

A GUIDE TO A WHEAT MILL

1 - PRESENTATION

1-1 Nature of the Activity

The milling of both soft wheat and durum wheat is the first step in production after the wheat has been collected. It provides flour or semolina made from wheat to units which conduct secondary transformation (bakeries, cookie factories, pasta producers, couscous manufacturers, etc.).

Or packages the product for the consumer (who effects the secondary transformation at home).

The adaptability of the cultivation of wheat to various climates (thanks to advances in genetics), the easy use, and the diversity of cooking methods make wheat the most widely consumed grain in the world (approximately 400 million tons).

1-2 Alternatives

* Raw Materials :

The mill can process all types of wheat.

* Finished Products :

- **Flour**: the alternatives depend essentially on the quality of the flour and on the packaging.

Quality : there are two principal criteria :

. purity (expressed in rate of ash). We also distinguish between types of flour ; type 45 (ash rate of < 0.5), type 55 (between 0.5 and 0.6) and type 65 (between 0.62 and 0.75).

. the rheological value (w), also called force or baking quality. It measures the tenacity, extensibility and cohesion of the dough.

Packaging :

- packaging for the consumer : paper bag or carton.
- 50 kg sacks or in bulk.

- By-products :

- . bran and middlings : these consist of fragments resulting of envelopes from the crushing and containing a high rate of kernels. They can be used for animal feed.
- . wheat germs : from which oil can be extracted.

*** Technology :**

The processing method is identical for all units and for all types of wheat : reception -> storage -> cleaning/packaging -> crushing and bolting (crushing with a grooved cylinder, separating with a plan-sifter, and re-crushing with a smooth cylinder or grinder) -> storage and packaging of flours and valorization of by-products.

The technological alternatives depend essentially on the capacity of the equipment the level of automation, and the presence of a certain amount of peripheral equipment (control systems, valorization of by-products, etc.)

The production diagrams vary depending on the rate of extraction for different types of flour.

Examples of production possibilities of a unit (from soft wheat with 14 % humidity rate and a specific weight of 78).`

Flour type 55	Flour type 45
Flour 77%	62% + 10 % primary flour recyclable with other types of flour + 5 % base flour
Middlings 4 %	4%
Bran : coarse 7 % fine 10 %	7% 10%
Waste 2 %	2%

1-3 Types of Possible Units

While the process is mostly uniform, the variables depend essentially on the quantity processed.

The smallest possible unit processes 60 tons of wheat per day : this guide does not include such a unit as the ratio of cost per ton is not advantageous and limits the diffusion possibilities.

Unit A : small unit of 120 t/day for regional distribution.

Unit B : an average-sized unit of 250 t/day located near its supply source (at port or near wheat collection areas). It can supply a special range of more sophisticated products catering to specific demands (unit that incorporates protein, vitamins, enzymes). It has a silo for 4,000 tons.

Unit B is planned with a possible extension to 750 t/day and 30,000 tons of storage capacity : for this capacity, it will suffice to augment the silo capacity and to equip the mill with appropriate equipment.

2 - TECHNICAL AND ECONOMIC GUIDE

2-1 Description of unit

2-1-1 Treated products

LINE	A : 120 t/day	B : 250 t/day
Products	Flour from soft wheat Granules from by-products	Same as A
Packaging	50 Kg sacks 1 Kg bags	Same as A
Capacity		
- daily	120 t	120 t
- annual	32 500 t	67 500 t

2-1-2 Technological Choices

OPERATIONS	TECHNOLOGICAL OPTIONS	SOLUTIONS	
		UNIT A	UNIT B
Reception	In bulk, by trucks, wagons or unloading of ships	Bulk, trucks or wagons Weighing of trucks + weighing on the line	Unloading at harbour Weighing of trucks + weighing on the line
Cleaning preparation	Obligatory cleaning Watering until 15,5 % to 16 % humidity	Water spraying	Water spraying - Constant control of grain's humidity optional
Crushing Bolting	Machinery with grooved and smooth cylinders + Plan-sifters for the separation	yes	yes
Fortification	Optional Various additives	no	Dosage and incorporation of additives
Drying	Sometimes necessary	no	Pneumatic dryer
Processing of by-products	- delivery in bulk - Cubage : put in granule form	Granules : mixer + granulating press + refrigerator	Same as A
Automation	More or less	Limited automation	Heavy automation (management of stock with programmable automation)

