

A GUIDE TO A JAM PRODUCTION UNIT

1 - PRESENTATION

1-1 Nature of Activity

The unit produces jams, jellies, and marmalades. It allows for the valorization of fruits that do not correspond to the specifications for commercialization of fresh fruit or other transformations.

1-2 Alternatives

* Raw Materials :

- Fresh fruit : the most frequently used in small or medium sized units that function principally during harvest periods.
- Fruit or frozen pulp, principally in units that produce all year round and when this type of supply is available. Freezing allows for better preservation of the organoleptic quality of the raw materials.

It is also possible to obtain appertized and stabilized pulps (SO₂).

For the jellies and marmalades, we use fruit juices or concentrates as well as citrus fruit rinds.

* Finished Products :

Three products : jams, jellies, marmalades.

Definition of products (French legislation) : for 1000 g of finished product :

- Jam : mix of 350 g minimum (generally but with the exception of certain fruits) of pulp or purée of one or various fruits and sugar.
- Extra Jam : 450 g minimum (generally) of pulp or purée of fruits.
- Jelly : mix of 350 g (generally) of juice and/or liquid extracts from one or various types of fruits and sugar.
- Extra Jelly : 450 g minimum (generally) of juice or liquid extract.
- Marmalade : mix of 200 g of pulp, puree, juice, liquid extract or rinds of citrus fruits or sugar.

There is also another category of high quality jams and marmelades containing fruit pieces.

* Technology :

In the case of a supply of fresh fruit, the process begins with a preparation phase for the fruit. Certain steps of this phase may be specific to certain fruits (peeling, stoning, barking, etc.). These pre-processing lines are more or less mechanized, depending on the size of the unit.

At the beginning of the preparation phase, the principal option is which cooking process must be chosen :

- cooking under atmospheric pressure in vats (discontinuous) which is the traditional method,
- cooking in a vacuum :
 - . discontinuous, in vacuum-concentrators,
 - . continuous, in smooth surface heat exchangers, (a sophisticated process not yet well developed.

Cooking in vacuum allows for the lowering of the cooking temperature (better preservation of organoleptic quality and nutrients as well as energy savings), which leads to greater control of the cooking process and higher yields .

* Packaging :

- Glass jars (most common size : 375 g)
- Cans 4/4 or 5/1
- Aluminium or plastic packaging in individual portions essentially destined for organizations and cafés, hotels, and restaurants.

1-3 Types of Possible Units

There are three types of units :

Unit A : with a 100 kg/hr capacity and cooking in vats.

Supply : fresh fruit during the harvest period.

Complementary workshop of a unit which processes or packages fruit and vegetables.

Unit B : with a 300 kg/hr capacity and discontinuous cooking in vats .

Supply : fresh fruit during the harvest period.

Unit C : with a 700 kg/hr capacity and discontinuous cooking in a vacuum in vacuum-concentrators.

Supply : fresh fruit during the harvest period.

2 - TECHNICAL AND ECONOMIC GUIDE

2-1 Description of Units

2-1-1 Finished Products

LINE	A 100 kg/hr	B 300 kg/hr	C 700 kg/hr
Range of products	Standard jams Wide range of fruit	Standard jams, jellies Wide range of fruit	Jams, standard and high quality Wide range of fruit
Type of packaging	Glass jars 375 g	Glass jars 375 g or cans Individual portions	Glass jars Cans Individual portions
Daily production	800 kg t (8 hr/day during harvest period)	4,8 t (16 hr/day during harvest period)	11 t (16 hr/day during harvest period)
Annual production	200 t/year	1000 to 1200 t/year	25 000 t/year

2-1-2 Technological Choices

OPERATIONS	TECHNOLOGICAL OPTIONS	SOLUTIONS		
		UNIT A	UNIT B	UNIT C
Cleaning	Manual or mechanized	manual (stainless steel sorting table)	manual sorting table and specific apparatus for the most common fruits	sorting table, washer, specific apparatus
Sorting				
Tailing coring				
Storage	Cold rooms	no (optional)	yes	yes
Weighing	Manual or automatic	manual	manual	manual
Mixing	Vats or tank	plastic vats	plastic vats	horizontal mixing tank with slow agitator
Transfer	Manual or automatic	manual	manual (pump optional)	by pump
Precooking	Optional	no	no	Continuous cooker (refiner optional)
Cooking	Under atmospheric pressure or vacuum	atmospheric vats of 100 l	atmospheric vats of 100 l	vacuum concentrator
Filling of jars	Dosimeter semi-automatic or automatic	dosimeter (heat) semi-automatic	dosimeter (heat) semi-automatic + portioner	dosimeter (heat) automatic + portioner
Closing	Depends on container	manual (jar)	manual (jar)	sealer and capper
Cooling	Water bath, or cooling tunnel	water bath	water bath	cooling tunnel
Labelling	manual or automatic	manual	manual	labeller

