

A GUIDE FOR A PRODUCTION UNIT OF DRINKS WITH A BASE OF FRUIT AND/OR VEGETABLE EXTRACT

1 - PRESENTATION

1-1 Nature of the Activity

In a primary transformation of fruit, one can extract :

- juice (with or without pulp, concentrated or not),
- flavouring compounds (essential oils...).

These two types of extracts can be used as bases for drinks.

The workshops that prepare fruit drinks will use products that have already been transformed (that can possibly be prepared on site).

Fruit drinks that go to the local market can be carbonated or not and more or less diluted (concentration of juice can be varied).

1-2 Alternatives

* Finished Products

One can carry out a double segmentation :

- Drinks with a fruit juice or vegetable extract base
- non-carbonated and carbonated drinks.

In the past fruit-based drinks were generally non-carbonated drinks, whereas drinks with a vegetable extract base were generally carbonated. Today, all combinations of new products are possible.

- Drinks with a base of fruit juice :

Water, sugar and possibly acid, and flavouring are added to the fruit juice. Depending on the proportion of water added, one will distinguish :

- . reconstituted fruit juices : one adds to the juice concentrate the quantity of water necessary to reconstitute the juice in its original form.
- . nectars : (addition of water varies according to the fruit).
- . fruit drinks : (minimum 12% fruit juice according to European regulations).

- Drinks with a base of vegetable extract :
 - . fruit flavoured : sodas with flavouring, essential oils and colouring.
 - . diverse flavours :
 - tonics and bitters : with a bitter almond and quinine base
 - colas : with vegetable extracts and caramel colouring
 - soft drinks : with lemon derived base.

* Raw Materials

The raw materials are :

- fruit juices (usually purchased in concentrate, but can also be produced on site)
- concentrated flavouring extracts
- water : from a natural source ; drinkable tap water ; river water or ground water (in these last two cases, the water must be treated)
- sugar : sucrose, glucose syrup, and non-nutritive sweeteners (aspartame) that permit a lower calorie content.
- other "ingredients" : acids, flavourings and possibly colouring.

The reconstituted fruit drink and fruit drink industry is the largest client for fruit juice concentrate producers (see corresponding guide).

* Technology

The technological options are principally in packaging, which directly determines the size of the workshops.

- Packaging in plastic bags or aluminium : here, packaging is done with heat. It is the least expensive method and is adaptable to small units.
- In plastic or glass bottles : In the case of glass, containers can be returnable or disposable. In the case of returnable containers, foresee cleaning unit.
- In metallic cans : as with glass bottles, packaging is done with heat. This necessitates a cooling line after packaging.
- In cardboard boxes : cold aseptic packaging. This is a sophisticated technology which requires high investment.

The last two options are possible only for medium-sized and large units.

1-3 Types of Possible Units

3 types of production lines will be considered, differing in their capacity and means of packaging used.

Unit A : large unit (10000 l/h) which manufactures a large range of finished products, and is supplied with juice concentrates and vegetable extracts. We have two options :

. non-carbonated drinks in cartons or carbonated drinks in bottles., both aimed at domestic markets. In the case of carbonated drinks in returnable bottles, foresee a bottle washing unit.

Unit B : medium-sized unit (5000 l/h) which is supplied with juice concentrates and commercializes fruit drinks in cartons on regional or domestic markets.

Unit C : small unit (800 l/h) for local market, with packaging in sachets. This limits production to non-carbonated drinks with fruit juice bases (concentrated or not). The unit can be connected to a workshop that manufactures fruit juice.

2 - TECHNICAL AND ECONOMIC ANALYSIS

2-1 Description of the Unit

2-1-1 Finished Products

LINES	A 10 000 l/h cartons + bottles	B 5000 l/h cartons	C 800 l/h Aluminium sachets
Range of products	- drinks with a base of fruit juice - carbonated fruit drinks	- non carbonated drinks with a base of fruit juice	- non carbonated drinks with a base of fruit juice
Types of packaging	- 11 cartons for drinks with a base of fruit juice - 33 cl bottles for carbonated fruit drinks	- 11 cartons	- 25 cl aluminium sachets
Production			
- hourly	10 000 l/hr	5000 l/hr	800 l/hr
- daily (8 hr/day)	80 000 l/day	40 000 l/day	6400 l/day
- annual	200 000 hl/year	100 000 hl/year	20 000 hl/year

2-1-2 Technological Choices

OPERATIONS	TECHNOLOGICAL OPTIONS	SOLUTIONS		
		LINE A : 10 000 l/h	LINE B : 5000 l/h	LINE C : 800 l/h
Water treatment	Water from a spring, according to legislation. Others : according to quality - filtration-flocculation - sterilization (ozone, UV, chlorine) - decarbonization, demineralization	According to local conditions	See A	See A
Blends - Preparation of sugar-syrup - Pre-mixing of ingredients - Blending together water, juice, and the rest.	- Preparation of sugar-syrup separately (or not) - Computerized, automated systems	- Separate preparation of sugar-syrup with hot water recirculation circuit - Continuous mixing - Computerized, automated installations	- Separate preparation of sugar-syrup without recirculation of water	- Blending of all primary ingredients in one vat after manual weighing of the ingredients
DEAERATION	- Vacuum action or injection of an inert gas (N ₂ or CO ₂ -> interesting for carbonated drinks)	vacuum action	See A	See A
PASTEURIZATION	- Tubular or plate pasteurizer	Plate pasteurizer	Plate pasteurizer	Tubular pasteurizer
PACKAGING	- With heat or aseptic with cold - Addition of CO ₂ (for carbonated drinks) - Bottles with posterior pasteurization. - Cartons for non carbonized drinks.	- Aseptic with cold in cardboard "bricks". - Bottles : washed and pre-heated before use in packaging. After packaging, pasteurization, then cooling in tunnel.	- Aseptic with cold in cardboard "bricks".	- With heat, in aluminium sachets. - Cooling after packaging.
ADDITIONAL PACKAGING	- Cardboard cases, formation in pallets.			

