Proper Farm Recording
Central Mindanao University, 26-28 March 2025***



Ching Lumanta during a visit to an agricultural learning site in Cabanglasan, Bukidnon

Home Is Where the Herd Is

Most people would opt to retire in places where they first saw light and grew up. Marilou M. Lumanta isn't one of them. After retiring from the National Dairy Authority, Ching, as she is fondly called, went to Barangay Dalwangan in Malaybalay City, Bukidnon in 2022 from her home province Bulacan.

It wasn't her first time in Bukidnon, though. Her stint at NDA, the successor-in-interest of the Philippine Dairy Corp. which was abolished upon the enactment of Republic Act 7884, had brought her to the province in the 1980s as a development organizer and one of the technicians. She spent three years in Dalwangan where she'd go to different farmers to check on their progress in making barns and forage production, a requirement for them to avail of financial assistance from the agency.

A graduate in Animal Science, she stayed at the Malaybalay Stock Farm operated by the Department of Agriculture, where the PDC placed 2,000 heads of cattle imported from Australia.

"I was tasked to go to areas and convince farmers to go into dairy production. It was a new idea for them, they didn't even know there are black and white cattle. They didn't know Sahiwal breed, they only knew Brahman," Ching recalled.

"I talked with the barangay chair and some farmers to form a group to avail of assistance from the government program. We had to form an organization of at least 25 farmers. I remember that we held our meetings in a farmer's house to accomplish the requirements and define the roles of each member in the group," she added.

During her stay in Dalwangan, the barangay chair asked her if she was interested in buying a piece of land there. She said she wasn't keen to the idea at first, but later relented.

"What will I do with it?" she asked herself because she's not a resident of the place. Nonetheless, she shelled out 2,000 pesos for the "rights" to the land. "I said I'll retire here perhaps, because this is a good place, cool and conducive to farming. I love farming."

From Dalwangan, Ching was assigned in Manila and went to other areas doing the same tasks. She took on many assignments and changes in her job description before becoming executive assistant to the NDA administrator in 2019, the last post she held until her retirement.

After leaving the service, Ching found herself going back to Dalwangan. She, however, was disappointed that the dairy cooperative she had helped form (Dalwangan Multi-purpose Dairy Cooperative) had not made progress due to mismanagement. “They had money but only a few people benefited, so I joined as a member.”

“There are many members on paper, but only 45 were active and only around 20 of them have cows. I became auditor, and in March this year (2025), I was elected vice chair,” she said.

In 2024, the cooperative received a dividend from the federation it is affiliated to.

“The manager previously had no compensation, only dedication. We chipped in amounts for our food during meetings. But now he is receiving an honorarium of 3000 pesos after we got a fund from the federation. The board members received 2000 pesos during board meetings or general assembly meetings,” she said.

Ching had never missed a session of the seven-module training for dairy mentors organized by NATCCO. And, as expected of her as one of the dairy mentors, she has been sharing her knowledge about dairy farming techniques to the other members of the cooperative, as well as helping the cooperative improve its management systems.

For her, it’s a different kind of homecoming – going back not to a childhood sanctuary but to a place where she has found a sense of mission.

CHAPTER FIVE

DAIRY ANIMAL CALVING, CALF REARING, AND CALF MANAGEMENT

Good calf rearing (from day of birth until weaning) practices means producing healthy calves, thus, proper feeding, bedding, sanitation, ventilation, prevention of health problem and close daily observation must be applied.



Dairy farm of Baclay Multi-Purpose Cooperative in Labangan, Zamboanga del Sur.

Objective of Good Herd Management

The aim of good herd management is to prolong the productive life of cows. Hence, it is important to understand what happens during a cow's pregnancy and the calving process, as well as proper calf management.

Calving

Calving is the birth of a calf followed by the expulsion of placenta and parturition. It is important to know the calving date, which is plus or minus three to five days.

Parturition is the process of delivering a fully developed fetus from the female from the uterus after completion of the natural gestation period, which is 283 days for cows and around 330 days for carabaos (buffaloes). Gestation is reckoned from the time the embryo enters the uterus, which is two to three days after fertilization that occurs in the oviduct.

Pregnant cows should not experience stress as it may cause abortion.

Cows show the following signs during calving: enlargement of the udder; relaxation of the pelvis ligaments; depressed or hollow appearance on either side of tail head; vulva enlarged in size; discharge of liquified mucus; and uneasiness.

Stages of Calving

An increased understanding of the physiology of the parturition process is helpful. It enables the farmers and/or dairy workers to make sound decisions about providing assistance. Parturition or "calving" is generally considered to occur in three stages.

Stage 1: The first stage of parturition is dilation of the cervix. The normal cervix is tightly closed right up until the cervical plug is completely dissolved. In stage 1, cervical dilation begins some 2 to 24 hours before the completion of parturition (2 to 6 hours would be most common).

Stage 2: The second stage of parturition is defined as the delivery of the newborn, which could last from 2-10 hours. It begins with the entrance of the membranes and fetus into the pelvic canal and ends with the completed birth of the calf. Other texts state that it lasts from 2-5 hours, while some studies indicate shorter periods.

Stage 3: The third stage of parturition is the shedding of the placenta or fetal membranes. In cattle this normally occurs in less than 8 to 12 hours. The membranes are considered retained if after 12 hours they have not been shed. Years ago it was considered necessary to remove the membranes by manually "unbuttoning" the attachments. Research has shown that manual removal can be detrimental to uterine health and future conception rates. Administration of antibiotics usually will guard against infection and the placenta will slough out in 4 to 7 days. Contact your veterinarian for the proper management of retained placenta.

A retained placenta leads to poisoning, thus the need for flushing. Another technique is hanging a bottle from the placenta to pull it out. In Europe, they would pull it out with the hand.

Dealing With Difficult Calving (Dystocia)

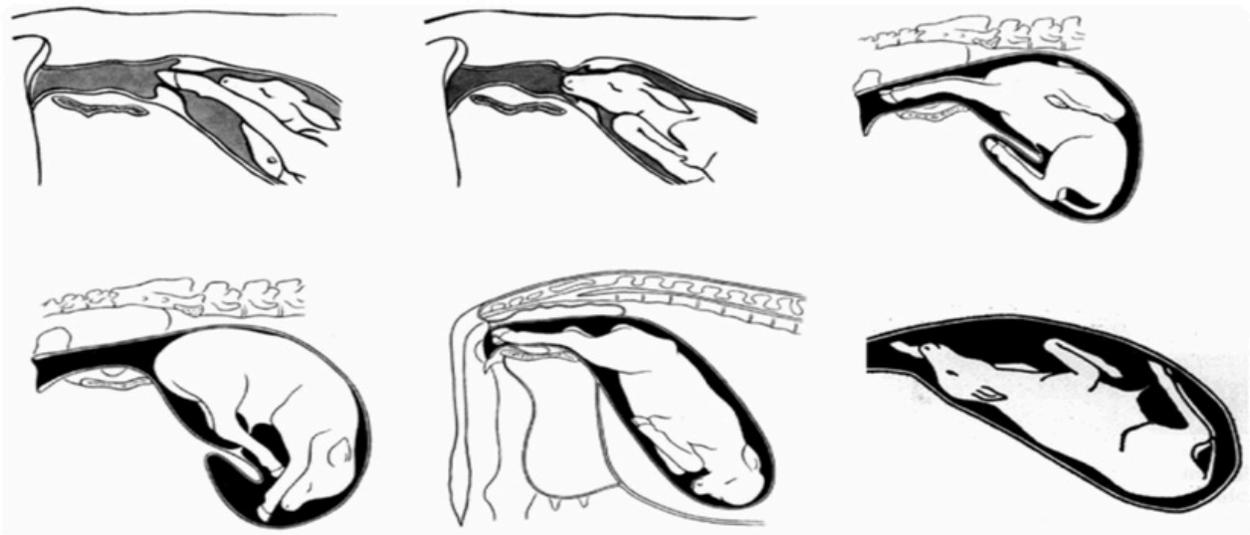
Cows should take 30 minutes to one hour to calve – no more than two hours. Heifers should take two to three hours to calve – no more than four hours. There should be progress every 20 minutes, otherwise, intervention may be needed.

Before doing any intervention, assess the calf presentation. Normal presentation is when the two front feet and head move through the pelvis first. The feet and head of the calf create a wedge which assists in opening the birthing canal. Even if a calf is in the right position, assistance may be needed if the calf is too big for the cow. The calf may need to be rotated to fit through the pelvis.

A calf in normal presentation.



Examples of abnormal presentations



Intervention is needed if calving is not proceeding normally. Keep in mind though that assisting a cow in dystocia event can neither be done too early once stage 2 labor has started, nor too late as it can result in a dead or weak calf.

When assisting with calving, wash and disinfect arms, hands, the vulva and all equipment to prevent contaminating the uterus. Wear gloves to prevent spreading bugs between you and the cow and vice versa. Use plenty of lube to protect the cow, and to help make the calving easier for you and her. Correct the calf position and assist the cow to calve with gentle traction as she pushes. Call for help if you are not making progress.

If you need to correct the calf presentation, be sure to cup the calf's hooves or teeth with your hand to help protect the cow's uterine wall from being damaged. Ask a vet or anyone who is experienced in calving cows if you are unsure how to correct an abnormal presentation.

Calving ropes, chains, jacks, or pulleys can be used in pulling out the calf, but they must be correctly used so as not to harm the cow or her calf. A moving vehicle must not be used to provide traction to assist calving. Giving contraction hormones such as oxytocin and prostaglandin (used in other countries) may also be resorted to.

If the cow or heifer has not dilated appropriately yet, use some patience and manually dilate the cervix and vagina by applying firm steady pressure with your hands and arms inserted into the birth canal. Make sure the cervix and vagina have dilated appropriately before you try pulling the calf, or you can cause some tearing of the tissue.

Post-calving/Post-calving Complications

Cows will undergo involution or shrinkage of the uterus within 40 days, and ovulation in as early as 15 days but will only be in heat within 60 days after calving.

As explained earlier, some cows that have calved experience retained placenta or the failure to expel the placenta within 12 hours of calving. It should be removed manually. Repeated oxytocin or prostaglandin injections may be applied in severe cases to facilitate uterine evacuation. Prostaglandin can induce heat. This complication can be avoided through proper sanitation during calving and proper nutrition during dry period.

Cows that have just calved and are in early lactation may suffer from metritis or inflammation of the mammary gland due to the invasion of microorganisms. Symptoms include swelling, redness and heat in the affected udder quarter; hardness or abnormal firmness of the udder; pain upon palpation, leading to discomfort in the cow; discolored, bloody or foul-smelling milk; and decreased milk production.

Calf Rearing

During calving, assist when needed. If there are complications, call a vet if necessary.

Observe the calf. If it refuses to suck milk, it is a sign of depression. If it lies down, it lacks calcium. Provide the nutrient through intravenous method as forcing it to stand will cause stress. Apply oral method using a gun if it is not severe. However, we must know how to diagnose because sometimes it is not lack of calcium but injury.

Good calf rearing (from day of birth until weaning) practices means producing healthy calves, thus, proper feeding, bedding, sanitation, ventilation, prevention of health problem and close daily observation must be applied.

What to Do Within the First Hour of Birth

Make sure the calf breathes. Breathing problems are associated with difficulty of calving. If the calf is not breathing, do the following:

- Clear the nose and mouth of mucus.
- Lay the calf with its head lowered or lifted upside down for a few seconds.
- Apply artificial respiration by alternately compressing and relaxing the chest walls.
- Respiration may be stimulated by tickling the calf's nostril with a piece of straw or by pouring cold water on the head.

Dry the calf (optional). A wet calf in a windy environment is likely to get cold and sick rapidly.

- When the calf is kept dry and protected from draft, the environmental temperature can go well below 0°C without affecting the calf's health. In most cases, only a few cm of umbilical cord remains attached to the calf.
- Clean straw or a sack may be used to rub the calf dry at the time of birth. The umbilical region should be soft and pliable (no infection).

Identify the calf. Each farm has its own method of identification. Newborn should be identified in a permanent fashion and birth date should be recorded in an individual permanent record.

o Methods of Identification:

- Neck strap or chain with a number
- Metal or plastic ear tag
- Ink tattoo (not ideal for cattle)
- Freeze brand (banned under Animal Welfare Act) – it uses liquid nitrogen at -196 degrees and the cost is high
- Others (photograph or sketch of animal's marking)
- Ear tags – with chip or without chip

Feed colostrum. Colostrum, the thick, creamy, yellow secretion collected from the udder after calving, gives the calf passive immunity. It is different from the secretions from the second to the eighth milking day which are called transition milk because the composition gradually becomes similar to that of whole milk.

