FEEDING

MAY 2017

DANONE

DANONE ÉCOSYSTEME

MILK CYCLE

HOW TO READ THIS BOOKLET

All along this notice, you will find some golden rules (the ones from the poster) and tips about feeding that can be applied directly in the field. They will be distinguishable with icons:

GOLDEN RULES

TIPS

TABLE OF CONTENTS (1/2)

TABLE OF CONTENTS (2/2)

INTRODUCTION AND OBJECTIVES

INTRODUCTION AND OBJECTIVES

Feeding is the main expense on a dairy farm, and can represent more than 80% of the farm's costs. This notice is intended for technicians to improve dairy farms feeding management. It aims to present:

1.

Fundamentals about feeding management on a dairy farm

2.

Methodologies to calculate competitive and balanced rations valorizing local feeds

2

FUNDAMENTALS

2 FUNDAMENTALS

2.1

DIGESTIVE PHYSIOLOGY OF COWS

DIGESTIVE PHYSIOLOGY OF COWS

Cows are ruminants, they need to eat grass or any other source of fiber rich feed stuff. Cows have a complex digestive system. Indeed, they have a stomach with a capacity of 200 liters, composed of 4 compartments (rumen, omasum, reticulum and abomasum).

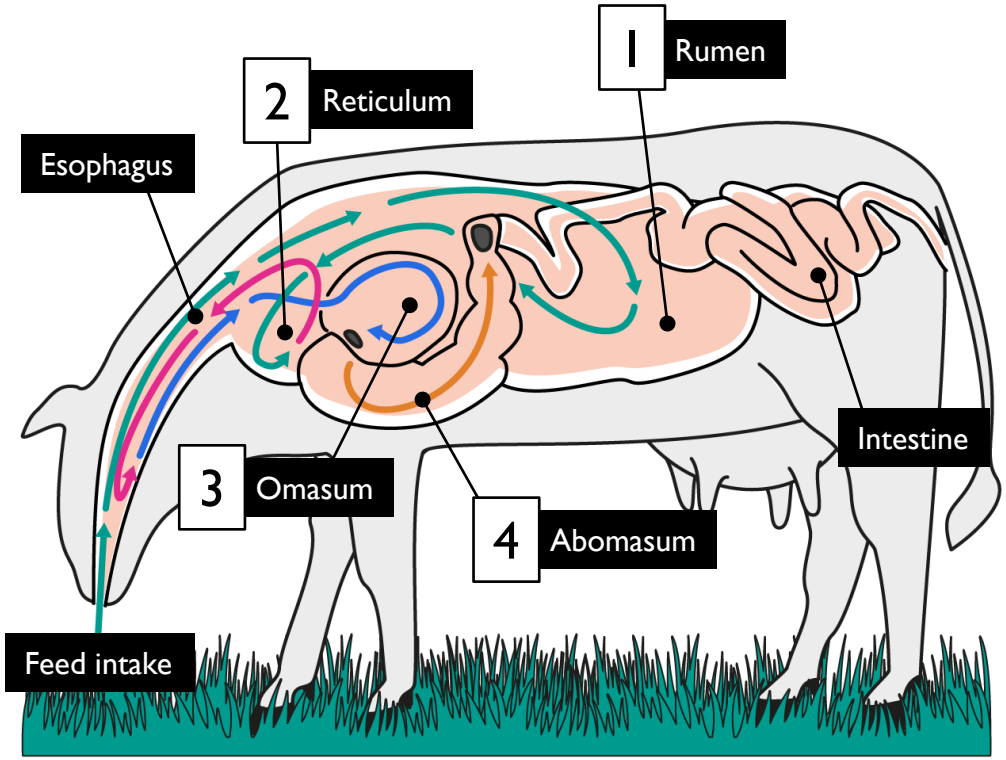
DIGESTIVE PHYSIOLOGY OF COWS

Digestive process has 3 steps: ingestion, digestion and absorption:

1- INGESTION

Feed is chewed, mixed with saliva and swallowed. Then feed is regurgitated, chewed and swallowed again: it is the **process of rumination.** Regurgitating enlarges the surface area of the feed which helps micro-organisms to digest it. A cow produces between 40 to 180L of saliva per day, depending on the feed she receives.

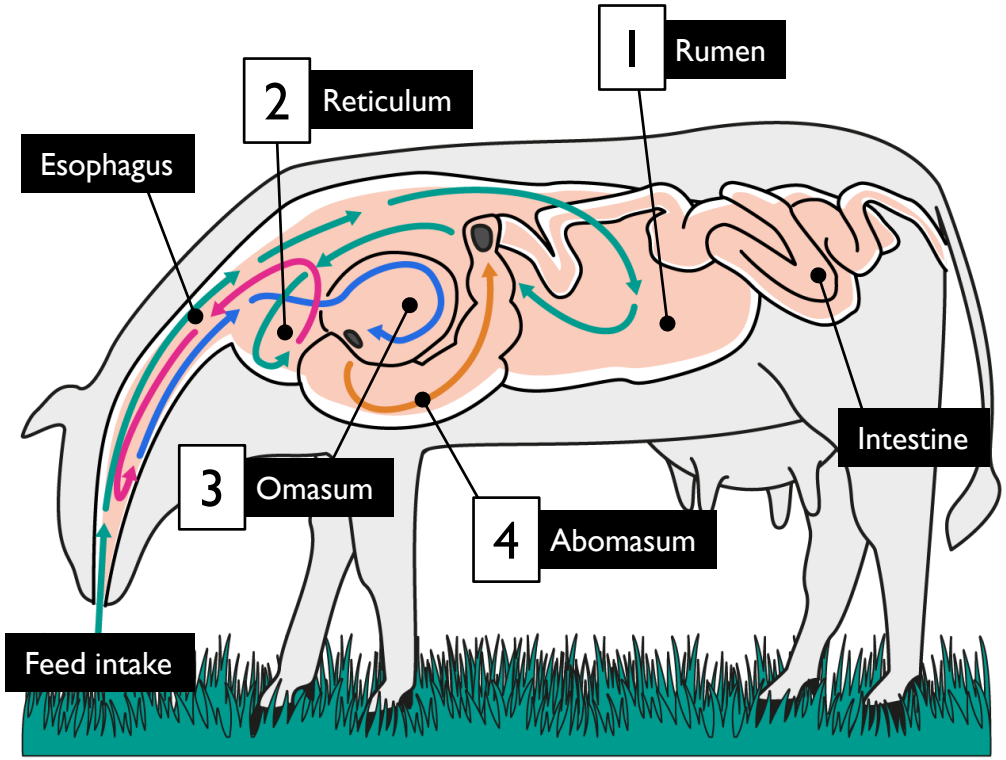
Saliva has a buffer effect in the rumen meaning that it compensates acidifying agents such as concentrated feed on the ruminal pH. It is important because the ideal pH level for rumen is between 6 and 7 and micro-organisms which digest cellulose cannot work at less than pH-6.



DIGESTIVE PHYSIOLOGY OF COWS

2- DIGESTION

As the feed has been crushed by rumination, rumen microbes can degrade feed. Then, the ingesta moves to the abomasum. The main function of the abomasum is to digest proteins from both feed and ruminal microbes.



3- ABSORPTION

The feed goes through the small intestine where nutrients are absorbed by blood.

DIGESTIVE PHYSIOLOGY OF COWS

Feeding a cow means feeding billions of bacteria in the rumen which degrade feed in nutrients usable by the cow.

- **Cows' needs depend on several factors** such as their weight, dairy production, life stage and activity level. **Define the ration in order to have a balanced and competitive one.**
- **Do not change the diet of cows brutally.** It is fundamental to keep the rumen microbiota balanced.

- A good indicator to measure whether or not a ration is balanced (in terms of quantity and quality) is the refusal rate. The **refusal rate** is the part of the ration that cows have not consumed. A reasonable goal is to have around **5% of feed refused.**
- Second indicator is the **cow's dung. The consistency should be solid porridge like, without any non-digested feed particles.**

2.2

GENERAL PRINCIPLES TO FEED A COW

GENERAL PRINCIPLES TO FEED A COW

❖ Cows have a limited intake capacity

Cows are limited on their ingestion because of the rumen size. Micro-organisms degrade feed in the rumen. If feed particles are too big, they stay longer in the rumen. When the rumen is filled, cows cannot eat more. This is part of what is called **intake capacity**. This feed intake capacity depends on who is eating the feed and what feed is consumed. On the feed side, the main factors are: **dry matter content and the digestibility of the feed.** On the cows side, **intake capacity differs per stage of lactation, parity, age and breed of the cow.**

Select good quality feed components adapted to the cows' needs. The ration quantity (in KG or LBS) depends on the rumen size which is limited.

Cows are generally able to eat 3% of their body weight.

GENERAL PRINCIPLES TO FEED A COW

❖ Cows have needs to be covered

Providing cows with the right nutrients is key. Cows need **water, energy, protein, minerals and vitamins.** Bring **the needed nutrients daily splitting the distribution into at least 2 meals per day** and homogenize the ration beforehand.

▪ Water needs

Water is the basic need of a cow. The body of a cow contains 70 to 75% of water and **milk contains 85% of water.** 2 to 4 additional liters of water per cow can be available at a very low cost and can make a real difference.

Provide cows with clean, fresh water (<25°C) permanently available. The must: **to provide the water in a covered water trough.** Drinking water should be separated from any concentrated slurry.

GENERAL PRINCIPLES TO FEED A COW

Water needs depends on climate, milk production and alimentation (higher water needs with dry fodder). For example, during hot season, a cow can drink up to 200 liters a day.

- Supply the cow with ad libitum access to clean water. Cows like to have a water depth of around 7 centimeter. So they can drink without sucking air.
- Supply sufficient drinking points in the barn/field to ensure water is always within short reach.

GENERAL PRINCIPLES TO FEED A COW

▪ Nutrient needs

- Energy ensures body functions, dairy production and reproduction
- Proteins and nitrogen ensure growth, dairy production and reproduction
- Vitamins (A, B, C, E) and minerals (calcium, phosphorus, sodium, magnesium) ensure body functions and reproduction

Nutrients needs depend on several factors such as cow's activity, cow's weight, dairy production and physiological stage (lactation stage, gestation stage, and number of gestations).

❖ Feeding a balanced ration to cover the cows' needs

The aim is to feed a balanced ration in sufficient quantities and containing all essential nutrients.

A balanced ration is a ration with several types of components: **energy, protein, fiber, minerals and vitamins. The ration must contain at least 70% of fodder, or roughage type of fibrous feed,** essential for rumination and rumen activity. It should not contain more than 30% of leguminous plants.

GENERAL PRINCIPLES TO FEED A COW

▪ Fodder

Fodder or roughage is fresh plant material, fed directly or ensiled for later use. It is the aerial part of the plant: the stem, the leaf and the seeds. Here are some examples of most common fodders:

Fodder	Energy value	Protein value	Rumination capacity	Ingestion
Oats hay	Medium	Weak	Excellent	Medium
Green lucerne	Medium	Excellent	Very good	Very good
Green sorghum	Medium	Medium	Very good	Very good
Corn silage	Very good	Weak	Good	Excellent
Ryegrass pastura	Excellent	Good	Good	Excellent

GENERAL PRINCIPLES TO FEED A COW

Cultivate fodders adapted to soil and climate (more economic, more resistant and better environmental impact). The quality of the fodder depends on the plant stage and the conservation method (dry or humid):

Method	Details	+	-
Hay	Conservation by air-drying deshydratation. It requires several days of good weather after harvesting, and a plant picked at an optimal stage (beginning heading for grass and bud stage for legumes).	This method is ideal for farmers with small surfaces or with a low level of mechanization on the dairy farm	Sensitive to climate and humidity (mould risks)
Silage	Conservation of humid fodder by lactic fermentation. The fodder stored into a silo without air.	Best conservation method for nutrients. This method is also less dependent on climate	Requires technical skills and equipments on the farm

GENERAL PRINCIPLES TO FEED A COW

▪ Supplementing a ration

Fodder rarely brings all the nutrients to cover the cows' needs. The ration can be supplemented with **concentrated feed.** Agricultural and agro-industrial **byproducts available locally** are a good alternative. However, the quality of concentrate feeds varies from region to region. In some regions, protein meals are the major source of concentrate, whereas, in other locations it could be cereal brans or other byproducts.

