

# TECNICA MOLITORIA

## INTERNATIONAL



*...together with you, we will  
continue to write the history of pasta*

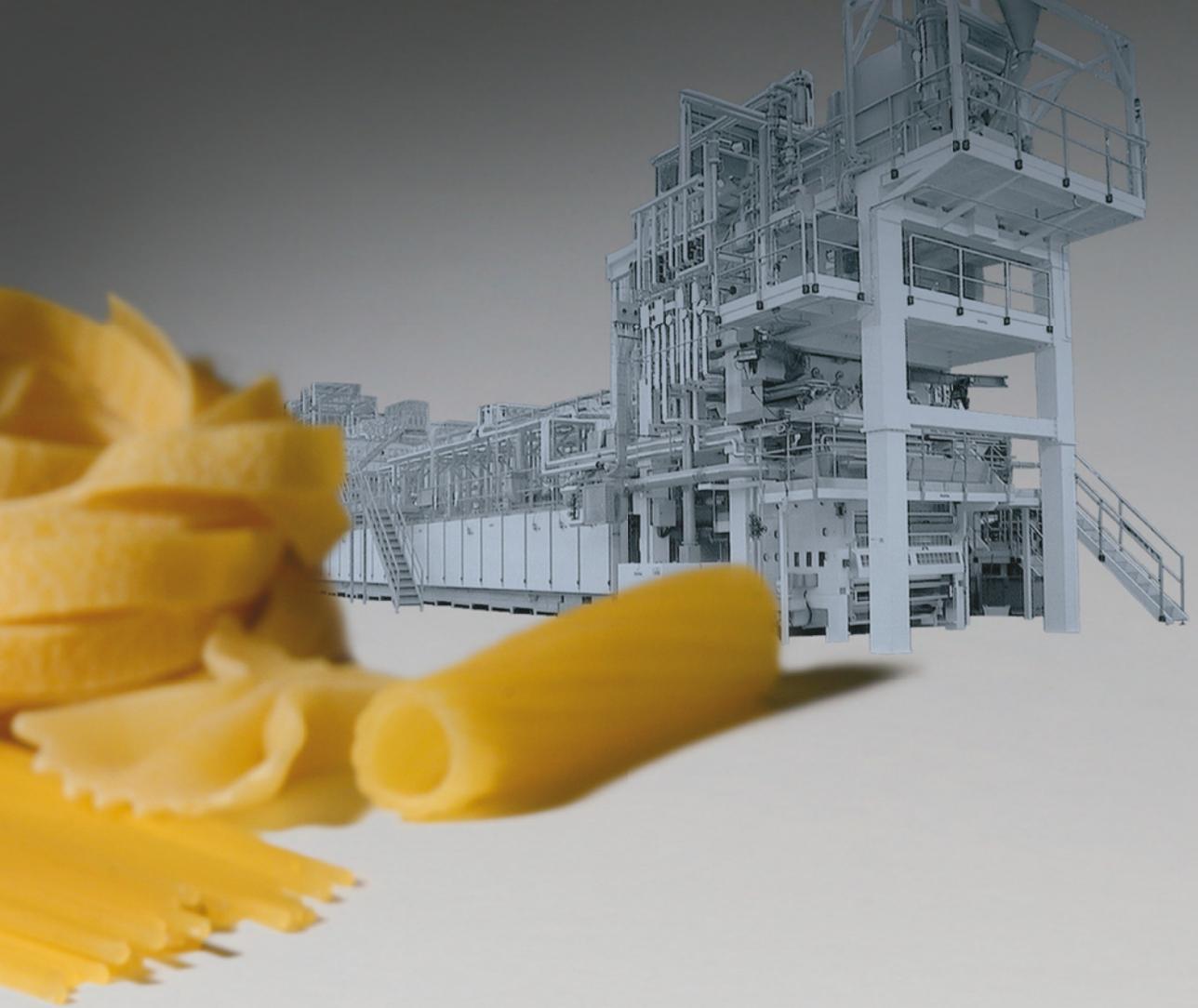
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**FAVA**  
pasta equipment

- WITH SUPPLIER DIRECTORY -



CHIRIOTTI EDITORI



*...and, together with you, we will  
continue to write the history of*

There are machines that have marked an era, distinguishing themselves for their technology and innovation. Through the years they have spanned across the world, winning over the most important pasta producers. Today, thanks to our enthusiasm for this sector combined with our advanced research, we plan for the future...



**FAVA**

pasta equipment

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# Strahl

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**SELVA GIDA** (durum wheat), **MOLINO EL ROSAL** (durum wheat)

**SEMOLIFICIO e MOLINO LOUIDICE** (durum wheat)

**INDUSTRIE ALIMENTARI BALLETTA** (durum wheat)

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*La Parmigiana* s.r.l.

**Macchine e impianti per pasta - Pasta producing machines and plants**



# UPS EVO

How to replace a valve bag with an open mouth bag

Machine installed at "Braga" Flour Mill in Dello (Brescia) - ITALY



Formats from 5 to 50 Kg

## PINCH-TOP Closing

- ❖ No accidental product loss
- ❖ No external contamination
- ❖ No modification to the palletising
- ❖ No pallet size increasing
- ❖ Flour output 500 bags/h





**NEWS**

# colour sorting machine Futura HP Led Series

After the introduction of 2048 pixel CCD digital technology and infrared camera

**Futura HP Led Series introduces the  
LED lighting system**



## LED LIGHTING SYSTEM VANTAGES:

- No Spare parts (50.000 h/life);
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di Pietro e Giuseppe & C. S.a.s.

## THE ART AND SCIENCE OF MILLING



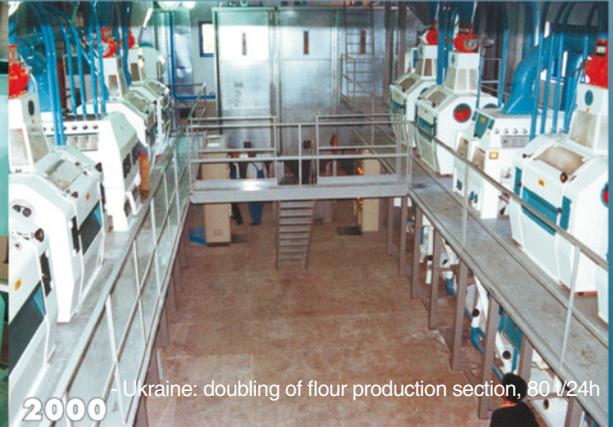
1980



1997 - Morocco: Couscous production, 40 t/24h



1998 - Ukraine: flour milling, 40 t/24h



2000 - Ukraine: doubling of flour production section, 80 t/24h

## BEWARE OF IMITATIONS

our dynamic technological know-how - proved by our well-established presence on international markets - is at disposal of all the agribusiness field. Thanks to our efficient and effective service, we are able to offer a wide range of machines and plants of various sizes.



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## VIBRATOR MOTORS

Since 1972 O.M.B. Is well known all over the world for the designing and manufacturing of electric and pneumatic vibrator motors. All our products are manufactured in conformity with the EEC regulations in force, and our range reaches such performances as to satisfy at maximum levels any market requirement in vibrating equipments of all sectors (Centrifugal force from 0 to 230 kN). All the company activities are carried out in conformity with the iso 9001:2000 Standard, and the quality system has been certified by the prestigious BVQI international institute.

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Di Ferrari Luigi Alberto & C. s.n.c.

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**DRIER - ROASTER** performing 5 - 10 T/hour



Rollers mm 1000 x 1200  
Total weight: kg 24.000

**FLAKES and CRUSHED CEREAL:** performing 5 - 10 T/hour

These technical details and aspect are indicative and subject to changes. Please get in touch for more info

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# STONE GRINDING MILL

11

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*To obtain real wholewheat flour*



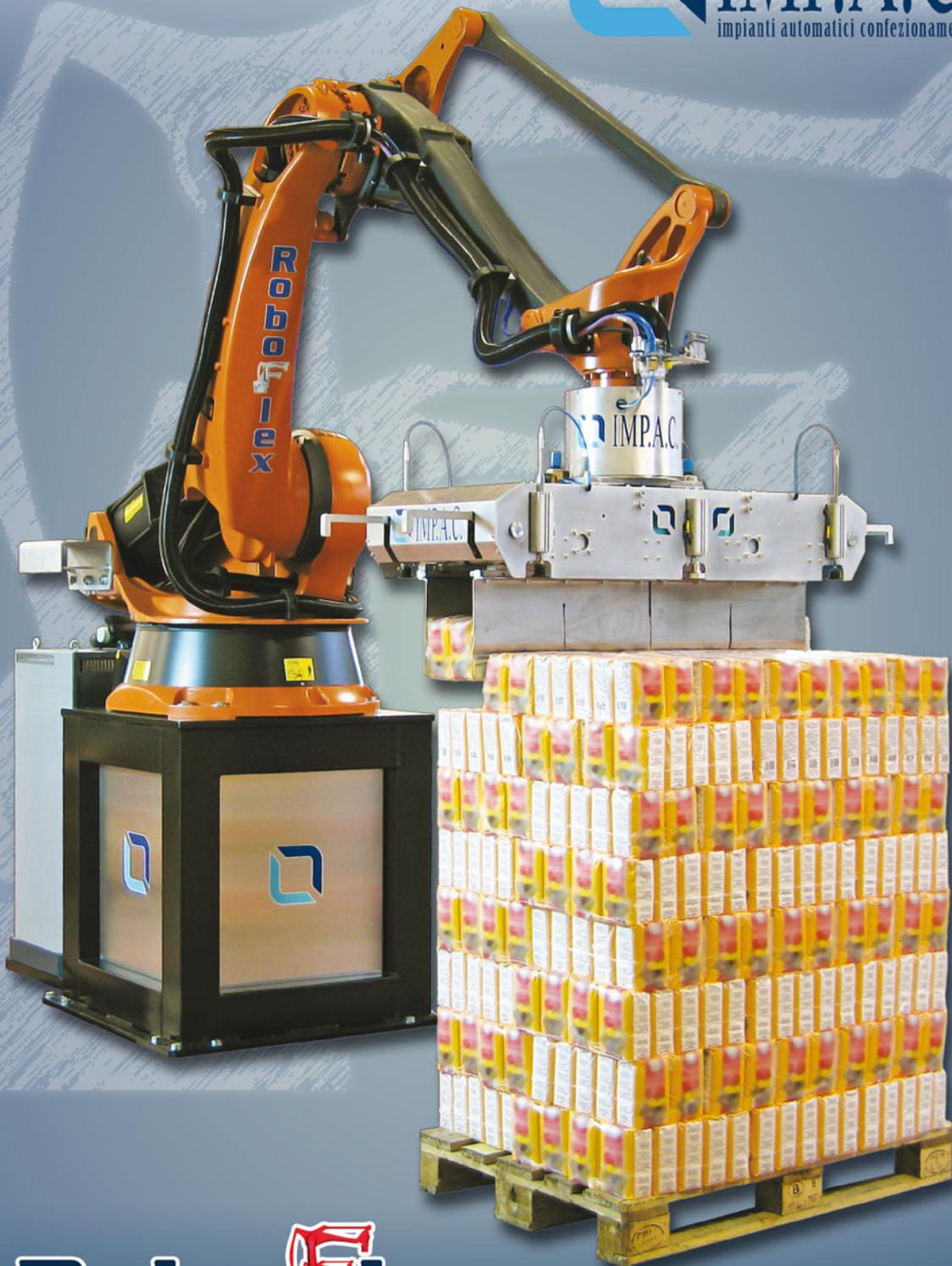
*In 60 years we never  
changed our mind....  
.... but only some details*



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**IGF+FFS™** for pre-made bags and bags obtained  
by a tubular reel  
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■ **Workable bags material:** paper, double-layer, PE-coated paper, PE, aluminised.

■ **Workable bag type:** flat, gusseted, pinch-top

■ **Closing system:** sewing, thermo-sealing, pinch-top, adhesive tape application.

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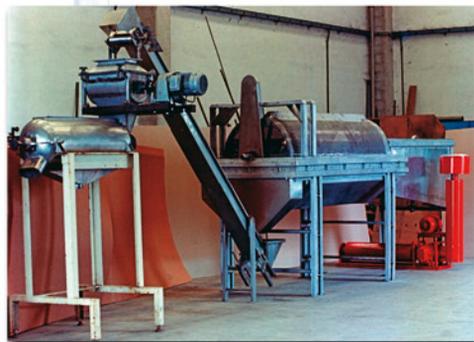
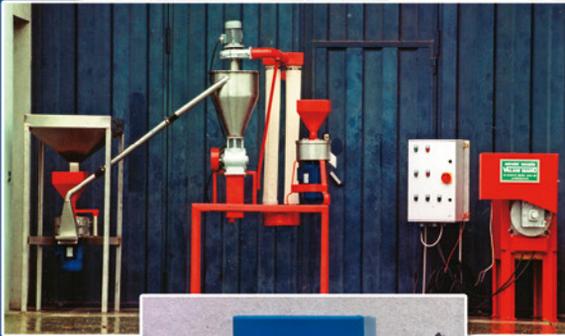




# Villani Mario

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Established in 1973 in province of Parma, the Company VILLANI MARIO specializes in the production of stone mills which can be employed for domestic use and in cereal transformation plants processing wheat, maize, barley, rice, manioc, oat, chick-peas, lentils to produce whole meal used in bread and pasta production, as well for other foodstuff. The company manufactures also custom-made plants on small scale: for example plants for the production of peanut butter, cocoa paste, pulped tomatoes and others on requirements.





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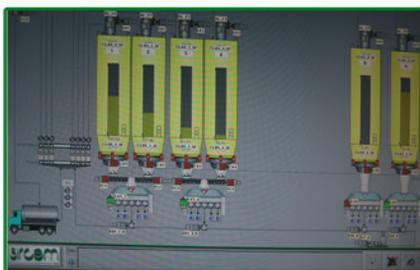
## GAMMA PRODUTTIVA

- ◆ Impianti completi di stoccaggio prodotti granulari e polverosi.
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- ◆ Trasporti pneumatici in compressione ed aspirazione.
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- ◆ Elevatori a tazze: verticali, inclinati ed a zanca.
- ◆ Filtri autopulenti e statici.
- ◆ Quadri di comando con P.L.C. e computer.



## PRODUCTION RANGE

- ◆ Systems complete with granular and dusty product stockings.
- ◆ Systems complete with short format pasta ensilage and packaging machine feeding line.
- ◆ Systems complete with dosing and mixing units.
- ◆ Systems for scrap and waste pre-crumbling and grinding.
- ◆ Compression and suction pneumatic conveying lines.
- ◆ Mechanical conveyance: belt, chain and Archimedean screw conveyors.
- ◆ Vertical, sloped and Z bucket elevators.
- ◆ Static and self-cleaning filters.
- ◆ Control panels with P.L.C. and computer.





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fondazione 1895

# COLOMBO PIETRO

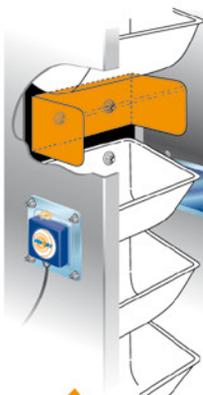
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- **CONTINUOUS METAL FLIGHTS**
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- **MICRO FLIGHTS**
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- **SAFETY EQUIPMENT FOR ELEVATOR**



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- BELT ALIGNMENT

*news*



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- UNDER SPEED MONITOR

### • **ELEVATOR BELT**

**ATEX** 



### • **BOLTS**



- **ELEVATOR BUCKETS TYPE**
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### • **BELT JUNCTION**





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for feeding pasta

●  
Argentina



# Emilio Luque

# *Combined Line for :*

- Special Shapes*
- Pasta Nests*
- Short Cut Pasta*

# *Innovative concept :*

- Low investment costs*
- High flexibility*
- Short set up time*



*Pasta Nests*

# Special Shapes



## Short Cut Pasta



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**WITH REFERENCE TO PAGE: 134-135**



# Scotti



Rice mill - 70 tons /24h

**MACHINES AND PLANTS FOR FOOD INDUSTRIES**

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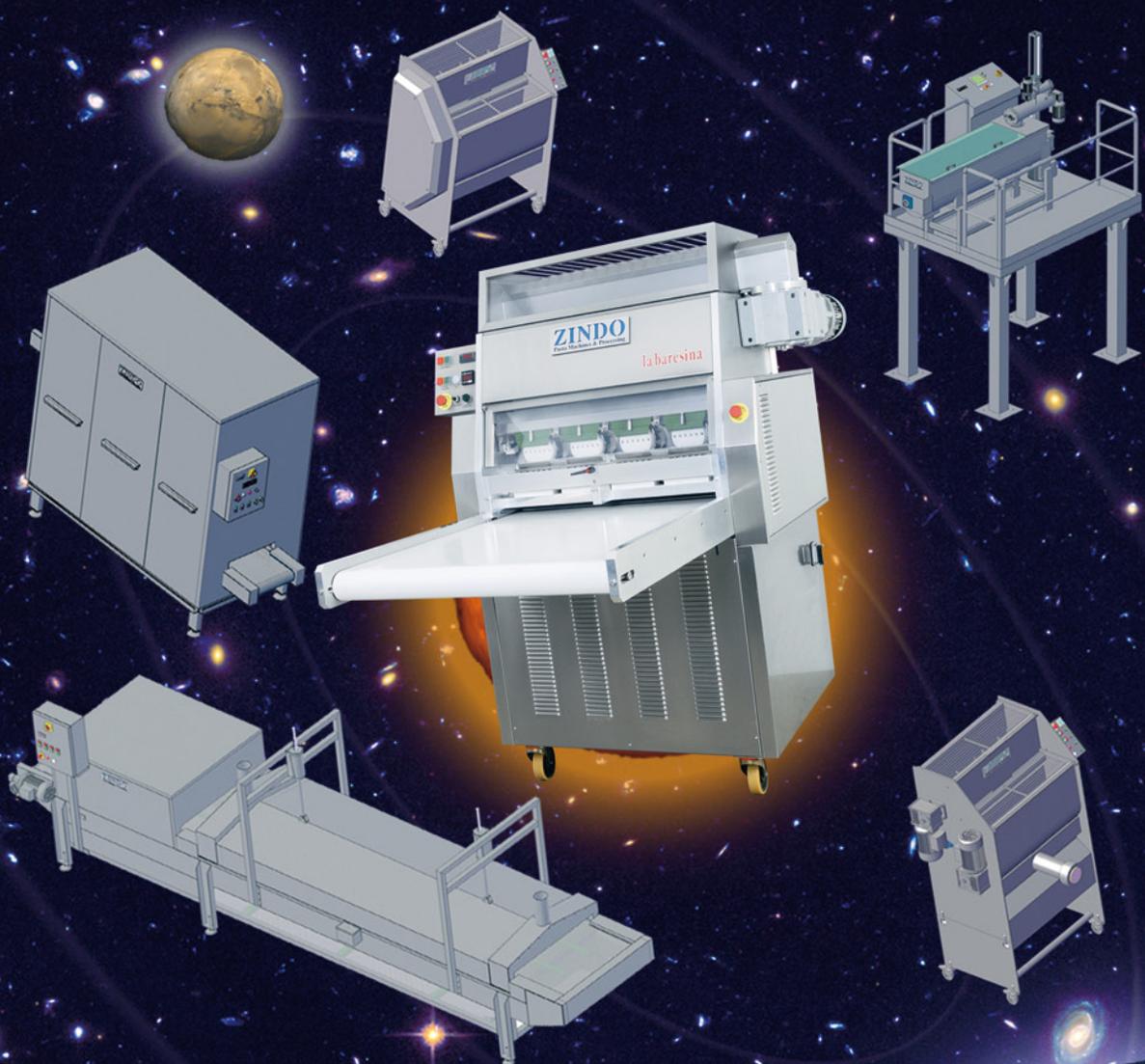
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# masterpieces of technology