Colostrum provides antibodies needed to protect newborn calves from many infections that may lead to diarrhea & death. Antibody concentration in colostrum is 6% (6g/100g) with a range of 2-23%, while antibodies in milk is only 0.1%.

Immunoglobulins in colostrum boost immune system so calves would be less morbid. More than 22 percent of calf mortality could be attributed to a lack of immune resistance. If colostrum is of questionable quality, a previously frozen high quality may be thawed and offered to the newborn.

- How much colostrum should be fed?
 - 1.25 to 2.5kg per meal (not >5% BW)
 - Should be for the first 3-4 meals on day of birth (within 24 hours). In Australia and Denmark, calves are given colostrum once with the recommended amount of up to 4 liters.
- When should it be fed?
 - First meal should be given as soon as the calf is breathing and not later than 1 hour after birth.
 - Within 24 hours after calving is the best absorption period for colostrum.
 - When first feeding is delayed, more frequent feeding within 24 hours is needed.
 - No other feed before the colostrum – 1st meal within 1st hour; 2nd meal within 6-9 hours
- How to feed?
 - Colostrum warmed to body temperature (39°C) in a water bath and fed with a pail or bottle equipped with a clean nipple
 - Equipment (bottle, stir stick, measuring cup, etc.) must be thoroughly cleaned after each use.
 - Thawing for frozen colostrum
 - Bottle feeding is not practical in large-scale operations as it takes time compared to using gun.

How is colostrum quality evaluated?

To assess colostrum quality, both the amount and types of antibodies must be considered.

- Amount of antibodies:
 - Visual observation: a thick creamy colostrum is rich in antibodies
 - Concentration of antibodies in C is influenced by numerous factors:
 - Inadequate length of the dry period (<4 weeks) or no dry-off period, premature calving, milking before calving and milk leakage before calving.
 - The age of the cow: Higher in older cows (>8%) and produce more diverse antibody than first-calf heifer (5-6%)
 - The Breed: Lower concentration in Holstein Friesian (6%) than in Ayrshire, Brown Swiss, Guernsey, and Jersey (8-9%), although the Holstein Friesian breed gives the highest volume of colostrum

What are antibodies?

- Antibodies or Immunoglobulins are proteins normally found in the bloodstream.
- Vital components of immune system – responsible in giving protection to animal from organisms that cause diseases, e.g., pathogenic bacteria in gastrointestinal tract, particularly the large intestine; beneficial bacteria aid in digestion; there must be balance between them; stress could disturb the balance (bad bacteria dominate), thus the importance of microbiota
- They help identify and destroy bacteria and other foreign particles (antigen) that have invaded the body
- Antibodies are not present in the bloodstream of newborn calves because they cannot cross the placenta during pregnancy.
- Antibodies are absorbed through the intestine.
- Mortality of newborn calves increases dramatically in the first few days and weeks of life if antibodies are inadequate in the blood.

How do antibodies fight infection?

- They contain several types of antibodies.
- IgG and IgM destroy antigens or micro-organisms that have entered the blood (systemic infections). Less IgG in blood means lower resistance.
- IgA, a third type antibody, protects the membranes that line many organs against infection, especially the intestine, & prevents antigen from entering the bloodstream.

Feeding milk and milk replacer:

- The Stomach of Newborn Calf
 - The calf's digestive system is not fully developed at birth but undergoes drastic development during the first few months of life.
- Milk Digestion by Calves
 - Milk is digested primarily by acids and enzymes (Pepsin, Rennin and HCl).
 - Other milk components (whey protein, lactose and most minerals) separate from the curd and pass into small intestine rapidly-200 ml/hr.

Types of milk that can be fed:

- Fermented milk – Colostrum, transitional milk or whole milk stored at room temperature (lower than 21°C) will ferment. But compared to whole milk, feeding fermented milk reduces the average daily gain of calves.
- Whole milk can be fed after weaning, after colostrum and transitional milk feeding phases.
- Mastitic milk can be fed to calves as long as contact between them is not allowed for at least 30 minutes after feeding to prevent bacteria that cause diarrhea and pneumonia and other infectious agents to be transmitted from calf to calf. Giving milk containing antibiotic residues may result in antibiotic treatments becoming less effective over time.
- Skim milk – relatively high in protein but less energy (50%) and fat-soluble vitamins (Vitamins A and D) than whole milk because the fat has been removed
- Milk replacers – may be given at 4-6 days of age; usually contain less fat and thus less energy (75% to 86%) than whole milk on a dry matter basis, resulting in less body weight gain compared to calves fed whole milk
- In Denmark, calves are fed powdered milk because it is cheaper; all milk from cows goes direct to the tank.

Weaning:

- For beef cattle, weaning is separating the calf from its dam. In dairy practice, since the calf is separated from its mother immediately after birth, weaning means depriving the calf of milk and giving it pure solid food.
- Give water to the calves after weaning it from milk. Do it gradually, from twice a day to just once while offering concentrate. A calf's stomach easily develops. After weaning off, let them rest in the barn five to seven days before moving to a pen with solid food feeding.
- When weaning, maintain a first week routine, followed by creep-feeding, and weaning from milk. Ideally, the herd should have uniform growth. In large farms, smaller or stunted animals § are culled. Creep-feeding or giving supplemental feed to the calves like concentrate, should be offered not forced.

- o Place the calves in individual pens for 7-10 days. Afterward, those of the same age may be placed in the same pen (about six heads in each pen). Putting calves of different ages in the same pen may result in others not able to feed well due to the disparity in size.
- o Do not practice full isolation, let them (calves) know there are others like them.
- o Build good hygiene habits starting on the first week of birth to reduce the spread of many diseases.
- o Newborn cannot drink from the basin or bottle and should be trained using fingers with gloves.
- o Do not overfeed as it may result in diarrhea.
- o Rehydrate calves with scouring/diarrhea with water, salt, glucose, and electrolytes.
- o Observe appropriate ventilation.

Disbudding and Dehorning:

- o Disbudding or destroying or excising horn-producing cells before they attach to the skull, typically before eight weeks of age, is recommended in all situations. Dehorning (10-16 weeks) is removing horns that have already grown and are attached to the skull. During the process, give sedative and anesthesia; in the absence of anesthesia, find ways to make it less painful/manageable. Some farms use anesthesia but without sedative.
- o Disbudding is advisable compared to dehorning because it is less invasive and less painful. Use caustic soda, blowtorch or disbudding iron.
- o Dehorning is meant to avoid injury to other cows or people, allow efficient use of space during feeding, and give the cows a uniform appearance.
- o Don't dehorn when it's raining as it may cause infection.

Herd Health Management

Biosecurity

Biosecurity means practices to prevent the entry of diseases in the farm, or to prevent the spread of diseases from one farm to another, regardless of farm size. Examples of biosecurity measures are footbath and wheel bath. It is necessary to reduce production cost, protect livelihood, and gain the trust of consumers. For dairy farmers this means safe and high-quality milk.

It requires knowing its importance to cow care; understanding the methods of preventing diseases that adversely affect cow's health; following good practices in sanitation and disinfection of farm, equipment and facilities; and understanding the risks and effects of not following biosecurity measures.

It is the responsibility of the biosecurity coordinator, farm owner or farm manager. As the biosecurity boss, he or she can train the workers in cleaning boots, pens, deworming and placing signages; make a yearly updating of plans; and make a biosecurity plan. Meanwhile, farm workers must follow farm procedures.

Farm layout and access controls:

Designate access control points where biosecurity measures are placed. Mark as red zones (no entry to visitors) the areas where cows usually stay, and as green zones the open public spaces in the farm.

Cleaning and disinfection:

When entering animal areas, use supplies like boot brushes, disinfectant, PPE (gloves, coveralls).

Scrub boots/tools to remove bacteria. Soak these in disinfectant and dry before entering. The contact time between boots and foot bath should be at least 30 seconds to one minute. Foot bath can be iodine-based or ammonium-based, depending on availability, and follow the mixing instructions

Animal management for healthy herd:

- Closed herd idea – avoid always buying new animals
- Quarantine – no contact between new and old animals (3 weeks)
- Grouping – calves (most vulnerable); heifers; lactating cows; sick pen for diseased animals
- Daily check for diseases – locate those that are coughing, scouring, and not eating well

Feed safety:

- Cover the feed and place it where rats could not reach to avoid salmonella that causes scouring.
- Don't give spoiled and moldy feed.
- Clean drinking vessels and don't let cows stand on or near the water source, as they may urinate or defecate on it.
- Store manure downwind (direction away from the cows).

Pest control and deadstock:

- Seal sacks and install traps for rodents.
- Remove manure and wet beddings to minimize flies.
- Install fence to ward off wildlife; don't allow the birds to go near.
- Bury dead animals within 24 hours in a pit 2.5 to 3 feet deep.
- Never leave deadstock for scavengers, as they spread disease.

Emergency outbreak response:

1. Signs of emergency outbreak:

- sudden death/contamination of different animals (disease from cows may spread to other animals)
- fast spread of disease
- outbreak in nearby areas

2. Quick response:

- Stop moving animals to prevent further spread.
- Separate the sick animals.
- Call the proper authorities right away.
- Heightened biosecurity – double disinfection; no visitors; protective gear
- Long-term plan – record keeping: track the movement of animals and their vaccination (no record means difficulty in diagnosis); know what vaccinations are available in the locality; communicate to proper authorities and, if possible, neighboring farms

Reporting:

- If animals are dying or getting sick, contact the barangay livestock coordinator.
- If the agricultural technician is not available, the BPAV with the permission of the veterinarian and municipality can collect samples for laboratory tests.
- The agricultural technician will investigate the animal deaths, bring samples (tuberculin tests; feces for parasitism 200 grams; blood for bovine viral diarrhea), and report to the BAI regional office. BAI has e-services for sample submissions.

Bringing sample to the lab:

1. Packaging:

- Container – use insulated, leak-proof container for transport; make sure to place blood and fecal samples in separate containers to prevent contamination
- Cushioning – use absorbent material around the samples for protection and to absorb leaks

2. Temperature control:

- Cool packs – maintain at 4°C during transport; prevent direct contact between the sample and ice to prevent freezing
- Insulation – use thermal insulation materials to maintain the temperature.

3. Documentation:

- Submission form – animal information; kinds of sample and date/time collected; tests needed
- Communication – inform the laboratory of the samples to be sent, esp. if there are special management instructions

Physical examination:

- A routine examination to see physical symptoms and determine if the animals have diseases; diagnosis is made based on laboratory tests.
- Signalment – breed, age, sex, color, weight, stage of lactation/gestation, use
- Complaint – details of the problem (replying with “I don’t know” not advisable); what the animals feel
- History – of cow and farm; feed source; pregnancy status; vaccination, meds; magnet administration (dairy cattle); closed or open herd; number of animals affected; number of cattle; exposure to domestic animals or wildlife; production in previous years, outbreaks; mastitis history; disease history

How to do physical exam:

- Hands-off examination – observe the behavior; body condition (BC score is 1-5 for dairy cattle); skin condition (wounds); general appearance – feet, udder, etc.; posture and gait; feces and urine color; breathing pace; abdominal contour, symmetry on each side
- Patient environment – walls, floor, bedding; feces and urine; feed and water; ventilation; presence of other animals



BCS = 1



BCS = 2



BCS = 4



BCS = 3



BCS = 5

Ideal BCS for cows:

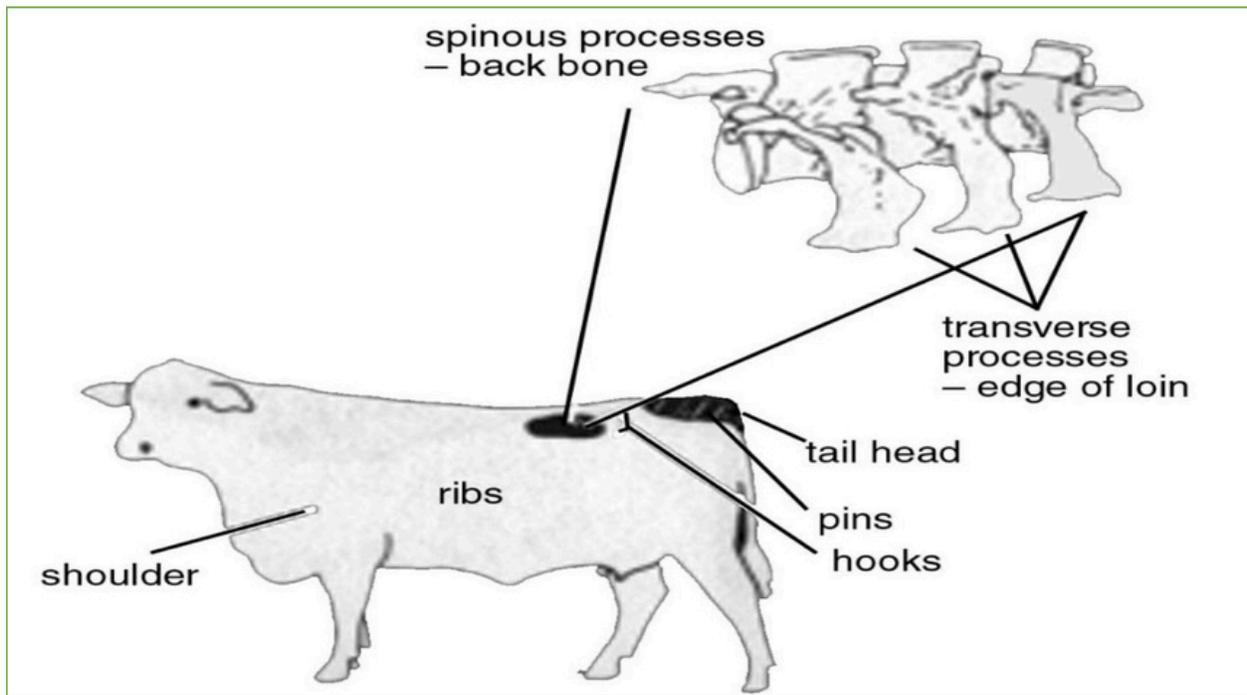
1. At calving: 4 - 4.5
2. 1 to 2 months after calving: 3 - 3.5
3. Dry period: 3.5 - 4