The quantity of feed provided to a cow depends on its body weight, milk production and life stage.

GENERAL PRINCIPLES TO FEED A COW

Classification energy/protein	Poor in energy	Moderate in energy	Rich in energy
Poor in protein	Rice straw Corn sterm Sugarcane straw Manioc residues	Rice bran (poor) Most of grass Ears of sweet corn Banana stump Rice straw treated with urea	Cassava chips Paddy rice Molasses Sweet potatoes Pineapple residues Corn silage
Moderate in protein		Brown rice Grass well managed Soya Humid herbs	Corn grain Sorghum grain Rice bran (rich) Wheat bran
Rich in protein	Urea	Entire cottonseed Fish waste Manioc hay Most of legumes	Brewer grain Coconut meal Soybean curd Industrial concentrated feed Flours made of legumes

GENERAL PRINCIPLES TO FEED A COW

- **Supplement the ration with concentrated feed to bring energy and protein and thus to cover the cows' needs.** Using **local byproducts (agricultural or agro-industrial)** instead of industrial concentrated feed can reduce costs and have a positive impact on the environment.
- **Do not distribute concentrated feed when the rumen is empty,** as it risks causing an increase of gastric acidity. Always ensure to provide a balanced ration splitting the distribution into at least 2 meals per day.
- **Never distribute more than 3KG of concentrated feed per meal** and split the distribution **into at least in 2 meals per day. Never provide more than 12KG of concentrated feed per day:** an excess could block the rumination and cause acidosis.

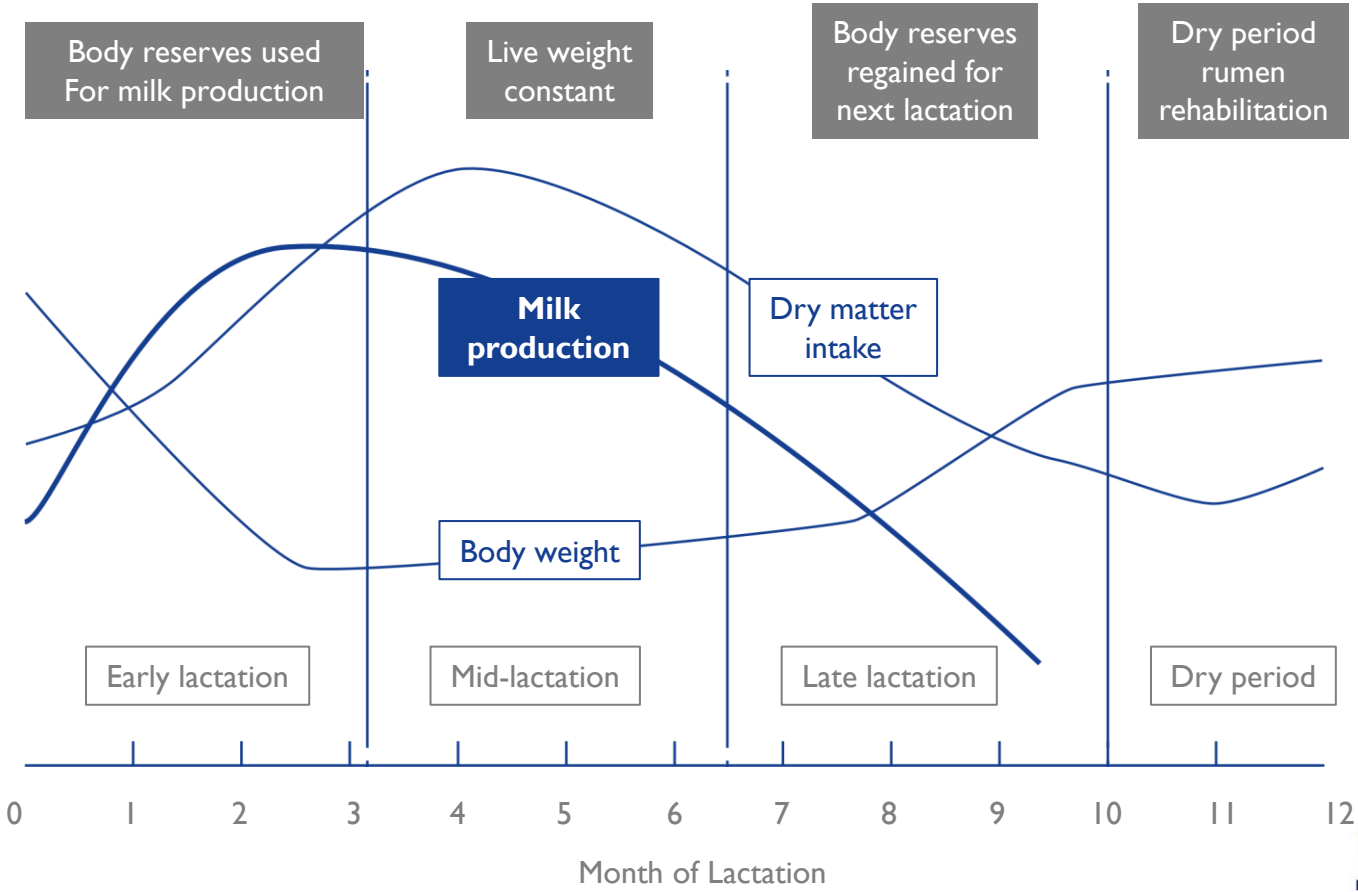
- Distribute maximum 30% of concentrated feed in the ration.
- Use mineral lick-block to avoid nutritional deficiencies (minerals and vitamins).

2.3

LACTATION CYCLE AND FEED STRATEGY

LACTATION CYCLE AND FEED STRATEGY

A good feeding management means to match cows' needs and physiological stage. A cow which produces 20 liters of milk a day has 4 times more requirements needs than a dry cow. There are 4 important steps during a lactation cycle: beginning of lactation, middle of lactation, end of lactation, drying period.



LACTATION CYCLE AND FEED STRATEGY

❖ Lactation is prepared during drying period

- Dry period (5 weeks) : rest time – a good quality fodder with a slight complementation. Still high feed intake but with low energy content
- Preparation period (3 weeks) : a good quality fodder with a good density + mineral nutrients (calcium, phosphore). Energy density needs to increase because of lower feed intake capacity. The unborn calf inside the uterus will grow fast the last month of the pregnancy. So the physical space inside the cow for feed is reduced, while energy needs grow.

❖ The beginning of lactation

- It is fundamental not to change the diet of cows brutally: thus, between the preparation period and the beginning of lactation, it is important to ensure a smooth transition in feed change. For instance, we should distribute 5 kg of concentrated feed in 5 days (1 kg per day) instead of giving it all at one time.
- High needs versus still low feed intake capacity so cows generally loose weight (use of body reserves to produce milk).
- Rations should be rich in energy to avoid deficits.

LACTATION CYCLE AND FEED STRATEGY

❖ The middle of lactation

- This is the period where the cow is ready for another pregnancy. So a weight regain is necessary to make the reproduction successful.

❖ The end of lactation

- At the end of the lactation the milk production is decreasing. So the needs for energy and protein are reducing. Adapt the ration accordingly.
- Rations should be less rich in energy and protein to avoid an excessive fattening and a nutrient waste.

2.4

BALANCED FEEDING FOR IMPROVING ANIMAL HEALTH AND MILK PRODUCTION

BALANCED FEEDING FOR IMPROVING ANIMAL HEALTH AND MILK PRODUCTION

❖ A bad feed management has effects on cows health and milk production

Imbalanced feeding leads to excess feeding of some nutrients whilst others remain deficient. This not only reduces milk production and increases costs per kg milk, but also affects various physiological functions including long term animal health fertility and productivity. Some effects of imbalanced feed:

- A deficit of fibers reduces **rumination**, essential for cows.
- An excess of concentrated feed causes **acidosis**.

BALANCED FEEDING FOR IMPROVING ANIMAL HEALTH AND MILK PRODUCTION

How to avoid and get over acidosis:

- Introduce slowly feed with high starch contents such as concentrated feed (+0,5KG per cow per day).
- Distribute the concentrate as much as possible over the whole 24 hour of the day. The more smaller meals the better.
- When introducing **more concentrate** in the ration make sure to provide also **more fibrous** rich fodder, like any hay or straw type.
- Introduce **buffer** into the feed to maintain an ideal rumen pH level. (sodium bicarbonate ; magnesium oxide ; sodium bentonite).

- A deficit of energy causes a **loss of weight** and a **loss of fertility**.
- An excess of energy causes an **excessive fattening with risks for calving** and lower milk production next lactation.
- An excess of protein causes **intoxications**.
- A deficit of protein causes **fattening of cows**.
- Moldy or deteriorated feed with bad storage conditions causes serious **intoxication with mycotoxins**.

BALANCED FEEDING FOR IMPROVING ANIMAL HEALTH AND MILK PRODUCTION

❖ A good observation allows to detect and to avoid feeding management mistakes

- **Rumination:** from all 10 cows lying and resting -> at least 6 need to ruminate
- **Cow dungs:** should have a soft consistency, like porridge. To form a small circle on the ground.
- **Cow feet:** when walking cows should use all 4 feet in a balanced tred and a straight backbone.
- **Skin/hair:** cows need to be clean at the tail and back end. The hair needs to be shinny.
- **Other observations** which can be checked on the cows → see the appendix slide 105.

BALANCED FEEDING FOR IMPROVING ANIMAL HEALTH AND MILK PRODUCTION

❖ General benefits of balanced rations

Continues access to a palatable, well balanced ration and ad libitum clean water improves the health of the cows and their milk production. Resulting in good technical and economic benefits on farm.

Note: You could also notice lower veterinarian costs and more sustainable productivity (both on fertility and production).

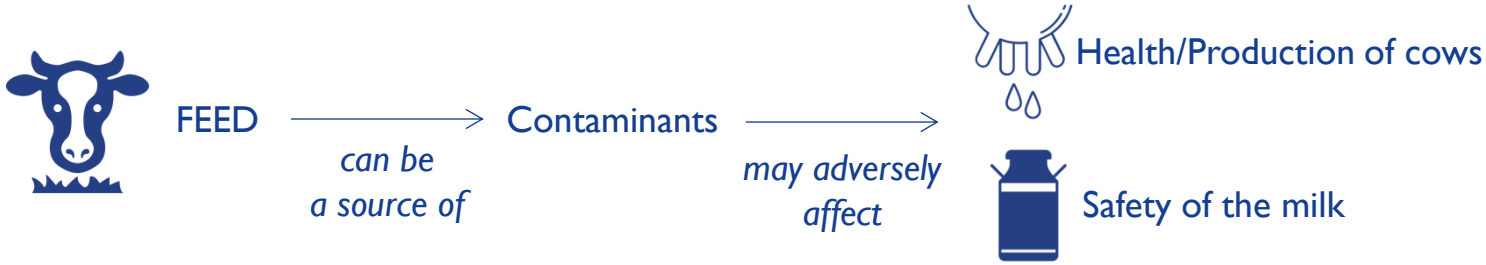
2.5

TRACEABILITY AND FEED SAFETY

TRACEABILITY AND FEED SAFETY

On top of all these advice, one must make sure that the fodders and the concentrate feed that are used in the cow ration are traced and controlled for "FEED" safety to avoid impairing the cow's health on short or mid terms.

Some **FEED** safety risks are linked to **FOOD** safety risks.



Indeed, some contaminants of the feed can lead to food safety risks in the milk, such as the presence of Aflatoxins M1. The AFM1 are excreted in the milk after metabolization of the Aflatoxin B1 that can spoil fodder or grains.