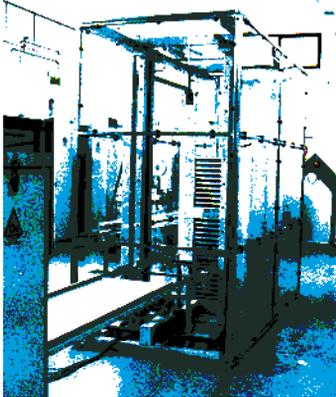
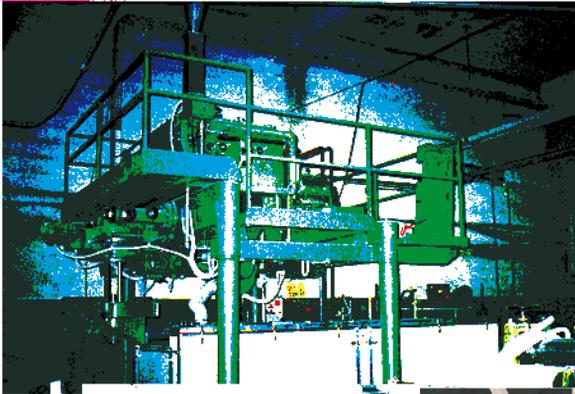
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## GREEN DRIER/COOLER ENERGY SAVING

European patent n. 08154223.5

This system offers the feed producer the solution for all problems connected with the environmental protection, with a really interesting cost/income ratio.

### The system is projected towards the future: a future to be prepared today.

The advantages offered by this system are:

#### 1. Environmental respect:

- no emission, not even of very fine powders;
- no smell into the atmosphere, as there is no air emission
- no noise problems, as it often happens to traditional systems

#### 2. Low energy consumption

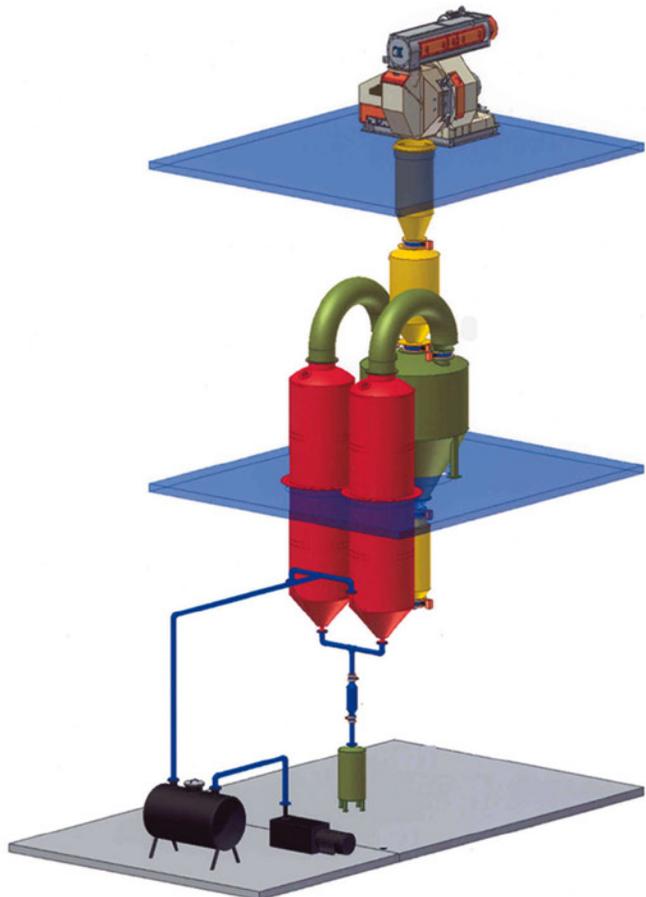
- Energy consumption is only related to the vacuum pump
- During the summer, a further energy consumption may be necessary, for a limited time, for the cooling of condensation water

#### 3. Small dimensions

- The system has small dimensions
- It can be normally assembled together with existing installations

#### 4. Good pellet quality

- Temperature of the finish product is constant all year round
- Increased alimentary safety owing to the elimination of the possibility of pellet pollution because of cooling air.



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di Giuseppe Pellicola & Figli

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The success of Molitecnica Sud in Italy and in other foreign countries has not changed the search for perfection in the creation of any product!

Or rather... Quality, experience and tradition.

Innovation, investment in new technologies, development of staff ....

All that distinguishes us from others.

Our objective? Success in the world.

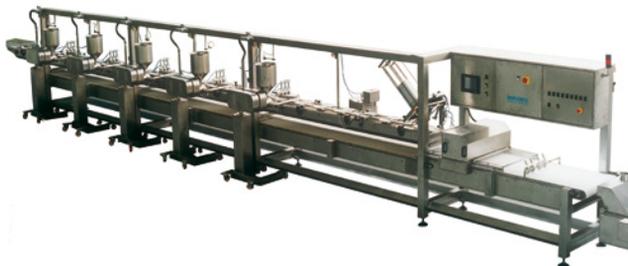
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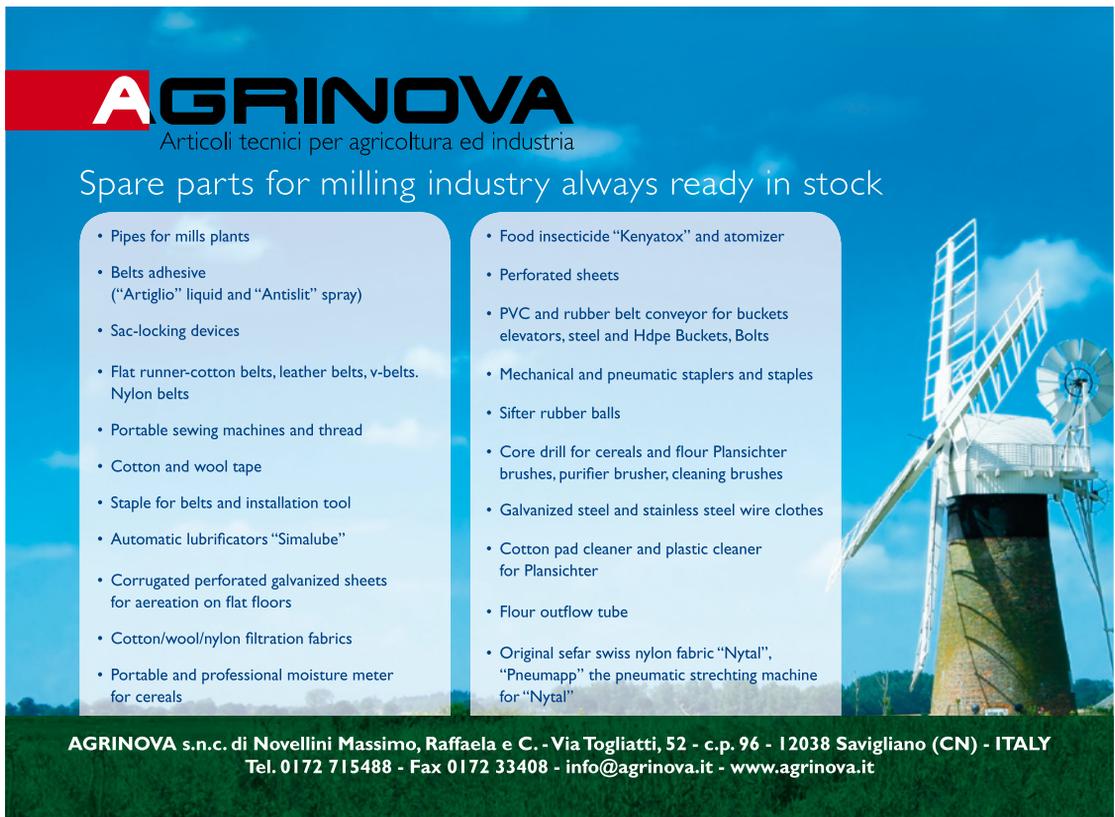




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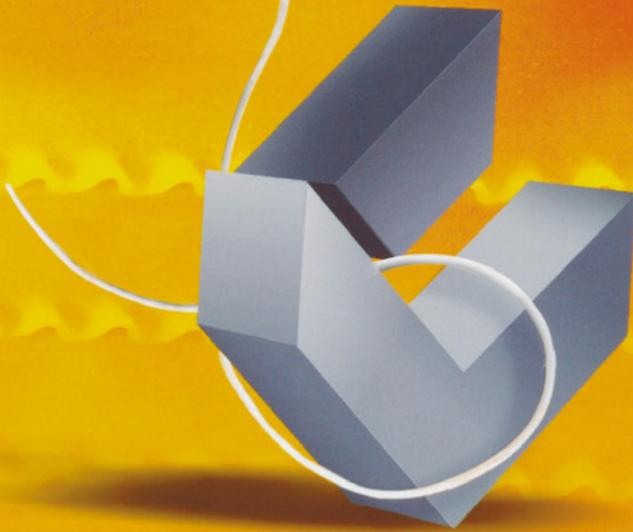


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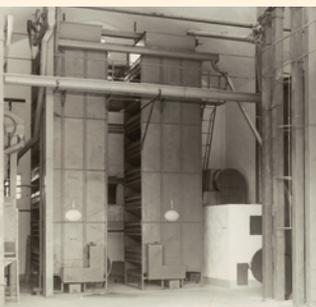
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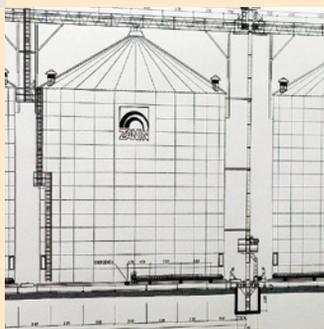
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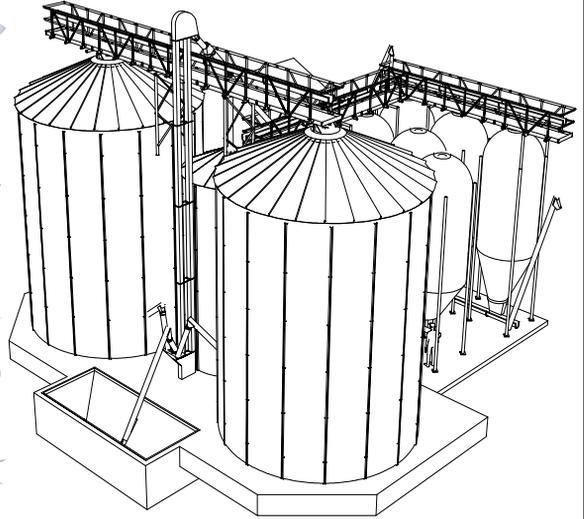
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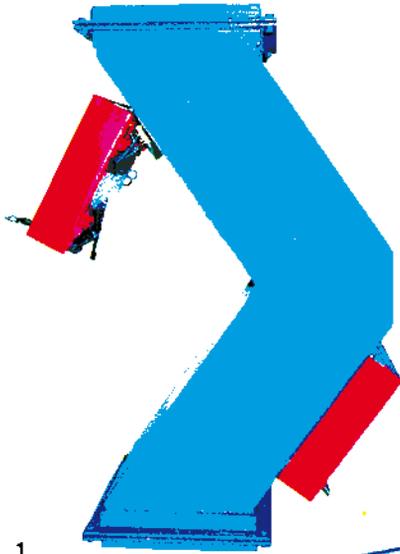
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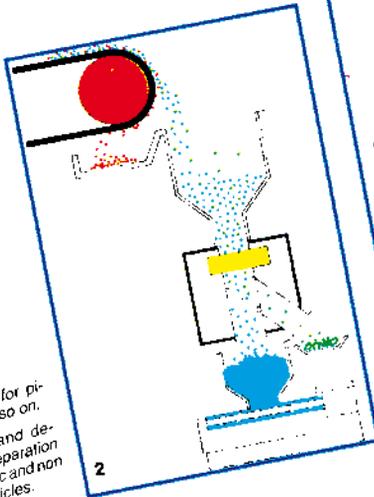
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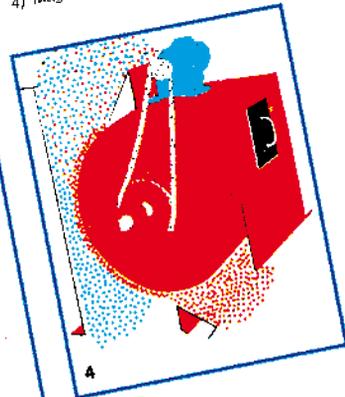
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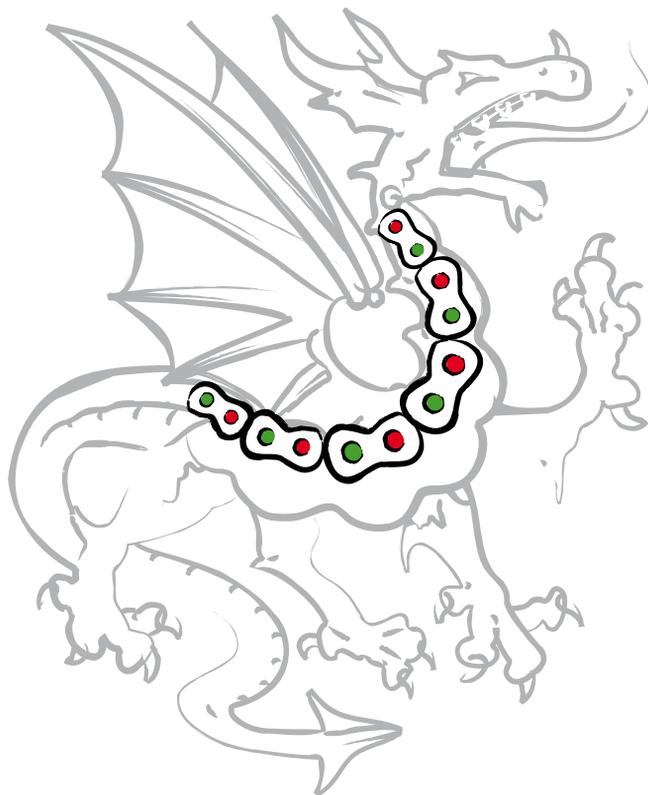
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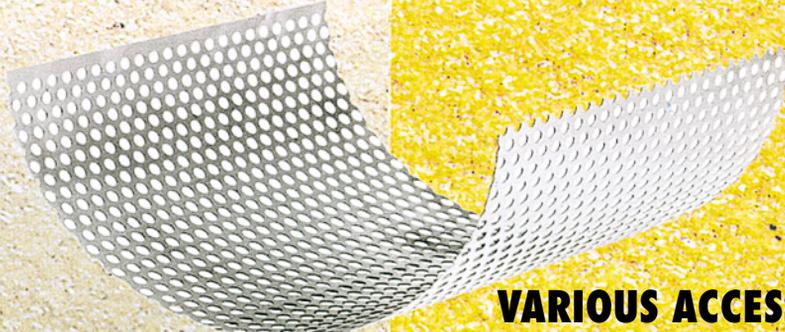
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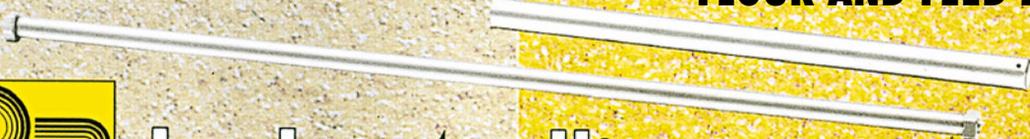
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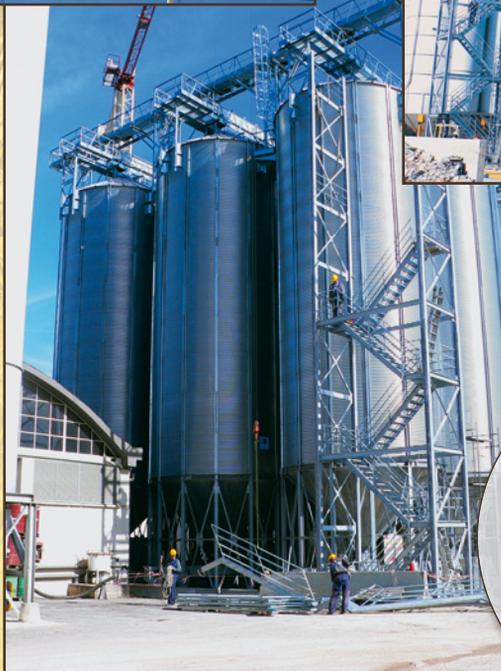


