A GUIDE TO A SMALL MULTI-PRODUCT DAIRY

1 - PRESENTATION

1-1 Nature of the Activity

A small multi-product dairy treats from a few to around 10 m3 of milk per day, and converts it into various products depending on local conditions (consumer habits, distribution conditions, competition, etc.).

A small dairy can :

- promote the creation of a small dairy area and encourage its growth,
- respond to dairy product demand despite fluctuation in dairy production,
- adapt to varied demands : fats, fresh products, preserved products, etc
- create some jobs and develop the industrial framework

1-2 Alternatives

* Finished Products

With milk as a raw material, a wide variety of products are possible. They can be categorized as :

- liquid milk : sterilized or pasteurized for conservation. It can receive different additives (flavors, vitamins, etc.),
- preserved milk : some or all of the water is eliminated from the initial product. This leads to longer shelf life and lower storage and transportation costs. These are : concentrated milk (sweetened or non- sweetened) and powdered milk (skim or whole),
- fermented milk : using specific flora which produce a varying degree of curds (e.g. yogurt),
- cheese : a very wide range resulting from microorganisms' effect on milk. There is a concentration of nutritive elements, a longer shelf life, and many finished products.

Cream cheese/sour cream (higher water content, shorter shelf life) are distinguished from ripened cheeses (soft, hard, semi-hard, blue, ect...)

- fat products : cream, butter, concentrated butter. These result from milk's lipid phase,
- by-products : as a result of the processing of certain cheeses (milk serum from cheese, buttermilk from butter) for use in animal feed.

* Technology

The technological options are related to the raw material employed and the desired finished product.

- Raw materials : milk from the local herd or powdered milk + butter oil or milk fat (imported). When using powdered milk, supplementary investment is necessary to reconstitute the milk before conversion.
- Pasteurization : a largely indispensible step before any conversion. Vat, plate, tubular, and electric pasteurization methods can be considered. For milk which is for direct consumption, pasteurization can take place before or after packaging.
- Sterilization : only for milk which is for direct consumption. Before or after packaging (in bottles (glass or plastic), plastic bags, or tetrapak).
- Concentration-drying : only in large units.
- Standardization : at the outset of producing a specific product, standardize the amounts of fats , proteins, and minerals. This can be achieved by extraction (skimming for fats, ultrafiltration for water and small particles) or the addition of powdered milk, fats etc.
- Other operations : churning, coagulation, cutting, moulding, etc. These operations can be more or less mechanized.
- Energy production : all dairy operations call for heat (pasteurisation, sterilization, concentration), refrigeration (of the milk at reception,after pasteurization, storage), electricity (pumps, creamers) and compressed air. There are different energy possibilities :
  . centralized production : (gas, coal, electric, fuel heaters),
  . decentralized production : (water heaters, resistors...).
- Cleaning : a basic activity in the dairy sector, the most developed method being cleaning in place (C.I.P.), more or less automated.

1-3 Types of Possible Units

We will only consider two diversified workshop options for "small multi-product dairies".

Unit A : small dairy (10 m3/day) which produces pasteurized milk, butter, yogurt, ripened cheeses.

These go to a local market with the exception of the ripened cheeses which can be more widely distributed.

Unit B : a mini-dairy (3 m3/day) which has the same products as A, except the cheeses are fresh and not ripened.

2 - TECHNICAL- ECONOMIC GUIDE

2-1 Description of the Unit

2-1-1 Finished Products

LINE	A Small dairy 10 m3/day	B Mini-dairy 3 m3/day
Range of products	-Pasteurized milk in plastic bags (0,25, 0,5, 1l) - Table butter (60 g, 125 g, 250 g) - Classical yogurt, sweetened flavoured (125 g packs) - Cheese, semi-hard, ripened	- Pasteurized milk in plastic bags (0,25-0,5 l) - Table butter packaged in containers or slabs - Classical yogurt, sweetened or flavoured (125 g packs) - Fresh cheese with or without flavouring
Production		
Daily	Pasteurized milk : 55 m3/day Sweetened yogurt : 1,2 t/day Butter : 240 Kg/day Ripened cheese : 470 Kg.day	Pasteurized milk : 2,6 m3/day Sweetened yogurt : 300 Kg/day Butter : 60 Kg/day Fresh cheese : 30 Kg/day
Annual (300 days base)	Pasteurized milk : 1650 m3 Yogurt : 360 t Butter : 72 t Ripened cheese : 141 t	Pasteurized milk : 780 m3 Yogurt : 90 t Butter : 18 t Fresh cheese : 9 t

2-1-2 Technological Choices

OPERATIONS	TECHNOLOGICAL OPTIONS	SOLUTIONS LINE A	LINE B
Receiving	- Local milk or imported powder to be reconstituted (skim powder + dairy fats imported or whole milk powder)	Local milk and reconstituted milk optional	Local milk and reconstituted milk optional
Pasteurized milk Standardize	Skim by centrifuge : ultrafilter, add powder	Use centrifuge and homogenize	same
Pasteurize Package Package Pasteurize	- Pasteurize before or after packaging - Pasteurize in vats, or with tube or plate apparatus - Package in plastic bottles, complex packing "bricks" polyethylene bags, glass bottles	Pasteurize (before packaging) with plate apparatus. Package in plastic bags	same
Butter Skimming	Can be made from milk, cream, butter oil or milk fat	Use cream	same as A
Pasteurization Churning Working	Cream pasteurization before maturity optional	No cream pasteurizing	same as A
Packaging	Automated or manual	Mechanical and manual packaging	manual
Yogurt Pasteurization	- In vats or plate apparatus - Existing methods in the unit can be used	Use the same method as for milk	same as A
Sowing Packaging Fermentation Cooling	- Package after fermentation for stirred yogurts - Packaging more or less automated - Dating (automatic or manual) of containers recommended - Vat or hot room fermentation	- Package before fermentation - Semi-automatic filling - Dating - Vat fermentation	- Package before fermentation - Manual filling - Dating - Vat fermentation
Cheese Standardization	see : pasteurized milk	Use centrifuge or add powder	same as A
Pasturization	see : yogurt	- Use the same method as for other products	same as A
Fresh cheese Sowing Coagulation Draining Packaging Ripened cheese Sowing	- Coagulate in vats or moulds -Fresh cheese options : pre-drain on canvas : smoothing		- Coagulate in vats - Smoothing
Cutting	- Manual or automatic curd cutting	Manual cutting	
Molding	- Removal and molding of curds can be automated	Non-automated operation	
Pressing	- Different press types	Column press	
Ripening	- Temperature and humidity (more or less) controlled caves - From a few days to more than a year	21 days ripening in caves with partial air conditioning	
Washing	- Manual or automated cleaning in place	Mini cleaning in place	Non-automated cleaning