TRACEABILITY AND FEED SAFETY

Keeping the traceability of the origin of the Feed is of importance in case of incident or crisis in the feed chain supply. It allows warning the farmers to withdraw the feed from the cows' ration when possible.

❖ Fodder

Concerning raw materials the main question is "what are the potential contaminants?" - chemical or biological.

TRACEABILITY AND FEED SAFETY

- Linked to farmer practices **at field level**

Contaminant family	Example of contaminant	Origin	Example of material
Mycotoxins (S. Risk +++)	Aflatoxin B1 -> AFM1	Mold development: - Induced in field - During storage of feed	Peanuts (& other product like pistachio, cashew..) > soya + cotton meals > corn
	DON*		Cereals
	Zearalenone		Corn
Pesticides (S. Risk + to +++)	Many very different molecules DDT*, fipronyl… Depending on type of culture and areas	- **Treatments used at field** level: insecticides, anti-fungal, herbicides… - Treatment **in post-harvest** to preserve - **Accidental contamination:** animal access to treated grains…	- Depending of cultures: late treatment on cotton… - To preserve : Cereals (importance of local climatic conditions)
Natural toxic substances	Gossypol (+) Other alkaloids	Cotton seeds Toxic plants in hay or silage	

* DON: Deoxynivalenol (mycotoxin) /
DDT : Dichlorodiphenyltrichloroethane (insecticide)

TRACEABILITY AND FEED SAFETY

- Linked to **pollution around the fields/farms fodder storage**

Contaminant family	Example of contaminant	Origin	Example of material
Dioxin + PCB* (S. Risk +++)		- Contamination at **field level** by external pollution (soil, water for irrigation) - Use of **"byproduct"** or **recycle products** (oil) - **"Original" contamination** of some substances Drying methods	- Grass, corn… - Mixed Oil - Kaolin, clays…
Heavy metal (S. Risk +++)	Lead, cadmium, Arsenic, aluminum…	**External pollution** / field: - Plant close to the field (incinerator…) - Contaminated sludge, use of waste water for irrigation - Over-dosage or **non decontaminated minerals** Metallicolous flora	Grass, corn… Minerals
HAP*		Field close to road, city…	Grass…

* PCB: Polychlorinated biphenyl (toxic organic chlorine) /
HAP : Polycyclic Aromatic Hydrocarbons (produced by combustion)

TRACEABILITY AND FEED SAFETY

❖ Concentrate feed:

Concerning « complete feed or premix » the main questions are :

- What are the raw materials to authorize / to ban?
- What are the risks of contamination during the process (cross contamination, risk during storage of raw materials…)? :

  - Abnormal level of additives
  - Residues of veterinary drugs
  - Residues linked to a specific raw material
  - Technical agents & Preservative
  - Conditions of preparation or storage

TRACEABILITY AND FEED SAFETY

- Linked to **fraud or process**

Contaminant family	Example of contaminant	Origin	Example of material
Fraud	Melamine use to increase protein content (++)	Abnormal adjunction to increase Nitrogen	Soya
Chemicals used during the process	Solvent residue	Process to extract oil	Soya meal…

- Linked to **biological contaminants**

Contaminant family	Example of contaminant	Origin	Example of material
Prion (Non Conventional Transmissible Agents) (S. Risk +++)	TSE*	Use of sub-products of meat (cows, sheep…) / slaughter house	Bone and meat meal. Risk evaluate per country. Risk level depending on technology used Animal fats
Botulism (S. Risk +++)		Feed storage	Silage
Salmonella (S. Risk +++)		Feed storage	Milk replacer Cereals on open storage

* TSE : Transmissible Spongiform Encephalopathies

TRACEABILITY AND FEED SAFETY

- Linked to **"chemical" contaminants**

Contaminant family	**Example of contaminant**	**Origin**	**Example of material**
Abnormal level of additives	Grow factors Anti coccidian Minerals	Some additives may be authorized in some countries for "medicated feed". Mistake concerning dosage	Compound feed make in a non-specialized plant (cow, poultry..)
Residues of veterinary drugs (S. Risk + to +++)	Hormones Antibiotics	**Cross contamination** with medicated feed and/or feed for other species	Compound feed delivered by a truck working for different species
Residues linked to a specific raw material	All	**Cross contamination** **Use of unauthorized raw material** Or a **contaminated raw material**	Peanut cake and aflatoxin
Technical agents	Lubricants	Products used during the process	
Preservative (S. Risk + to +++)	Insecticides, rodenticides	Products use to preserve the compound feed	

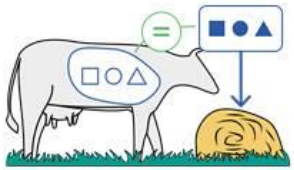
2.6

KEY POINTS TO REMEMBER

THE 10 GOLDEN RULES FOR FARMERS

Cows are ruminants, they need to eat grass. If cows don't ruminate, they will die.

1



Cows' needs depend on several factors such as their weight, dairy production, life stage and activity level. **Define the ration to have a balanced and competitive one.**

2

Do not change the diet of cows brutally. It is fundamental to keep the rumen microbiota balanced.

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Select good quality feed components adapted to the cows' needs. The ration quantity (in KG or LBS) depends on the rumen size which is limited.

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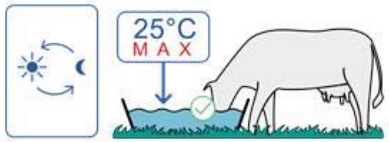

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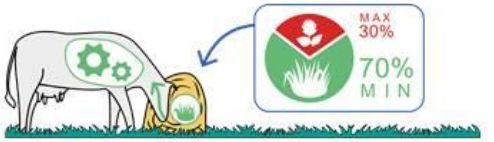

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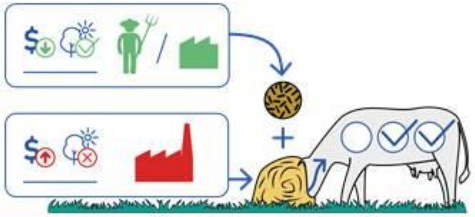
7



Supplement the ration with concentrated feed to bring energy and protein and thus to cover the cows' needs. Using **local byproducts (agricultural or agro-industrial)** instead of industrial concentrated feed can reduce costs and have a positive impact on the environment.

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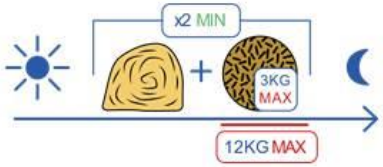

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10

Continues access to a palatable, well balanced ration and ad libitum clean water improves the health of the cows and their milk production. Resulting in good technical and economic benefits on farm.

Meal *High-grade feed* *Concentrated feed*

Water *Nitrogen* *Vitamins* *Leguminous*

Energy *Minerals* *One day* *Fodder*

DANONE DANONE ECOSYSTEME MILK CYCLE

3

RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

3 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

Many agricultural or agro-industrial wastes are unavoidable materials arising from food production systems, typically described as **byproducts or residues**. More generally, a byproduct is an output, resulting from a **production process**, the primary aim of which is not the production of that item: thus, a byproduct is in minor quantity compared to the main product(s). Some examples of byproducts :

- Agricultural byproducts: crop residues, leaves, peels
- Agro-industrial byproducts: brewer residues, cereals brans, soybean meal…

These byproducts are in fact ideal raw materials to create new products, providing a major opportunity and **transforming the "waste" into a valuable "resource" for the agricultural system**. A good valorization of these resources is the **introduction of byproducts within the feed rations of dairy farms.**

3 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

3.1

BYPRODUCTS VALORIZATION AND CIRCULAR ECONOMY: OPPORTUNITIES AND CHALLENGES

3 | RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

BYPRODUCTS VALORIZATION AND CIRCULAR ECONOMY: OPPORTUNITIES AND CHALLENGES

The cost of feed is becoming more and more important for farmers.

> *“Feed management is a key element for our small farmers: we are lacking of farmers and farmers cannot earn their living with their work so they are really vulnerable. We have to make local feeds available and provide them a technical support in order to increase efficiency.”*

Billel, project manager of H’lib Dzair, Algeria

→ To know more about this project, read further!

> *“With the fast shrinking of arable lands and natural resources, availability and quality of feed is increasingly becoming a challenge. Feeding byproducts to the cows can be a way to enhance milk quantity and quality and reduce feed costs.”*

Sambhaji, project manager of Punjab 2020, India

→ To know more about this project, read further!

3 | RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

BYPRODUCTS VALORIZATION AND CIRCULAR ECONOMY: OPPORTUNITIES AND CHALLENGES

In this context of environmental and economical pressures, we must increasingly consider byproducts as an alternative for animal feeding. Industrial, agro-industrial or agricultural byproducts can be processed to obtain new materials and high added value products. The valorization of these byproducts is reached by their re-use in the feed ration following circular economy concepts. Unlike the industrial concentrated feed, these byproducts are not always balanced in proteins and energy.

Thus, when introducing these products in cattle feed, it is important to get information on their nutritional value. However, they will certainly bring nutrients and also, by eliminating avoidable wastes and minimizing demands on resources, farms' efficiency will be increased and costs will be reduced.

3 | RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

BYPRODUCTS VALORIZATION AND CIRCULAR ECONOMY: OPPORTUNITIES AND CHALLENGES

"Concentrates can represent up to 50-60% of milk production costs so it's very expensive. We try to reduce the costs by using the byproducts [e.g. cocoa meal, cereal straw], reaching the lower costs but keeping good nutritional value."

Arif, project manager of Merapi, Indonesia

→ To know more about this project, read further!

"[About byproducts as feed for cattle] We have to take the opportunities from the market: the cheapest for our farmers and the best for their cows. [e.g. beer drenches and wheat straw] (…) Little by little, the results we can see it in milk quantity, milk quality, and farms in general."

Catalin, project manager of Chance For All, Romania

→ To know more about this project, read further!

3 | RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

BYPRODUCTS VALORIZATION AND CIRCULAR ECONOMY: OPPORTUNITIES AND CHALLENGES

This valorization within the animal feed must start from a sustainable partnership between agribusiness and livestock sectors. This relation will have a positive economical and environmental impact and ensure the traceability of production.

Each partnership need to be adapted to the local context: each region of a country has its specificities in terms of byproducts and cows' needs.

> *"These byproducts are less expensive but they are not produced all year long [e.g. tomatoes pulp]: it's one of the difficulties to get through in order to implement this practice: we must build a sustainable partnership."*

Myriam, project manager of Milky Way, Tunisia

→ To know more about this project, read further!

3 | RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

BYPRODUCTS VALORIZATION AND CIRCULAR ECONOMY: OPPORTUNITIES AND CHALLENGES

More than all, the key point is to disseminate best practices among farmers in terms of feed and particularly byproducts valorization:

> *"Years after years, we have increased byproducts' availability [e.g. rice bran, sugarcane straw] and we have made technical recommendations to farmers about feed mixtures and the adaptation to the local breed and the dairy production level."*

Arona, project manager of KOSAM, Senegal

→ To know more about this project, read further!

3.2

RATION FORMULATION TOOLS FOR DAIRY COWS

3.2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

RATION FORMULATION TOOLS FOR DAIRY COWS

Meeting the nutrient requirements of dairy animals using a balanced diet is vital. Therefore we want to share with you two ration formulation easy-to-use tools for your technicians to advice farmers: one developed by the FAO in 2016 and one, work-in-progress, developed by the Ecosystem project KOSAM, in Senegal in collaboration with the Centre de Coopération International en Recherche Agronomique pour le développement (French Agricultural Research for International Development, CIRAD) and the Institut Sénegal des Recherches Appliquées (Senegal institute of applied research, ISRA).