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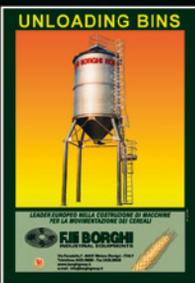
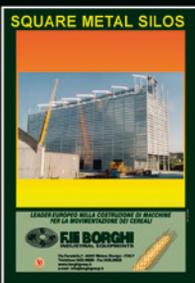
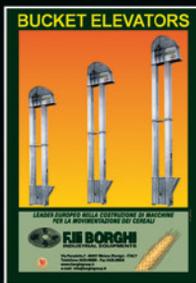
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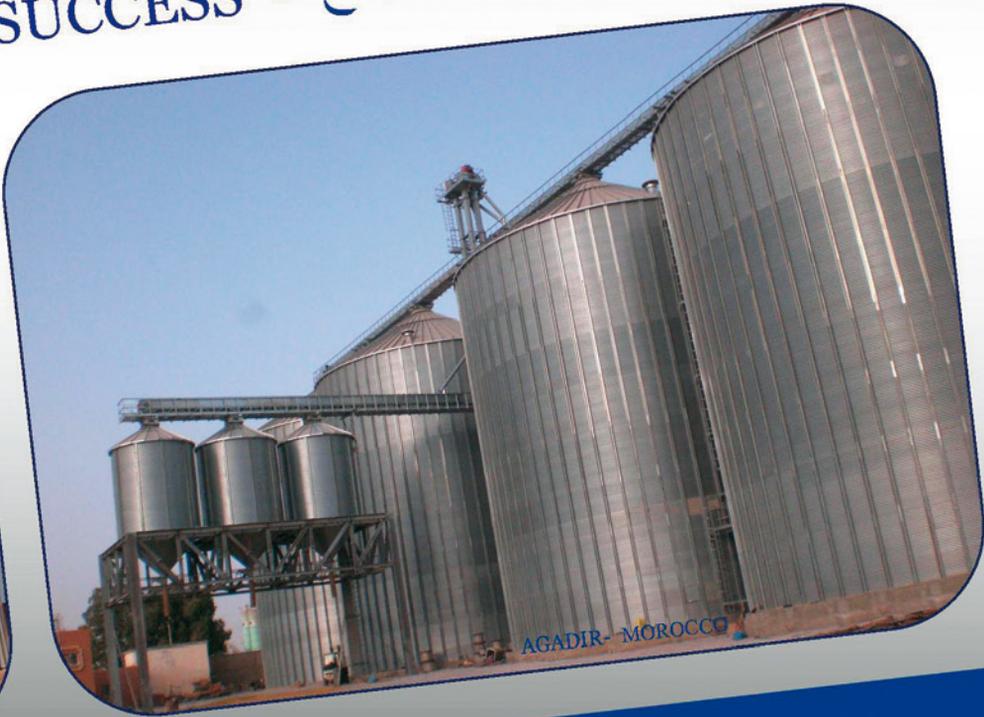


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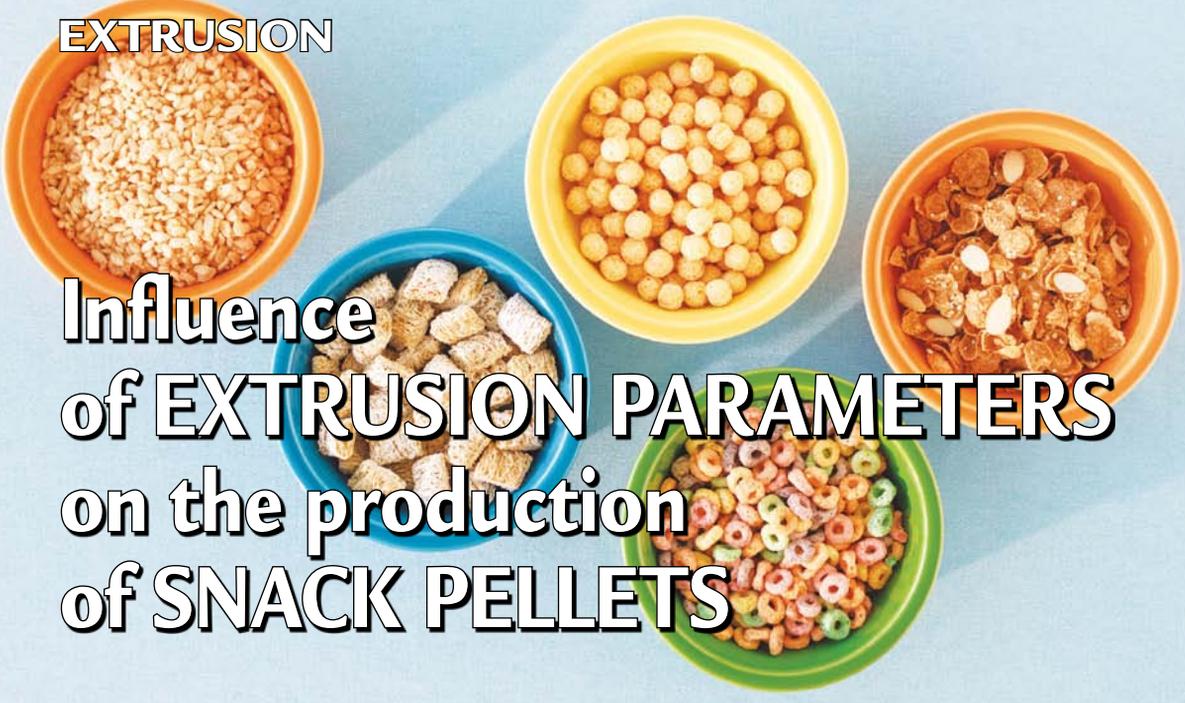
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**EXTRUSION**



# **Influence of EXTRUSION PARAMETERS on the production of SNACK PELLETS**

Key words: cooking-extrusion, starch gelatinisation, pellets, expansion, frying, viscosity, texture, production capacity

**GERMANA ZURLO<sup>1</sup> - CLAUDIO MARIA POLLINI<sup>1\*</sup> - ALICE BITTANTE<sup>2</sup> - MICHELE MODESTI<sup>2</sup>**

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## ABSTRACT

Snack pellets industrial production is here investigated by means of specific analysis and evaluations on the final dry product and the fried expanded one.

A wheat-tapioca blend has been processed by a one ton/h line, the heart of which was a Pavan TT 92 twin screw cooker-extruder; final product was a flat triangular dry pellet.

Cooking-extrusion process is analysed and most influent parameters are emphasized; in particular, how total flow changes influence the shear rate and consequently the heat transfer to the dough. Brabender Viscoamylograph and TXT Texture Analyser revealed themselves quite valid instruments in order to identify structural variations induced by process parameters.

## INTRODUCTION

Cooking extrusion is a quite common process in the production of different types of foods, ranging from breakfast cereals to baby foods and snack foods, not forgetting plenty of filled co-extruded products.

There is a theoretically infinite number of combinations of cereal/tubers flours and starches mixes, and a parallel infinite number of possibly obtainable final outputs; herein we'll focus our attention on wheat-tapioca mixes dedicated to the production of triangular chips obtained by means of the expansion of pellets.

## MATERIALS AND METHODS

A blend of wheat flour "frog brand" type (Thai Flour Mill Industry Co.) and tapioca starch (National Starch & Chemical Ltd.) has been processed in different cooking extrusion conditions; protein content of wheat flour was around 10%, while moisture content was about 13%; tapioca starch had a moisture content ranging from 12.5 to 15.0%.

Dry pellets have been characterised mainly by viscosity bends and peaks, utilising a Brabender visco-amylograph (**fig. 1**) with a 700 cmg cell; fried pellets have been evaluated by means of their crunchiness and consistency employing a TXT texture analyzer equipped with Kramer cell and Chip Fixture cell (**fig. 2**).

## EXPERIMENTAL

Production line was composed by a Pavan TT 92 twin-screw corotating cooking extruder provided with a hydration mixing vessel; extruded sheets, after a conditioning phase in

# EXTRUSION

Fig. 1 - Brabender Viscoamylograph.

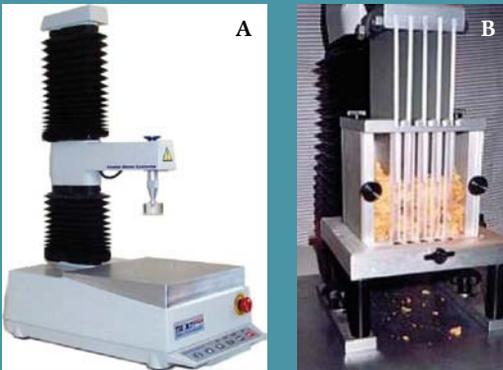


Fig. 2 - The TXT Texture Analyser (A) equipped with: Kramer cell (B), Chip Fixture cell (C).

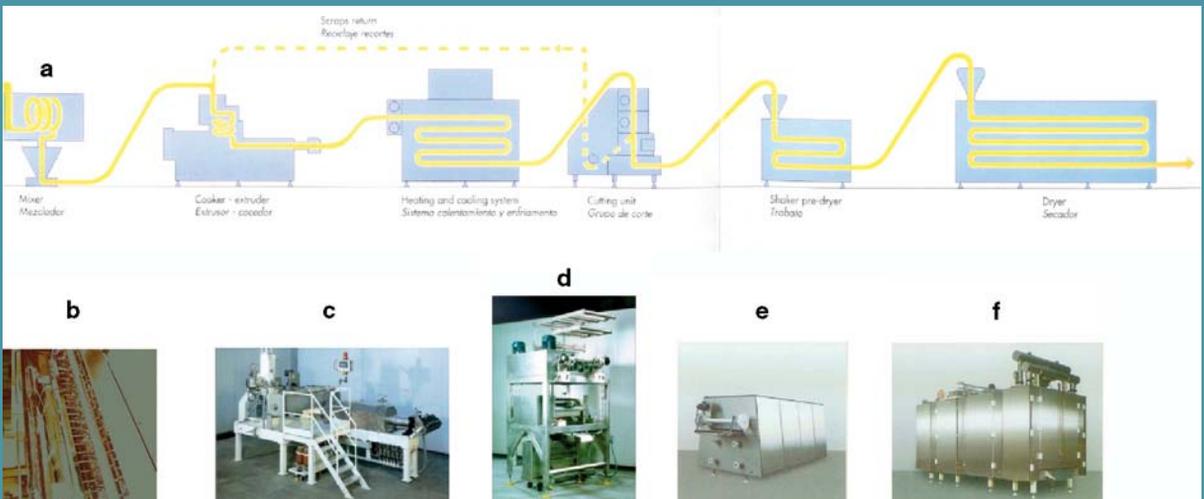
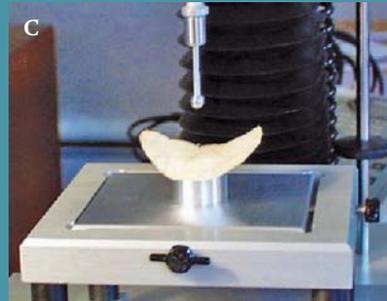


Fig. 3 - The extrusion line: scheme of the process (a), mixing tank (b), extruder (c), cutting section (d), pre-drier (e), drier (f).

3 passages, were shaped and cut by means of a special rotating device; shaped wet pellets were then conveyed through the shaker pre-dryer (7 vibrating floors) and the dryer (7 tiers).

Frying equipment was a laboratory batch fed by a bi-fractionised palm oil, at Pavan Research Centre.

## THE EXTRUSION PROCESS

The production technology leading to the formation of pellets, including the geometry and the parameters governing the process, is here presented.

The production of pellets for snacks is a very vast field, as many can be the formulations (wheat, corn, soya, rice flour, potato flakes, tapioca, potato starch, and so on), as well as the shapes (triangles, disks, cones, wheels, and so on) or the final uses (toasting, frying or micro-wave ovens). Regardless of the above, the main production phases are essentially the same. In **fig. 3a** a simplified diagram is shown of the whole working process leading to the production of pellet, which can be summarised in the six following phases:

- mixing/kneading;
- extrusion/cooking;
- conditioning;
- cut;
- pre-drying;
- drying.

During the first phase the raw materials are mixed together with water, according specific dosages to form the dough which will then be introduced inside the extruder. Usually this unit consists of a mixing tank equipped with blades (fig. 3b), in which, volume dosing units introduce the flour mixtures and cold or warm water, or steam.

Here the dough undergoes a small mechanical process, and then goes on to the extruder, fig. 3c. It is in this phase that the homogenization and cooking phases take place. By means of two screws, the dough is pushed inside a cylinder, which is externally either heated or cooled down through water circuits. From here the dough, processed and cooked, is then extruded in the form of a sheet.

The third phase then starts: it is that of conditioning, through hot or cold air. In this phase an effort is made to stabilize the product and obtain mechanical resistance properties for it to make it adequate to undergo the cutting process. The sheet goes through rollers which, if necessary, create a surface with holes; subsequently it is cut in the desired length and shape, by means of a machine equipped with blades, or through rollers equipped with sharp moulds (fig. 3d). The scraps are re-cycled by the extruder, to optimise product output.

At this point the pellet is formed, but it contains rather high humidity, around 30-32%. It is therefore necessary to go on to the drying process of the product, so as for it to acquire structural and resistance characteristics to make it fit to undergo the next working phases, or simply to be preserved with no problems. There is a pre-drying phase first, fig. 3e, aimed at a fast reduction of the humidity, up to 26-28%. This process is achieved with very hot air (93°C) uniform jets, blown onto the vibrating pellet transportation belts for few minutes (1-3 min). The next production step is the drying procedure, to remove humidity to reach values of about 10-12%. This is the process phase lasting the longest. The permanence time of the pellets in the drying unit's on average around 4-5 hours.

As a consequence of these long resting periods the drying unit is the largest device of the entire production process (fig. 3f). It is not unusual to find dryers of around 30 metres in length and 5 metres in height. This is a very delicate phase and it should be handled with utmost care so as to safeguard the work done so far. The drying unit consists of different tiers between which the pellets are conveyed onto transportation belts. Each level corresponds to various humidity conditions, temperature, and ventilation. The scope is to succeed in drying the pellets evenly lengthways in throughout their thickness. To do so, it is necessary that the phase of highest stress, caused by the high temperatures and by ventilation aimed at removing the water trapped inside the pellets, is followed by a phase in which the product has sufficient time to re-establish its balance, its internal structure from the chemical and physical point of view. By alternating these phases a product is obtained which is evenly dried, devoid of veining which may bring about cracks or breakings of the pellets. In these conditions there will not be preservation problems and the pellets may be kept in storage with no particular worry for over 2-3 years.

For this semi-manufactured product to be marketed, it must be expanded and then packaged. Usually these phases take place at a subsequent time, either because the devices used are located at different premises, or because it is often more convenient to produce large amounts of pellets and subsequently go on to the final phases, so as to concentrate production on only one of the two activities. Expansion of pellets takes place physically by means of the water present inside the pellets themselves. In fact the water, when evaporating, exerts high pressure onto the product structure, provoking the formation of bub-

bles and therefore expansion. To obtain optimum expansion it is essential, as well as having pellets evenly humid, also to supply large amounts of heat in a brief time, so as to avoid jeopardising the product nutritional properties. In practice the expansion methods vary according to the technique used for heat exchange.

In particular, the tapioca triangles, which are object of the present study, require their frying in oil as a final phase.

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## PROCESS ANALYSIS

In **fig. 4** a generic cooking-extrusion system is showed: it essentially consists of a feeder, a feeding zone, a kneading zone, a cooking zone, to end with a head, a proper die and a cutting system.

In the first zone the material is loaded, already mixed, together with the necessary amount of water. Here the screw simply has the task to randomly press the dough, which is not yet properly kneaded, and push it towards the following area. For this reason the screw presents a deep wide-pitched thread.

The next phase is that of kneading. It is, together with that of cooking, the heart of the extrusion process. Its function is to receive the material from the feeding area, homogenize through a light mechanical procedure, and convey it to the last phase. The part of the screw involved in this process has decreasing thread depths and it may often present reversed threaded tracts (**fig. 5a**), or cutting items, **fig. 5b**, to increase the mixing ability.

As the end of the process is approached, the space between the cylinder and the screw is reduced, so that the material is pressed more and more dissipation phenomena take place. The heat absorbed by the mixture is thus in-

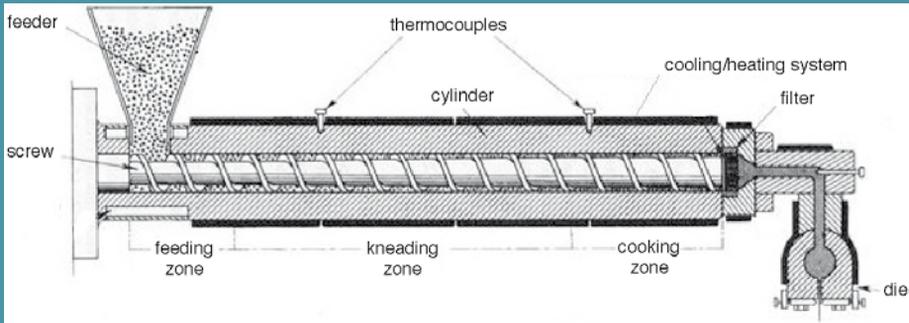


Fig. 4 - Simplified sketch of a single-screw extruder.

Fig. 5 - Detail of reversed threading for two co-rotating screws (a), cutting and mixing elements for two co-rotating screws (b).

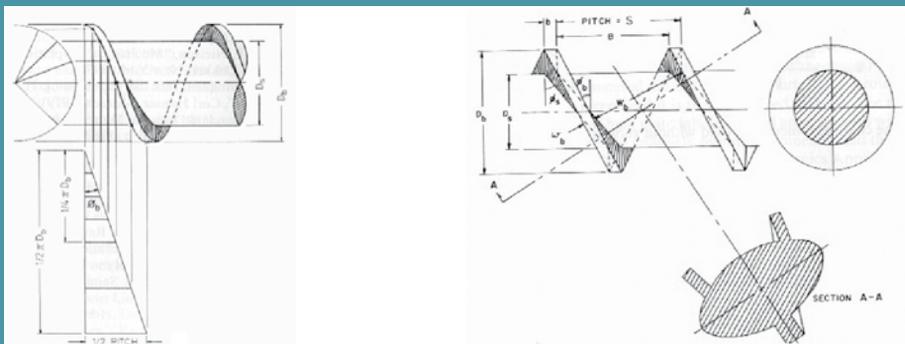


Fig. 6 - Geometrical parameters characteristic of the screw.



creased, and the dough approaches the cooking phase. In these first two areas, the volume of the cylinder is not completely used up and, but there are a few empty areas, especially in the space between the threads and the cylinder. When the cylinder is completely full of dough, instead, it is the cooking phase. Here higher viscous efforts play a role, and then high temperatures and extensive pressures. The gelatinization phase is developed. The dough reaches the cooking stage desired, it is even, humid and very compressed. The screw threads are not very deep and the screw geometry is rather linear. From this point the material is forced to coming out through an adequately shaped die.