Effects of BCS 1 and 2:

1. On calf: low birth weight; weak calf; high mortality rate; low average daily gain
2. On cow: dystocia; low milk yield; short lactation; repeat; breeder; long calving interval

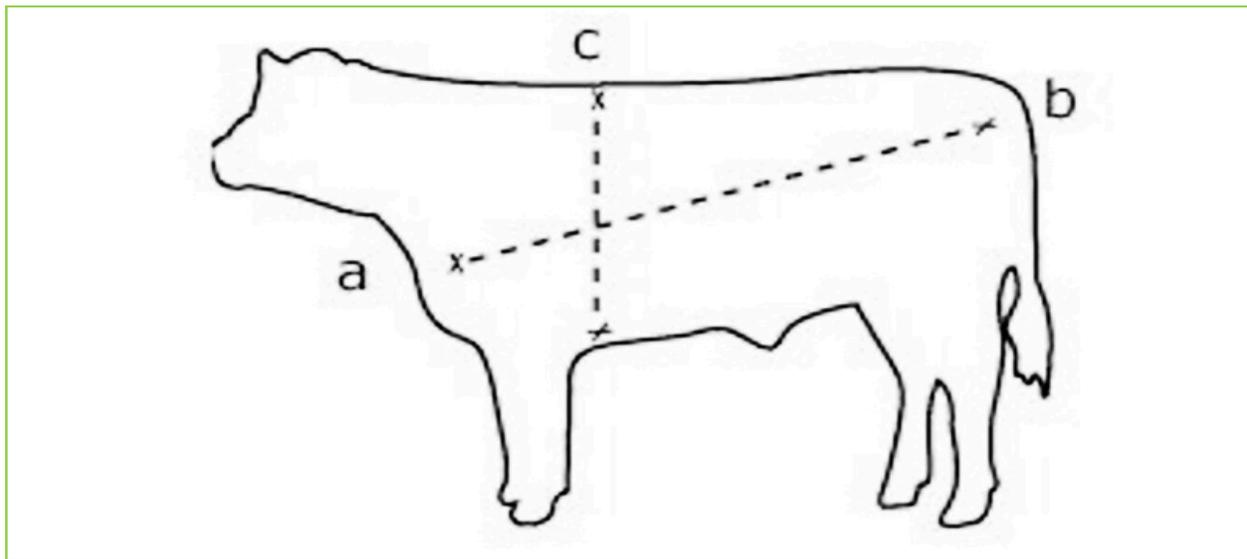
BCS 3 is the ideal for dairy cows. BCS 5 (obese) will give the cow difficulty in getting pregnant and during calving. It will also cause dystocia, prolapse, low milk production and make it a repeat breeder.

Key areas to examine for body conditioning scoring (BCS):



Body weight estimation:

- Using a tape measure, measure from point of shoulder to the pin bone near the base of tail (this is the body length); measure the heart girth (elbow to elbow)

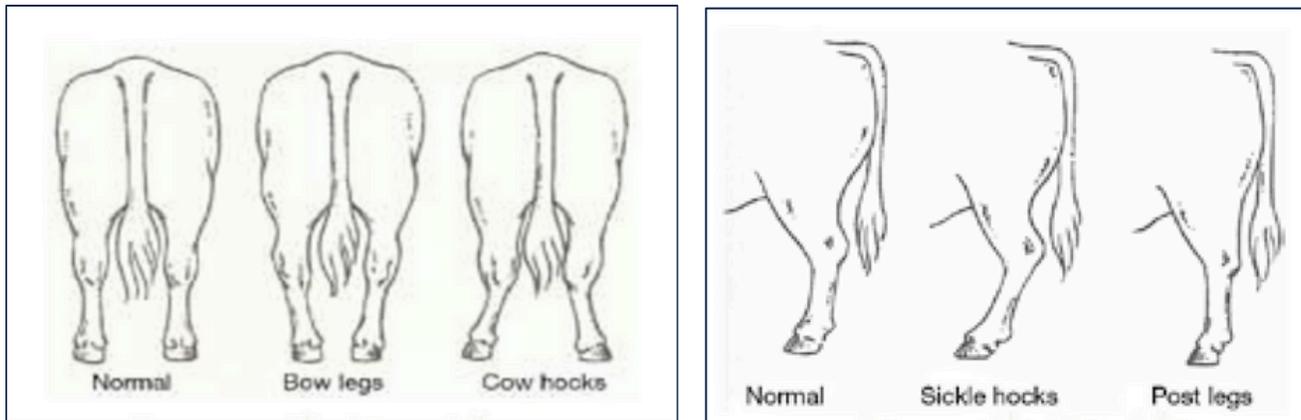


- Use the following formula:

$$\text{Body Weight (kg)} = \frac{(\text{heart girth in cm})^2 \times \text{body length cm}}{10,840}$$

*Average weight may vary according to feeds

Legs (symmetry):



Head (symmetry):

Examine the ears and eyes for discharges. The muzzle (nose and mouth) must not be dry, and examine it for discharges, wounds and odor.

Oral examination:

Oral examination covers the mucous membrane (must be pink, hyperemic, red, purple), odor (purulent or necrotic), dental pad for ulcers or cavitation (which causes difficulty in eating), gingiva for hyperemia or increased amount of blood, teeth, tongue, soft palate, and papillae for its color, shortening or blunting.

Neck:

Check the skin, pre-scapular lymph nodes which are clear in normal cows, and jugular veins. Large jugular veins and venous pulsation may be a sign of cardiovascular disease. Also check for wounds.

Symptoms and diseases:

- Common symptoms include:
 1. cold ears – hypocalcemia (milk fever, or dangerously low levels of calcium in the blood); IV treatment with calcium must be gradually given
 2. sunken eyes – dehydration
 3. swollen jaw – low electrolytes of blood protein levels; possible heart failure
 4. swollen lymph nodes – infection, illness or injury
 5. nasal discharge – infection or illness
 6. chewing her cud – she is okay

Left side of the animal:

- Palpate and auscultate the heart – check for abnormalities.
- Auscultate and percuss the lung field – check for abnormalities
- Check the abdominal shape and contour.
- Palpate and auscultate the rumen.
- Percuss and auscultate the body wall.
- Ballott the lower flank. (Ballotement is a technique used to diagnose pregnancy or determine the contents of an animal's abdomen; it involves tapping the wall of the abdomen to bounce a structure against the other wall.)

Physical examination:

- Heart rate should be 60-80 bpm but higher in calves
- Respiration rate should be 10-40 bpm

Right side of the animal:

- Palpate and auscultate the heart – check for abnormalities
- Auscultate and percuss the lung field – check for abnormalities
- Check the abdominal shape and contour
- Check the position and size of the liver
- Percuss and auscultate the body wall
- Palpate and auscultate the sublumbar fossa
- Ballott the lower flank

Udder and teats:

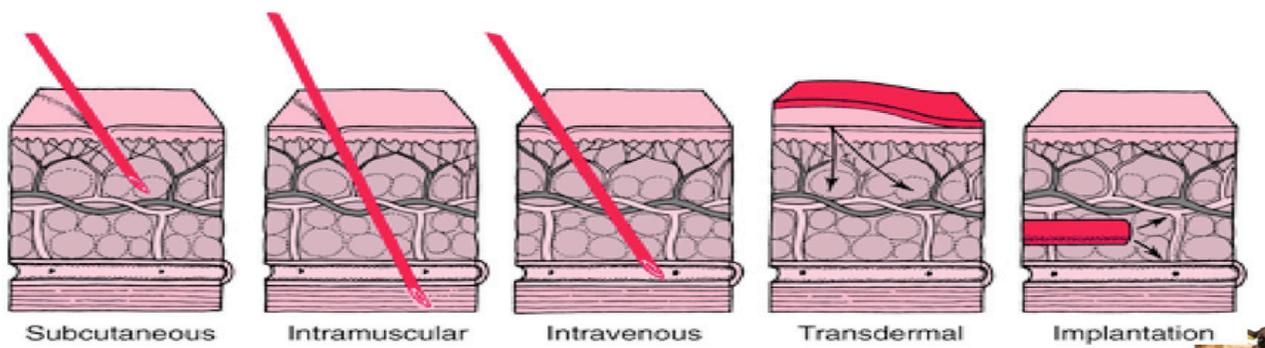
- Feel the left side of the udder:
 - for temperature and hardness - if soft and spongy, it's normal; firm when there's milk; if too warm or too firm, it could be mastitis
 - if it has edema, there's an inflamed tissue
 - look for wounds
 - examine the milk using the California Mastitis Test

Tail end and hindlimbs:

- Examine the pulse, vulva and genitalia. Check for diseases, wounds and hygroma (swelling of joints and elbows. Get the normal temperature (rectum), which is 38 – 39.3°C for adults and 38.5 – 39.5°C for calves.

Ways of administering medicines:

- Subcutaneous – introduced under the skin
- Intramuscular – administering medication directly into a muscle tissue
- Intravenous (IV) – directly injecting into the blood
- Transdermal – transporting through layers of skin for systemic distribution
- Implantation – implanting a device or tissue into the body



*Slant of needles must face upward when injecting.

Common diseases of dairy cattle

List of notifiable diseases:

Bovine genital campylobacteriosis	Bovine viral diarrhea	Bovine spongiform encephalopathy
Bovine anaplasmosis	Enzootic bovine leukosis	Theileriosis
Bovine babesiosis	Hemorrhagic septicemia	Trichomoniasis
Bovine tuberculosis	Contagious bovine pleuropneumonia	Trypanosomiasis
	Infectious bovine rhinotracheitis/ Infectious pustular vulvovaginitis	

Commonly called “mad cow disease,” Bovine Spongiform Encephalopathy affects the central nervous system.

Classification of Animal Diseases in the Philippines:

Disease Classification	Examples	Characteristics
First priority	Foot-and-mouth disease	Communicable
	Hemorrhagic septicemia	Very serious and rapidly spread
	Rabies	Of serious socioeconomic and/or public health importance
	Anthrax – cow openings show blood coming out	Are presently the priority of government
Second priority	Blackleg	Communicable
	Bovine anaplasmosis	Of serious socioeconomic and/or public health importance
	Bovine babesiosis	Of major importance in international trade
	Bovine tuberculosis	
	Brucellosis	
	Fasciolosis	
	Leptospirosis	
	Surra	
Emerging	Caprine arthritis/encephalitis	communicable
	Japanese encephalitis	recently detected in the country
	Bovine Virus Diarrhea	still confined in limited areas
Diseases of farm concern	Parasitic gastroenteritis (worms that cause diarrhea)	prevention and control are of primary concern of the farm
	Orf (wounds in mouth)	
	Colibacillosis	
	Ephemeral fever	
	Pink eye	
	Mycoplasmosis	
	Mycotoxiosis	
	salmonellosis	
	Myiasis	

Control and prevention:

Intermittent coughing is a sign of tuberculosis, and can contaminate humans. Test the animals, and, if positive, slaughter them. Milk from cows with TB can affect humans. Treatment is expensive and not cost-effective for small farmers.

FMD can enter the vesicles, thus the need for antibiotics. Symptoms include vesicle or blister formation on tongue, dental pads, gums, muzzle, interdental space, and teats. Prevention is through vaccination and disinfection.

Rabies causes hydrophobia (fear of water) and aerophobia. There is no treatment once hit. Hypersalivation may be caused by wounds in the mouth.