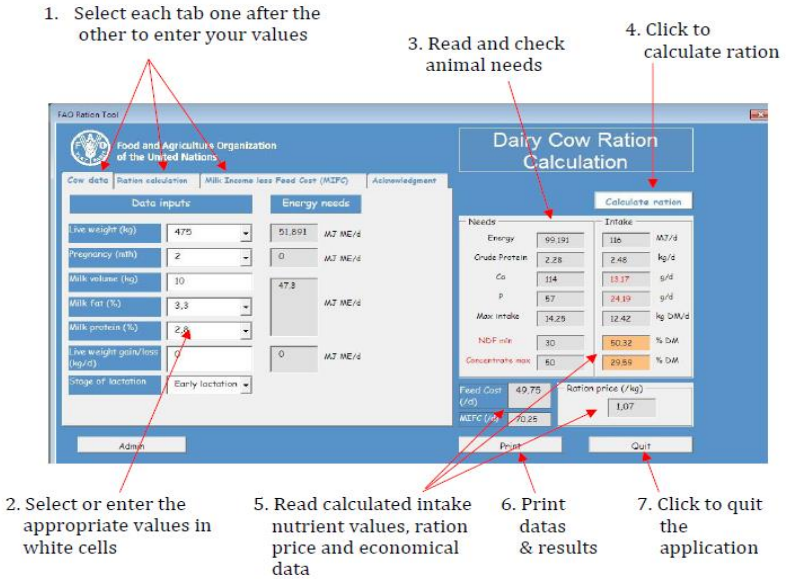
3.2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

❖ FAO RATION FORMULATION TOOL

The Food & Agriculture Organization released a Ration Formulation Tool for dairy cows. This tool, available in French, English and Spanish, calculates least-cost rations for dairy cows using locally available resources. It has been specifically designed for technicians looking for a simple and easy to use formulation tool. In addition to the Excel software, the package contains user and administrative manuals, a presentation that will take you through the software step-by-step, and a training webinar.

Important: You should only work using the user form, not directly on the Excel file.

- Tool overview – Quick use



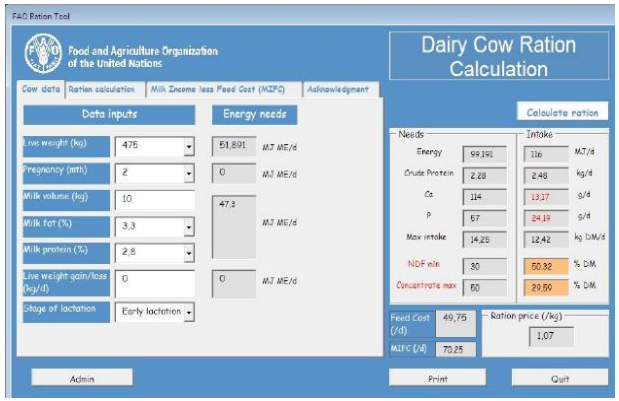
Source: Userguide FAO Ration tool

3.2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

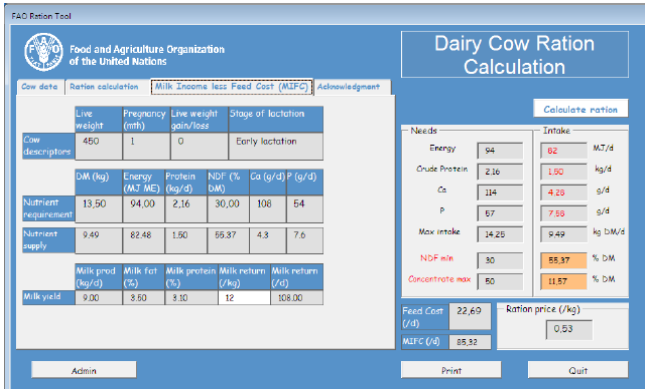
❖ FAO RATION FORMULATION TOOL

- 3 steps before formulating the ration

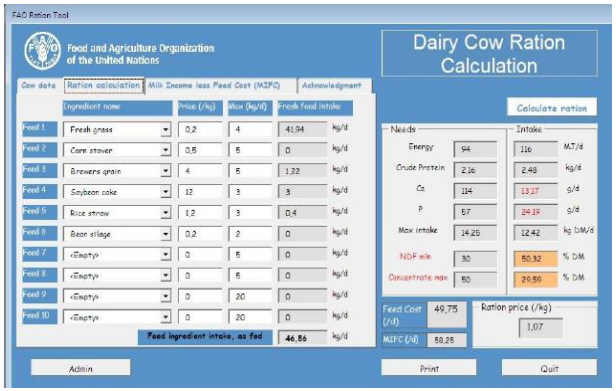
#1: Enter cow data



#2: Select ingredients (dropdown list)



#3: Milk Income less Feed Cost (MIFC)



Enter their prices on feed basis, and set the maximum quantities the farmer can give to his/her cow per day.

Note: Up to 10 ingredients can be selected to ration calculation. Prices are set per kg, in the currency of your choice.

The tab allows user to calculate the incomes of the farmer's milk production per day. Only milk return per kg is required, the other values are calculated automatically from inputs of tabs "Cow data" and "Ration calculation".

Source: Userguide FAO Ration tool

❖ FAO RATION FORMULATION TOOL

- The formulation of the ration

Two options are possible:

- Manual ration formulation. Manually enter the quantities of each ingredient based on your experience. And read the nutritional values for the mix and compare with needs
- Use a **least-cost function**, done by the FAO Ration tool.

Source: FAO Ration tool, Training Course

→ To know more about this tool, check this link:
http://www.feedipedia.org/content/fao-ration-formulation-tool-dairy-cows

3.2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

❖ KOSAM PROJECT RATION FORMULATION TOOL

- Creation context:

Animal feed of traditional livestock's system depend on the quality of rainy season. Over the 10 months of dry season, only 5 months are covered by a pasture but this pasture is dry and non-nutritive. The team project realized the opportunity of valorizing byproducts and other local supplies as animal feed.

Therefore, by involving the CIRAD and the ISRA, they decided to set up animal feed database, to analyze their nutritive value and to create animal feed ration's software to advise dairy breeders.

3 2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

❖ KOSAM PROJECT RATION FORMULATION TOOL

- General presentation

A tool in 3 parts:

- Database of nutritive value of byproducts & local animal *feed / to be completed, updated regularly*

- Data to be filled in by the breeder: herd identification, weigh, byproducts and local animal feed supplies available / quantity by animal… / *to be corrected until that a balanced ration is achieved.*

- Summary of balanced ration and cost to advise to breeder.

A tool used by livestock technicians

- Livestock technicians of KOSAM's Project

- Technicians of Pilot Farm and other farms

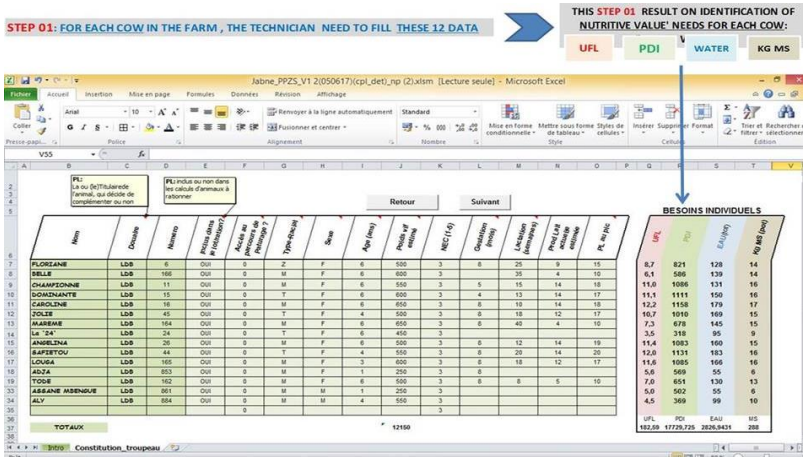
A tool to advise breeders on animal feed ration, to be profitable

3.2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

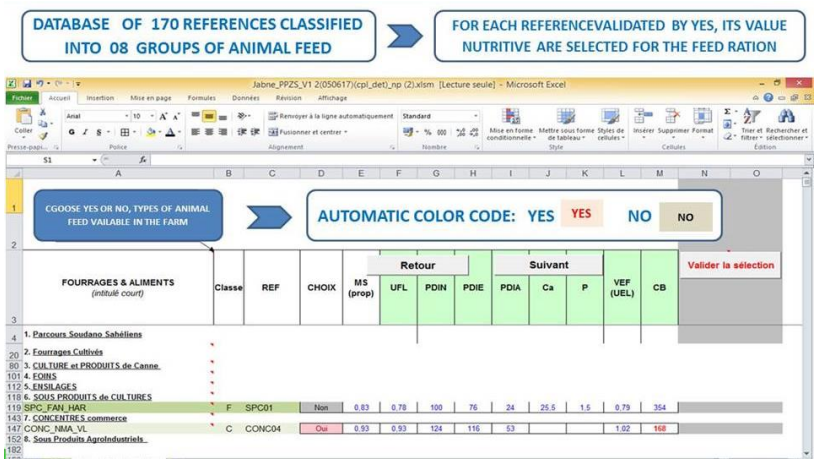
❖ KOSAM PROJECT RATION FORMULATION TOOL

- 4 Steps before formulating the ration

#1: Enter farm characterization



#2: Select feed available into the farm

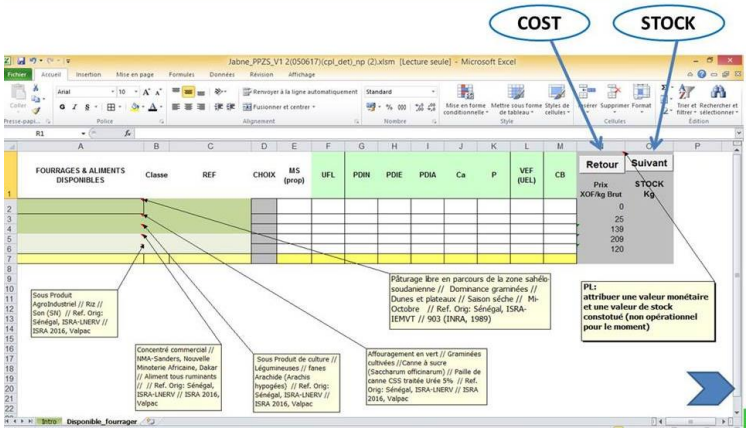


3 2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

❖ KOSAM PROJECT RATION FORMULATION TOOL

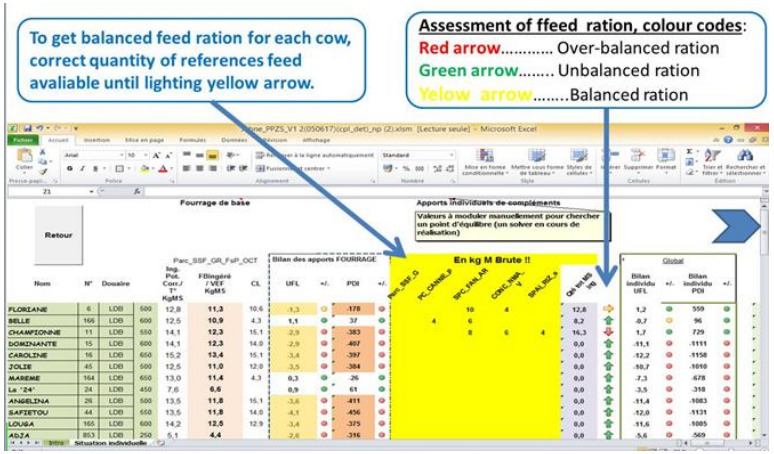
- 4 Steps before formulating the ration

#3: Update cost/stock of each selected feed



Note: The stock functionality is not yet operational.