Before the die, a filter is often located, or a system of adequately calibrated filters. They consist of very thick-weaved nets the task of which is to retain any impurities and create the necessary loss of load to guarantee product reflux between the screw and the cylinder, with the aim of improving the dough homogeneity. It is therefore in this area that high pressure values are reached. The flow through the die takes place based on its geometry (resistance), of the dough viscosity and of the pressure difference. Small variations in the diameters and in the thickness of the die shaped holes may create considerable variations of the above mentioned properties. Observing now the screw-cylinder system, high interest from the geometrical point of view is devoted to the screw. Also the cylinder, however, may be characterised by some manufacturing specific elements. First of all its overall length is measured by the number of diameters of its hole ( $L/D$ ) and it usually has values ranging between 20 and 30  $D$ . The inside surface of the cylinder can be smooth or present scores, which can be more or less deep, or differently shaped. The scores have

the scope of increasing heat production as a transformation of the friction forces and to favour product reflux. In these cases, the deeper the scores, the more these effects are produced. The cylinder may be grooved, also to avoid sliding of the dough along its surface when the shear stress given by the screw goes beyond the friction of the material onto the cylinder itself. Spiral scores are often used to intervene in the flow along the extruder. According to the direction of the spiral, the scores may enhance or delay advancement of the material. For example, in the extruding cylinders at reduced resting time, the spiral scores tend to enhance transportation in the forward proceeding direction of the mixture, so as to reduce its resting time.

Considering now the geometry of the screw, it is useful to observe **fig. 6**.

The screw consists of:

- external diameter,  $D_b$ ;
- internal diameter,  $D_s$ ;
- angle,  $\emptyset$ ;
- flight tip,  $b$ ;
- channel width,  $W_b$ ;
- channel depth,  $H=(D_b-D_s)/2$ ;
- pitch,  $S$ ;
- "clearance" or distance between the flight tip of the screw and the cylinder,  $\delta$ ;
- length,  $L$ .

The screw diameter, and therefore that of the cylinder inside which the screw turns, represents the fundamental dimension identifying the class of the machine in terms of production capacity. The other parameters, such as the thread pitch ( $S$ ), the screw dowel ( $b$ ,  $D_s$ ), the length (in terms of  $L/D$ ) and the rotation speed of the screw itself represent the most characteristic elements of the "rheological" behaviour of the machine, and therefore its particular field of application. While the length of the screw and the external diameter

remain constant, the depth of the channel may vary greatly along the screw, reducing in the final lamination area. This is a characteristic geometry of the extruders with cooking and gelatinization phases. The  $H_m/H_{10}$  ratio, between the initial and the final depth value, takes into consideration the volume workload of the material, which decreases when a homogeneous dough is formed, and the higher compression request during the cooking phase, which requires high amounts of heat. This ratio is called “compression ratio” and it usually has values between 2 and 2.5.

Here above a reflux has been mentioned of the material which, instead of proceeding towards the die, tends to return back in the direction of the feeding area. This is because in the extruder, the net flow of the material may consist of three components:

- Viscous drag flow. It gives a positive contribution as it is the component promoting product proceeding towards the die. It depends on the speed of the screw and on its geometry. It is, instead, independent of the pressure and the dough viscosity;

- Pressure gradient flow. It is due to the difference in pressure ( $\Delta P$ ) in the different areas of the extruder. Since usually the  $\Delta P$  has a value higher than zero, because in the headblock higher pressures are reached, the contribution of this flow is usually negative; i.e. it represents the material which tends to come back. Naturally this flow is proportional to the gradient of pressure and inversely proportional to the resistances due to viscosity or screw geometry;

- Flow through “clearance” (Leakage flow). This is a negative contribution and it represents the motion of the material between the cylinder and the flight tip. With clearance values around  $0.001 D$ , where  $D$  is the screw diameter, the contribution of this flow is negligible. If this value increases, instead, it

is necessary to consider also this component in the calculation of the net flow.

In **fig. 7** the speed profiles are shown, referred to the different flows, and their combination between the borderline cases of “open discharge” extrusion procedure, where there are no flow restrictions, and close discharge.

According to the hypotheses of the Newtonian analysis (the material is considered a Newtonian fluid, its viscosity  $\eta$  is independent of the temperature, the effects of the channel curve where it flows are neglected and the depth of the channel is much smaller than the screw diameter, so that the simplified model of the “Parallel plates” can be applied), the total flow ( $Q_t$ ) which is the sum of the above described flows, is expressed in the following relation:

$$Q_t = \frac{[p U_z (H-\delta)W]}{2} - \frac{(p W H^3 \Delta P)}{12\mu} (1 + f_L),$$

where  $p$  represents the number of parallel threads,  $\mu$  the viscosity of the fluid,  $f_L$  the correction factor for the leakage flow and  $U_z$ , which is a geometrical parameter, defined as:  $U_z = \pi D N \cos\phi$ , with  $N$  (rpm) as the screw rotation speed.

Other two important parameters in the definition and classification of the screws are the tangential speed (shear rate), the tangential tension and the shear stress. The shear stress is represented with  $\tau_e$  ( $N/m^2$ ), according to the theories developed by prof. J. Harper and L. Levine, represented in the following relation:

$$\tau_e = m_0 e^{A/T} e^{BM} \gamma^n,$$

where:

$m_0$  = texture index,  $Nsec/m^2$ ;

$A$  = constant value (2,500);

$T$  = temperature in °K;

$B$  = constant value (-7.9);

$M$  = humidity fraction;

$\gamma$  = shear rate,  $\text{sec}^{-1}$ ;

$n$  = flow index (-0.41).

The shear rate, indicated with  $\gamma$  ( $\text{sec}^{-1}$ ) is instead defined as:

$$\gamma = \frac{\pi D N}{60 H}$$

Moreover, for the double screw extruders it is possible to differentiate also the shear rate for intermeshing and for the cylinder. The following will therefore be obtained:

$$\gamma (\text{intermesh. Hinge}) = \frac{\pi (D_b + D_s) N}{60 \partial \text{int}}$$

$$\gamma (\text{cylinder}) = \frac{\pi N D}{60 \partial \delta}$$

where:

$\partial \text{int}$  = coupling clearance;

$\partial \delta$  = clearance between screw and cylinder.

From these relations it can be noticed that with the same diameter and turns of the screw the shear rate increases with the decrease of the thread depth. This is what in fact happens in the extruder, where the screw geometry requires a decrease in the depth of the channel along its axis.

## PROCESS PARAMETERS

The most important process parameters in the extrusion procedure are:

- shape and dimension of the die;
- shape and dimension of the screw;

- pressure;
- process temperatures;
- product resting time in the extruder;
- internal friction (Shear rate and Shear stress);
- screw speed;
- water content in the raw material and in the mixture during its processing.

While the first two are design parameters - i.e. once the machine has been manufactured, they remain fixed - the other are actual operational parameters. It is possible to adjust, modify, increase production of any given system, by changing one or more of these parameters. Considering the system for tapioca pellets object of the present study, but these considerations hold true in general for other types of extrusion systems, the temperature is constantly monitored by thermocouples located in every thermal exchange section of the cylinder. It is in fact equipped with seven thermoregulation systems, requiring heating with electrical resistances and cooling down circuits with water. In this way it is possible to create a temperature profile along the extruder, which is best adapted to the target set.

For what concerns pressure, it is calculated according to the shape and geometry of the die, but also the mechanical work exerted especially in the final part of the screw plays an important role. The internal friction, as well as the resting time of the product, depends on this. The parameters in question are not independent of one another, but they are strictly connected with each other. In particular, if we consider temperature, it is strictly connected to cooking and gelatinization of starch. This is, on the other hand, directly linked to the dough viscosity, therefore with the requirement of mechanical work and also with the friction and the consequent developed heat.

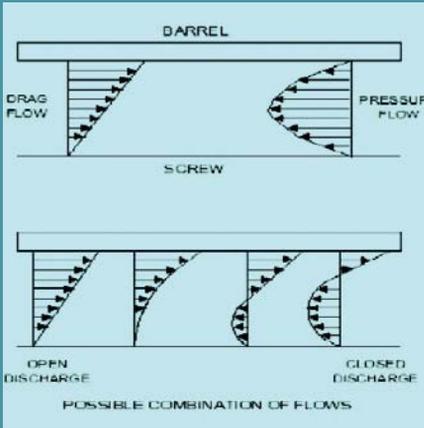


Fig. 7 - Speed profiles along the flow direction.



Fig. 8 - Tapioca-wheat pellet and fried product.

Table 1 - Results of the analyses carried out to the pellets and to the fried product.

	ORIGINAL		SAMPLE 1		SAMPLE 2		SAMPLE 3	
	pellet	fried	pellet	fried	pellet	fried	pellet	fried
<b>CHEMICAL ANALYSES</b>								
humidity (%)	7.49	4.47	9.93	3.66	9.5	4.63	9.63	3.98
<b>CHEMICAL-PHYSICAL ANALYSES</b>								
apparent density (g/L)	380.51	<b>50.08</b>	395.36	47.08	391.93	46.05	403.68	48.96
oil absorption (%)		<b>17.7</b>		23.6		27.1		28.3
<b>VISCOSITY ANALYSIS</b>								
sample weight (g)	50		50		50		50	
cartridge (cm-g)	350		350		350		350	
analysis start temperature (°C)	28		25		25		28	
analysis start viscosity (U.B.)	90		70		80		50	
viscosity peak (U.B.)	<b>1,020</b>		350		380		270	
peak temperature (°C)	<b>56.2</b>		70.6		68.8		70.3	
viscosity at 95°C (U.B.)	440		200		230		200	
viscosity at 95° (+10') (U.B.)	390		210		220		210	
viscosity after cooling at 50°C [U.B.]	690		330		360		380	
<b>DIMENSIONAL ANALYSES</b>								
base (mm)	31.02		31.73		31.52		30.8	
height (mm)	19.49		20.06		19.86		20.65	
thickness (mm)	1.35		1.32		1.23		1.36	
average weight (g)	0.5		0.46		0.47		0.51	
expansion rate (%)		<b>16.31</b>		11.83		13.87		13.61

## RESULTS

In the following paragraph the results of the laboratory analyses carried out onto different samples of pellets, are presented.

The study performed was based on the comparative analyses between the original reference sample and three samples produced with two different operational conditions of the industrial system. Samples 1 and 2 correspond to the first operational condition, picked up at different times, whereas sample 3 refers to the second condition (**fig. 8**).

In **table 1** the results of the analyses carried out are shown.

In particular, the following analyses have been carried out:

- viscosity analysis to the pellets previously milled;
- dimension analysis of the pellets length and thickness values;
- apparent humidity and density both for pellet and for the fried product;
- oil absorption and expansion rate for the fried product.

In table 1 the most significant values resulted are highlighted in boldface. In general, significant differences between samples 1, 2, and 3 have not been noticed. Essentially the samples have shown rather similar rheological behaviour and chemical-physical characteristics. Unlike the original sample, instead, the pellets of the new increased production have shown some rather different values. In particular, for what concerns oil absorption, whereas samples 1, 2, and 3 present a percentage ranging between 23 and 28%, the original sample has a value lower by almost 10 percentage points: its oil absorption is around 17%. This is an important datum as such a high difference in this type of analysis implies a conservable variation in the nutritional values of the product. Also

the volume expansion ratio shows definitely more positive values for the original sample with respect to all the other samples. The 500 kg/h production pellet expands, during the frying process, by 16.21%, whereas the samples of the increased production reach the 13.87% at most. If we observe the analyses carried out onto the dried pellets, it can be noticed that the results are very similar with one another. Maybe the only analysis showing a higher difference is that on viscosity. In particular, both observing the values presented in table 1 and **fig. 9** the rather different rate of performance between the pellets of the 1, 2, 3 samples and the original is evident. While the original sample presents a very evident peak, by around 1020 UB, against a temperature of around 56°C, the other samples show a rather smooth performance rate, with no true peaks, but only with slight increase, which in any case does not go beyond the value of 380 UB, against higher temperature values, of about 68°-70°C. This so different amylograph behaviour may be explained with the fact that the original presents a cooking degree which is lower than the other samples. The starch granules present in the original sample have not undergone an overall gelatinization process, but they probably expanded only partially, without reaching situations of breaking of the chains or amylose dispersion. They therefore preserve their semi-crystal original structure. When the milled pellet undergoes a viscosity analysis, many of the granules which are not swollen or even still completely raw, are now able to develop a considerable viscosity, considering that they undergo the whole gelatinization process during the analysis. The resulting graph has a similar shape to that of the raw material, but with lower peak values, because the material is partially already cooked. The starch of the other samples, instead, has reached a more advanced

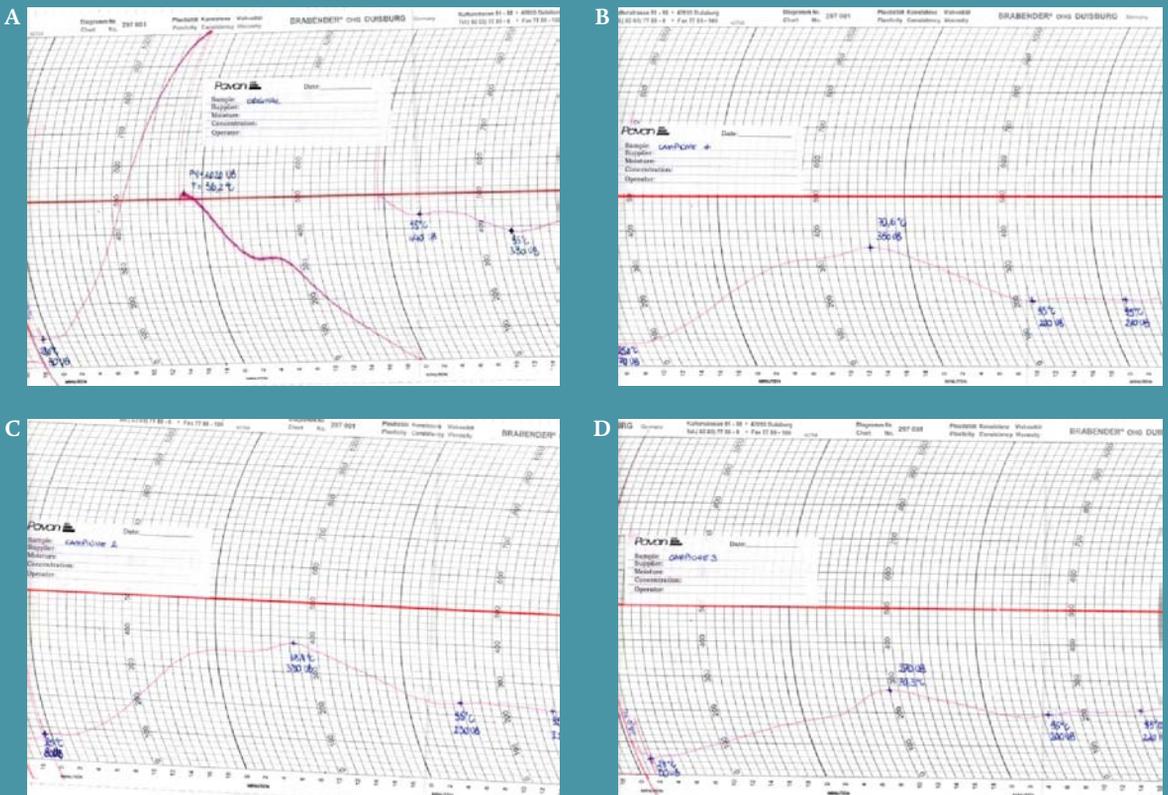
gelatinization phase and therefore, as the pellets are dried and cooled, it presents a retrograded form, which means that it presents the partial re-crystallization process of the amylose chains and in part of amylopectin.

The other analyses carried out and not shown in table 1, are those relevant to the fried pellets crunchiness and texture. They have been carried out by means of the Texture Analyser, using the Kramer cell and that of Chip Fixture. In **fig. 10** the curves are shown representing the analysis result with the Kramer

cell, which evaluates the product crunchiness and the texture. Three tests have been carried out for each sample. The graphs obtained with this instrument show the strength (g) with respect to the distance (mm).

In **table 2** instead, the average values of maximum force (g) are shown, the area below the curves (g mm) and the number of intensity peaks higher than 300 g for each of the sample analysed.

As can be easily observed both from the graphs and from table 2, the values between



**Fig. 9** - Amylograph charts resulted from the analysis carried out with the Brabender amylograph viscosity unit: (A) original, (B) sample 1, (C) sample 2, (D) sample 3.