Hemorrhagic septicemia is fatal to cows; they may die within 8-24 hours. Most susceptible are those six months to two years old. It can hit cattle, goats, carabaos (most susceptible) and horses. Vaccine is the only measure.

Anthrax comes from the soil especially if alkaline and is communicable to humans. People have been killed by eating anthrax-hit carabaos, hence the importance of communicating the disease and informing the authorities. Don't open the animal's body, as you may inhale it. Bury the animals and control scavengers.



Healing lesion on the tongue of a cow affected by foot-and-mouth disease. *Courtesy of National Veterinary Institute, DTU Vet, Lindholm, Denmark*

Second priority diseases:

Disease/Cause	Symptom/s	Treatment/Control
Blackleg		
	necrotic, black leg	prophylactic penicillin for 14 days
		for calves 3-6 months old: multivalent bacterin vaccine, twice, and booster after 4 weeks
		burning or burying the dead animal in a deep pit
Anaplasmosis		
ticks through trans/Intra-stadial or transovarian or mechanical transmission via biting	brown to reddish brown urine, yellow mucus in eyes, on-and-off fever; thinning, resulting in low milk yield; signs are not clear in cattle that are below 1-year old; abortion; pale and icteric mucus membrane; usually hits old cattle and they can die within a few hours	treatment: tetracycline and imidocarb control: insect control
Acute babesiosis		
ticks	coffee-like color of urine; yellow vulva in severe cases;	diminazene aceturate imidocarb dipropionate NSAIDS/corticosteroids, fluid therapy blood transfusions in very anemic animals
	one week or less, the signs will show but not specific but may include hemolytic signs, loss of appetite, anemia and weight loss	using resistant breeds vaccination
	final signs: hemoglobinemia and hemoglobinuria	
	reproductive signs: late-term abortion, and temporary infertility in bulls	
Trypanosomiasis or surra		
tsetse flies, tabanus flies (major parasite for Asian water buffaloes)	anemia; fever; animals become thin but with big stomachs like they are pregnant or bloated; abortion; low milk yield;	for cattle: diminazene aceturate homidium bromide
common in marshy areas and also affects horses		
Brucellosis		
transmitted during breeding, in AI, when semen is deposited in the uterus	abortion, stillbirth or weak calves; subsequent pregnancies carried to final form	no practical treatment (only option is culling)
rare in large ruminants but common in small ones	seen in the 2 nd or 3 rd trimester of pregnancy in cows	test and slaughter: Brucella Milk Ring Test or Rose Bengal Plate Test (the former has many false-positive)
some species can contaminate humans	placenta with necrotic parts	cattle are tested 2-3 times and must test negative
	inflammation of the eggs and epididymitis in bulls	vaccination if there's history
	hygromas in knees, stifle, hock, nuchal ligaments, thoracic spines	quarantine of at least 30 days
Leptospirosis		
from rats esp. during floods	swelling and reddish color of kidney with blood spots	
	hemoglobinuria in bladder	
	abortion in cows	

Diseases of farm concern:

Disease/Cause	Symptom/s	Treatment/Control
Parasitic gastroenteritis		
parasites like round worms, tape worms and flukes	thinning of cows, low milk yield, weak and prone to disease, worms in feces	deworming using albendazole, oxi-bendazole and ivermectin
Colisepticemia (common in poorly managed calves)		
E. coli	Scouring, severe dehydration	IV fluid if diarrhea is constant
Mastitis		
Coliform bacteria	Swollen udder, milk curdling	Clean milk collection procedures, strip cup method testing, California Mastitis Test, treatment is antibiotic
Pregnancy toxemia/ketosis		
Low feed quality, twinning	at early stage, the cow becomes thin and loses appetite	feeding of high-energy mix (molasses, grains) and propylene glycol (100-200 ml/day, and drenching with rumen fluid from healthy cows
	at later stage, seizures and eventually death occur	IV glucose (dextrose) and fluids (20-60L/day), and induce calving if the pregnant cow is near its due date
		prevention measures include maintaining BCS 4-5 during pregnancy and BCS 3 near the calving stage
Bloat		
overfeeding with legumes and grain feed and sometimes by heat stress	open-mouth breathing, sticking out of tongue and drooling, and sitting in dog-like position (some cows show no symptoms before dying)	treatment: puncture with trocar and cannula
		prevention and control: wilting of fresh legumes; feed dry roughages before turning the cattle to luxuriant pasture
Milk fever/downer cow syndrome		
abrupt decrease in calcium after calving because milk production consumes 10g -30g/day	at stage 1 (standing cow) of the disease, the cow's muscle shivers	oral calcium bolus (40-55g)
at risk are high-producing cows and cows that are already on their third or more lactation	at stage 2 (down cow), it can no longer stand and the ears are cold	IV calcium gluconate (500mL, 23%) slowly over 10-20 mins
	at stage 3 (down cow), it just lies on its side and is helpless	IV calcium gluconate (500mL, 23%) slowly over 10-20 mins
		to prevent recurrence: follow with oral calcium after 12-24 hours



***Dairy Mentors Training Module 5: Dairy Animal Calving, Calf Rearing, and Calf Management
Central Mindanao University, 23-25 April 2025***



Never Too Old for the Job

Even after retiring from his work at a private company, Mario Jaraula has refused to sit back, relax, and spend time the way most other seniors do. For, he has found a different way to spend life post-retirement – engaging in dairy production.

He opened a 7,000-square meter farm between Barangays Amoros and Taytay in El Salvador City, Misamis Oriental. It is where he has placed the five carabaos that he received from the Philippine Carabao Center (PCC), which has partnered with Oro Integrated Cooperative (OIC). Mario has been a member of OIC Cogon Branch (Cagayan de Oro City) for nearly twenty years already.

The cooperative started as a savings and loan establishment. It was only in 2022 that it supported members who wish to go into dairy farming through the partnership with PCC.

PCC would provide the carabaos, all females, for free, but only after the recipients have finished a training with the center and built a shelter for the animals. No shelter, no release. In addition, the farm should be at least one-half hectare for the farmer to receive five heads. Those with bigger areas may avail of more animals.

Mario does the job of attending to the carabaos all by himself. He only hires an assistant who takes care of feeding the animals whenever he's out of town. He is relying on the cut-and-carry method, citing that he has plenty of Napier.

Unfortunately, Lady Luck frowned on Mario in his early days as a dairy farmer. The first carabao to get pregnant was unable to stand up five days after giving birth and never recovered. Its calf was fed with milk but died after a month, followed later by the mother. Another carabao suffered an injury after it slipped and died, too. PCC replaced the dead animals.

Moreover, having had no experience in handling carabaos, Mario said he is finding it hard to detect heat. He lamented that failing to detect heat on time means a missed opportunity and time wasted, as the PCC provides free artificial insemination.

Mario, however, seems to have the patience of Job. He said his nephews and nieces have asked him to stop. But he told them it would be such a waste to return the carabaos to PCC. "This is better than doing nothing at home," he said.

And, when he says home, he means his farm where he stays and sleeps.

CHAPTER SIX

GOOD MANUFACTURING PRACTICES AND STANDARD SANITATION AND OPERATING PROCEDURES

the procedures and precautions taken before, during, and after milking to ensure that milk is produced in a clean, safe, and contamination-free environment. These practices are critical for maintaining milk quality, protecting public health, and ensuring consumer confidence.



Milking parlor of Gingoog Dairy Farm. Photo by Olegario Ayensa Jr. Hygienic milk practices refer to all

Good Manufacturing Practices (GMPs)

Definition, Objective, and Basis

GMPs at the dairy farm level refer to a set of practices and procedures that ensure raw milk is produced, handled, and stored in a hygienic, safe and consistent manner to protect public health and maintain milk quality. It is established to provide flexibility to each dairy farm to decide how to best implement controls by using scientifically-sound design, processing methods, and testing procedures.

These practices:

- aim to consistently produce raw milk that is safe, clean, of high quality, and fit for further processing into dairy products without posing health risks.
- ensure that milk is handled properly from cow to container, minimizing contamination risks and upholding consumer trust.

Even if milk is harvested correctly, its quality is affected by the cow's health. Thus, it must be produced by healthy animals under generally accepted conditions. Also, it covers not only cow's health but also the workers' health, compliance to regulatory standards, and hygienic environmental conditions.

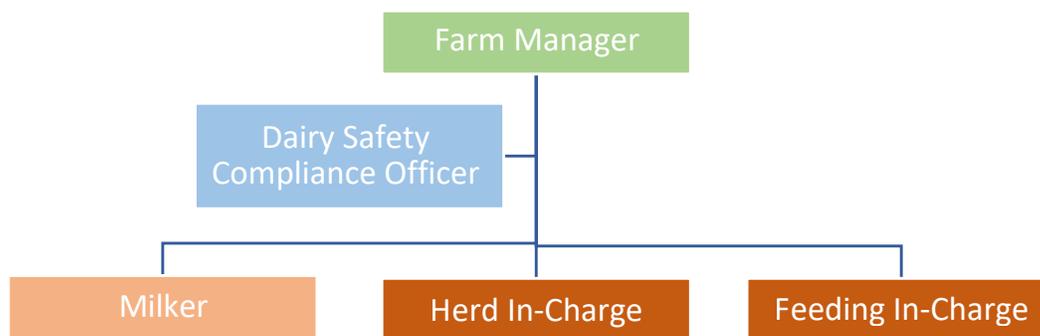
GMPs are based on standards set by Codex Alimentarius (international food standards set by the UN's Food and Agriculture Organization), World Organization for Animal Health, Food Safety Act of 2013, and the Bureau of Fisheries and Aquatic Resources.

Scope in making GMP Manual

To ensure compliance with standards set by law and international bodies, dairy farms must have a GMP manual that addresses the following: organizational structure, animal health and welfare, hygienic milk practices, health and hygiene of farm workers, waste management, clean and safe environment, facility sanitation and equipment maintenance, documentation and record-keeping, feed and water safety, and compliance with regulatory standards.

A. Organizational Structure

Define the qualifications and responsibilities of all personnel working in the farm. There should be an adequate number of personnel who are knowledgeable and capable in their assigned functions as well as skilled and well-trained. Don't assign too many tasks to a single person as it may affect performance.



B. Animal Health and Welfare

Maintaining animal health involves preventing diseases, monitoring conditions, and treating illnesses appropriately. It covers:

- preventive care: vaccination schedules, regular vet checkup, quarantine of new/sick animals;
- proper treatment of sick animals: follow prescribed medications to prevent antibiotic resistance, withdrawal period; and
- parasite and pest control

Animal welfare, as defined under the Animal Welfare Act of 1998, as amended by Republic Act 10631, refers to the physical and mental well-being of dairy animals. It goes beyond health—it includes comfort, nutrition, freedom of movement, freedom from injury and disease, freedom from fear and distress, freedom to express normal behavior, and humane treatment. They should have access to comfortable housing, access to clean water, and nutritious food.

C. Hygienic Milk Practices

Hygienic milk practices refer to all the procedures and precautions taken before, during, and after milking to ensure that milk is produced in a clean, safe, and contamination-free environment. These practices are critical for maintaining milk quality, protecting public health, and ensuring consumer confidence.

- Pre-milking hygiene – animal cleanliness; observing signs of mastitis; milking area preparation; clean the udder to prevent delay and drips from the body
- Milking hygiene – use of clean and functional equipment; milker’s hygiene; proper milking procedure; correct procedures are useless if the equipment are not hygienic
- Post-milking hygiene – teat disinfection; immediate milk handling; rapid cooling; refrigerate at 4-6 degrees Celsius two hours at most after milking as the milk becomes acidic after this period; the ideal is to deliver the milk right after milking
- Milk storage and transport - store milk in clean, sealed stainless steel or food-grade containers; milk should be transported in temperature-controlled vehicles, if possible
- Record keeping and traceability – milk per animal per day, at least the average harvest if there is no individual record of each animal; recording can help in identifying possible causes and in decision-making

D. Health and Hygiene of Farm Workers

The health and hygiene of farm workers directly affect the safety, cleanliness, and quality of milk produced on the dairy farm. Since milk is a perishable and highly sensitive product, anyone who handles it must follow strict hygienic practices to prevent contamination from physical, chemical, or biological sources. Farm workers must be committed to farm hygiene and sanitation.

- Personal hygiene – proper handwashing and wearing of PPEs, boots, hair net; instances like loose threads and buttons can affect the milk quality; farm owners must provide proper gear
- Health status of farm workers – it may be costly (medical checkup) but required in big farms

- Updated training – training on basic food safety and dairy safety regulations; there might be updates of training previously attended and practices from fellow participants
- Clean and safe working environment – handwashing station, comfort room, storage room, etc.; mindfulness of habits like hanging clothes everywhere; there should be areas properly designated for storage

E. Waste management

Waste management in a dairy farm refers to the proper handling, treatment, storage, and disposal or reuse of all by-products and waste materials generated during dairy operations. Effective waste management is essential for environmental protection, animal health, milk safety, and community well-being.