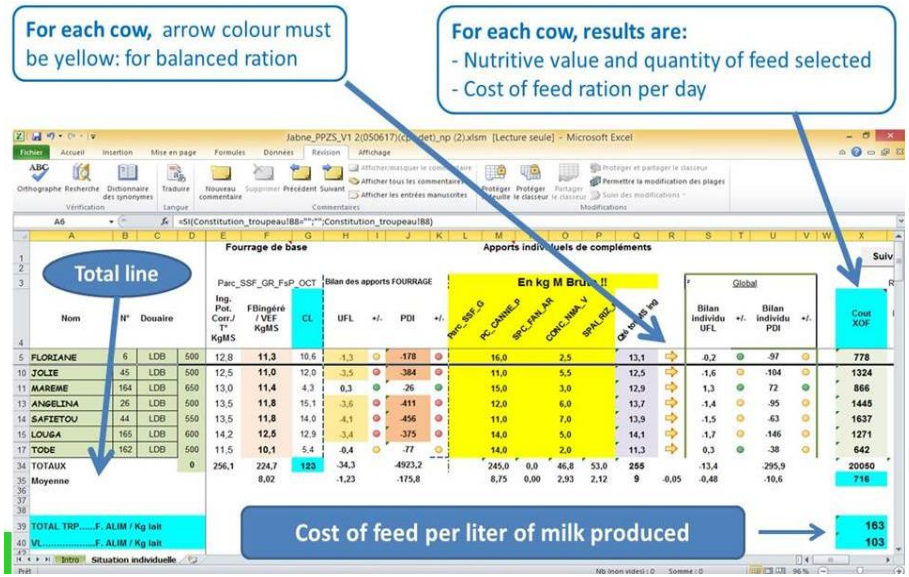
#4: Verify and correct to reach a balanced ration

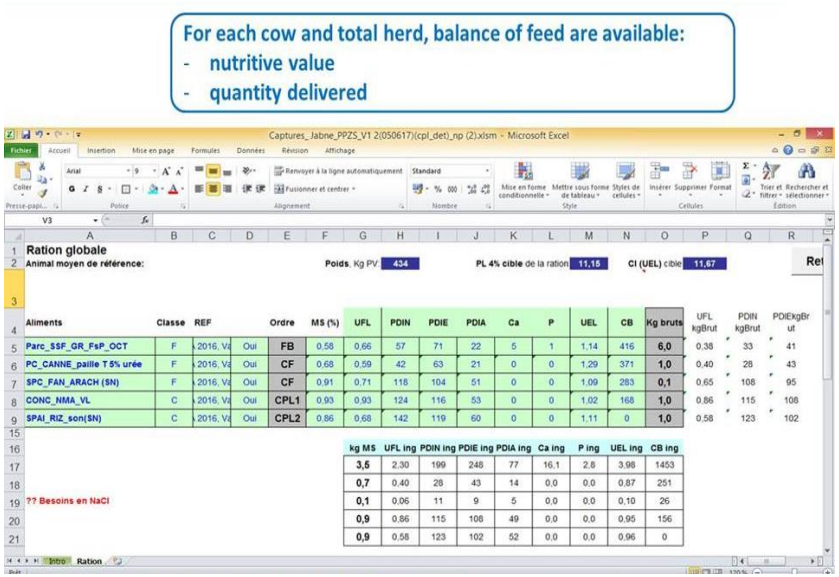


3 2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

❖ KOSAM PROJECT RATION FORMULATION TOOL

- The formulation of the ration





3 2 RATION AND BYPRODUCTS VALORIZATION AS FEED FOR CATTLE

❖ KOSAM PROJECT RATION FORMULATION TOOL

- Next challenges

- To **test the software** in pilot farms and small-farms selected: on-going
- Validation of **final version** and transfer to KOSAM project
- Practical uses as tool to advise dairy breeders on animal feed for profitability
- Opportunity to **migrate** « JABNDE software» into a tablet application

→ To know more, contact the projects managers of KOSAM (details in the acknowledgement)!

4

CASE STUDIES: CONCRETE EXAMPLES OF BYPRODUCTS VALORIZATION IN DIFFERENT GEOGRAPHIES

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4.1

PUNJAB 2020, INDIA

PUNJAB 2020 IN INDIA

THE PROJECT

30 farmers

8 heads/farmer with

9 ton/farmer of annual milk production

3 milking cows

Holstein Friesian

weighing **350 KG** and producing **10 L/day**

BYPRODUCTS VALORIZATION

TO REDUCE FEED COSTS & INCREASE FARMERS' AUTONOMY

- An improvement of byproducts **availability**
- A **27%** feed cost reduction
- An improvement of **milk quality**

To valorize:

- **Agricultural byproducts** (e.g. **wheat straw**)

Today, almost **80%** of the farmers of the project have introduced these byproducts in their ration

THE COUNTRY

1.31 billion inhabitants

154,000,000 tons/year of milk production

Insignificant value of milk importation

ICONIC PRODUCT

PROJECT TEAM

Sambhaji Palve

Siddharth Kashyap

LOCAL DAIRY FARMS

Dairy Business provides livelihoods to over 60 million farmers in India. Farmers earn on seasonal basis from their agriculture production hence their dependency is more on dairy business to meet out their daily financial requirement.

Nearly 80% of India's milk production is provided by small and marginal farmers, with an average herd size of 1 to 2 milching animals.

In India, there is high dependence on family labor and limitations to deploying mechanized milching systems, given the small herd size holding. Most of the farmers are still practicing the traditional way of raising their cattle and they consider dairy as agriculture allied livelihood activity, there is long way before considering dairy as main business as consistently decreased profit out of it.

FEED AVAILABLE LOCALLY

Currency conversion: 1 € = 71.1 ₹ (Indian Rupee)

Fodder/ Byproducts	Energy value	Protein value	Rumination power	Digestibility	Cost (Local currency/ KG DM) DM: Dry Matter
Maize	Very good	Good	Good	Good	₹ 2/Kg
Sorghum	Medium	Good	Good	Good	₹ 2/Kg
Bajra	Medium	Good	Good	Medium	₹ 2/Kg
Ryegrass	Very good	Very good	Very good	Very good	₹ 7/Kg
Berseem	Very good	Very good	Very good	Very good	₹ 2.5/Kg
Barley	Very good	Very good	Very good	Good	₹ 3/Kg
Cowpea	Very good	Excellent	Very good	Very good	₹ 8/Kg
Maize straw	Good	Good	Good	Good	₹ 4/Kg
Wheat straw	Good	Good	Good	Good	₹ 4/Kg
Paddy husk	Good	Good	Good	Good	₹ 7/Kg
Concentrated feed	Good	Good	Good	Good	₹ 22/Kg
Linseed oil cake	Good	Good	Good	Good	₹ 50/Kg
Mustard cake	Good	Good	Good	Good	₹ 22/Kg
Groundnut cake	Good	Good	Good	Good	₹ 22/Kg

Byproducts: *Agricultural* *Agro-industrial*

DAIRY FARMING OPERATING SYSTEM DESCRIPTION

Average from project farms reality

- FARM DESCRIPTION

Total area of farming operation: 12150 Ha (agriculture land) – 400 Ha (dairy farm area)

Total surface dedicated for feed production: 2750 Ha

Total surface for cattle pasture: 0

Total feed production per year: Data not available

- CATTLE DESCRIPTION

Milking cows: Holstein Friesian

Weight: 350 KG

Yield per milking cow: 8 to 20 L/day (average: 10 L/day)

Total herd: 4 heads per farmer

Total milking cows: 3 per farmer

Total milk production per year: 9 ton per farmer

EXAMPLE OF FEED RATIONS VALORIZING LOCAL BYPRODUCTS:

FEED RATION 1 For a cow which produces: 10 KG/Day of milk	
FEED	**KG DM per day**
Green fodder (hay)	18 KG
Concentrated Feed	3.5 KG
Wheat straw	5 KG
Mineral mixture	0.1 KG

Cost: **₹ 9.17/KG**

FEED RATION 2 For a cow which produces: 20 KG/Day of milk	
FEED	**KG DM per day**
Green fodder (hay)	15 KG
Concentrated Feed	8 KG
Wheat straw	5 KG
Mineral mixture	0.15 KG

Cost: **₹ 9.17/KG**

Byproducts: *Agricultural* *Agro-industrial*

BYPRODUCTS: KEY PROJECT INPUTS

The context:
To tackle the current deficit of green fodder and concentrates in India.

Punjab –one of the developed states in India- has experienced green revolution which transformed wheat and paddy growing areas since the last 3 decades. Project area is facing feed and fodder availability challenges due to declined fodder productivity and fodder growing area. The current deficit of green fodder and concentrates is about 34%. Most of the farmers have to purchase feed from market so dairy sector is no more considered as a profitable business.

The idea:
To valorize agricultural byproducts (e.g. wheat straw).

Most of the farmers burn wheat and paddy crops straw after harvesting which cause environmental pollution as well as loss of resources. This available wheat straw can be converted into animal feed by proper processing which will ensure feed availability at farmer's dairy farm level with reduced costs and also enhance the milk quality and quantity.

Global implementation results of the project:

- **An improvement of byproducts availability**

The intervention of Punjab 2020 project helped to protect more than 50 tons of wheat straw burning and further converted it into animal feed. The cultivated wheat crop was through organic agriculture practices hence the formulated feed was chemical free and was having good tests.

- **A 27% decrease of feed costs**

The interventions helped 25 farmers to make available additional feed during 100 days with a cost reduction of ₹ 8000.00 feed cost meaning a 27% decrease.

- **An improvement of milk quality**

The quality of milk from Punjab 2020 project has been improved and found all parameters in line with Danone's milk quality requirements.

The impact:
Almost 80% of the farmers of the project are implementing these byproducts in their feed ratios.

Since Punjab 2020 was in first phase when implementing these new practices, we tried this intervention with 30 farmers and 25 farmers adopted these new practices.

Our ambition is to reach out over 1000 farmers to promote these practices in project area, during the phase 2 of the project.

The challenges:

- Changing how our farmers tend to manage their field while they have been following ancestral and traditional practices for their whole life.

The dissemination of these practices:

- Existing means of communication:
  - **Learn from others-Field visits** : to spread the good practices among farmers
  - **Training programs** to farmers with focus on feed management
  - **Technical advice:** the team has collected some samples of available byproducts and suggested farmers on how to valorize them

"With the fast shrinking of arable lands and natural resources, availability and quality of feed is increasingly becoming a challenge. Feeding byproducts to the cows can be a way to enhance milk quantity and quality and reduce feed costs."

SAMBHAJI PALVE, Project Manager

ACKNOWLEDGEMENT:

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4.2

MILKY WAY, TUNISIA

MILKY WAY IN TUNISIA

THE PROJECT

1650 farmers

3.3 heads/farmer with

10 ton/farmer of annual milk production

3.3 milking cows

Brown swiss
weighing **550 KG** and producing **12 L/day**

Holstein
weighing **475 KG** and producing **15 L/day**

Cross breed
weighing **450 KG** and producing **10 L/day**

PROJECT TEAM

Abderrahmen Essaied

Myriam Amri

BYPRODUCTS VALORIZATION

TO REDUCE FEED COSTS & INCREASE FARMERS' AUTONOMY

- A **33%** feed cost reduction
- **A high nutritional value-added** potential of byproducts

To valorize:
- **Agro-industrial byproducts** (e.g. **beet or tomatoes pulp**)
- **Agricultural byproducts** (e.g. **wheat straw**)

Today, **15** farmers of the project have implemented these practices – **Implementation process**

THE COUNTRY

11 million inhabitants

1,376,000 tons/year of milk production

4,000 tons/year of milk importation

ICONIC PRODUCT

LOCAL DAIRY FARMS

In Tunisia, livestock represents a major component of the agricultural production and the national economy . Livestock has been ranked as one of the priority area as it generates 2 strategic production: milk and meat. There are 112 000 cattle breeders in Tunisia, and 83% of them have less than 5 cows.

The herd is constituted by approximatively 437 000 cows, and half of them are pure-bred animals (Holstein, Brune des Alpes, Tarentaise). The other 45% are composed by crossbreeds and local breeds. We are facing a continuous decline of the percentage of local and cross breed cows (-1.7% per year) and an increase of the percentage of pure breeds (+2% per year). The milk production is about 1.3 M tons (+9% per year).