2-2 Economic Analysis

2-2-1 Investments

	LINE A : 120 t/day	LINE B : 250 t/day
EQUIPMENT	FOB price US \$	FOB price US \$
Cleaning	\$ 400 000	\$ 600 000
Milling-bolting	\$ 2 000 000	\$ 2 400 000
Processing of by-products	\$ 400 000	\$ 660 000
Packaging and storage of finished products	\$ 400 000	\$ 560 000
Total equipment	\$ 3 200 000	\$ 4 220 000
Buildings		
Reception-storage	4000 t of storage Area : 400 m2	15 000 t (with planned extension for 30 000 t) Area : 1500 m2 (2500 m2 taking into consideration the wharf)
Mill building + general services	Area : 300 m2	Area : 1200 m2 (including 750 t/day extension)
Building for storage of finished products	Area : 300 m2	Area : 1200 m2
Land	15 000 m2	40 000 m2 (including 750 t/day extension)
Other investments	Electrical power : 350 kw	Electrical power : 750 kw
Total investments	\$ 6 to \$ 7 million	\$ 8 to \$ 10 million (without planned extension) or \$ 12 to 14 million (with harbour silo of 15 000 t capacity and planned extension for 750 t/day)

2-2-2 Functioning

	LINE A	LINE B
Skilled labour	1 chief miller 3 chief watchmen 3 conductors 1 maintenance manager 1 electrician 1 mechanic 1 lab technician Total skilled personnel : 11	1 chief miller 1 chief of silo 3 chief mill watchman 3 chief silo watchman 3 mill conductors 3 silo conductors 1 maintenance manager 1 electrician 1 mechanic 1 lab technician Total skilled personnel : 18
Unskilled labour	14 workmen 3 labourers Total unskilled personnel : 11	24 workmen 6 labourers Total unskilled personnel : 18
Annual consumption		
Wheat	32 500 t	67 500 t
Electricity	1950 Mwh	4050 Mwh
Vapour	325 t	675 t
Water	500 m3	1000 m3

3 - KEY FACTORS TO THE PROJECT'S SUCCESS

3-1 Supply

The supply conditions determine the geographic location of the unit as well as its reception and storage structures. The sources of supply can be of different origins : local, regional, domestic, or imported with all possible combinations.

3-2 Technology and Equipment

The most delicate point of the process is the "milling and bolting" stage which determines quality and yield of each product.

3-3 Personnel

Specific training is necessary for the personnel who handle the running and regulating of the mill.

The other positions in the factory from one end to the other of the milling do not require specific qualifications.

3-4 Quality Control

The unit must include a laboratory capable of measuring the following :

- humidity
- rate of ash
- extensograph
- amylasic capabilities
- acidity
- panification test
- granulometry.

3-5 Distribution and Commercialization

There are many possible options : delivery in 1 kg bags to consumers, delivery in 50 kg sacks to small artisanal businesses (bakeries, pastry shops, pizzerias...), delivery in bulk or 50 kg sacks to AFI, exporting...

Depending on the chosen market, the commercial needs will be very different.

3-6 Financing

The level of investment is high but the investment/turnover ratio is about 0.5.

Foresee significant working capital, taking into consideration the average storage period for finished products and raw materials.

3-7 Other Specific Problems

No pollution problems : low water use and integral valorization of by-products.

4 - INDUCED ACTIVITIES

- The mill is a crucial element in the development of the cereal products industry.
- The existence of a mill can permit the rapid development of animal feed production units, even the creation of poultry farming.

The mill will also generate subcontracting (mechanics transportation etc.).