- Manure management – frequency of collection; dumping area; composting and use as fertilizer and for biogas production
- Waste water management – no direct discharge into water bodies; establish lagoons; use of settling tanks
- Feed and bedding waste
- Proper dead animal disposal
- Chemical and packaging waste – use containers for chemicals and observe protocols for disposal like labeling

F. Clean and safe environment

Maintaining a clean and safe environment in a dairy farm is essential for the health and productivity of dairy animals, the safety of milk, the wellbeing of farm workers, and the overall sustainability of the operation.

- Animal housing and barns must be dry, well-ventilated, and frequently cleaned.
- Milking area and equipment must be washed, sanitized and properly stored. Observe regular cleaning and maintenance schedule.
- Water supply – farms are required of water testing by the NDA (no fee)
- Biosecurity Measures – in using chlorine, the concentration is different for each purpose as it may either be ineffective or too much, e.g., applying too much for clothing may affect the worker's health.
- Monitoring and Maintenance

G. Facility Sanitation/Equipment Maintenance

Facility sanitation refers to the systematic cleaning and disinfection of all areas where animals are housed, milked, or handled.

Milk is highly susceptible to contamination, especially from dirty, poorly maintained, or malfunctioning equipment. Regular cleaning and upkeep of dairy equipment are essential for milk safety.

- Milking parlor must be kept clean and dry and the floors designed to slope towards drain.
- Frequent checks on water source and drainage.

- Make checklist of monitoring/maintenance activities and responsible persons.
- Set a sanitation schedule.

Equipment maintenance:

- Chest type freezers must be cleaned at least once a month, as there are microorganisms that thrive even in low temperatures
- There must be dedicated refrigerators and freezers.
- Milking equipment, milk storage equipment and forage choppers must be maintained.

H. Documentation and Record-keeping

Documentation and record keeping are vital in dairy farming to ensure traceability, support quality assurance, meet regulatory requirements, and monitor animal health and treatments. They promote transparency, accountability, and effective farm management. These include:

- Animal Health Records
- Milk Production Records
- Feed and Nutrition Records
- Breeding and Reproduction Record
- Cleaning and Sanitation Logs
- Equipment Maintenance Logs
- Waste Management Records
- Personnel Training Records
- Farm Inputs and Purchases

Use whatever form/resource is available as long as it is understandable:

- Use structured forms, logbooks or software for consistency.
- Assign a designated staff member responsible for updating records.
- Keep records for at least 2–3 years, or as required by regulations.
- Maintain backups: physical copies should be stored safely, and digital records should be backed up regularly.
- Spreadsheets (Excel, Google Sheets) as optional tools

Farmers may find NDA forms too tedious for them. However, under the buy-back program of the agency, those with records fetch higher prices because the government is evidence-based.

I. Feed and Water Safety

- Quality of Feed Ingredients
 - from reliable and certified suppliers
 - be cautious of mycotoxins (aflatoxins) commonly found in moldy feed/silage
- Storage and Handling
 - First In First Out
 - Clean, dry and well ventilated
 - Use wood/plastic pallet

- Safe use of additives
- Water source and quality

Antibiotic residue test is available at NDA. Register for a license to operate or LTO as NDA allocations for testing and kits per region depend on the number of farms in their registry system.

J. Compliance With Regulatory Standards

Compliance with regulatory standards in dairy farming ensures that all farm operations meet legal, food safety, animal welfare, and environmental requirements set by local and national authorities. It is a key pillar of GMP and is essential to producing safe, high-quality milk that meets both consumer expectations and market access requirements. Buyers may, in the future, require compliance with these standards.

The NDA issues dairy safety regulations and LTO, while the Bureau of Animal Industry issues Good Animal Husbandry Practices Certificate. Meanwhile, licenses for processing/plant level operations are under the mandate of the Food and Drugs Administration.

Standard Sanitation Operating Procedures (SSOPs)

Dairy Farm Level

What are SSOPs?

SSOPs are written, step-by-step instructions that describe how sanitation tasks are to be carried out in a dairy farm to maintain milk safety, cleanliness, and hygiene. They are essential components of GMP and are required for farms to meet food safety and regulatory standards.

Importance of SSOP:

- Protect Milk Safety and Quality
 - Prevent contamination from dirt, bacteria, chemicals, or animal waste.
 - Reduce risks of spoilage and foodborne illnesses.
- Ensure Animal and Worker Health
 - Promote clean housing and feeding environments.
 - Reduce disease transmission among cows and from cows to humans.
- Meet Legal and Market Requirements
 - Compliance with the Food Safety Act, NDA, FDA, and local LGU ordinances.
 - Prepare for audits, inspections, and certification.
- Promote Consistency and Accountability
 - Sets a standard that all workers follow.
 - Easier to monitor and evaluate cleanliness and compliance.

In Developing SSOPs:

- Keep instructions simple and visual (e.g., charts, posters).
- Train all workers — not just milkers — on sanitation protocols.
- Use low-cost but effective cleaning agents (bleach, iodine, etc.).

- Use locally available resources.
- Reward or recognize consistent adherence to SSOPs.

Summary:

- SSOPs are non-negotiable for safe milk production.
- Clean milk comes from clean cows, clean hands, and clean equipment.
- Implementing SSOP doesn't have to be expensive — just consistent.
- Good sanitation protects your product, your animals, your people, and your reputation.

Dairy Safety Regulations

Dairy safety regulations are issued by the NDA, an agency attached to the Department of Agriculture and mandated to ensure the accelerated development of the Philippine dairy industry through policy direction and program implementation. The regulations cover all dairy animals (cattle, goat, buffalo), and processes from primary production to post-harvest handling.

Republic Act 10611 (Food Safety Act of 2013) mandates the NDA as a DA-Food Safety Regulatory Agency. On 12 March 2019, NDA issued Administrative Circular No. 4-2019 on Dairy Safety Regulations.

Objectives of Dairy Safety Regulations

- Protect farmers from unsafe and adulterated locally-produced milk;
- Enhance industry and consumer confidence in the dairy industry regulatory system;
- Achieve economic growth and development by promoting fair trade practices and sound regulatory foundation for domestic distribution; and
- Upgrade the capability of local dairy farmers, consumers and dairy workers in ensuring dairy safety.

Issuance of NDA License to Operate Certification

Key parameters:

- Farm location and surroundings – milk storage and milking area
- Farm management – milking process
- Transportation and delivery – personnel
- Waste management – monitoring and records

Guidelines on the dairy production chain

Location	Must not be in an industrial site	Must be free from garbage	The feed stored near the parlor shall be contained
Milk	Pass mastitis test	Has no foul odor and visible dirt	Stored at a temperature of not more than 6°C
	Undergo pasteurization if consumed	Owner shall be accountable	Disposed accordingly if unfit for consumption
	Ensure that colostrum is properly identified and handled		
Dairy Inputs	Must be from registered suppliers	Stored properly and separately	Properly labeled and recorded
Farm Owner	Responsible for ensuring compliance with dairy safety		
Dairy Animal	With ETN	Free from TB and Brucella	No signs of injury
	Sick animals shall be isolated and treatments shall be recorded		
Water	Potable quality	Adequate quantity	Shall have water certificate of analysis for portability test
Maintenance and Services	Cleaning and sanitation program	Milking procedure	Pest control and management
	Waste water management	Milk cooling and filtering procedure	
Records	Dairy health services	Animal movement/herd list	Input records (fertilizers, feeds, veterinary drugs)
	Water analysis report	Milk safety and quality test	
Transport Vehicle	Must be cleaned and sanitized	Interior and cover must be free from chemical and physical hazards	

Guidelines on milk collection chain

Milk	Must pass microbial analysis standard	Somatic cell count <400,000	Milk fat not less than 3%
	Lactic acid must be at least 0.14-0.18%	pH 6.5-6.7	No foul odor and visible dirt
	Negative for antibiotic residue test	Temperature must not be >6°C	
Milk Container	Must be stainless steel 304 or 316	Smooth surface	
Collection Center	In good physical condition	Provision of cooling and filtering system	Availability of drainage
	Availability of ample potable water	Utensils must be smooth and made from stainless steel	

Process flow



A food technician will evaluate those who are really milking and selling to ensure compliance with the risk management plan. The farmers will decide the period of compliance (reasonable timeframe). The 500 pesos for farm registration is a one-time payment; a communal farm is counted as one. Cooperatives may issue a certificate of operation. The passing rate of the inspection/audit is 75%. After the approval, pay only for the milking line. Monitoring will continue after the issuance of the License to Operate (LTO). The LTO is valid for one year, and for three years more upon renewal.

Farm registration may be done even if there are no milking cows yet.

Basic Milking Practices

Good milking practices follow a general rule – safe handling of animals and good sanitation practices. The main objective is to milk clean, dry, and properly-stimulated teats to efficiently harvest milk and reduce the risk of mastitis. Observance of proper milking protocols ensures the production and harvest of high-quality milk.

Note that stress just prior to milking can interfere with oxytocin release and milk letdown. Loud noise, new faces, or any changes in the milking procedure can cause stress on the animals and interfere with milk letdown. Good milkers are patient with animals and pay attention to details.

Elements of good milking practices:

1. Personal hygiene;
2. Sanitation practices – clean water needs to be sanitized; assess the milking parlor environment to know what needs to be done to sanitize it; all items used for milking must be treated with sanitizer to eliminate pathogens;
3. Good facilities, equipment, materials and supplies;
4. Cow/Animal health;
5. Access to good and clean water supply;
6. Availability of electricity or power supply – needed during mechanization.

Pre-milking protocol (alley or chute):

- Cleaning and washing/bathing – to enhance animal waste discharges (urine and manure);
- Dissipate heat to reduce heat stress – high-stress hormone will be produced instead of oxytocin; dissipate heat starting from the feet;
- Check physical/cow health (inflammation of the mammary gland and injuries) – milking is painful for the cow if there are injuries;
- Facilities, equipment materials and supplies;
- Cow/Animal health

The milking parlor: A system of routine, efficiency, safety, hygiene and sanitation:

- Establish cow routine through training of pregnant or beginner animals (entrance, milking area, stanchions and exit) – physical changes of the milking area affect behavior.
- Establish milker's route (entrance, working area, exit).
- Place a barrier between the milking pen and the milking machine.

Facilities, tools, equipment, materials and supplies:

- Holding area and milking parlor with stanchions and headlocks – can be used during washing;
- Milking machine;
- Power sprayer;
- Water tank and containers, pails;
- Sanitizers (50 to 75 ppm), disinfectants;
- Mastitis test kit;
- Absorbent cloth;
- Milk buckets – Clean the buckets inside out. Treat them with sanitizer overnight until the next use, as milk residues will leave a pungent smell.

Guidance notes: Apply 5S, CLAYGO and food sanitation practices:

- 5S – Sort materials (organize), Set in order, Shine (clean), Standardize (whether can be re-use nor not), Standardize, and Sustain
- CLAYGO – Clean as You Go

Milking parlor must be according to capacity of your farm (either smallholder, semi-commercial, or commercial):

1. On-floor stanchions
2. Elevated (herringbone and pit type) – necessary for improving hygiene; standards may be adjusted depending on conditions, e.g., the elevation vis-à-vis the worker's height.
3. Elevated and rotary

Feed may be used to entice cows to the milking area, although this is not practical in big farms. Watch out for cows who may be left behind by the herd during milking as it would affect their behavior. There are also some realities in the milking parlor to watch out for, e.g., interference by urine or manure in the process.

10-minute rule of milk letdown (efficiency time):

1. Pre-milking (Iodine Solution) teat dip to reduce the spread of mastitis-causing organisms;
2. Stimulation of udder and washing (10-20 seconds);
3. Apply detergents and soap to the udder and teats;
4. Washing with clean water (mild-concentration sanitizer);

5. Drying with clean and sanitized cloth (absorbent cloth);
6. Stripping (lock and strip 2-3 times?);
7. Mastitis test;
8. Milk collection through hand/machine milking – There is roughly a 3-second window to place the teat claw on the cow;
9. Post-milking iodine solution teat dips.

Use iodine solution of 50 ppm to kill bacteria. **Wipe the udder from the bottom up** to avoid contamination.

Stripping, or holding the teat between the thumb and forefinger, is needed after machine-milking to cause the milk to flow down in a stream.

It is easy to tell when a hand-milked udder has no more milk to give. Machine milking is easier but may result in overmilking and teat-end trauma if done improperly, for instance, applying excessive vacuum pressure, which is painful for the cows. The pressure of the milking machine is adjusted depending on the number of cows. Check the pulsator to adjust the pressure.

The 10-minute rule is not applicable to buffaloes because they need massage.