FEED AVAILABLE LOCALLY

Currency conversion: 1 € = 2.6 TND

Fodder/ Byproducts	Energy value	Protein value	Rumination power	Digestibility	Cost (Local currency/ KG DM) DM: Dry Matter
Oat hay	Medium	Weak	Medium	Weak	0.33 TND/Kg
Alfalfa	Medium	Excellent	Excellent	Excellent	0.35 TND/Kg
Ryegrass	Excellent	Medium	Medium	Excellent	0.38 TND/Kg
Bersim	Medium	Excellent	Medium	Excellent	0.34 TND/Kg
Sorghum	Medium	Medium	Excellent	Medium	0.38 TND/Kg
Wheat straw	Weak	Weak	Medium	Weak	0.07 TND/Kg
Tomatoes pulp	*no analysis made so far at project level*				0.05-0.15 TND/Kg
Beet pulp	*no analysis made so far at project level*				0.05-0.15 TND/Kg

Byproducts: *Agricultural* *Agro-industrial*

DAIRY FARMING OPERATING SYSTEM DESCRIPTION

Average from project farms reality

- *FARM DESCRIPTION*

Total area of farming operation: 8 ha

Total surface dedicated for feed production: 3 ha

Total surface for cattle pasture: 1 ha

Total feed production per year: 5 tons (for the hay)

- *CATTLE DESCRIPTION*

Milking cows: Brown swiss – Holstein – Cross-breed

Weight: 500-600 KG (Brown swiss) – 400-550 KG (Holstein) – 400-500KG (Cross breed)

Yield per milking cow: 12 L per day (Brown swiss) – 15 L per day (Holstein) – 10 L per day (Cross breed)

Total herd: 3.3 heads per farmer

Total milking cows: 3.3 per farmer

Total milk production per year: 10 ton per farmer

A focus on **water** : "To produce 1 liter of milk, we need at least 5 liters of water. Water is one of the vital needs of dairy cows. Water is necessary for life, temperature regulation, milk production!"

EXAMPLE OF FEED RATION VALORIZING LOCAL BYPRODUCTS:

FEED RATION 1 For a cow which produces : 15 KG/Day of milk	
FEED	**KG DM per day**
Beet pulp	2.5
Oat hay	7
Wheat straw	3

Cost: **3.5 TND/KG**

FEED RATION 2 For a cow which produces : 15 KG/Day of milk	
FEED	**KG DM per day**
Tomatoes pulp	1.89
Bersim	3
Wheat straw	3
Oat hay	4

Cost: **4.4 TND/KG**

Byproducts: *Agricultural* *Agro-industrial*

BYPRODUCTS: KEY PROJECT INPUTS

The context:
To tackle the difficulties of fodder's availability.

Tunisia is characterized by a difficulty climate, close to semi-arid climatic conditions. In this context, fodders are not developed and cows feeding is based on concentrates (3000 to 3500 kg/cow/year) with a high deficit in fibers. This unbalanced undermines the physiology and the reproduction of cows and thus, there is a deficit in heifers for herd renewal and a high cull rate.

The idea:
To valorize agro-industrial (e.g. tomatoes and beet pulps) and agricultural (e.g. wheat straw) byproducts.

On the project intervention area there is a large production of beet pulp or tomatoes pulp (particularly in the North West and in the East). There are also many processing plants which produce large quantities of tomatoes pulp. Good to know: tomatoes and beet pulps can be conserved as silage.

Global implementation results of the project:

- **A 33% feed cost reduction**

A ration based on concentrates costs approximatively 6 TDN per cow per day. With the byproducts, we can reduce by 2 TDN the ration cost.

- **A high nutritional value-added** potential of byproducts

The project team would like to develop the integration of byproducts within feed rations by starting with an analysis of the nutritional benefits of these byproducts.

The impact:
Today, 15 farmers of the project have implemented these practices – Implementation process

"We try to replicate this practice to all beneficiaries of the project.

The challenges:

- These byproducts are less expensive but they are not produced all year long: it's one of the difficulties to get through in order to implement this practice: to make them available.

The dissemination of these practices:

- Existing means of communication:
  - **Learn from others/Peers-to-peers network**: farmers develop the new practices by looking at others who have already shown benefits.
  - **Visits:** organizing visits to the farmers using byproducts in their ration
  - **Trainings**
  - **Information days**

"Local byproducts can represent a solution to tackle our difficulties of fodder ressources' disponibilities."

MYRIAM AMRI, Project Manager

ACKNOWLEDGEMENT:

For any questions related to this project, please contact the project managers:

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DANONE ÉCOSYSTEME

4.3

CHANCE FOR ALL, ROMANIA

CHANCE FOR ALL IN ROMANIA

THE PROJECT

300 farmers

12 heads/farmer with

16.5 ton/farmer of annual milk production

6 milking cows

Holstein

weighing **600 KG** and producing **20 L/day**

Baltata cu Negru Romaneasca (local breed)

weighing **600 KG** and producing **6-7 L/day**

PROJECT TEAM

Catalin Andrecia

Alina Rus

BYPRODUCTS VALORIZATION

TO REDUCE FEED COSTS & INCREASE FARMERS' AUTONOMY

- A **33% increase** of milk production per cow
- A **x 10 increase** of milk collected and CBU needs representation
- An improvement of **animal welfare**

To valorize:

- **Agro-industrial byproducts** (e.g. **beer dreche**)
- **Agricultural byproducts** (e.g. **wheat straw**)

Today, **80%** of the farmers of the project have introduced these byproducts in their ration.

THE COUNTRY

19 million inhabitants

953,405 tons/year of milk production

126,151 tons/year of milk importation

ICONIC PRODUCT

LOCAL DAIRY FARMS

In Romania, we count up to 1.2 millions of cows. 80% of cows are in farms with 1 to 5 cows per farm.

Milk is collected by dairies; there is almost the same quantity from direct selling by milk producers.

FEED AVAILABLE LOCALLY

Currency conversion: 1 € = 4.5 ron

Fodder/ Byproducts	Energy value	Protein value	Rumination power	Digestibility	Cost (Local currency/ KG DM) DM: Dry Matter
Corn grain	Excellent	Weak	Very good	Excellent	0.6 ron/Kg
Wheat bran	Good	Good	Medium	Medium	0.2 ron/Kg
Wheat straw	Good	Weak	Excellent	Weak	0.2 ron/Kg
Alfalfa hay	Excellent	Excellent	Excellent	Excellent	0.6 ron/Kg
Beer dreche	Good	Very good	Weak	Weak	0.2 ron/Kg
Beet pulp	Very good	Weak	Very good	Good	0.17 ron/Kg
Silage by corn/barley/alfalfa/triticales	Excellent	Excellent	Excellent	Excellent	0.145 ron/Kg

Byproducts: *Agricultural* *Agro-industrial*

DAIRY FARMING OPERATING SYSTEM DESCRIPTION

Average from project farms reality

- FARM DESCRIPTION

Total area of farming operation: 600 ha spread (from 0.5 to 120 ha)

Total surface dedicated for feed production: 100%

Total surface for cattle pasture: 1 000 ha out of which 156 is managed by local association

Total feed production per year: 3000 tons of silage : corn, triticales, barley, alfalfa. In 2017, we expect to achieve 7200 tons of silage

- CATTLE DESCRIPTION

Milking cows: Holstein and Baltata cu Negru Romaneasca (BNR)

Weight: 600 KG (Holstein) – BNR (600 KG)

Yield per milking cow: 20 L per day (Holstein) – 6-7 L per day (BNR)

Total herd: 12 heads per farmer

Total milking cows: 6 per farmer

Total milk production per year: 16.5 ton per farmer

EXAMPLE OF FEED RATIONS VALORIZING LOCAL BYPRODUCTS:

FEED RATION 1 For a cow which produces : 10 KG/Day of milk	
FEED	**KG DM per day**
Corn grain	4 KG
Wheat bran	3.5 KG
Wheat straw	6 KG
Beer dreche	5 KG
Pasture	25 - 35 KG

Cost: **5.765 ron/KG**

FEED RATION 2 For a cow which produces : 20 KG/Day of milk	
FEED	**KG DM per day**
Corn grain	5 KG
Wheat bran	1.5 KG
Wheat straw	2 KG
Beer dreche	7 KG
Alfalfa hay	4 KG
Beet pulp	20 KG

Cost: **10.225 ron/KG**

See more in Appendix (p6)

Byproducts: *Agricultural* *Agro-industrial*

BYPRODUCTS: KEY PROJECT INPUTS

The context:
To find feed alternatives to develop the small farmers and the animal welfare.

Some members of the project team realized zootechnical studies and they have learnt in the faculties that it was important to have byproducts in the cows' rations.
One of the project partners (Polaris Group) is zootechnical engineer and knowing how important good quality feed in cows' nutrition is, we created recipe and shared them with the project beneficiaries.

The idea:
To valorize local agro-industrial (e.g. beer dreche) and agricultural (e.g. wheat straw) byproducts.

Agro-industrial byproducts such as beer dreche and wheat bran are very cheap local byproducts and they are really good for cows in terms of nutritional value, animal welfare and also in terms of milk productivity.

These byproducts have to be taken as opportunities for our farmers but we have to take into account that project's farmers are really small and not technified.

Global implementation results of the project:

- **A 33% increase of milk production per cow**
These practices allow to pass from an average of 6 to 9 liters of milk per cow.

- **A x 10 increase of milk collected and CBU needs representation**
From 444 liters of milk collected representing 1% of CBU needs in 2013, we achieve in 2016 4 700 liters of milk, representing 10% of CBU needs

- **An improvement of animal welfare**

The impact:
Today, 80% of the farmers of the project have introduced these byproducts in their ration.

212 out of 300 farmers are implementing these practices in their farm.

The challenges:

- In Chance for All project, we are working with small farmers who cannot see themselves as professional farmers; they don't see their farms as a business. They have no education and the experience in farming is very low.

The dissemination of these practices:

- Existing means of communication:
  - **Field visits** : to spread the good practices among farmers
  - **Technical advices** to farmers with focus on feed management

Due to trainings, we succeed to change the mindset and the vision about farming and to show the benefits of investing in byproducts as feed for cattle.

"[About byproducts as feed for cattle] We have to take the opportunities from the market: the cheapest for our farmers and the best for their cows. (…) Little by little, the results we can see it in milk quantity, milk quality, and farms in general"

CATALIN ANDREICA, Project Manager

ACKNOWLEDGEMENT:

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APPENDIX

EXAMPLE OF FEED RATION VALORIZING LOCAL BYPRODUCTS:

FEED RATION 3 For a cow which produces : 12 KG/Day of milk	
FEED	**KG DM per day**
Corn grain	5 KG
Wheat bran	1.5 KG
Wheat straw	2 KG
Beer dreche	7 KG
Alfalfa hay	4 KG
Beet pulp	17 KG

Cost: **8.415 ron/KG**

4.4

H'LIB DZAIR, ALGERIA

H'LIB DZAIR IN ALGERIA

THE PROJECT

330 farmers

8-10 heads/farmer with

42 ton/farmer of annual milk production

1-10 milking cows

Brune de l'Atlas (local breed)

weighing **300 KG** and producing **4-5 L/day**

Holstein

weighing **650 KG** and producing **18-25 L/day**

Montbéliarde

weighing **725 KG** and producing **15-25 L/day**

PROJECT TEAM

Billel Hadjal

Hélène Picart

BYPRODUCTS VALORIZATION

TO REDUCE FEED COSTS & INCREASE FARMERS' AUTONOMY

- A **50%** increase of milk production per cow
- A **30%** of feed cost reduction
- An improvement of **byproducts availability**

To valorize:

- **Agro-industrial byproducts (e.g. tomatoes pulp and olive pomace)**
- **Agricultural byproducts** (e.g. **cereal straw**)

Today, **up to 10%** of the farmers of the project have introduced these new practices

Implementation process

THE COUNTRY

39.7 million inhabitants

3,500,000 tons/year of milk production

4,000,000 tons/year of dairy importation

ICONIC PRODUCT

LOCAL DAIRY FARMS

Key figures on local context:

Availability vs Need
50%

+

Low technical Knowledge
Small producers (100K)
99 %

⇩

Low efficiency
10L/C/D

⇨

Imports vs Need
50%

⇨

Milk consumption 130l/c/y
7,1 BL/y

FEED AVAILABLE LOCALLY

Currency conversion: 1 € = 120 DZD

Fodder/Byproducts	Energy value	Protein value	Rumination power	Digestibility	Cost (Local currency/ KG DM) DM: Dry Matter
Oat hay	Medium	Weak	Excellent	Medium	50 DZD/KG
Alfalfa hay	Medium	Excellent	Excellent	Excellent	55 DZD/KG
Corn silage	Excellent	Weak	Weak	Good	15 DZD/KG
Vesch Oat	Medium	Medium	Good	Good	14 DZD/KG
Cereal straw	Weak	Weak	Good	Weak	40 DZD/KG
Olive pomace	*Depends on fat content*	Weak	Good	Weak	3 DZD/KG
Tomatoes pulp	Medium	Very good	Good	Good	3 DZD/KG
Beer dreche	Good	Excellent	Good	Weak	4 DZD/KG

Byproducts: *Agricultural* *Agro-industrial*

DAIRY FARMING OPERATING SYSTEM DESCRIPTION

Average from project farms reality

- FARM DESCRIPTION

Total area of farming operation: 04 m² per cow

Total surface dedicated for feed production: 800,000 ha (for cattle and small ruminant)

Total surface for cattle pasture: insignificant / zero grazing

Total feed production per year: 03 million Tons

- CATTLE DESCRIPTION

Milking cows: Brune de l'Atlas – Holstein - Montbéliarde

Weight: 250-300 KG (Brune de l'Atlas) – 600-700 KG (Holstein) – 650-800 KG (Montbéliarde)

Yield per milking cow: 4-5 L per day (Brune de l'Atlas) – 18-25 L per day (Holstein) – 15-25 L per day (Montbéliarde)

Total herd: 8 to 10 heads per farmer

Total milking cows: 1 to 10 per farmer

Total milk production per year: 42 ton per farmer

A focus on **water, from H'lib Dzair field data** : "Free access to water is key to improve the milk production and the cow's health. In the same way that the diets need to be balanced, water must be provided in sufficient quantity (free water is the best) and in good quality. An underconsumption of water has impact on production: if you reduce by 20% the water available, the production will decrease by 7.6%, and by 16% if you reduce by 40% the availability of water. You can thus loose until 02liters of milk/cow/day.

EXAMPLE OF FEED RATION VALORIZING LOCAL BYPRODUCTS:

FEED RATION 1 For a cow which produces: 15 KG/Day of milk	
FEED	**KG DM per day**
Oat hay	4.5 KG
Maize silage	6 KG
Olive pomace	3.2 KG
Concentrated feed	4 KG

Cost: **598 DZD/KG**

FEED RATION 2 For a cow which produces : 15 KG/Day of milk	
FEED	**KG DM per day**
Tomatos pulp	5.2 KG
Oat hay	5.6 KG
Straw	1.8 KG
Concentrate feed	3.1 KG

Cost: **427 DZD/KG**

See more in Appendix (p6)

Byproducts: *Agricultural* *Agro-industrial*

BYPRODUCTS: KEY PROJECT INPUTS

The context:

To find local feed alternatives in order to reinforce the autonomy of farmers in terms of feed (reduction of availability) and also to improve farms' yields.

Milking cows have important needs in fodder. Feed management represents up to 90 % of the farming costs so from the beginning of the project we worked on an action plan on feed. A good feed management helps to reinforce the autonomy of farmers but also, it improves the efficiency and the yield of the farms.

The idea:

To valorize agro-industrial (e.g. olive pomace and tomatoes pulp) and agricultural (e.g. cereal straw) byproducts.

A lot of agro-industrial byproducts are available in the regions of the project: beer byproducts, tomato pulps, olive-pomace. In the Extreme Est of Algeria, tomatoes pulp is frequently used during dry periods (in august) to reinforce the fodder ration. It is conserved as silage.

Olive-pomaces are also good industrial byproducts which come from olive oil extraction. They can be introduced in a feed ration with a supplement in nitrogen.

Global implementation results of the project:

- **A 50% increase of milk production per cow**

This practice helped to pass from 10 liters per cow to 20-25 liters of milk per cow in some farms which implemented these practices.

- **A 30% of feed cost reduction**

Feed rations valorizing byproducts can be more than 30% cheaper than standard ration (e.g. the feed ration n°2 in page 3 is 39% cheaper than a standard ration).

- **An improvement of byproducts availability**

The impact:

Today, up to 10% of the farmers of the project have introduced these new practices in terms of feed

Today, 10% of the farmers of the project are using byproducts because it really depends on the availabilities of byproducts locally.

The challenges:

- To valorize local byproducts of Algerian good industry (circular economy)
- To secure full year byproducts procurement with the improvement
- To make P&L dairy farmers increase

The dissemination of these practices:

- Existing means of communication:
  - **Trainings** with a focus on the added-value of byproducts (cost benefits, secure procurement, secure procurement feed & business)
  - **Field visits**
  - **Newsletters, Website, Facebook Community**
- Ambitions:
  - **App** (to be developed at the end of 2017)

"Feed management is a key element for our small farmers: we are lacking of farmers and farmers cannot earn their living with their work so they are really vulnerable. We have to make local feeds available and provide to farmers a technical support in order to increase efficiency. "

BILLEL HADJAL, Project Manager

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DANONE
ÉCOSYSTEME

EXAMPLE OF FEED RATION VALORIZING LOCAL BYPRODUCTS:

FEED RATION 3 For a cow which produces : 15 KG/Day of milk	
FEED	**KG DM per day**
Tomatoes pulp	4.8 KG
Maize silage	6 KG
Oat hay	1.8 KG
Concentrate feed	1.8 KG

Cost: **472 DZD/KG**

MULTINUTRITIONNAL BLOCK (under test):

Feed Components	Formulations (%)		
	1	2	3
Urea	3	2	5
Molases (cement)	10	10	10
Wheat bran	20	15	
Shredded cereal straw		15	25
Olive pomace	20	15	
Cactus fruit	30	30	
Tomatoes pulp			45
Quicklime	10	10	10
Salt	5	2	3
CMV	2	1	2

Cost: **56 DZD/KG**

TO BE CHECKED: INPUTS CONFORMITY WITH DANONE STANDARDS

4.5

KOSAM, SENEGAL

KOSAM IN SENEGAL

THE PROJECT

800 farmers

50 heads/farmer with

1 ton/farmer of annual milk production

5 milking cows other raised for meat

Zebu Gobra

weighing **350 KG** and producing **1-3 L/day**

Hybrid
Mix Zebu/Girolando/Maur/Montbeliard

weighing **500 KG** and producing **10 L/day**

PROJECT TEAM

Arona DIAW

Aminata NIANG

BYPRODUCTS VALORIZATION

TO REDUCE FEED COSTS & INCREASE FARMERS' AUTONOMY

- A **50%** increase of milk production per cow
- **More than 20%** of feed cost reduction
- An improvement of byproducts availability

To valorize:
- **Agro-industrial byproducts** (e.g. **rice bran**)
- **Agricultural byproducts** (e.g. **sugarcane straw**)

By the year 2018, **more than 60%** of the farmers of the project will have introduced these byproducts in their ration.

THE COUNTRY

13 million inhabitants

226,700 tons/year of milk production

157,700 tons/year of milk importation (41% of total milk consumption) as powder milk mostly

ICONIC PRODUCT

LOCAL DAIRY FARMS

In Senegal, there are 350 000 families who traditionally live from livestock. They raise cattle exclusively as their "bank savings" and for "meat" when sold. Milk is considered as an additional source of income but most of the time farmers do not have access to market to sell their milk.

In general, there are big herds (20 to 100 head of cattle per farmer) but in average only 5 dairy cows per farmer. More recently, « modern » farms have been developed by entrepreneurs in the country's capital area, Dakar (in Senegal 20 farms with 30 to 1000 heads of cattle).

FEED AVAILABLE LOCALLY

Currency conversion: 1 € = 655,957 FCFA

Fodder / Byproducts	Energy value	Protein value	Rumination power	Digestibility	Cost (Local currency/ KG DM) DM: Dry Matter
Groundnut hay	Medium	Good	Good	Good	125 FCFA/KG
Rice straw	Weak	Weak	Good	Good	15 FCFA/KG
Sorghum Fodder	Good	Weak	Good	Good	40 FCFA/Kg
Bush straw	Weak	Weak	Good	Good	10 FCFA/KG
Sugarcane straw	Weak	Weak	Medium	Good	32 FCFA/KG
Maralfalfa	Good	Weak	Good	Good	30 FCFA/KG
Cowpea (Niébé)	Medium	Very good	Medium	Good	30 FCFA/KG
Cotton cake	Medium	Good	Medium	Medium	130 FCFA/KG
Baobab cake	Medium	Good	Weak	Medium	130 FCFA/KG
Groundnut cake	Medium	Good	Medium	Medium	130 FCFA/KG
Rice bran	Good	Medium	Medium	Good	120 FCFA/KG
Molasses	Good	Weak	Weak	Medium	15 FCFA/KG
Corn grain	Very good	Medium	Medium	Medium	200 FCFA/KG
Urea	Weak	Good	Weak	Medium	5 FCFA/KG

Byproducts: *Agricultural* *Agro-industrial*

DAIRY FARMING OPERATING SYSTEM DESCRIPTION

Average from project farms reality

- FARM DESCRIPTION

Total area of farming operation: extensive dairy farming model (without lands)

Total surface dedicated for feed production: 4ha

Total surface for cattle pasture: not quantifiable

Total feed production per year: for those who cultivate, 23 tons in 2016.

- CATTLE DESCRIPTION

Milking cows: Zebru Gobra & Hybrid (Mix Zebu/Girolando/Maur/Montbeliard)

Weight: 350 KG (Zebu) – 500 KG (Hybrid)

Yield per milking cow: 1-3 L per day (Zebu) – 10 L per day (Hybrid)

Total herd: 50 heads per farmer

Total milking cows: 5 per farmer (other raised for meat)

Total milk production per year: 1 ton per farmer

EXAMPLE OF FEED RATION VALORIZING LOCAL BYPRODUCTS:

FEED RATION For a zebu who produces 6 KG/Day of milk, in middle of lactation	
FEED	**KG DM per day**
Rice straw or sugarcane straw	For free
Groundnut hay	1 KG
Rice bran	1 KG
Groundnut cake	0.5 KG
Industrial concentrate feed	1 KG
Molasses	0.2 KG
Mineral supplementation	50 G

Cost: **144 FCFA/KG**

Byproducts: *Agricultural* *Agro-industrial*

BYPRODUCTS: KEY PROJECT INPUTS

The context:

To valorize much more the local byproducts, both the quality and the quantity available, in order to decrease the milk production costs and increase farmers' autonomy.

In Senegal, on the one hand, few lands are available for feed production but on the other hand, farmers have always valorized different local byproducts (both agro-industrial and agricultural) in feed rations.

The idea:

To valorize agro-industrial (e.g. rice bran) and agricultural (e.g. sugarcane straw) byproducts.

KOSAM Project tries to develop a strong support to farmers in terms of feeding by improving the availabilities and the introduction in rations of local byproducts such as rice bran, groundnut cake (agro-industrial byproducts) and rice straw or sugarcane straw (agricultural byproducts).

KOSAM project aims to optimize the traditional practices of farmers by:

- increasing byproducts nutritional values (feed efficiency/balanced ration);
- developing the individualization of the ration : to adapt the feed quantity to every cow
- managing costs.

Global implementation results of the project:

- **A 50% increase of milk production per cow**

In addition to a better livestock watering management, these practices allow to pass from a minimum of 2 kg of milk per cow per day to a minimum of 4 kg per cow per day.

- **More than 20% of feed cost reduction**

These feed improvements helped to achieve a feed cost of 110 FCFA per KG of milk versus 140 FCFA before.