2-2 Economic Analysis

2-2-1 Investments

Equipment	LINE A FOB price \$ US	LINE B FOB price \$ US	LINE C FOB price \$ US
Dilution and sterilization unit	\$ 320 000	\$ 240 000	Dilution + homogenization \$ 80 000
Vats	\$ 80 000	\$ 60 000	\$ 30 000
Carton packaging unit 5000 l/hr	\$ 800 000	\$ 800 000	
Bottle packaging unit	\$ 1 300 000		Pasteurization \$ 100 000 Filling \$ 160 000 Cooling \$130 000
Miscellaneous processes	\$ 150 000	\$ 130 000	\$ 15 000
Total equipment (handling chain not included)	Bottles : \$ 1 850 000 Cartons : \$ 1 350 000	\$ 1 230 000	\$ 515 000
Buildings	Factory area : 800 m2 + 1200 m2 storage Land : 5000 m2	Factory area : 400 m2 + 800 m2 storage Land : 3000 m2	Factory area : 350 m2 + 350 m2 stockage Land : 1500 m2
Other Investments			
- Boiler	1 t/hr	0.5 t/hr	0.2 t/hr
- Ice water (negative calories)	300 000 nc/hr	150 000 nc/hr	50 000 nc/hr
- Electrical power :	300 Kw	200 Kw	50 Kw
Total investment	\$ 6 to 7 million	\$ 3 to 4 million	\$ 1.3 to 1.6 million

2-2-2 Functioning

	LINE A 10 000 l/h	LINE B 5000 l/h	LINE C 800 l/h
Labour			
- Unskilled	20	15	10
- Skilled	3	3	2
Annual consumption			
- water	140 000 m3	70 000 m3	15 000 m3
- concentrate (eq. diluted juice)	40-50 000 hl	20-25 000 hl	4-5000 hl
- bottles 33 cl	60 million or		
- packs 1 l	20 million	10 million	
- sachets 25 cl			8 million
- cartons	850 000 cartons of 24 units	425 000 cartons of 24 units	160 000 cartons of 50 units
- vapour	1000 t	500 t	200 t
- electricity	450 000 Kwh	300 000 Kwh	75 000 Kwh
- ice water	480 million negative calories	200 million negative calories	80 million negative calories

3 - KEY FACTORS TO THIS PROJECT'S SUCCESS

3-1 Supply

- Transportation of empty packaging material is often burdensome, especially with cans and bottles. This makes a rural location difficult.
- Regular supplying of, or capacity to stock juice concentrate necessary (preserved with SO₂ or frozen).

3-2 Technology and Equipment

At the time of blending raw materials, it is necessary to :

- respect the determined order of incorporation (generally from the least acidic product to the most acidic product),
- limit oxygenation so as to obtain the purest blend possible
- watch over the temperature at the time of carbonation because this is an exothermic process

- water treatment is an essential step, as water plays a important role both as an ingredient and as hot water for technical processes (washing of containers...),
- possibility of systems to recover heat from water used for washing, pre-heating, and cooling so as to reduce energy consumption.

3-3 Personnel

This is a relatively delicate food industry that necessitates a training program for team leaders and maintenance personnel (an electro-mechanic and a mechanic).

Two sensitive areas :

- reception of raw materials and blends
- packaging in bottles : pay attention to the regulating of the packaging workshop (risk of breakage of bottles).
- packaging in cardboard : in order to limit interventions on the part of the equipment manufacturers (very costly), it is necessary to train an electro-mechanic for regular maintenance.

In all cases there should be a good stock of spare parts.

3-4 Quality Control

- Physico-chemical and microbiological tests on :
 - . water : raw, treated, softened (for bottle-washing)
 - . dry sugar
 - . blend of sugar-syrup with ingredients : brix, acidity (pH)
 - . finished products
 - microbiological (yeasts, moulds, etc.)
 - carbonization test for cabonated drinks
- Control of soda residues in the washed bottles , control of crimping, elimination of defective bottles before packaging.
- Foresee small laboratory in the unit.

3-5 Distribution and Commercialization

With the exception of unit C, the workshops do not use agricultural raw materials. They can be set up in regions of consumption in order to reduce the costs of distribution.

It is important to optimise the delivery circuits (elevated costs for heavy products).
Delicacies : packaging and communication are extremely important for these products (in order to face the competition of multinationals often present on the soda market).

3-6 Financing

Investment/turnover ratio greatly inferior to 1.

Consumption is often seasonal which necessitates production reports.

3-7 Other Specific Problems

This activity causes little pollution. However, foresee a water treatment system for the pipe cleaning water. (Send to a purification station or perform simple neutralization before rejection).

4 - INDUCED ACTIVITIES

Not related to local agriculture. The industry can, however, create a market for intermediate food products (juice concentrates, sugar, cane juice...) as well as for bottles ; the cardboard for the boxes is generally imported in sheets. The induced activities in the service industry : transportation for supply and distribution, circuit for recuperation of glass bottles, etc.).