Watch out for these signs of mastitis:

- Swollen udder (quarter, half, or whole)
- Udder or teat redness
- Hot udder
- Pain when udder is touched
- Abnormal milk (clots, clumps, blood, watery color, gas, smell)
- Positive California Mastitis Test (high somatic cell count)

An alcohol precipitation test is needed if CMT is positive. It can be done using a simple procedure. Mix 5 ml of milk with an equal amount of ethanol solution. No coagulation, clotting, or precipitation should occur if the milk is of good quality. On the other hand, the presence of flakes or clots during this test indicates poor milk quality.

Separate the milk from mastitic sources. Milk from three good teats can be separated from the affected fourth teat. When using machines, plug or fold the affected part.

A 2% teat dip (iodine solution) must be used in challenging environments. For this, the volume of iodine to be used from a 10% iodine solution with a volume of 1,000 ml can be obtained using the formula $C1V1=C2V2$, where:

C1 = concentration of iodine to be used	= 10%
V1 = volume of iodine solution (Teat Dip)	= 1000 ml
C2 = desired iodine solution concentration to be used	= 2%
V2 = desired volume of iodine solution @2% concentration	= X

Solution:

$$\begin{aligned}
 (10\%) (1,000 \text{ ml}) &= (2\%)(X \text{ ml}) \\
 V2 &= \frac{(.1)(1,000 \text{ ml})}{.02} \\
 V2 &= \frac{100}{.02} = 5000 \text{ ml (iodine solution@2\% concentration)} \\
 V2 &= (5,000\text{ml}).02 = 100 \text{ ml} \\
 \text{Distilled Water} &= 50,000 \text{ ml} - 100 \text{ ml iodine; } = 4,900 \text{ ml}
 \end{aligned}$$

For a sanitizer using household bleach @ 5.25mg/100ml sodium hypochlorite (NaClO), also use the formula $C1V1=C2V2$, where:

- C1 = desired concentration (ppm)
- V1 = desired volume of Bleach Solution (Sanitizer)
- C2 = NaClO concentration (ppm) of bleach
- V2 = Volume of bleach used

Problem 1 : A sanitizer has 10 ml of ordinary bleach with 52.5g/li NaClO. How much water will be added to make a 100 ppm NaClO sanitizer solution?

Let us get things into the same units:

$$\begin{aligned}
 1\text{ppm} &= 1.0 \text{ mg/L} \\
 100\text{ppm} &= 100 \text{ mg /L} \\
 100\text{mg/L} &= 0.1 \text{ g/L} \\
 \text{Bleach} &= 5.25 \text{ g/100 ml or } 52.5 \text{ g/L}
 \end{aligned}$$

- Let: C1 = desired Concentration (ppm)
- V1 = desired Volume of Bleach Solution (Sanitizer)
- C2 = NaClO Concentration (ppm) of bleach
- V2 = Volume of Bleach 10 ml

Solution:

$$C1V1=C2V2$$

- Let: C1 = desired concentration (ppm) = 0.1g/L
- V1 = desired volume of Bleach Solution (Sanitizer) = ?
- C2 = NAClO concentration (ppm) of bleach = 52.5g/L
- V2 = Volume of bleach used = 10 ml

$$(0.1\text{g/L}) (V1) = (52.5\text{g/L}) \times (10\text{ml})$$

$$V1 = \frac{_(52.5\text{g/L}) \times 10 \text{ ml}}{.1\text{g/L}}$$

$$V1 = \frac{522.5}{0.1} = 5,250\text{ml}$$

$$\text{Cold Water} = 5,250\text{ml} - 10 \text{ ml (bleach)} = 5,240 \text{ ml}$$

Problem 2: A 20-liter sanitizer has 50 ppm of NAClO. What is the volume of bleach with 52.5g/L NaClO to be added into water to make the final dilution? Let us get things into the same units:

$$\begin{aligned}
 1\text{ppm} &= 1.0 \text{ mg/L} \\
 50\text{ppm} &= 50 \text{ mg /L} \\
 50\text{mg/L} &= 0.05 \text{ g/L} \\
 \text{Bleach} &= 5.25 \text{ g/L (52.25g/1L)}
 \end{aligned}$$

Let: C1 = desired Concentration (ppm)
 V1 = desired Volume of Bleach Solution (Sanitizer)
 C2 = NACIO Concentration (ppm) of bleach
 V2 = Volume of bleach

Solution:

$$C1V1=C2V2$$

Let: C1 = desired concentration (ppm) = 0.05g/L
 V1 = desired volume of bleach Solution (Sanitizer) = 20 L
 C2 = NACIO concentration (ppm) of bleach = 52.5g/L
 V2 = Volume of bleach to be used = X

$$(0.05g/L) (20,000 ml) = (52.5g/L) \times (X ml)$$

$$V2 = \frac{(0.05g/L) (20,000 ml)}{52.5g/L}$$

$$V2 = \frac{1,000 ml}{52.5} = 19 ml$$

Cold Water = 20,000 ml – 19 ml (bleach) = 19,981 ml

Deep well water or water from the water district should be used for sanitizers. Spring water is not advisable because it reacts to the reagent, giving the mixture a murky color due to the presence of ions.

Hygienic Milk Handling and Proper Storage

Proper storage and refrigeration of milk can help control psychrophilic microorganisms and maintain milk freshness and safety. Psychrophilic bacteria are defined as cold-loving bacteria. Specifically, their cardinal temperatures are 20°C for maximal growth, 15°C or lower for optimal growth, and 0°C or lower for minimum growth.

Milking parlor:

- Raw milk – not yet subjected to intervention for another kind of product; unprocessed
- Milk – solids (minerals, fats, protein) 13%, water 87%
- Raw milk – has inherent bacteria like E. coli produced by the digestive system; sanitizer is used to reduce bacteria, staph, Bacillus species; high level of bacteria will ferment the milk
- Raw milk has a of pH 6.4-6.8. A lower pH indicates spoilage by bacterial degradation.

Handling raw milk:

- Sanitize tools (including strainers), containers, buckets.
- Bring raw milk in buckets to a cooling equipment – 2 hours maximum after harvest; temperature – freezers and refs, water/ice bath (Styrofoam with plastic lining); ideal temperature for storage is 3-3.3°C (milk can be stored for 7-10 days at this temp); abrupt temperature change is conducive to bacteria; frozen raw milk needs homogenizer in the plant; plants should also have chilling tanks.
- Cold chain – refers to the stage of production plus storage (in the farm) to transport to storage (in plants); maintain temperature from farm storage to transport for plant storage at 2-4°C; cold chain is important in a tropical country; cooperatives should invest in homogenizers.

From the production farm to the collection center, during transport, plant storage, and finally, plant production/processing, chilling the milk is an indispensable element.

Plants give premium price if the milk has high fat content. Feed is the key to getting more butterfat (milk from carabaos and goats have higher butterfat compared to cows'). Breed/genetics and species are also a factor.

Costing Vs Product: Materials and Time Spent Monthly in Milking Operation

(Based on Average Prices 2025):

Items	Amount (Pesos)	Total Cost (Pesos)
Disinfectants		
-detergent (45 g)	10.00/sachet x 2 x 30	600.00
-Joy antibac (200 ml)	100.00/bottle x 1	100.00
-alcohol (65-70%) ethyl (500 ml)	120.00/bottle x 1	120.00
-iodine (1 gallon)	1,200.00/gallon/3 years/12 mos	30.00
-distilled H ₂ O	80.00/liter	27.00
Sanitizers		
-bleach (Zonrox original) 2 L @ 500 ml per day	100.00 30/4 = 7	885.00
Utilities		
-power 3HP/2	Per day usage: 4 hours = 1.5 HP/hr	2,000.00
-water		180.00
Other supplies & materials		
-hairnet	75.00/pack @ 50 pcs = 4 pcs/day	560.00
-lubricants 1 L in 2 weeks	1 liter/2 weeks	500.00
Total Cost		5,002.00

P5,002/30 = daily cost of P167/40 (per liter price of milk) = 3-4 liters per day

Establishing Dairy GMP-SSOP Manual

There is no blueprint for a GMP-SSOP manual. Each farm has to produce a manual, which is important for those who will go into processing, based on its own situation and do it step by step. Begin by identifying all the processes and tasks that require standardization and highlighting critical activities that impact product quality and safety.

Keep in mind that milking process is the most important element in NDA audits. Aside from ensuring the conduct of mastitis test, farm owners should see to it that the layout of the milking parlor indicates the entrance and exit of both people and animals, location of the chilling tanks, and access to raw milk.

Write the manual in a clear, concise language. Regularly update your manual to reflect technological advancements and regulatory changes, as well as provide training to ensure adherence to such changes.

Following are sample GMP and SSOP manuals. However, you may add elements that are not in the samples but which you think should be included, and visualize the future of your operations. For example, scaling up operations means the milk will be picked up from the farm.

Good Manufacturing Practices Manual

Farm Name: _____
Location: _____
Owner/Manager: _____
Date of Implementation _____

1. Objective

2. Scope

3. Organizational Structure

Roles and Responsibilities of Personnel

- a.
- b.
- c.
- d.

4. GMP Guidelines

- A. Animal Health and Welfare
- B. Hygienic Milk Practices
- C. Health and Hygiene of Farm Workers
- D. Waste Management
- E. Clean and Safe Environment
- F. Facility Sanitation/Equipment Maintenance
- G. Documentation and Record-Keeping
- H. Feed and Water Safety
- I. Compliance with Regulatory Standards

5. Certification and Verification

Farm Owner/Manager Signature: _____
Date: _____
Reviewed by: (Technician/Inspector): _____
Date of Review: _____

Sanitation Standard Operating Procedures Manual

Farm Name: _____
Location: _____
Owner/Manager: _____
Effective Date: _____
Date Reviewed: _____

1. Objective

To ensure the production of safe and high-quality milk by implementing standardized cleaning and sanitation procedures in all areas of the dairy farm, especially where milk is handled, animals are housed, and equipment are used.

2. Scope

Covers cleaning and sanitation of:

- a. Milking equipment and utensils
- b. Milking parlor or area
- c. Animal housing/stalls
- d. Milk storage and transport containers
- e. Watering systems
- f. Personnel hygiene and facilities

3. Responsibilities of the Personnel

- a.
- b.
- c.
- d.
- e.

4. Areas and Procedures

a. Milking Equipment and Utensils

Frequency: Before and after every milking session

Responsibility: Milker/Equipment handler

Procedure:

- i. Rinse with lukewarm water to remove milk residues.
- ii. Wash with hot water (45-60oC) and food-grade detergent.
- iii. Scrub surfaces thoroughly using brushes.
- iv. Rinse again with clean water.
- v. Sanitize with approved sanitizer solution (e.g., chlorine-based) before use.
- vi. Air-dry in a clean, dust-free area.

b. Milking Area/Parlor

Frequency: After each milking and once daily for deep cleaning

Responsibility: Milker/Farm cleaner

Procedure:

- i. Remove all manure, spilled milk, and used bedding.
- ii. Wash floors and walls with clean water.
- iii. Scrub with disinfectant (e.g., quaternary ammonium or iodine-based solutions).

- iv. Rinse and allow area to dry.
- v. Ensure proper drainage and no standing water.

c. Animal Housing and Stalls

Frequency: Daily (manure removal), weekly (deep cleaning)

Responsibility: Assigned farm staff

Procedure:

- i. Remove manure, wet bedding, and uneaten feed daily. .
- ii. Disinfect feeding and drinking areas weekly.
- iii. Replace bedding with dry and clean materials.
- iv. Ensure proper ventilation and lighting.

d. Milk Storage Containers

Frequency:

Responsibility:

Procedure:

- i.
- ii.
- iii.
- iv.

e. Water Trough/Feeding Trough

Frequency:

Responsibility:

Procedure:

- i.
- ii.
- iii.
- iv.

Personnel Hygiene

f. Frequency:

Responsibility:

Procedure:

- i.
- ii.
- iii.
- iv.

5. Monitoring and Verification

- Use sanitation checklists to document daily cleaning activities.
- Conduct weekly inspections of sanitation practices.
- Keep records of cleaning schedules, issues found, and corrective actions.

6. Corrective Actions

When deviations occur:

- Immediately stop milking if equipment or area is found unsanitary.
- Clean and sanitize before resuming operations.
- Refrain staff if repeated violations occur.
- Record incident and action taken in the SSOP logbook.

7. Documentation and Record-keeping

Keep the following

- Daily sanitation logs
- Equipment cleaning records
- Personnel hygiene compliance logs
- Incident/corrective action reports
- Weekly sanitation review reports

8. Compliance Acknowledgment

I, the undersigned, acknowledge that I have read, understood, and will comply with the SSOP Manual of this dairy farm.