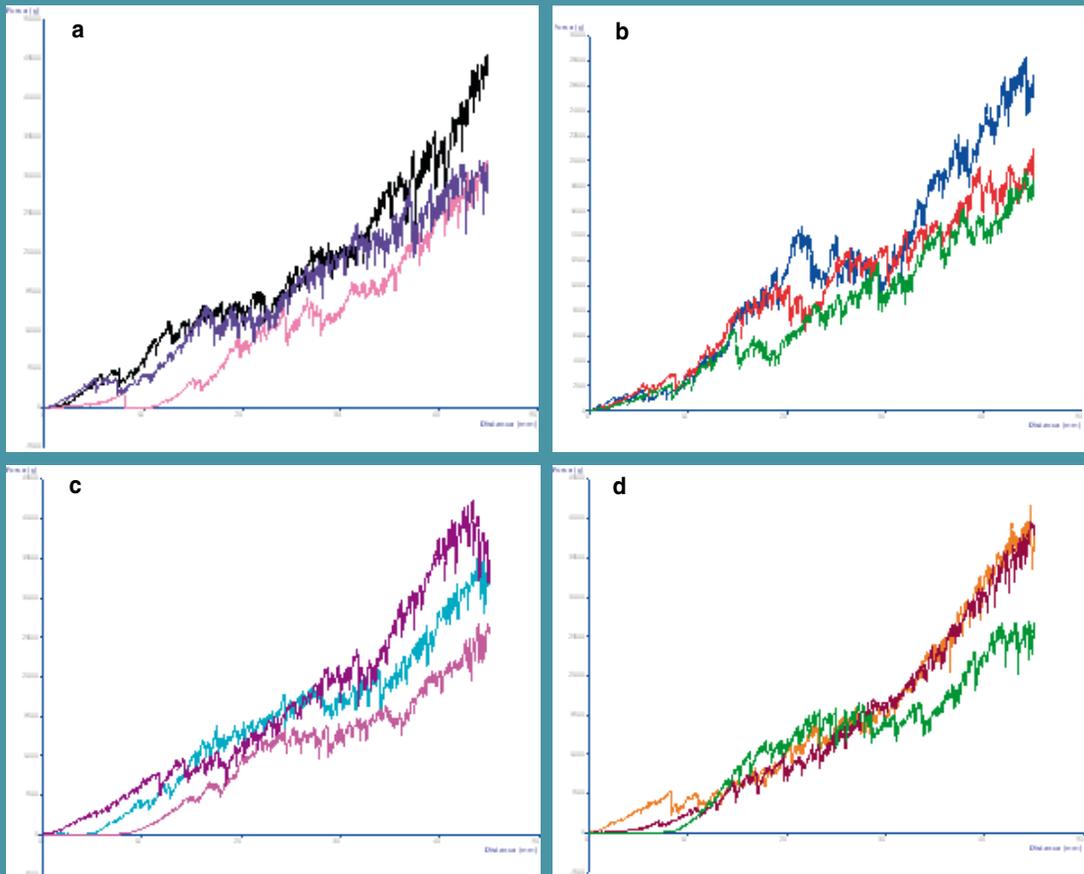


Fig. 10 - Curves resulting from the analysis carried out by means of the Texture Analyser with Kramer cell: (a) original, (b) sample 1, (c) sample 2, (d) sample 3.

Table 2 - Average values for maximum force, area below the curve and number of peaks for the four analysed samples.

	Maximum force	Area (g mm)	Number of peaks
<b>Original</b>	36.535	614.434	202.667
<b>Sample 1</b>	22.949	422.211	218.667
<b>Sample 2</b>	35.147	585.845	183.333
<b>Sample 3</b>	36.018	570.33	195

Table 3 - Average values for maximum force, area below the curve and number of peaks for the four analysed samples.

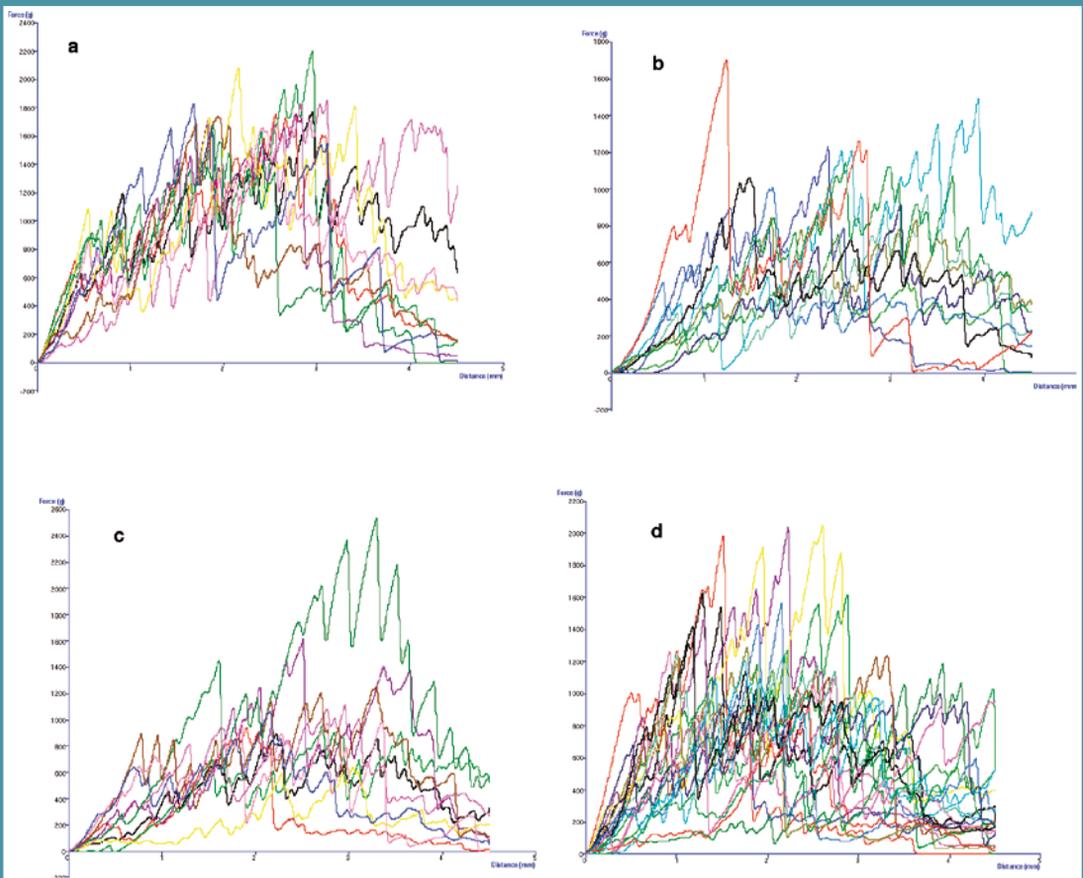
	Maximum force	Area (g mm)	Number of peaks
<b>Original</b>	1767.283	3740.4425	27
<b>Sample 1</b>	1045.9985	1852.6175	24.5
<b>Sample 2</b>	1025.4295	2105.719	24.5
<b>Sample 3</b>	1249.482	2257.091	24

the original sample and the other samples are all very similar. Considerable differences are therefore not noticed. The only datum showing values slightly different is the area relevant one. The original sample reaches higher values with respect to the samples. This means that the original fried pellet texture is slightly less crunchy.

In **fig. 11** the curves obtained in the analysis with the Chip Fixture cell are shown.

In **table 3** the average values of maximum force (g) are instead shown, the area below the curve (g mm), and the intensity peaks higher than 20 g for each of the samples analysed.

With this cell 10 tests have been carried out for each sample, except for sample 3 for which 20 tests have been carried out. The reason for this is that the last sample presented very different performance rates and therefore a decision has been made to increase the number of tests



**Fig. 11** - Curves resulting from the analysis carried out by means of the Texture Analyser with Chip Fixture cell: (a) original, (b) sample 1, (c) sample 2, (d) sample 3.

with the aim of reducing the error. Observing table 3 it can be noticed that the original sample shows all the highest values with respect of the other samples. In particular, the value presenting the highest difference is the one relevant to the area. This may be originated by the fact that the original sample presents a more even expansion. In this way, during its descent, the probe meets and perforates a layer of micro-bubbles, detecting force variations which are more or less constant. The curve obtained does not, therefore, present resistance precipitous falls caused by the burst of bubbles of higher dimensions. The resulting area has, therefore, a higher value. It should be pointed out that the differences highlighted so far do not result to be considerable for the organoleptic analysis for what concerns either aspect, taste, crispy nature or texture. It can be hypothesized that the final consumer will not be able to acknowledge these differences and therefore the result obtained in these tests may be considered satisfactory.

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## CONCLUSIONS

The object of the present study was the project of production increase of pellets for the food industry in a system equipped with double screw co-rotating extruding unit. The industrial system worked at the minimum of its potentials with a flour supply workload of 500 kg/h. In these conditions a tapioca and wheat based pellet conceived for frying in mixed seeds oil was produced and marketed. The food industry company intended to have the system work at its highest potentials, on the condition of obtaining the same product already present on the market.

With this purpose the flour supply at the beginning of the system has been increased to

750 kg/h, and a few trials have been carried out modifying a few process parameters, and keeping the same original raw material. The tests have been carried out by technicians on the industrial system. In the course of the experimentation carried out at Pavan premises, in Galliera Veneta (PD - Italy), the results of two tests and one "original" sample have been sent, of the previous 500 kg/h production, to be used as a reference example for the comparative analyses. The samples relevant to the first test have been named "Sample 1 and 2", while those relevant to the second operational conditions have been named "Sample 3". The process data sheets for the whole production cycle have also been supplied, both for the original production and for the two tests carried out with increased feeding.

The samples have been analysed both in the form of pellets, and after expansion subsequent to the frying procedure in oil. In particular humidity analysis, apparent density, viscosity, oil absorption, expansion rate, dimensional, organoleptic, and texture analyses with Texture Analyser have been carried out.

The results obtained have shown very similar behaviours for samples 1, 2 and 3. These, however, for a few analyses, differ from the results obtained for the original sample. In particular, considerable differences were observed for oil absorption, expansion rate, apparent density, and amylographic behaviour. For the original sample an oil absorption of 17% in weight was found, whereas for the other samples the oil absorption was 23-28%. This is an important datum, mainly from the point of view of the nutritional values of the product. The new production samples result in fact to be richer in fats. The volume expansion rate of the reference sample reaches values of 16% against the 11-13% of pellets 1, 2, and 3. This higher expansion confirms the

fact that the samples of increased production present a high cooking degree, with granules already collapsed or fragmented. Good expansion is in fact determined by the presence of swollen granules, not yet completely gelatinized, therefore before the viscosity peak. In this condition, at the moment of the frying procedure, the water present in the whole granule evaporates, expanding its structure. This high expansion rate may appear in contradiction with the apparent density values calculated. Against about 47 g/L for the samples at 750 kg/h, the original pellet presents an appearing density of 50 g/L. This can be explained by the fact that, when frying, the original sample expands keeping a flat shape, whereas the samples tend to assume curled up shapes. As a consequence, in a fixed volume, the original pellets arrange themselves in a more orderly way, leaving fewer empty spaces and more mass.

The amylographic behaviour is the datum showing the greatest differences between the samples and the original. The resulting graphs from this analysis highlight, in fact, that the original presents a cooking degree which is lower than the other samples. A peak of 1020 UB is in fact present, whereas for the other samples the curve makes a slight increase which does not go beyond 380 UB. To make it simple it can be said that the original sample is more uncooked. This is, on the other hand, confirmed by the involved temperatures during the extrusion-cooking phase. While for the production at 500 kg/h the temperatures of the cylinder sections did not exceed 60°C, in the tests carried out at 750 kg/h temperatures higher than 75°-80°C have been set, and reaching 90°C for pellets 3. Also the pressure values of the different operational conditions show much higher values for the increased production tests.

Lastly, also the texture analysis of the fried product have shown some slight difference between the original and the samples, which could be explained with a more homogeneous expansion, made of micro-bubbles of air, for the original pellets. However, the differences detected from the analyses carried out have not been considered significant for sensory analysis.

From the organoleptic point of view, and therefore in the consumer's shoes, the pellets showed to be rather similar both in aspect and in taste, and in crunchiness.

#### Acknowledgements

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**WHEAT**

# **QUALITY of partial waxy and complete WAXY TETRAPLOID LINES from the DURUM WHEAT cultivar Svevo**

Key words: partial waxy durum wheat lines, complete waxy durum wheat lines, grain quality

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## ABSTRACT

The introduction of the “waxy” character in wheat plants is a subject of interest in cereal science and technology. The nutritional and technological properties of waxy cereals, related to the reduced amylose content of waxy starch and to other accompanying features, are in fact very peculiar. At present, the selection of waxy lines from wheat and the assessment of their characteristics and functional properties in relation to specific end-products are the object of extensive studies worldwide. Our study aimed at characterizing waxy durum wheat lines derived from the Italian cultivar Svevo, widely used in the manufacture of traditional Italian wheat products. This *cv*, commonly used for pasta making thanks to its good gluten qualities, was crossed with the Japanese bread wheat cultivar Kanto 107 lacking the Wx-A1 and Wx-B1 proteins. Electrophoretic selection of backcrossed generations permitted the production of the two partial waxy lines (*wx-A1* and *wx-B1* null lines) along with the complete waxy (*wx-A1/wx-B1* null line) in durum wheat. Grains of the conventional *cv* and of the complete waxy line coming from two harvests (years 2007 and 2008), together with grains of the two partial waxy lines coming from harvest 2008 (not available in 2007) were analysed for thousand kernel weight, ash, insoluble and soluble fibre, total protein, dry gluten, gluten index, SDS sedimentation index,  $\alpha$ -amylase activity, falling number and resistant starch. As regards kernel characteristics of harvest 2008: thousand kernel weight was higher for the *wx-A1* null line and for the conventional *cv*, lower for the *wx-B1* null line and for the complete waxy line; ash content was lower in the conventional *cv*, higher in the complete waxy line and intermediate in the two partial waxy lines; protein content was increasing in the order: *wx-B1* null, conventional, *wx-A1* null, complete waxy. As regards protein quality indicators: relative SDS sedimentation index was not found to be different in the samples, whereas gluten index was halved in the complete waxy line with respect to the conventional *cv* and to both the partial waxy lines. As regards parameters related to starch:  $\alpha$ -amylase activity was higher in the complete waxy and in the *wx-B1* null lines, lower in the conventional *cv*; resistant starch was very low in all samples and therefore it was impossible to detect any difference. Similar results were found for the conventional *cv* and the complete waxy line in the 2007 year.

## INTRODUCTION

The introduction of the “waxy” character in wheat plants represents a subject of interest in cereal science and technology because of the peculiar characteristics possessed by waxy wheat.

Waxy varieties of cereals show in fact several peculiar traits in both the plant and the seed, the main feature being that their starch is composed essentially by sole amylopectin. As a consequence, their nutritional and technological properties exhibit interesting differences with respect to common non-waxy varieties. Partial waxy cereal varieties also exist, whose starch has a slightly reduced content of amylose, and they also show interesting properties.

The waxy condition was first identified and studied by modern science in maize plants in the early XIX century (Collins, 1909; 1920, Weatherwax, 1922) and it is likely the result of naturally occurring mutations and artificial selection. In fact, waxy and partial waxy varieties of several cereals have been selected and grown for a long time by many communities, especially in certain parts of the world, as ingredients for the preparation of traditional foods. For example, waxy rice is the sticky or glutinous rice popular in Asia and some wheat varieties appreciated for their good Asian noodle making quality turned out to be partial waxy varieties (Graybosch, 1998; Guoquan Hou, 2001).

Waxy starch, obtained mainly from waxy maize, has found during the course of the last century a very large number of applications in different industrial sectors (food and feed, textile, adhesive, papermaking industries). Actually, waxy maize is still the most economically convenient source of waxy starch for the starch industry.

From a genetic point of view, the waxy condition is related to a mutation of the gene(s) codifying for the main enzyme deputed to the synthesis of amylose (Granule Bound Starch Synthase, GBSS). When scientists took up investigating this subject, they discovered that the waxy allele occurred in many commonly cultivated varieties of all cereals, especially in Asia (Japan, Korea, Turkey, China), in Australia, and even in the US, where *cvs* originating from crossings with Asian varieties had been introduced. However, only the “complete waxy” genotype, that is null at all waxy *loci* (if there are more than one) of the plant genome, results in the waxy phenotype having sole amylopectin starch. Waxy varieties had been identified for maize, rice, sorghum and millet, but not for wheat, due to its multiple genome that makes extremely low the probability of a spontaneous occurrence of a complete waxy mutant. In fact, there are two waxy *loci* in the tetraploid genome (AABB) of durum wheat, and three in the hexaploid genome (AABBDD) of bread wheat. Genes at these waxy *loci* are located on the short arm of the chromosomes 7A (*Wx-A1* locus), 7D (*Wx-D1* locus) and on the long arm of the chromosome 4A (*Wx-B1* locus) (a part of 7B is translocated) (Nakamura *et al.* 1992). In durum and bread wheat, hence, respectively two and six partial waxy genotypes are possible, resulting in partial waxy phenotypes having a slightly reduced content of amylose with respect to normal non-waxy wheat. The complete waxy genotypes, null at two or three waxy *loci*, lack respectively in durum wheat the *Wx-A1* and *Wx-B1* proteins and in bread wheat *Wx-A1*, *Wx-B1* and *Wx-D1* proteins (Graybosch, 1998).

In the last decades, waxy and partial waxy cereals have been receiving increasing attention by the food and starch industry and by breeders. New waxy hexaploid and tetraploid wheat

lines were produced (Graybosch, 1998). At present, the development of waxy lines from wheat and the assessment of their characteristics and of their functional properties in relation to specific end-products are the object of extensive studies worldwide (Jonnala *et al.*, 2010). Partial waxy bread wheat is appreciated for the manufacture of high quality Asian noodles. Complete waxy wheat possible uses include: blending wheat for producing flours with a desired amylose content to be used for foods with special nutritional qualities; improving quality and stability of extruded products and of frozen products, improving shelf-life of baked products. Waxy wheat starch may have in principle the same applications of waxy maize starch (food, paper, adhesive, textiles) but its use is limited by economic factors and it might be more interesting if coupled to gluten production.

In this panorama, our study aimed at characterizing waxy tetraploid wheat lines derived from an Italian durum wheat cultivar widely used in the manufacture of traditional Italian wheat products.

The Italian *cv* Svevo, commonly used for pasta making thanks to its good gluten qualities, was crossed with the Japanese bread wheat cultivar Kanto 107 lacking the *Wx-A1* and *Wx-B1* proteins. Electrophoretic selection of backcrossed generations permitted the production of the two partial waxy lines along with the complete waxy one.

Grains of the conventional *cv* and of the complete waxy line coming from two harvests (2007 and 2008 years), together with grains of the two partial waxy lines coming from the 2008 harvest (not available in 2007), were analysed for thousand kernel weight, ash, soluble and insoluble fibre, total protein, dry gluten, gluten index, SDS sedimentation index,  $\alpha$ -amylase activity and resistant starch.

## MATERIALS AND METHODS

### Production of the waxy lines

The Italian *cv* Svevo was crossed with the Japanese bread wheat cultivar Kanto 107 lacking the Wx-A1 and Wx-B1 proteins. Electrophoretic selection of crossed and backcrossed generations permitted the production of the two partial waxy tetraploid lines (*wx-A1* null and *wx-B1* null lines) along with the complete waxy in durum wheat (*wx-A1/wx-B1* null line) (Urbano *et al.*, 2002).

The conventional and waxy wheats were cultivated under the same agronomical and environmental conditions in experimental plots for 2 consecutive years (2007 and 2008).

### Analyses

Thousand kernel weight was determined according to the method UNI 10266 (Italy).