- **An improvement of byproducts availability**

The impact:

By the year 2018, more than 60% of the farmers of the project will have introduced these byproducts in their ration.

The main focus is on small farms and the top 10 of milk collection centers. The goal is to reach 500 of the 800 farmers of the project. In parallel, the KOSAM project team is working with the CIRAD in order to validate in the field all these practices by:

- Dressing an inventory of byproducts and realizing nutritional analysis;
- Testing a first version of rationing software (calculating nutritional values and costs).

The challenges:

- Consolidate and confirm the **added-value** of these byproducts with scientific expertise (CIRAD)
- Keep improving rations with the incorporation of fodder produced locally such as sorghum silage

The dissemination of these practices:

- Existing means of communication:
  - **Learn from others/Peers-to-peers network**: farmers develop the new practices by looking at others who have already shown benefits.
  - **Technical advices** to farmers with focus on feed management
- Ambitions:
  - The KOSAM project aims to develop and display **communication supports** about feed rations and byproducts valorization

"Local byproducts represent opportunities that need to be seized. As a Kosam project team, we need to valorize more and disseminate the information related to byproducts as feed for cattle. We must build something more organized and more sustainable."

ARONA DIAW, Project Manager

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DANONE ÉCOSYSTEME

4.6

MERAPI, INDONESIA

MERAPI IN INDONESIA

THE PROJECT

116 farmers

3 heads/farmer with

8-9 ton/farmer of annual milk production

2-3 milking cows

Friesian Holstein

weighing **350-600 KG**

and producing **8-10 L/day**

BYPRODUCTS VALORIZATION

TO REDUCE FEED COSTS & INCREASE FARMERS' AUTONOMY

- A **body condition scores** improvement
- A **body weight** improvement
- An improvement of **the overall nutritional balance** of the ration

To valorize:

- **Agro-industrial byproducts** (e.g. **cocoa meal & wheat pollard**)
- **Agricultural byproducts** (e.g. **corn straw**)

Today, **35%** of the active farmers of the project are implementing these new practices.

Here is **MERAPI** project

THE COUNTRY

249.9 million inhabitants

584,000 tons/year of milk production in liquid

300,000 tons/year of milk importation in powder milk

ICONIC PRODUCT

PROJECT TEAM

SARIHUSADA NUTRISI untuk BANGSA

LPTP

Arif Wahyudin

Robith Sya'Bani

APRIL 2017

DANONE · DANONE ECOSYSTEME · MILK CYCLE

LOCAL DAIRY FARMS

In Indonesia, 98% of the farmers are small farmers with 3 to 5 cows per farm. The other 2% are big farms, with more than 50 to 3 000 cows per farm.

Out of the 116 farmers involved in the Merapi project : 7 are active farmers in barn, 56 are active satellite farmers (individual-surround barn, milk collection) and 53 are satellite farmers (who are active to attend the training but not yet sending the milk-potential)

FEED AVAILABLE LOCALLY

Currency conversion: 1 € = 14891.99 IDR

Fodder/ Byproducts	Energy value	Protein value	Rumination power	Digestibility	Cost (Local currency/ KG DM) DM: Dry Matter
Field grass	Excellent	Medium	Excellent	Medium	Free from field
King grass	Excellent	Medium	Excellent	Medium	IDR 57-76/KG
Odot grass	Excellent	Medium	Excellent	Medium	IDR 360-450/KG
Corn straw *(harvested with young cobs)*	Excellent	Weak	Excellent	Medium	IDR 235-329/KG
Turi *(kind of leguminosa)*	Weak	Excellent	Medium	Medium	Free from field
Lamtoro *(Kind of leguminosa)*	Weak	Excellent	Medium	Medium	Free from field
Onggok *(cassava dregs)*	Excellent	Weak	Weak	Excellent	IDR 595-850/KG
Wheat Pollard	Excellent	Medium	Weak	Excellent	IDR 2238/KG
Rice bran	Excellent	Weak	Weak	Excellent	IDR 1800/KG
Soybean meal	Weak	Excellent	Weak	Excellent	IDR 5950/KG
Copra meal	Weak	Excellent	Weak	Excellent	IDR 3349/KG
DDGS (Distillers Dried Grains with Solubles)	Excellent	Excellent	Weak	Excellent	IDR 3822/KG
Tofu meal	Weak	Excellent	Weak	Excellent	IDR 108-324/KG
Cocoa meal	Weak	Excellent	Weak	Medium	IDR 2115/KG
Corn Gluten Feed (CGF)	Medium	Excellent	Weak	Excellent	IDR 2880/KG
Molases	Excellent	Weak	Weak	Excellent	IDR 2114/KG

Byproducts: *Agricultural* *Agro-industrial*

DAIRY FARMING OPERATING SYSTEM DESCRIPTION

Average from project farms reality

- FARM DESCRIPTION

Total area of farming operation: 1 ha

Total surface dedicated for feed production: 10 ha

Total surface for cattle pasture: cut & carry system, no pasture

Total feed production per year: 1520 tons

- CATTLE DESCRIPTION

Milking cows: Friesian Holstein

Weight: 350 – 600 KG

Yield per milking cow: 8 - 10 L/day

Total herd: 3 heads per farmer

Total milking cows: 2-3 per farmer

Total milk production per year: 8-9 tons per farmer

EXAMPLE OF FEED RATION VALORIZING LOCAL BYPRODUCTS:

FEED RATION For a cow which produces: 10 KG/Day of milk	
FEED	**KG DM per day**
King Grass	7.56 KG
DDGS	0.27 KG
Cocoa meal	1.89 KG
Wheat Pollard	1.75 KG
Corn Gluten Feed (CGF)	0.54 KG
Copra Meal	0.27 KG
Soybean Meal	0.31 KG
Onggok (cassava dregs)	0.26 KG
Molases	0.03 KG

Cost: **IDR 2567/KG**
(exclude grass cost)

Byproducts: *Agricultural* *Agro-industrial*

BYPRODUCTS: KEY PROJECT INPUTS

The context:

To keep developing byproducts as feed for cattle (in a country where byproducts are already used in the rations) in order to ensure farmers autonomy

Using byproducts to make feed concentrates is a common practice in Indonesia, as we are in a developing country. Indeed, industrial concentrates are expensive for farmers and also, their material price is very volatile. The variety of byproducts comes from the localization, the composition, the availability and the price.

The idea:

To valorize agro-industrial (e.g. cocoa meal and wheat pollard) and agricultural (e.g. corn straw) byproducts.

The idea is to get lowest price but keep considering value. The composition we adopt is best practices from farmers in West Java, and we made small changes based on references from university.

An example of agro-industrial byproduct is the cocoa meal. It is waste from cocoa industry (skin of coca, skin of cocoa's seeds, cocoa slurry). The skin of cocoa contains low protein and high fiber contents (the use is limited to ruminants) but the skin of cocoa's seed contains high protein value so it can be used for any livestock. Wheat pollard is also a byproduct valorized from the flour milling of grain: very palatable, it contains about 17% of crude protein.

Global implementation results of the project:

- **A body condition scores improvement** *
- **A body weight improvement** *

*: *based on physical observation (measurement in progress)*

The project team can already observe physical improvements but have not yet realized measurement.

- **An improvement of the overall nutritional balance of the ration**

The impact:

Today, 35% of the active farmers of the project are implementing these new practices.

35% of the 56 active farmers of the project are already implementing these practices. The goal is to sell the feed to as many farmers as possible.

The challenges:

- We are facing specific challenges in Merapi project. Indeed, we still have problems with the reproduction (the number of pregnant is low): we need to fix the basics first.
- The target: to get the ideal body conditions scores and weight. Then we will work on increasing the performance.

The dissemination of these practices:

- Existing means of communication:
  - **Exhibition on farm:** to show to farmers the byproducts and their introduction as feed
  - **Informal meetings with farmers**
  - **Specific trainings on concentrates and best practices**

"Concentrates can represent up to 50-60% of milk production costs so it's very expensive. We try to reduce the costs by using the byproducts, reaching the lower costs but keeping good nutritional value"

ARIF WAHUYDIN, Project Manager

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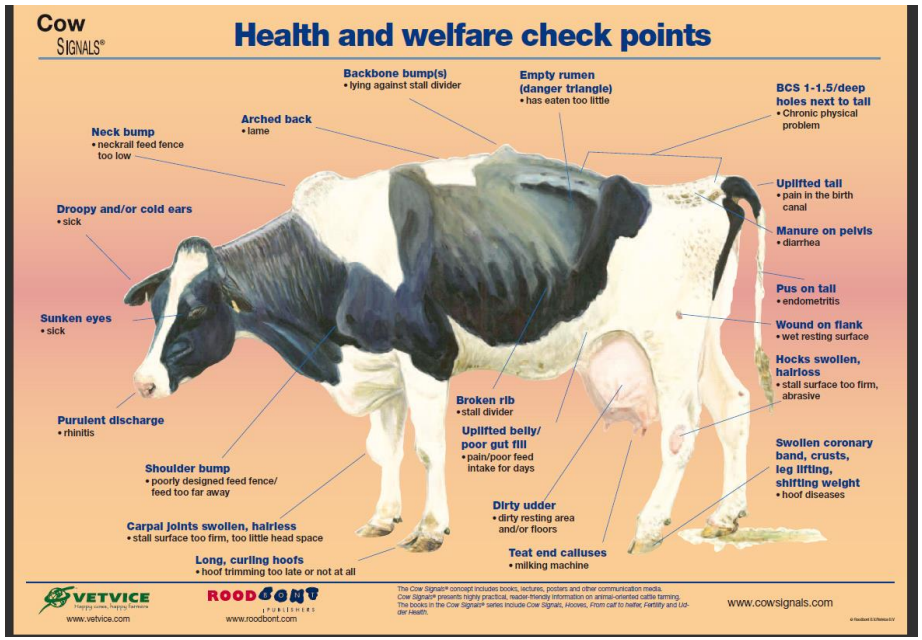
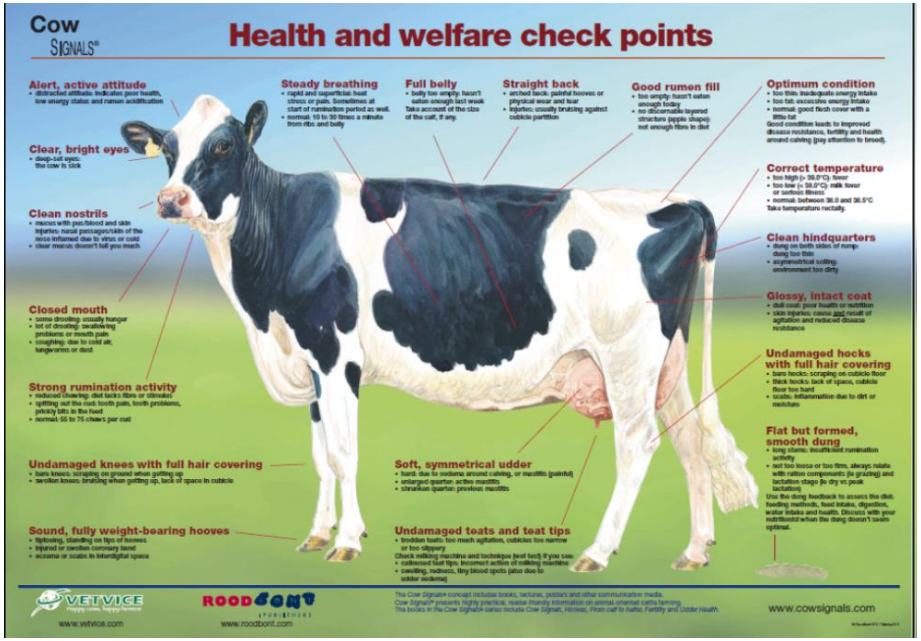
APPENDIX

- Checklist for health and welfare points:





(Source: Cow Signals, https://www.cowsignals.com/)

- Feedipidia: Animal feed resources system

http://www.feedipedia.org/