Name of Employee: _____

Signature: _____

Date: _____



Dairy Mentors Training Module 6: Good Manufacturing Practices and Standard Sanitation and Operating Procedures Country Fields Agri Tech Center, Butuan City, 9-11 July 2025



Dairy Mentors: Eager to Learn, Ready to Share

It was good to see the participants to the training series under NATCCO's Dairy Mentors Development Program under the CAFÉ-DAIRY project take the floor to either ask questions or share their own experiences as dairy farmers. But it was the testimonials after each training session that showed their passion to contribute to the development of the dairy industry by introducing changes to their farms based on newly acquired knowledge.

“These trainings will help improve our farms. Many of our animals have died, but we succeed through failures. Many youth have become passionate as farmers, although we in the cooperatives are finding it hard to convince other farmers that it's good to engage in dairy farming,” said Richard Hidalgo, general manager of Baclay Multi-Purpose Cooperative based in Zamboanga del Sur.

For Rodrigo Dumaluan, of Clavidaco, the trainings were an eye-opener. “In more than 20 years of ups and downs, I found that there are three considerations in dairy farming: genetics, nutrition, and management, including recordkeeping. Good genetics but poor nutrition is useless, and vice versa, they must go hand in hand. The absence of focus on management is a common cause of failure. We hope to be guided in terms of proper genetics especially by the NDA.”

Interestingly, it was during the session on Good Manufacturing Practices and Standard Sanitation Operating Procedures that many of the mentors realized that dairy farms need to have hands-on managers. “GMP-SSOP must be written as a reference to ensure quality milk,” one of them suggested.

Such a realization came after experiencing firsthand the meticulous and delicate processes involved in milking cows to ensure the harvest of sanitary milk. “The importance of a leader’s presence and patience was shown during the demo on proper milking and storage,” a participant observed.

“Dairy farming is not just *ibog-ibog* (roughly envy). There are procedures to follow, which must be documented to enable others to learn, too,” one of the twentyish female mentors emphasized. “Envy leads to nothing. If you can only be a mentor, it’s all right. But it’s better to be a farmer, too.”

Another mentor said he didn’t experience implementing sanitation procedures during his internship, but only learned it during the training. “It would be huge if students could have farm experience,” he added.

During the session on Animal Nutrition where the participants experienced making a Urea Molasses Mineral Block, a participant said the activity “helped me realize or understand that dairy farming is not an easy job. There are many things that you should consider especially in handling the food and nutrition of the cow. But thanks to the facilitators, they gave me an opportunity to experience this process.”

“I enjoyed learning even if the calculations were challenging,” he said, referring to the formula that one should follow to ensure that the cows receive the right amount of nutrients.

Many other participants acknowledged that it was only during the training that they learned about the correct feed formula. For some, it refreshed the knowledge they obtained as students.

Nonetheless, there were uncertainties and doubts. “I am starting to feel pressure as a mentor. It’s unfamiliar to me since I’m not an Animal Science graduate, but I’m trying to cope,” one of the participants admitted.

“In sharing knowledge, the mentors should choose what topics they are comfortable with,” Marilou Lumanta, of Dalwangan Multi-purpose Dairy Cooperative responded. “Dairy farming is a challenge vis-à-vis the country’s low milk production and the emergence of big companies. The mentors can help by sharing their knowledge.”

Lumanta’s words echoed the Philippine Dairy Road Map 2020-2025, which states: “When dairy farmers are well-equipped with knowledge, the management of their dairy farms are likely to improve, productivity of the farm is improved, and income increases.”

CHAPTER SEVEN

DAIRY FARM ECONOMICS AND FINANCIAL MANAGEMENT

Making small-scale dairy farming a viable and profitable business requires balancing costs, optimizing production, and adapting to technologies and market trends.



AI-generated image

Dairy Farm Economics

It is crucial to know the economics of small-scale dairy farming to ensure its profitability and sustainability. The inability of the domestic supply to meet the rising demand for dairy products provides a huge opportunity for dairy farmers to expand their operations. However, dairy farmers must ensure production efficiency and adopt relevant market strategies to become competitive.

There are at least three things that dairy farmers must factor in their planning – initial investment and costs, revenue streams, and cost management [to maximize profitability].

- **Initial Investment and Costs**

- Initial investment and costs include purchasing livestock and equipment, building animal shelters and other structures, and installing milking systems. Feeds will account for the biggest portion of expenses for daily operations. Labor, transportation, medicines, should be considered in financial planning, too.
- It should be noted that, based on studies, dairy production has lower economies of scale due to its high labor input. The milk production costs of small-scale producers are similar to those of large-scale dairies, as small-scale producers often use family labor. In contrast, dairy processing is more capable of developing economies of scale.

- **Revenue Streams**

- Milk is the daily source of income for dairy farmers. Income, however, can be increased by going into value-adding or processing activities such as producing cheese, yogurt, and snack items like milk bars. Farms can also obtain additional income through the sale of manure for fertilizer, forage, [male] calves, and culled animals. Some farms are earning revenues as training/learning centers and agritourism destinations, and by accommodating interns for a certain fee.

- **Profitability and Cost Management**

- Effective cost management means higher profitability. While automation remains far-fetched for the country's small-scale producers owing to its high cost, they can streamline some aspects of their operations. They can cut costs by producing their own forage instead of constantly buying it, and using feeds that are cheaper but as effective as high-priced ones. Adopting efficient breeding programs and herd management will ensure higher milk yields. Implementing biosafety measures can prevent losses and additional expenses caused by animal disease or mortality. Securing contracts with buyers will ensure steady flow of income.

Basic Financial Management in Dairy Farm Operations

Making small-scale dairy farming a viable and profitable business requires balancing costs, optimizing production, and adapting to technologies and market trends. In addition, farmers need to have a good understanding of the basics of establishing, interpreting and managing the financial aspects of dairy farm production, without which it would be difficult to determine the viability and sustainability of their venture. Besides, organizational capabilities such as financial management skills will boost the business performance of farmers as well as cooperatives.

This chapter deals with the following topics on financial management: overview of the tools for measuring financial performance and position, the three financial statements, elements of the financial statements, an overview of the tools for business financial analysis, and budgeting.

Difference Between Business Financial Position and Business Financial Performance:

- Business financial position refers to assets, liabilities, and owner's equity.
- Business financial performance refers to sales, expenses, and profit, which determine profitability, liquidity, and solvency.

Business Non-Financial Performance Is Based On:

- Reliability – consistency in delivering products and services as promised, e.g., on-time delivery by a dairy cooperative, maintaining trust and reducing spoilage, to build consumer confidence and strengthen supplier contracts
- Product/Service Quality – the degree to which products meet standards and customer expectations, e.g., low somatic cell count in milk, proper pasteurization, and clean packaging to enhance brand reputation and reduce returns or complaints
- Customer Relationship Management – quality of interaction levels among clients or members, e.g., receiving feedback, training, and support from dairy mentors to drive loyalty, repeat business, and cooperative participation
- Supplier Relationship Management – strength and transparency of partnerships with input providers or processors, e.g., feed suppliers consistently meeting quantity and quality specifications to ensure smooth operations and reduces procurement risks
- Innovation and Process Improvement – adoption of new technologies (knowledge and facilities) or practices to improve efficiency, e.g., adoption of digital farm records to boost productivity and keep the business competitive

Business Financial Performance

Business financial performance is reflected in the financial statements and is measured using the tools of financial analysis, which will examine the profitability, liquidity, and solvency of a business.

- **The Tools of Financial Analysis:**

- **Profitability** – The ability of a business to generate income relative to its expenses over a given period. Its key indicators are net income, return on investment (ROI), and contribution margin.
- **Example:** If a cooperative dairy farm earns ₱500,000 in milk sales and spends ₱400,000 on feed, labor, and overhead, its profitability is reflected in the ₱100,000 net income and ROI from those operations.
- **Liquidity** – The ability of a business to meet its short-term financial obligations using its current assets. Its key indicators are current ratio, net cash flow, and working capital.
- **Example:** A farm with ₱300,000 in cash and receivables and ₱200,000 in payables has ₱100,000 in working capital, indicating it can cover immediate costs like feed purchases or loan payments.
- **Solvency** – The long-term financial stability of a business, its ability to meet all debts and continue operations over time. Its key indicators are debt-to-asset ratio, equity-to-asset ratio, and interest coverage ratio.
- **Example:** If a farm owns ₱2 million in assets and owes ₱1.2 million in loans, its solvency is reflected in its ₱800,000 equity and a debt-to-asset ratio of 0.6, suggesting moderate financial risk.

- **Definition of the Indicators Used in Financial Analysis**

Net Income – Net income is the money left over after taxes, deductions, and other expenses are subtracted from total revenue.

Return on Investment (ROI) – ROI is calculated by dividing the net income from an investment by the original cost of the investment, the result of which is expressed as a percentage using the following formula:

$$\text{ROI} = \text{net income} \div \text{cost of investment} \times 100$$

Contribution Margin – Contribution margin represents the portion of a product's sales revenue that isn't used up by variable costs, and so contributes to covering the company's fixed costs.

Current Ratio – It is a liquidity ratio that measures a company's ability to pay its short-term obligations (those due within one year) using its short-term assets (those that can be converted to cash within one year). It is calculated by dividing total current assets by total current liabilities.

Net Cash Flow – Net cash flow is the net amount of cash moving into and out of a business over a specific period, calculated by subtracting total cash outflows from total cash inflows.

Working Capital – Working capital is the difference between a company's current assets and its current liabilities on its balance sheet.

Debt-to-Asset Ratio – The total debt-to-total-asset ratio is calculated by dividing a company's total debts by its total assets. All debts and assets are considered.

Equity-to-Asset Ratio – Also known as equity ratio, the equity-to-asset ratio is a financial metric that measures the proportion of a company's assets financed by its shareholders' equity, calculated by dividing total equity by total assets.

Interest Coverage Ratio – The interest coverage ratio is a financial ratio that is used to determine how well a company can pay the interest on its outstanding debts.

- **The Three Financial Statements:**

- **Income Statement (Statement of Financial Performance)** – reflects the revenue, expenses, and net income. Income statement is only for the business component of the cooperative; patronage refund and dividend cannot be included in it.
- **Cash Flow Statement (referenced with the income statement)** – Cash flow is the movement of money into and out of a company over a certain period of time. It is calculated by subtracting total cash outflow from total cash inflow, and can be categorized as cash flows from operations (daily business activities like purchasing and selling), from investing, and from financing. If the company's inflows of cash exceed its outflows, its net cash flow is positive. If outflows exceed inflows, it is negative.
- **Balance Sheet or Statement of Financial Position** – summarizes a company or a cooperative's assets, liabilities and shareholders' equity at a specific point in time.

Sample Income Statement

Dairy Milk Processing Enterprise
INCOME STATEMENT
For the Year Ended December 31, 2024
(All Figures in Philippine Pesos)

REVENUES

Milk Sales (pasteurized, yogurt, etc.)	1,200,000
By-product Sales (e.g., whey)	80,000
Other Income (training, tours)	20,000
TOTAL REVENUES	1,300,000

COST OF GOODS SOLD

Raw Milk Purchase	600,000
Packaging Materials	100,000
Processing Supplies	50,000
TOTAL COST OF GOODS SOLD	750,000

GROSS PROFIT 550,000

OPERATING EXPENSES

Salaries and Wages	120,000
Utilities (electricity, water)	40,000
Equipment Maintenance	25,000
Transportation and Delivery	30,000
Marketing and Promotion	20,000
Administrative Expenses	15,000
TOTAL OPERATING EXPENSES	250,000

OPERATING INCOME 300,000

OTHER INCOME/EXPENSES

Interest Income	5,000
Interest Expense	(10,000)
NET OTHER INCOME/EXPENSE	(5,000)

NET INCOME BEFORE TAX 295,000
Less: Income Tax (assumed 30%) 88,500
NET INCOME AFTER TAX **206,500**

Sample Cash Flow Statement

Dairy Milk Processing Enterprise **CASH**
FLOWSTATEMENT
For the Year Ended December 31, 2024
(All Figures in Philippine Pesos)

CASH FLOWS FROM OPERATING ACTIVITIES

Cash Inflows from Operating Activities

Cash received from milk and by-product sales 1,300,000

Total Cash Inflow from Operating Activities **1,300,000**

Cash Outflows from Operating Activities

Cash paid for raw milk purchases 600,000

Cash paid for packaging and supplies 150,000

Salaries and wages paid 120,000

Utilities and maintenance expenses 65,000

Transportation, marketing, admin expenses 65,000

Interest paid 10,000

Income tax paid 88,500

Total Cash Outflow from Operating Activities **1,098,500**

NET CASH PROVIDED BY OPERATING ACTIVITIES **201,500**

CASH FLOWS FROM INVESTING ACTIVITIES

Cash Inflows from Investing Activities

Interest income received 5,000

Total Cash Inflow from Investing Activities **5,000**

Cash Outflows from Investing Activities

Purchase of equipment or upgrades (assumed) 100,000

Total Cash Outflow from Investing Activities **100,000**

NET CASH USED IN INVESTING ACTIVITIES **(95,000)**

CASH FLOWS FROM FINANCING ACTIVITIES

Cash Inflows from Financing Activities

Loan proceeds 0

Cash Outflows from Financing Activities

Loan repayments 0

NET CASH FROM FINANCING ACTIVITIES **0**

NET INCREASE IN CASH **106,500**

BEGINNING CASH BALANCE **50,000**

ENDING CASH BALANCE **156,500**

Sample Statement of Financial Position (Balance Sheet)