Grinding of samples was performed by means of a Bühler MLI 204 laboratory mill (Bühler AG, Uzwil, Switzerland) or by a Perten Laboratory Mill 3100 (Perten Instruments, Huddinge, Sweden), or by a Cyclotec laboratory mill (Foss.Tecator, Hillerød, Denmark), as specified in the standard methods below.

Moisture content was determined by oven drying at 105°C according to the Official Methods for Analysis of Cereals approved by the Italian Ministry for Agriculture (MIPAAF 1967).

Ash content was determined by incineration in muffle at 575°C according to the ICC standard 110/1 (2003) or AACC method 08-01 (2005).

Soluble and insoluble fibre content were determined according to the AOAC enzymatic-gravimetric methods 991.42 and 993.19 (AOAC 1995), using the reagent kit K-TDFR

from Megazyme (Megazyme Int. Ireland, Wicklow, Ireland).

Total protein was determined by the Kjeldahl method according to the ICC standard 105/2 (2003) or AOAC standard 2001.11 (2002), using a conversion factor of 5.75.

Dry gluten and Gluten Index were measured according to the ICC standard 158 (2003), using a Glutomatic gluten extractor, a centrifuge 2015 and a Glutork 2020 hot plate (Perten Instruments, Huddinge, Sweden).

SDS sedimentation test was performed according to the AACC standard 56-70 (2005). Relative SDS sedimentation index was calculated according to Cubadda *et al.*, 2007.

Alpha-amylase activity was determined by the enzymatic-spectrophotometric method according to the AACC standard 22-02 (2005), using the reagent kit K-CERA from Megazyme.

Falling number (according to Hagberg-Perten as a measure of the alpha amylase activity in grain and flour) was determined according to ICC standard 107/1 (2003).

Resistant starch content was determined by the enzymatic-spectrophotometric method according to the AACC standard 32-40 (2005), using the reagent kit R-STAR from Megazyme.

All analyses were performed at least in duplicate and standard deviation is reported.

## RESULTS AND DISCUSSION

### Kernel appearance and thousand kernel weight

The kernels of the complete waxy tetraploid line had the shape of an ordinary durum wheat kernel, however, they were not as vitreous as those of ordinary durum wheat, or as opaque

as those of bread wheat either, but they had a very peculiar, immediately recognizable dull and smooth appearance (**fig. 1**). Even the waxy endosperm was neither vitreous nor floury, but dull, smooth and homogeneous, resembling wax (Vignaux, 2004; Graybosch, 1998). The kernels of both partial waxy lines still had a vitreous appearance instead and in this sense they were indistinguishable from ordinary non-waxy durum wheat kernels at visual inspection (Graybosch, 1998).

The complete waxy grains were less homogeneous as far as dimensions were concerned, and appeared slightly more shrivelled than the conventional Svevo grains. In fact, the thousand kernel weight of the complete waxy sample was in both years lower than that of the conventional sample (47.5 *vs* 52.0 g in 2007; 45.4 *vs* 50.9 g in 2008, **table 1**). In the year 2008 the TKW of the *wx-B1* null was even lower (41.8 g), whereas the TKW of the *wx-A1* null was slightly higher than that of the conventional Svevo sample (53.0 g).

### Kernel ash content

The complete waxy grains had a higher kernel ash content than the *cv* Svevo grains in both years (2.01 *vs* 1.81% d.m. in 2007 and 2.20 *vs* 1.97% d.m. in 2008, table 1) probably as a consequence of kernel shrivelling which gave an inferior TKW. The grains of both partial waxy lines in 2008 also show higher ash content than the *cv* Svevo grains, however lower than that of the complete waxy grains. Other researchers as well reported an increase of the ash content in complete waxy with respect to partial waxy tetraploid wheat lines and to wild type lines from the same breeding program, and a slight increase with respect to the parent durum cultivar (Vignaux *et al.*, 2004; Grant *et al.*, 2004).

### Dietary fibre content

The insoluble dietary fibre content was comparable in all the samples; however, in the 2007 year it was slightly higher in the complete waxy grains than in the conventional grains, while in the 2008 year it was very similar in the complete waxy and in the conventional grains and slightly lower in the partial waxy grains (table 1). The soluble fibre content was quite similar in all the samples.

### Kernel protein content and protein quality indexes

The complete waxy grains had higher total protein than the *cv* Svevo grains in both years (16.7% *vs* 15.8% d.m. in 2007; 20.1% *vs* 18.3% d.m. in 2008; **table 2**). These values are quite high, but it must be noticed that the *cv* Svevo is a high protein cultivar, and in fact the INRAN durum wheat database (<http://www.politicheagricole.it/SettoriAgroalimentari/SeminativiColture/Cereali/Frumento.htm?Tipo=duro>) reports protein contents up to 17% for the conventional *cv* Svevo grown in Italy in the last decade. In our case, considering the fact that the waxy grains were shrivelled with respect to the conventional Svevo grains, we could say that the higher amount of protein is not necessarily associated with the waxy character. However, in the literature it is reported of waxy tetraploid lines having a protein content which is in some cases higher, in some cases lower than that of the parent durum *cv* (Vignaux *et al.*, 2004; Grant *et al.*, 2004; Chakraborty *et al.*, 2004). The *wx-B1* null total protein in 2008 was about 1% lower than that of the conventional grains, whereas that of the *wx-A1* null grains was nearly 1% higher (table 2), so that the protein content was increasing in



Fig. 1 - Grains and endosperm of the complete waxy line (A) and of the parent conventional *cv* Svevo (B).

Table 1 - Thousand kernel weight (TKW), ash and dietary fibre contents.

Sample	TKW g	Ash % d.m.	Dietary fibre		
			Insoluble % d.m.	Soluble % d.m.	Total % d.m.
Conventional 2007	52.0±1.4	1.81±0.02	9.5±0.2	1.8±0.4	11.3±0.5
<i>wx-A1/wx-B1</i> null 2007	47.5±0.8	2.01±0.02	10.4±0.01	1.5±0.01	11.9±0.02
Conventional 2008	50.9±1.0	1.97±0.03	10.0±l.d.	1.4±0.1	11.4±>0.1
<i>wx-A1</i> null 2008	53.0±0.7	2.10±0.06	9.5±0.02	1.3±0.1	10.8±0.1
<i>wx-B1</i> null 2008	41.8±0.4	2.14±0.04	9.2±0.1	1.3±l.d.	10.5±>0.1
<i>wx-A1/wx-B1</i> null 2008	45.4±0.14	2.20±0.1	10.3±0.2	1.5±0.1	11.8±0.25

Table 2 - Total protein and protein quality indexes.

Sample	Total protein % d.m.	Dry gluten % d.m.	Gluten Index %	SDS index mL	Relative SDS index mL/g of protein d.m.
Conventional 2007	15.8±0.05	13.7±0.6	78±0.4	36.1±0.3	2.3±0.03
<i>wx-A1/wx-B1</i> null 2007	16.7±0.17	15.6±0	40±0.4	34.5±0.4	2.1±0.04
Conventional 2008	18.3±0.4	16.4±0.2	50±4	35.0±0	1.9±0.04
<i>wx-A1</i> null 2008	19.3±0.15	18.3±0.2	48±4	37.0±0	1.9±0.01
<i>wx-B1</i> null 2008	17.2±0.05	15.9±0.2	50±3	32.5±0.7	1.9±0.05
<i>wx-A1/wx-B1</i> null 2008	20.1±0.2	19.5±0.8	26±2	37.5±0.7	1.9±0.05

Table 3 - Alpha-amylase activity, falling number and resistant starch content.

Sample	Alpha-amylase activity CU/g	Falling number s	Resistant starch % d.m.
Conventional 2007	0.10±0.007	not determined	0.28±0.03
<i>wx-A1/wx-B1</i> null 2007	0.17±0.005	not determined	0.39±0.06
Conventional 2008	0.14±0.006	396±10	0.08±0.02
<i>wx-A1</i> null 2008	0.23±0.04	355±4	0.19±0.05
<i>wx-B1</i> null 2008	0.36±0.03	246±2	0.05±0.02
<i>wx-A1/wx-B1</i> null 2008	0.39±0.005	62±0	0.07±0.01

the order: *wx-B1* null, Svevo, *wx-A1* null, and complete waxy.

Dry gluten (table 2) is strictly dependent on protein content. So the highest total protein in the complete waxy line in both years is matched by the corresponding highest dry gluten. So the dry gluten content is increasing in the same order as the protein content. As regards protein quality, changes were observed in the gluten quality determined by the Gluten Index. The gluten index of the waxy sample was nearly half that of the conventional sample in both years (40 *vs* 78 in 2007, 25 *vs* 50 in 2008; table 2), indicating a poorer gluten quality, and this is in contrast with the picture emerging from the values of the SDS indexes.

The SDS sedimentation index of the complete waxy sample was lower than that of the conventional Svevo sample in 2007 (34.5 mL *vs* 36.1 mL; table 2), whereas it was higher in 2008 (37.5 mL *vs* 35.0 mL). In 2008 the *wx-B1* null sample had the lowest SDS index (32.5 mL), whereas the *wx-A1* null had a higher value (37.0 mL), close to that of the complete waxy. However, when the relative SDS index was calculated (Cubadda *et al.*, 2007) values were very close between the samples in each year (2.3 and 2.1 mL/g of protein d.m. in 2007; 1.9 mL/g of protein d.m. for all samples in 2008; table 2). It is in fact known that the SDS index is influenced by the protein content whereas the gluten index measurement is independent of it. So the influence of the waxy character on protein quality measured by means of quality indexes needs further investigation. Vignaux *et al.* (2004) compared a series of isogenic complete waxy, partial waxy and wild type lines and their parent durum *cv*, concluding that the complete waxy lines had only a slightly lower protein quality, measured by micro SDS test on ground ker-

nels and by gluten index on semolina, than the other lines and the parent durum *cv*.

### Alpha-amylase activity

Alpha-amylase activity ranged from low to good in the different samples, being generally higher in the year 2008 than in the 2007 (table 3); however in both years higher values were measured in the complete waxy sample than in the conventional Svevo sample (0.17 *vs* 0.10 C.U. in 2007; 0,39 C.U. *vs* 0,14 C.U. in 2008). In 2008 also the two partial waxy samples had higher alpha-amylase activity than the conventional Svevo sample. Similar results were found in the literature (Vignaux *et al.*, 2004; Chakraborty *et al.*, 2004).

The alpha-amylase activity was measured enzymatically because in the literature it is reported that the full-waxy mutation deeply affects the behaviour of wheat in the falling number test (Graybosch *et al.*, 2000). The falling number is defined as “the time in seconds required to stir and to allow a viscometer stirrer to fall a measured distance through a hot aqueous meal undergoing liquefaction due to alpha amylase activity” (ICC standard 107.1, 2003). Generally, the higher the alpha amylase activity in a meal, the lower the falling number: this is because the viscosity of the hot aqueous meal is increased by the swelling of the starch granules at first, but then it is lowered by the liquefying action of the amylolytic enzymes, facilitating the falling of the stirrer. However, it is reported in the literature that the falling number of complete waxy lines (both hexaploid and tetraploid) is constantly very low (60-70 s in a range of 60-400 s), independently of the alpha-amylase activity of the sample; the same happened in our experiment (table 3). The reason for the lack of correlation between the falling

number and the alpha-amylase activity in complete waxy wheat lies in the peculiar pasting properties of its starch, that can be appreciated by examining the pasting curves of waxy and non-waxy wheat obtained by Graybosch by means of the Rapid Visco Analyser (Graybosch *et al.*, 2000). The RVA curves show that the hydrated complete waxy wheat flour (or starch), under shear, reaches maximum viscosity at 80°C, whereas at higher temperatures the viscosity is lowered to a minimum, due to the breakdown of the starch granules. Non-waxy and partial waxy wheat flours reach maximum viscosity at 95°C instead. In the falling number instrument, the flour to be tested is hydrated and then it is maintained at a temperature of 95°C during stirring and the subsequent falling of the stirrer, because the instrument is calibrated on non-waxy wheat. The RVA curves show that at this temperature the hydrated complete waxy wheat flour has already reached its minimum viscosity, hence low falling numbers are measured even in the absence of alpha-amylase activity. In fact, also in our case, the complete waxy sample in 2008 with a falling number of 62 s had an alpha-amylase activity close to that of the *wx-B1* null, which had a falling number of 246 s.

### Resistant starch content

The resistant starch content of all samples was extremely low (table 3), and it was not possible to detect any meaningful difference (the standard error of the enzymatic kit used for this measurement is higher than 5% in samples containing less than 2% of RS). However, considering the importance of resistant starch in the human diet and the influence of processing on its development in food (Carcea *et al.*, 2009), it is planned to study the

presence of resistant starch in food products such as pasta.

### CONCLUSIONS

In conclusion, the complete waxy character influences several quality parameters of the durum wheat grains, such as ash content, protein quality evaluated by the gluten index, and alpha-amylase activity. Higher ash content and a slight increase in alpha amylase activity are reported in the literature and thus they seem to be ascertained features of the waxy wheat kernel. In the literature, milling experiments are also reported (Vignaux *et al.*, 2004, Grant *et al.*, 2004) in which the waxy semolina extraction rate was correlated with ash content, in order to find the best conditions for milling this kind of wheat. As regards the protein quantity and quality, studies are reported in the literature where differences in protein content, SDS sedimentation index, wet gluten and gluten index (measured on semolina) were not evidenced or were not judged as important between waxy, partial waxy, wild-type lines and parent *cv*s; some papers also take into consideration the possible effect of the growing conditions and of the second parent *cv* (i.e. the hexaploid partial waxy wheat), however they state that gluten of waxy wheat seems to be of slightly inferior quality than that of non-waxy wheat (Vignaux *et al.*, 2004). In our research, inferior gluten quality was detected in the complete waxy grains with the gluten index method only and the two methods (gluten index and SDS test) were not in agreement. In this regard it is also worth considering that our grains come from small experimental plots which might be a limiting condition for the expression of the full quality potential of du-

rum wheat proteins. Different pasting properties, instead, are well-recognized peculiar, unique properties of waxy wheat, as well as of all waxy cereals. It shall be interesting to evaluate the quality of some durum wheat products, such as pasta, to assess the grains behaviour under processing conditions and the influence of grain quality on the quality of the processed food.

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# CHARACTERIZATION of TYPICAL Italian WHOLE-GRAIN BREADS made in Sicily

Key words: wholemeal bread, total dietary fiber, resistant starch

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## ABSTRACT

The new guidelines suggest whole grain intake as rich source of fibre components useful in health safeguarding. Over 50 different kinds of durum wheat bread are produced in Sicily, an island situated in the Southern of Italy. Traditional processes are still used, with durum wheat flour as the main raw material. In order to safeguard and to add value to typical high quality products, this study aimed to examine three kinds of whole grain bread produced in the island. “Pane nero di Castelvetro” (from Trapani) and “Pane di Lentini” (from Ragusa) are still traditionally produced by small bakeries using an old autochthonous population of durum wheat, “Timilia”, traditional millstones, and natural yeasts; the “Pane intero del Dittaino” (from Enna) is an industrial product that safeguards the traditional bread-making conditions by using natural yeasts.

The chemical characterization of the three kinds of bread showed significant differences. As matter of fact, on average, protein content ranged from 11.1 to 13.8 (% d.m.) and lipid concentration from 2.7 to 3.4 % d.m.; total starch content showed minus marked differences. The three kinds of bread could be identified as high fibre products, being the fibre content higher than 6.0%. However, significant differences occurred among the considered breads in total dietary fibre (TDF) and Resistant Starch (RS) contents; moreover, marked differences were evidenced in the protein and lipid content between crust and crumb, the two different bread portion separately analysed, too.

The results of this study could allow to promote consumption of Sicily high-fibre breads and to identify the best value-adding opportunities for bread producers.

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## INTRODUCTION

Whole grain cereals are considered important foods (Slavin *et al.*, 2000; Liu, 2007) that contain many protective factors including vitamins, minerals, antioxidants, phytoestrogens and fibre (soluble and insoluble). Following the recommendations of the guidelines and the new trend for the consumption of foods functional for human health, whole grains can strongly contribute to increase the consumers' intake of fibre and associated bioactive compounds, their importance in nutrition and health being well defined (Ward *et al.*, 2008; Saura-Calixto *et al.*, 2009). Besides, many investigations on Mediterranean diet confirmed the link between this appropriate dietary pattern and the prevention of chronic diseases; Trichopoulou and Lagiou (2001) reported nine main components in the definition of Mediterranean diet, among them it was recommended “high consumption of cereals, mainly unrefined cereals and bread” (Saura-Calixto and Goni, 2009). Bread, pasta and cookies are the traditional wheat-based products that are obtained, generally, with refined grain, i.e. by removing the outer part of the kernel during milling. In this way the traditional wheat products present a lower bioactive component content, in particular dietary fibre (Camire, 2004).

Bread is the oldest staple food of many populations, as it mainly consists of flour and water with the usual addition of leaving agents as yeasts. There is a wide variety of types and forms of bread, that characterize different parts of the world. Famous is the traditional French baguette, thin bread made with soft wheat flour, defined as “a perfect balance between the crust and a soft interior”. White bread from soft wheat flour represents a traditional food of the Italian diet and a good

source of protein, starch, some vitamins and calcium, low is the fat content.

In recent years different cereals have been included in the bread composition; the use of other cereal flours, from whole wheat, rye or oats, affects the bread nutritional value that is strongly related to the raw materials used (Dewettinck *et al.*, 2008). In the aim to raise fibre consumption, over the last decade there has been an increased availability on the market of high-fibre products, including pasta and bread. They are produced by enriching semolina or flour with fibre, or by directly processing wheat grains without removing the bran. Among the other components, whole bread consumption permits an adequate intake of dietary fibre, that is widely recognized as a significant factor in healthy diet, several studies having established its role in reducing the risk of many diseases (American Dietetic Association, 2008); moreover, specific healthy effects on chronic diseases have been associated with different fibre components, particularly the soluble fractions as, for example, the arabinoxylans, the major nonstarch polysaccharide of wheat endosperm (Garcia *et al.*, 2007). In addition, the baking process as many other thermal processes (Muir *et al.*, 1995; Sgrulletta *et al.*, 2005) could favour the formation of the resistant starch fraction, classified as the starch part that resists to digestion and is physiologically active as dietary fibre (Englyst *et al.*, 1992).