2-2 Economic Analysis

2-2-1 Investments

Equipment	OPTION A		OPTION B		OPTION C	
	Description	FOB price in US \$	Description	FOB price in US \$	Description	FOB price in US \$
Preparation of fruit	stainless steel table	\$ 1300	stainless steel table, scale		stainless steel table specific equipment, scale	\$ 65 000
Weighing	scale	\$ 3200	specific equipment	\$ 20 000	continuous cooker	\$ 24 000
Mixing					pump	
Precooking	2 tipping vats with agitator	\$20 000	3 tipping vats with agitator	\$ 32 000	vacuum concentrator	\$ 56 000
Cooking					automatic dosimeter	\$ 32 000
Filling of jars	dosimeter (100 g 1 kg)	\$ 8000	2 dosimeters (100 g to 1 kg)	\$ 16 000	capper sealer	\$ 32 000
Closing			Packaging machine (individual portions)	\$ 55 000	packaging machine (individual portions) thermoshaping	
Cooling					tunnel	\$ 64 000
Labelling					Labeller	\$ 10 000
			laboratory equipment	\$ 16 000	laboratory equipment	\$ 1600
			cold room		cold room	\$ 64 000
			equipment	\$ 32 000		
Total equipment	30 to \$ 40 000			\$ 160 000		\$ 500 000
Options	Cold room equipment	\$ 8000	semi automatic sealer (4/4 or 5 l) pump + vat	\$ 5000 \$ 4000	refiner	\$ 11 300
Building	Storage of fresh fruit : 10 m3		Storage of fresh fruit (under canopy) : 60 m3		Storage of fresh fruit : 150 m3	
	Preparation building (processing) : 100 m2		Preparation and processing : 350 m2		Preparation and processing : 450 m2	
	Storage (packaging + finished products) : 150 m2		Storage (packaging + finished products) : 300 m2		Storage (packaging and finished products) : 500 m2	
	Total area : 250 m2		Total area : 650 m3		Total area : 1100 m2	
Other investments	Electricity : 20 Kw		Electricity : 20 Kw		Steam : 500 kg/hr	
	Water : 3 m3/hr		Water : 6 m3/hr		Electricity : 30 Kw	
					Water : 30 m3/hr	
Total investments	\$ 130 000 to \$ 160 000		\$ 400 000		\$ 900 000	

2-2-2 Functioning

	UNIT A	UNIT B	UNIT C
Personnel		by team	by team
- Skilled	1	1	1
- Unskilled	7	10	10
Consumption			
- water	0,1 to 1,5 m3/hr	0,3 to 4 m3/hr	10 to 20 m3/hr
- vapour	0,3 T/t (gas)	0,3 T/t (gas)	0,3 T/t (boiler)
- electricity			
. production	60 kwh/t	80 kwh/t	100 kwh/t
. storage			
- sugar	600 kg/t	600 kg/t	600 kg/t
- additives			
. pectine	7 kg/t	7 kg/t	7 kg/t
. citric acid	10 kg/t	10 kg/t	10 kg/t
Packaging	jars cartons according to format	jars cans cartons according to format	jars, cans, small dishes, cartons according to format

3 - KEY FACTORS TO THIS PROJECT'S SUCCESS

3-1 Supply

It is necessary to have access to an abundance of raw materials at competitive prices. Moreover, the period between harvest and processing must be very short. The units must therefore be located at the production sites and should foresee contracts with producers for at least part of their supply.

In the case of continuous supply of fruit that is not over-ripe, the cold room is not needed. The supply of jars and cans can be difficult : foresee sufficient stocks.

3-2 Technology and Equipment

The technology must be mastered : the parameters for sugar/fruit/pectin/acid determine the firmness of the jam.

Cooking in vats is particularly difficult because of the risks of overheating (among the skilled workers, a cook is necessary for unit A).

The equipment for the preparation of the fruit must be adapted to the fruit being prepared. A peeler for pineapples, a pitter and refiner for mangoes, etc...

3-3 Quality Control

The primary equipment necessitates a pH meter and a refractometer (to control acidity and the sugar content).

3-4 Building

The size of the storage area depends on the availability of packaging and the flux in the commercialization on the finished product.

3-5 Distribution and Commercialization

The exportation of jams is difficult, considering the cost of transportation and the low added value of the finished product.

One must therefore target the domestic market or the markets of neighbouring countries.

There exists an export market for certain jams of specific exotic fruits.

3-6 Financing

The required working capital is significant because one must assure the stocking of the finished product between seasonal production and continuous marketing.

4 - INDUCED ACTIVITIES

A production of fruit adapted to industrial demand.