Dairy Milk Processing Enterprise
STATEMENT OF FINANCIAL POSITION
As of December 31, 2024
(All Figures in Philippine Pesos)

CURRENT ASSETS

Cash and Cash Equivalents	156,500
Accounts Receivable	80,000
Inventory (Milk and Supplies)	70,000
Total Current Assets	306,000

NON-CURRENT ASSETS

Equipment and Machinery	1,200,000
Building and Improvements	500,000
Land	200,000
TOTAL NON-CURRENT ASSETS	1,900,000
TOTAL ASSETS	2,206,500

CURRENT LIABILITIES

Accounts Payable Short-Term	100,000
Loans	100,000
TOTAL CURRENT LIABILITIES	200,000

NON-CURRENT LIABILITIES

Long-Term Loans	1,000,000
TOTAL NON-CURRENT LIABILITIES	1,000,000
TOTAL LIABILITIES	1,200,000

OWNER'S EQUITY

Capital Contribution	800,000
Net Income (Retained Earnings)	206,500
Total Owner's Equity	1,006,500

Total Liabilities and Owner's Equity **2,206,500**

- The statement of financial position is done after making the income statement and cash flow statement, in that order. Thus, the items/figures therein should correspond to those in the income statement and cash flow statement upon counterchecking.
- It shows the assets of a business, which include the total liabilities and total owner's equity, i.e., Assets = Liabilities + Owner's Equity.
- The financial position is the reflection of management. Look into the financials on a regular basis; doing it yearly could mean great damage shall have been done.
- A business is in good financial position if it's capable of paying both short- and long-term liabilities.

Profitability, Liquidity, and Solvency Tests Based on the Following Assumptions:

- Total Assets = PhP 2,000,000
- Total Current Assets = PhP 300,000
- Total Liabilities = PhP 1,200,000
- Total Current Liabilities = PhP 200,000

Profitability Test

Metric	Formula	Computation	Result	Interpretation
Net Profit Margin	Net Income ÷ Total Revenue	206,500 ÷ 1,300,000	15.88%	As a rule of thumb, 5% is a low margin, 10% is a healthy margin, and 20% is a high margin
Return on Assets (ROA)	Net Income ÷ Total Assets	206,500 ÷ 2,000,000	10.33%	A good ROA generally falls between 5% and 20%, with anything over 20% considered excellent
Return on Equity (ROE)	Net Income ÷ Owner's Equity	206,500 ÷ 800,000	25.81%	A good ROE typically falls between 15% and 20%

Liquidity Test

Metric	Formula	Computation	Result	Interpretation
Current Ratio	Current Assets ÷ Current Liabilities	300,000 ÷ 200,000	1.5	A current ratio of 1.0 or greater is considered acceptable
Working Capital Ratio	Current Assets – Current Liabilities	300,000 – 200,000	1.5	A range of 1.2-2.0 indicates good financial health
Net Cash Flow	Cash Inflows – Cash Outflows	1,300,000 – 1,098,500	201,500	A positive net cash flow is healthy

Solvency Test

Metric	Formula	Computation	Result	Interpretation
Debt-to-Asset Ratio	Total Liabilities ÷ Total Assets	1,200,000 ÷ 2,000,000	0.60	A ratio of below 1.0 is relatively safe
Equity-to-Asset Ratio	Owner's Equity ÷ Total Assets	800,000 ÷ 2,000,000	0.40	A ratio of 0.5 or higher is considered strong
Interest Coverage Ratio (ICR)	Operating Income ÷ Interest Expense	300,000 ÷ 10,000	30.0	The higher the ICR, the better

Computing the Breakeven Volume (Minimum Volume Required)

The breakeven volume is the total amount of the product that needs to be produced and sold to cover the total cost of production (variable and fixed costs). The formula is to divide the total fixed cost with the selling price less the unit variable cost:

$$\text{Breakeven Volume} = \frac{\text{Total Fixed Cost}}{(\text{Selling Price} - \text{Unit Variable Cost})}$$

Assumptions:

1. The selling price per bottle of 1 liter of milk is 100.00.
2. The minimum standard production is 7,500 bottles sold.

$$\text{Breakeven Volume} = \frac{260,000}{(150 - \text{Unit Variable Cost})}$$

$$\text{Unit Variable Cost} = \frac{750,000}{7,500} = 100$$

$$\text{Breakeven Volume} = \frac{260,000}{(150 - 100)}$$

$$\text{Breakeven Volume} = 5,200 \text{ bottles}$$

Check:

$$150 (5,200) = 260,000 + 100 (5,200)$$

$$780,000 = 260,000 + 520,000$$

$$780,000 = 780,000$$

Step-By-Step Budgeting

1. Set the Budget Period

Define the timeframe. Ideally, it should be yearly. Align with production cycles and cooperative planning.

2. Estimate Revenue

Use historical data to project future sales, and adjust the volume based on seasonal demand, marketing efforts, or cooperative expansion.

$$\begin{aligned} \text{Projected Milk Sales} &= \text{Selling Price} \times \text{Expected Volume} \\ &= \text{PhP}150 \times 10,000 \text{ bottles} \\ &= \text{PhP}1,500,000 \end{aligned}$$

3. Forecast Variable Costs

Base these on expected production volume.

Raw Milk Purchase	= P600,000
Packaging Materials	= P100,000
Processing Supplies	= P50,000
Total Variable Costs	= P750,000

4. Plan Fixed Costs

These remain stable regardless of output.

Salaries and Wages	= P120,000
Utilities	= P40,000
Equipment Maintenance	= P25,000
Transportation and Delivery	= P30,000
Marketing and Promotion	= P20,000
Administrative Expenses	= P15,000
Interest Expense	= P10,000
Total Fixed Costs	= P260,000

5. Calculate Projected Net Income = Revenue – (Variable Costs + Fixed Costs)
= P1,500,000 – (P750,000 + P260,000)
= P490,000

6. Create A Budget Table

Projected Revenue	= P1,500,000
Variable Cost	= P750,000
Fixed Cost	= P260,000
Net Income	= P490,000

7. Monitor and Adjust:

- Track actual versus budgeted figures monthly or quarterly.
- Use dashboards or mentor-led reviews to analyze variances.
- Adjust budget based on market shifts, cost changes, or cooperative goals.



***Dairy Mentors Training Module 7: Dairy Farm Economics and Financial Management
Central Mindanao University, 27-29 August 2025***



Andre Paulo at his farm in Impasugong, Bukidnon

Pagong: Looking Beyond the Farm

In one of the training sessions for dairy mentors organized by NATCCO, Andre Paulo O. Paraguya, apparently in jest, introduced himself as the COO – Child of the Owner – of Spring Integrated Dairy Farm. It gave the participants a good laugh.

However, Andre Paulo's early experience as a dairy farmer was no laughing matter. It was mainly experimental and random. For instance, he would give his cows with whatever feed material was in sight. "Grains were always available. I gave them spent grain, pulp, silage. But since three years ago, it has all been silage, no more fresh forage. At that time, I had no technical knowledge of how much feed to give, mata-mata lang (I just estimated)," he recalled.

To be exact, it wasn't all estimates and experience. Pagong, as he is fondly called, also learned from fellow dairy farmers and the National Dairy Authority, and by watching YouTube tutorials.

He credited the training on animal nutrition as a major factor for the improved milk production of his cows. He said that after using the feeding formula taught during the training, at least two of his cows increased their milk yield to 20 liters per day. "The rest produced less, but I guess it might be because they were already in the late stage of lactation."

Learning from experience, Pagong has confined all of his cows in a barn to prevent tick infestation, which happens to animals that are left to graze on the field. Several published sources attest that

pastured cattle are at higher risk of exposure to ticks, which also increases the risk for people who attend to them. Heavy tick infestation can cause decrease in weight and milk production and a disease called tick fever that can lead to enormous losses.

Pagong currently maintains a total of 36 tons of corn silage for his milking line, 18 tons at the farm and 18 tons inside the family's sprawling home compound, both in Impasugong, a town in northern Bukidnon known for its picturesque ridges and laid-back charm. The rest of the herd are fed with Napier.

Pagong has three full-time workers – a milker, a feeder, and an alternate in case either one of the first two could not go to work due to ailment or other reasons.

For the silage, he buys sweet corn stalks at 50 centavos per kilo, although he has devoted one hectare of land to corn. He has also planted another one hectare with Napier. And, while waiting for [his] Napier to flourish, he is harvesting the grass from the banks of a creek. At the moment, he produces around five tons of Napier silage. Since the area belongs to the commons, “sa makauna lang og pangumpay (it depends on who gets to harvest first),” he said with a chuckle.

Yet, while his “pangumpay” is an important part of his enterprise, it has stopped his routine of delivering fresh milk house to house. “There's no one else to drive the truck [used for hauling the forage],” he said.

For now, he averages P34,000 monthly from raw milk sales at the farm. In addition, he sells yogurt, which is processed and sold at the family's store located near their home. “I'm selling at least 50 liters a month for P200 per liter. There are mango and strawberry flavors. Some locals are buying it. There's also a local food establishment that's using it for dressing,” he said.

A holder of NC II from TESDA, Pagong is also planning to turn his dairy farm into a learning and agritourism site. He has been accepting high school interns the past three years, and just recently, students from a local college.

“The number of tourists is increasing. Sometimes, people who ride our ATVs would reach 200 a week. I guess RotyPeaks have around 500 visitors per week, and the Communal Ranch potentially one thousand visitors per week. If I can get even just a little percentage [of their visitors], it would be fine,” he said.

RotyPeaks is a campsite located on the northwestern side of Impasugong, while the Communal Ranch is a local government-operated ranch that offers a stunning view of the ridges east of the town.

“The visitors can learn about our dairy operations and how our burger and yogurt are produced at the store, and see these food items as local resources,” Pagong said.

Ten years ago, the 31-year-old farmer-entrepreneur started with only five cows. Now, the herd has grown to 17 cattle. He doesn't stop finding opportunities for [his] business to grow, and apparently has the acumen for it.

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CAFE-DAIRY PROJECT

OBJECTIVE

To promote peace through agriculture development using the value chain approach in dairy and coffee industry in Region 9 and 10 to benefit 1,800 farmers including Indigenous Peoples, women and youth.

PROJECT COMPONENTS AND ACTIVITIES

- Improving Business Services
- Industry Sector Development

DURATION

36 months (Nov 2022 – Oct 2025)



Maribel G. Isidro
Project Manager

A PROJECT OF



ABOUT THE PROJECT

CAFÉ-DAIRY Project is part of the project 'Strengthening the Implementation of Regional and Local Peace and Development Agendas' (SPADe).

The project SPADe is a collaborative effort by the Philippine Government, financed by the European Union (EU) and the German Federal Ministry for Economic Cooperation and Development (BMZ) through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Cooperative Assistance and Farm Extension to Develop Agri- entrepreneurs, Indigenous Peoples and Rural Youth

AREA OF COVERAGE

Region 9 - Zamboanga del Sur
Region 10 - Bukidnon, Misamis Oriental and Misamis Occidental
2 Regions, 3 Provinces, 8 Municipalities, 3 Cities, and 26 Barangays



PROJECT PARTNERS

National Dairy Authority (NDA), Philippine Carabao Center (PCC), Department of Trade and Industry (DTI), Department of Science and Technology (DOST), Department of Agriculture (DA), Central Mindanao Universities, ACDI/VOCA, Peace and Equity Foundation (PEF), CLIMBS and CISP, Asian Farmers Association (CA), and Collectif Stratégies Alimentaires (CSA)

PROJECT BENEFICIARIES, INTERVENTION AREA, AND VALUE CHAINS



Target Group
1,800 farmers
• 68% IPs
• 38% Women
• 10% Youth



7,200 indirect beneficiaries
11 Primary Cooperatives
1 Secondary Coop Federation



Supported Value Chains
• Coffee and Dairy

COOPERATIVE PARTNERS



www.natcco.coop

nzalmera@natcco.coop
cc:agalmental@natcco.coop

Door #2, 2nd Flr., RJK God's Grace Bldg., Tiano-Montalvan Sts., Cagayan de Oro City