Wholemeal bread, prepared with the whole wheat grain, is becoming a significant food for Italian people daily nutrition, in particular, for some regions in Southern Italy, like Sicily, where durum wheat grain is preferred for bread production. Besides the typical durum wheat flavour, the durum wheat bread generally has higher nutritional value and

tends to delay the staling process. Among 50 different kinds of bread, produced with durum wheat flour as the main raw material and traditional processes (Consorzio di Ricerca "Ballatore", 2001), in Sicily wholemeal bread is also produced (Boggini, 2009). In order to obtain good quality products, the durum wheat utilization for wholemeal bread-making requires raw material with specific technological properties (Boggini *et al.*, 1995; Boggini, 2009) and characteristics conforming to the Italian law (DPR 187/01). In addition many bread kinds are produced accordingly to the approved model of product certification procedure, in order to guarantee the desired quality standard and add value to products. Scarce is, however, the information on chemical composition or actual nutritional potentiality of typical bread, because the available data are generally referred to undifferentiated wholemeal bread (Food Composition Tables, INRAN Eds.).

In this paper a study aimed at characterizing three kinds of durum wheat bread produced in Sicily requiring certified bread-making procedures and raw materials is presented. These results will favour the knowledge of the specific compositions of typical breads and will provide useful information for the consumers on their nutritional potentiality, helping to improve the diet nutritional quality.

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## MATERIALS AND METHODS

### Breads

Three kinds of whole durum wheat round loaf produced in Sicily were considered: 1) "Pane di Lentini" (from Siracusa) and 2) "Pane nero di Castelvetro" (from Trapani) are still tra-

ditionally produced by small bakeries using an old autochthonous population of durum wheat, “Timilia”, traditional millstones, and natural yeasts; while 3) “Pane intero del Dittaino” (from Enna) is an industrial product that safeguards the traditional bread-making conditions.

Two samples for each bread kind were purchased directly by the producers, belonging to different making and raw materials batches. The normal daily bread productivity of the two small bakeries (Lentini and Castelvetro) doesn't exceed 100 kg/day; while for “Pane intero del Dittaino” the daily production is around 200 kg/day.

The analyses were performed on whole bread and on the two main different portion of bread: crumb and crust.

## Chemical analysis

For chemical analyses 100 g of sample of whole bread, crumb and crust were freeze-dried and then grounded in a Udy Mill Cyclotec (FossItalia, PD, Italy) with a 0.5 mm sieve. Moisture was determined with a thermo-balance (Sartorius MA 40, Göttingen, Germany) at 120°C. Total nitrogen content was estimated through micro-Kjeldahl analysis; nitrogen was converted to protein by multiplying by 5.7. Resistant Starch (RS) content was evaluated by an enzymatic method using Megazyme kit (Mc Cleary and Monaghan, 2002; Mc Cleary *et al.*, 2002). Total dietary fibre (TDF) content was determined using AOAC Method 991.42 (1995) on whole bread, as well as Total Arabinoxylan (AX), performed with the Englyst method (1992). Two determinations were carried out for each sample and the data are reported on dry matter basis.

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## RESULTS

The three kinds of durum wheat bread presented different round forms and volumes as shown in the following pictures. Pane di Lentini (**fig. 1**) presented soft crust and thick crumb structure; Pane nero di Castelvetro (**fig. 2**) was characterized by thick and crispy crust and soft crumb; Pane intero del Dittaino (**fig. 3**), higher round loaf, presented soft crust and homogenous crumb structure. The chemical characterization of the bread samples showed significant differences among the considered factors (**table 1**), as highlighted by the statistical analysis reported in **table 2**, that, on the contrary, didn't point out significant differences between samples of the same bread, this last result guaranteed the uniformity and stability of employed raw material and technological process conditions.

### Variability between bread portion

Castelvetro crumb presented the highest protein content, the Pane intero del Dittaino and Pane di Lentini ones had similar contents. Marked differences were evidenced among bread crumbs in relation to lipid concentration that ranged from 2.89 (Dittaino) to 4.12 (Castelvetro) % d.m.; total starch content showed no significant differences, whereas very different was the ash content, the range being from 3.08 (Castelvetro) to 3.80 (Dittaino) % d.m., as well as the Resistant Starch (RS) content (range: 0.90-1.40% d.m., for Castelvetro and Lentini, respectively). In comparison with crumb composition, crust samples presented higher protein contents (average: 11.92 *vs* 12.40% d.m.) and lower lipid concentrations (average: 3.45 *vs* 2.71% d.m.).



Fig. 1 - Pane di Lentini.



Fig. 2 - Pane nero di Castelvetrano.



Fig. 3 - Pane intero del Dittaino.

Table 1 - Bread composition (% d.m.).

Bread kind	Bread portion	Total proteins	Total lipids	Total starch	Resistant starch	Ash
Lentini	Crumb	11.26	3.35	61.92	1.40	3.18
	Crust	11.88	2.98	61.84	1.36	3.17
	Whole bread	11.60	3.18	63.21	1.11	3.19
Castelvetrano	Crumb	13.52	4.12	62.61	0.90	3.08
	Crust	14.02	2.86	60.83	1.06	3.06
	Whole bread	13.75	3.36	61.84	1.36	3.08
Dittaino	Crumb	10.97	2.89	61.53	1.08	3.80
	Crust	11.31	2.30	62.91	1.03	3.65
	Whole bread	11.08	2.69	61.31	1.00	3.78
<b>Averages</b>	<b>Crumb</b>	<b>11.92</b>	<b>3.45</b>	<b>62.02</b>	<b>1.12</b>	<b>3.35</b>
	<b>Crust</b>	<b>12.40</b>	<b>2.71</b>	<b>61.86</b>	<b>1.15</b>	<b>3.29</b>
	<b>Whole bread</b>	<b>12.14</b>	<b>3.08</b>	<b>62.12</b>	<b>1.16</b>	<b>3.35</b>
Variation coefficient %		0.57	6.80	0.34	3.91	0.32

## Variability among bread kinds

Significant differences occurred among the considered breads in all the examined components, except total starch (mean value: 62.12, range: 61.31-63.21 % d.m.). Castelvetrano bread samples showed the highest concentrations of proteins (13.75 % d.m.), lipids (3.36 % d.m.) and RS (1.36 % d.m.) and the lowest ash content (3.08 % d.m.). Dittaino bread samples presented the lowest contents for all the considered parameters, except ash content (3.78 % d.m.).

Comparison of bread TDF content is reported in **table 3**. The three kinds of bread can be identified as high fibre products, being the fibre content higher than 6.0%. The breads included in this study showed significant dif-

ferences and a large range of variation also for TDF content (mean value = 10.53 % d.m.). Castelvetrano bread presented the lowest value (9.22% d.m.), Lentini the highest one (11.48% d.m.). The different kinds of bread also varied in total arabinoxylan content, the fibre composition of Dittaino bread exhibited the highest AX content (5.43 % d.m.), representing more than 49% of TDF.

## CONCLUSIONS

Wide is the variety of bread production in Italy but scarce is the information on the composition of the different breads. The data presented in this paper provide indications on

Table 2 - ANOVA analysis. F value significativity.

Variability factors	Degrees of freedom	Total proteins	Total lipids	Total starch	Resistant starch	Ash
Replication	1	n.s.	n.s.	n.s.	n.s.	n.s.
Bread type (A)	2	***	***	n.s.	**	***
Bread portion (B)	2	***	***	n.s.	n.s.	***
A x B	2	n.s.	n.s.	***	***	***
Error mean square	6	0.05	0.044	0.044	0.02	0.000

\*\*, \*\*\* significant at  $p \leq 0.01$ , 0.001 respectively; n.s. not significant.

Table 3 - TDF (Total Dietary Fiber) and AX (Total Arabinoxylan) bread content (% d.m.).

Bread type	Bread portion	TDF	AX	AX/TDF
Lentini	Whole bread	11.48	5.12	44.55
Castelvetrano	Whole bread	9.22	3.22	34.87
Dittaino	Whole bread	10.90	5.43	49.80
<b>Average</b>	<b>Whole bread</b>	<b>10.53</b>	<b>4.59</b>	<b>43.07</b>
F significativity		**	**	**
Variation coefficient %		1.98	6.82	7.38

\*\* significant at  $p \leq 0.01$ .

three kinds of durum wheat bread, that are characteristic of Sicily but are very appreciated in national and international markets. The results showed the wide range of nutritional quality of examined high fibre bread and some significant differences between crumb and crust were also evidenced, in that all the bread showed higher amount of proteins and a lower lipid concentration in the crust in respect to the crumb. In general, the data suggested that the differences in bread composition reflected the different raw materials and processes used. However, on the basis of previous data on durum wheat whole grain (Sgrulletta *et al.*, 2005), during baking processes the formation of resistant starch, an important fibre component that is fermented in the large intestine by beneficial bacteria helping to improve colon health, was always evidenced, the wholemeal bread presenting RS values similar to those previously observed in cooked high fibre pasta.

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The image shows several petri dishes containing different types of fungal cultures. The central dish is the most prominent, showing a dense, dark brown, fuzzy growth on a reddish-brown agar. Other dishes around it show lighter, more diffuse growths in various colors like yellow, orange, and grey. The text is overlaid on this image.

**MYCOTOXINS**

# **Worldwide SURVEY on MYCOTOXINS – an update for the year 2009**

Key words: aflatoxins, zearalenone, deoxynivalenol, fumonisins, ochratoxin A, mycotoxins, mycotoxin analysis, mycotoxin occurrence

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## ABSTRACT

Mycotoxins are highly toxic secondary metabolic products of molds which impair health and cause disease and death in humans and animals consuming contaminated food or feed products. However, do you know how many and how much of these toxins are present in the feed our animals are ingesting? Biomin GmbH is a pioneer in Mycotoxin Risk Management and also routinely provides answers to questions such as these to the feed and animal production industry. As done in previous years, Biomin provides the players of these industries with the biggest mycotoxin survey report ever. This article provides the interested reader with detailed information regarding the types of commodities tested, specific region allocation, average and maximum contamination levels, and most contaminated commodities.

## DATA ORIGIN

From January 2009 until November 2009, a total of approximately 2,030 samples were analysed for the most important mycotoxins in terms of agriculture and animal production: aflatoxins (Afla), zearalenone (ZON), deoxynivalenol (DON), fumonisins (FUM), and ochratoxin A (OTA). Due to the high limit of detection - 125 µg/kg (ppb) - of the Thin Layer Chromatography method for T-2 determination, this toxin was kept out of the survey as its occurrence at levels lower than that, may already cause serious problems to animals.

As it can be seen in **fig. 1**, the origin of the samples was various and included: America (North, Central and South), Europe, Middle East and Africa, and Asia-Pacific (North, South-East, South Asia, and Oceania). An overview about the occurrence of mycotoxins since 2005 in Italy is also given; however, samples which were not analysed in 2009, are not a part of this chart.

Samples tested were diverse, ranging from cereals (such as corn, wheat and rice) to processing by-products, namely soybean meal, corn gluten meal, dried distillers grains with solubles (DDGS) and other fodder such as straw, silage and finished feed.

## ANALYTICAL PROCEDURE

High Performance Liquid Chromatography (HPLC) methodology was used for the analysis of all mycotoxins. For the purpose of data analysis, non-detection levels are based on the detection limits of the test method for each mycotoxin: Total aflatoxins < 4 µg/kg (ppb); zearalenone < 32 µg/kg (ppb); deoxynivalenol < 50 µg/kg (ppb); fumonisins < 100 µg/kg (ppb); and ochratoxin A < 2 µg/kg (ppb).

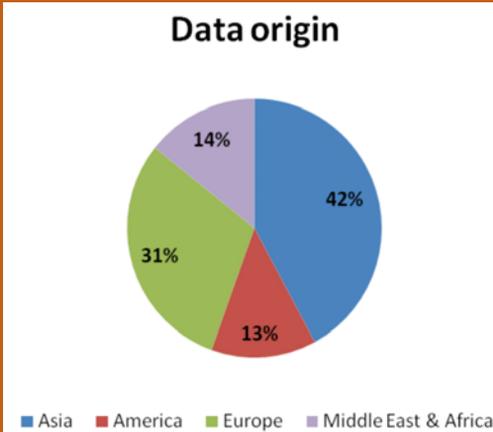


Fig. 1 - Data origin of Biomin's Mycotoxin Survey.

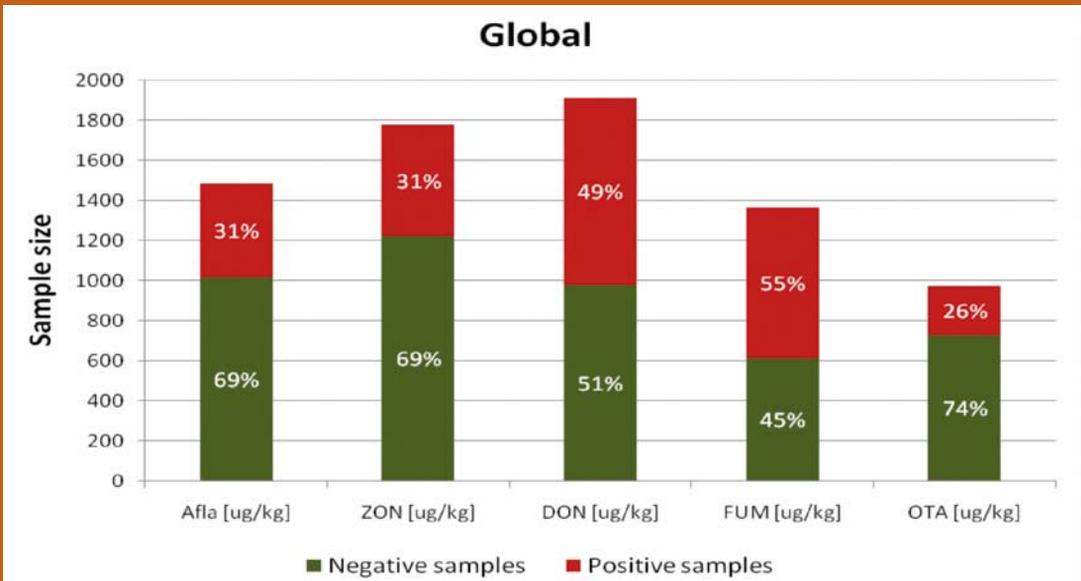


Fig. 2 - Overall survey results (please note that not all samples are analysed for all mycotoxins, therefore the number 2,030 of total samples analysed is not reached in a single bar).

Table 1 - Overall survey results in more detail.

	Afla	ZON	DON	FUM	OTA
Number samples tested	1483	1777	1913	1366	976
Percentage of positive (%)	31	31	49	55	26
Average of positive (ug/kg (ppb))	62	228	791	2171	13
Maximum (ug/kg (ppb))	2454	7422	11836	32510	1582
Commodity found	Finished feed	Maize	Corn Gluten Meal	Corn Gluten Meal	Finished feed
Country of origin	Pakistan	Japan	Malaysia	Malaysia	Pakistan

## OVERALL RESULTS

If analytical results are taken altogether, the following panorama is observed: from the approximately 2030 samples analysed worldwide, 31, 31, 49, 55, and 26% were positive for Afla, ZON, DON, FUM, and OTA, respectively (**fig. 2**). **Table 1** gives more details regarding the exact number of samples analysed for each mycotoxin, the percentage of positive, the average of positive results and maximum levels found for each mycotoxin, and the commodity and country of origin where these levels were observed.

### Results by geographical region

When results are observed from a geographical perspective, much more interesting conclusions can be withdrawn.

**Fig. 4** reflects the percentage of samples which were positive for each analysed mycotoxin, showing that from the approximately 900 samples analysed for the region 30, 48, 46, 46 and 24% were positive for Afla, ZON, DON, FUM, and OTA, respectively. However, when the results for the region are “dismantled” it is clear that in North Asia there is a much higher prevalence of the “field mycotoxins” ZON, DON, and FUM while in the Southern (**fig. 3**). Average of positive results was 78, 268, 834, 1743 and 14 ppb for Afla, ZON, DON, FUM, and OTA, respectively.

In Europe it is clear that the mycotoxin pattern differs substantially from that of Asia (**fig. 5**). The prevalence of the trichothecene DON is higher when in comparison with other mycotoxins: 59% of DON-positive samples against 8, 15, 53, 38, and 2% positive for Afla, ZON, FUM, and OTA, respectively. Average of positive results was 2, 147, 691, 3070, and 4 ppb for Afla, ZON, DON, FUM, and OTA, respectively.

Although aflatoxins are not a major problem in this continent, the “Asian” phenomenon can also be seen in this region: the closer to the Equator, the greater the number of samples contaminated with this family of mycotoxins (**fig. 3**).

From the more than 250 samples analysed from America, 41% were positive for Afla, 12% for ZON, 26% for DON, 86% for FUM, and 22% were positive for OTA (**fig. 6**). Average of positive results was 9, 269, 779, 3971, and 4 ppb for Afla, ZON, DON, FUM, and OTA, respectively. Once again, as to be expected due to the preferred climate for each fungal species, in North America the prevalence of the fusariotoxins ZON, and DON is greater than in South America, where Afla and notably FUM are of major concerns (**fig. 3**).

The Middle East and African regions were included in the survey for the first time this year and revealed some interesting results. The most prevalent mycotoxins in the Middle East region were DON (with 42% of positive samples) and FUM (with 36% of positive samples) (**fig. 7**). 18% of the tested samples were positive for Afla, 16% were positive for ZON, and 67% were positive for OTA (but less samples were tested for this mycotoxin therefore no clear conclusion can be withdrawn from this figure at this point). Average of positive results was 66, 94, 402, 535, and 22 ppb for Afla, ZON, DON, FUM, and OTA, respectively.

For the African continent the prevalence of mycotoxins is greater for FUM (72% positive), followed by DON (69% positive), Afla (48% positive), and ZON (35% positive) (**fig. 8**). 67% of samples were positive for OTA but only 6 samples were analysed, which again does not allow any conclusion to be taken out of that figure. Average of positive results was 88, 70,

*(the text continues at page 104)*

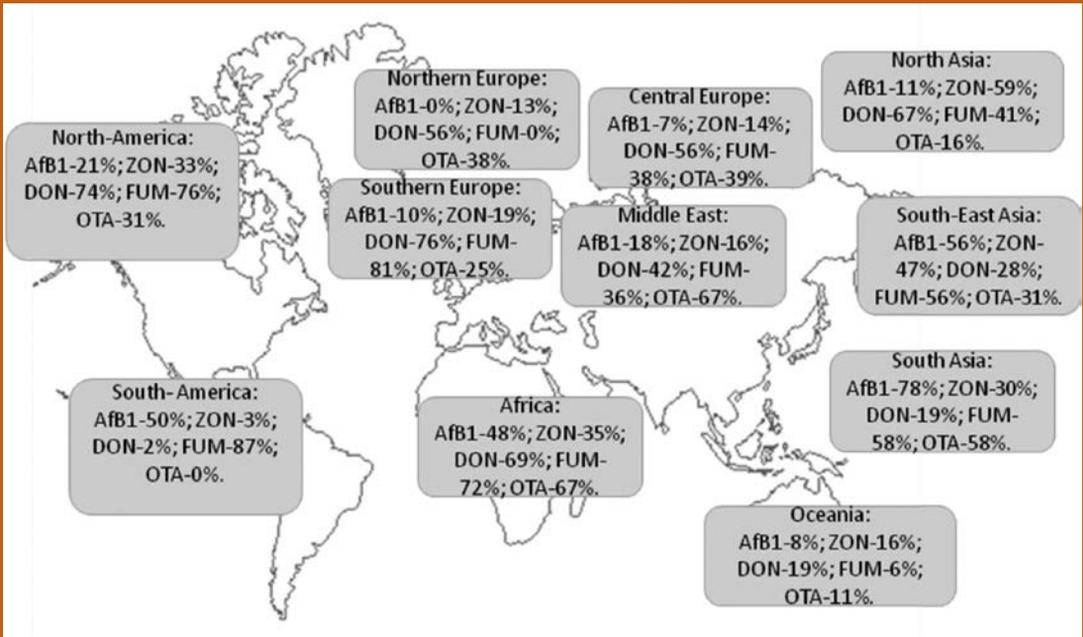


Fig. 3 - Overall results by geographical region.

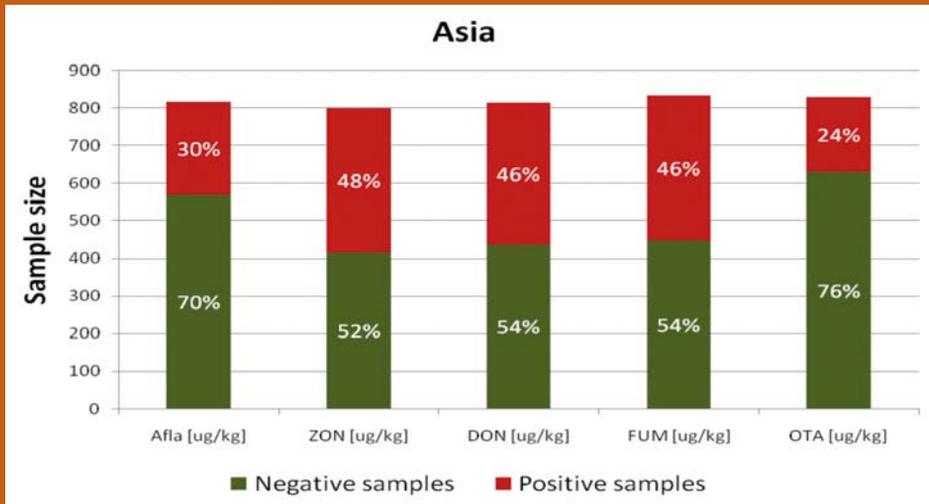


Fig. 4 - Results of the survey by geographical region: results from Asia.

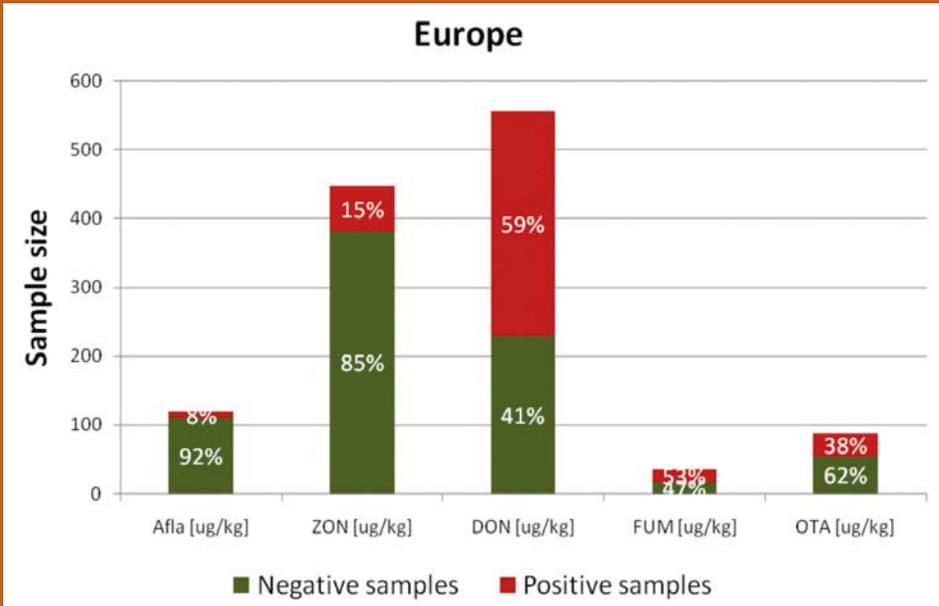


Fig. 5 - Results of the survey by geographical region: results from Europe.

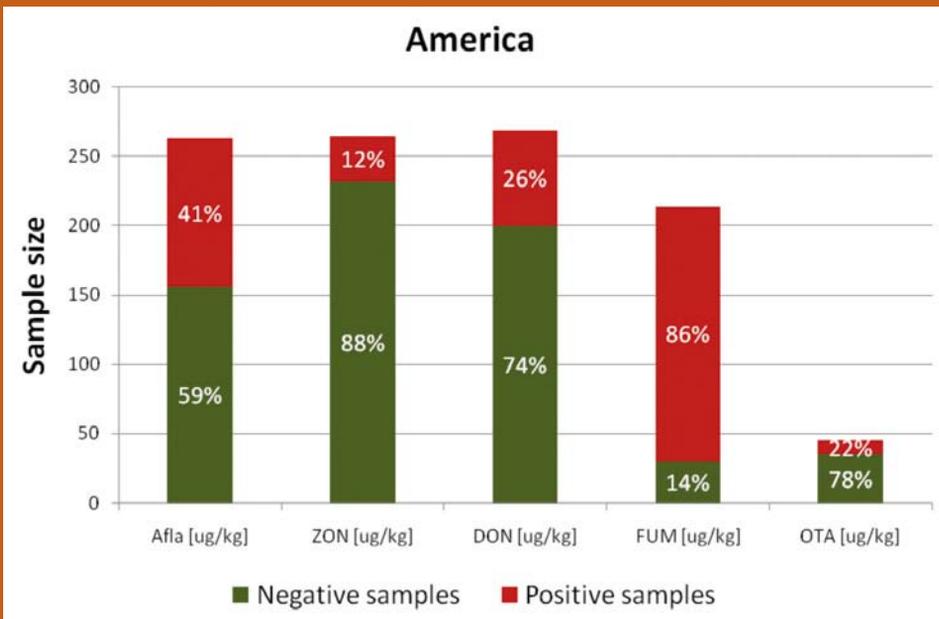


Fig. 6 - Results of the survey by geographical region: results from America.

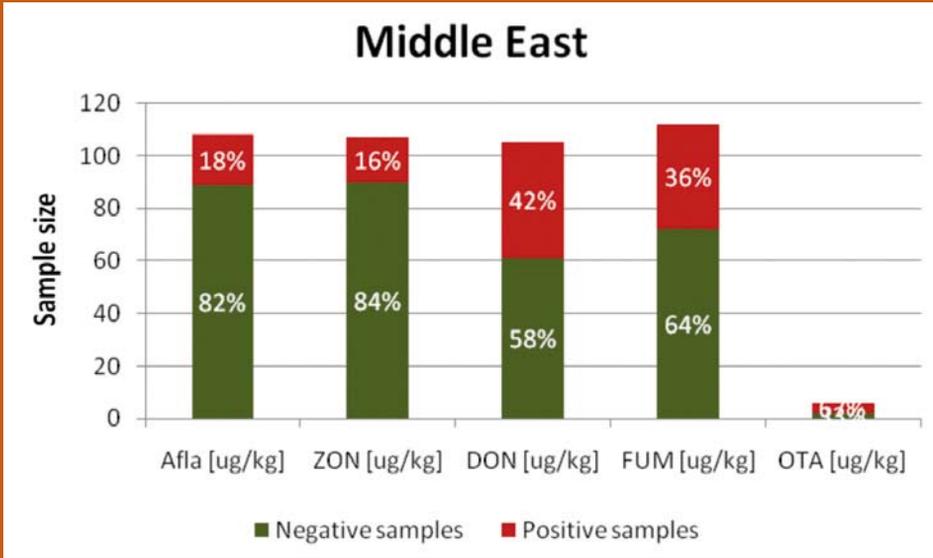


Fig. 7 - Results of the survey by geographical region: results from Middle East.

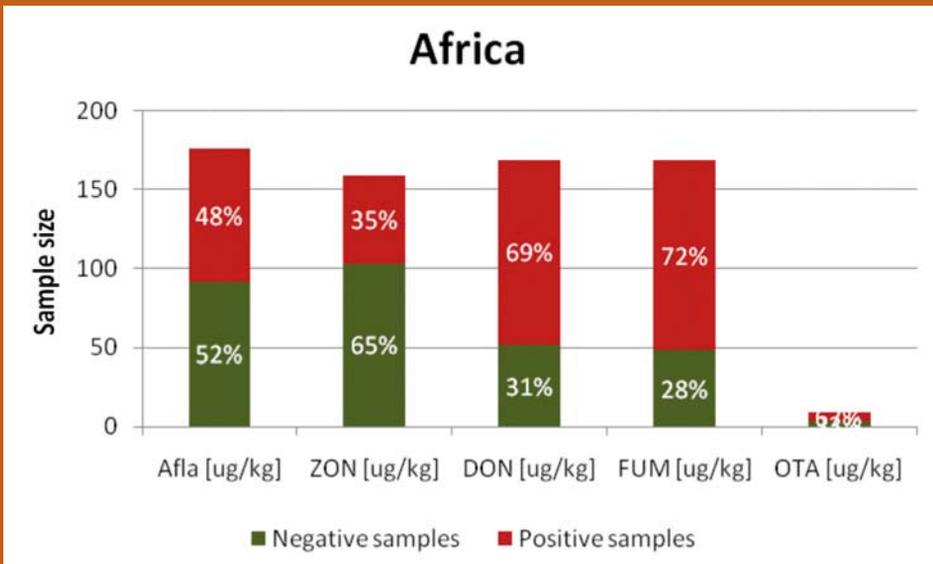


Fig. 8 - Results of the survey by geographical region: results from Africa.

Table 2 - Occurrence of mycotoxins in Italy.

	Afla	ZON	DON	FUM	OTA
Number samples tested	48	54	72	51	27
Percentage of positive (%)	48	35	72	73	22
Average of positive ( $\mu\text{g}/\text{kg}$ (ppb))	7	729	1076	7983	23
Maximum ( $\mu\text{g}/\text{kg}$ (ppb))	66	2939	4827	36390	54
Commodity found	Corn	Corn	Corn	Corn	Finished feed

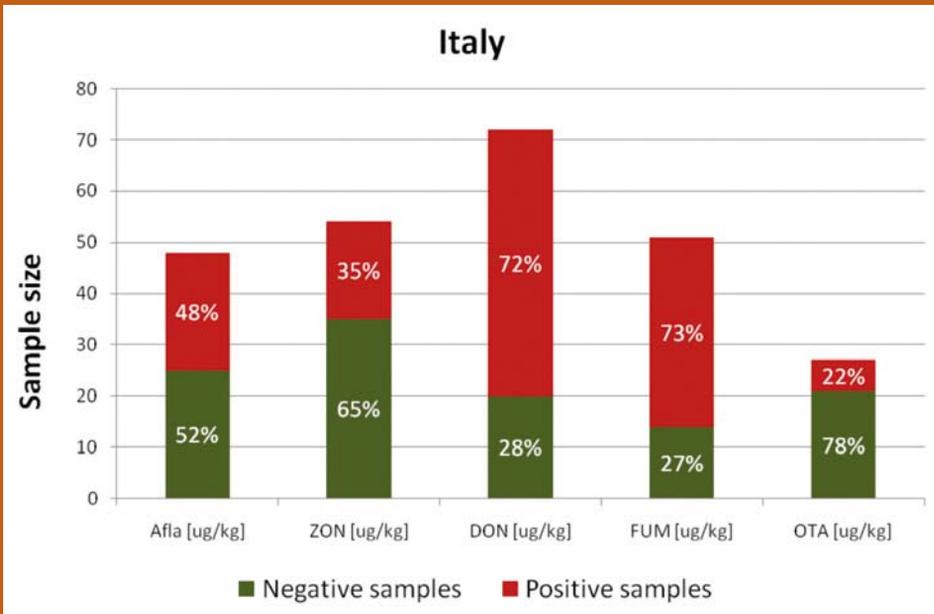


Fig. 9 - Results of the survey from Italy.

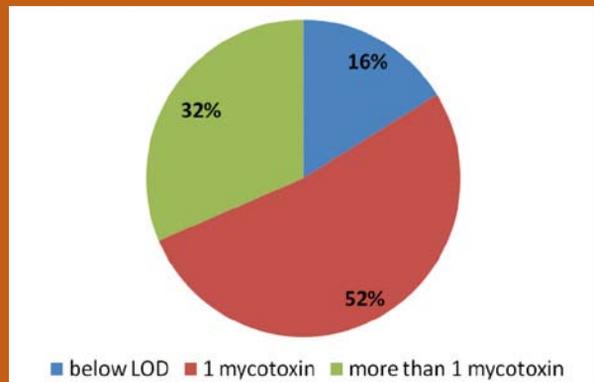


Fig. 10 - Co-occurrence of mycotoxins in Italian samples.

Table 3 - Results of the survey by commodity.

	Afla	ZON	DON	FUM	OTA
<b>Corn</b>					
Number samples tested	372	428	449	357	191
% Positive	44	17	45	89	13
Average of positive (µg/kg (ppb))	71	418	702	3196	4
Maximum (µg/kg (ppb))	1395	7422	5478	23100	17.5
<b>Soybean meal</b>					
Number samples tested	69	71	78	67	42
% Positive	22	13	29	18	17
Average of positive (µg/kg (ppb))	32	79	283	1682	6
Maximum (µg/kg (ppb))	342	398	908	7090	21
<b>Wheat/Bran</b>					
Number samples tested	92	164	191	82	54
% Positive	13	13	57	7	13
Average of positive (µg/kg (ppb))	4	110	814	406	4
Maximum (µg/kg (ppb))	20	465	11022	874	7
<b>Rice/Bran</b>					
Number samples tested	29	29	29	29	29
% Positive	55	69	14	21	48
Average of positive (µg/kg (ppb))	25	77	310	700	5
Maximum (µg/kg (ppb))	113	193	503	2545	20
<b>DDGS</b>					
Number samples tested	46	46	50	29	33
% Positive	26	78	92	90	36
Average of positive (µg/kg (ppb))	10	190	1856	1923	7
Maximum (µg/kg (ppb))	35	2319	10945	8449	20.5
<b>Finished feed</b>					
Number samples tested	491	539	587	462	302
% Positive	40	50	51	73	42
Average of positive (µg/kg (ppb))	46	133	681	1108	17
Maximum (µg/kg (ppb))	2454	1705	7754	22693	1582



Fig. 11 - Mycotoxin contaminations of maize (Source: Chamber of Agriculture, Styria, Austria).



1082, 1207, and 10 ppb for Afla, ZON, DON, FUM, and OTA, respectively.

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## OCCURRENCE OF MYCOTOXINS IN ITALY

105 samples were collected from Italy over a 4.5 year period, from January 2005 until August 2009. Results are shown in **table 2** and **fig. 9**.

Italian samples resulted in being rather frequently contaminated by Afla with 48% of the samples testing positive (23 out of a total of 48) for this mycotoxin. Contamination with toxins produced by *Fusarium* sp. seemed to be of main concern as 72% of the samples tested were positive for B-trichothecenes (52 out of a total of 72), 73% positively for FUM (37 of 51), and 35% positively for ZON (19 of 54). The highest fumonisin level detected was 36390 ppb in a corn sample from north Italy where the average FUM contamination was relatively high (7983 ppb). The number of samples (32%) which tested positive for more than one mycotoxin category was also surprisingly high (**fig. 10**).

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## RESULTS BY COMMODITY

When the results of the survey are analysed from the point of view of commodities, some conclusions can also be taken (**table 3**). Corn

seems to be a “preferred” substrate for the development of fungi and mycotoxin production (**fig. 11**), as the prevalence and concentration of mycotoxins in this commodity is rather high when in comparison with other commodities, such as wheat. Soybean meal for example seems to be a “safer” ingredient, not only in terms of mycotoxin prevalence but also in terms of concentration of mycotoxins found. Unfortunately from a nutritional point of view, these commodities have different roles in an animal diet and therefore cannot be replaced by each other. The mycotoxin contamination of DDGS depends greatly on the quality of the corn used for the production of bio-ethanol; unfortunately while the tendency is still to use the worst quality corn for this end, DDGS mycotoxins load (especially ZON and DON) must still be carefully screened prior to its use in animal diets.

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## CONCLUSIONS

If you were wondering how concerned you should be regarding the mycotoxin-contamination of your commodities, we can give you a hint. Mycotoxins are ubiquitously present at levels which can create serious problems to the animals ingesting them. More detailed information can be requested directly to the Authors or upon registration on our website: [www.biomin.net](http://www.biomin.net).



# PASTA and COUSCOUS: basic foods of MEDITERRANEAN tradition

Key words: durum wheat, pasta, couscous, quality traits

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## ABSTRACT

A brief overview of the main durum wheat final-products, pasta and couscous, is here presented. Data about production and consumption of these two products are reported. The influence of raw material characteristics and processing conditions on quality are also discussed as well as the present research trends.

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## INTRODUCTION

Durum wheat is a crop of primary importance for many Mediterranean countries where its derived products represent staple foods. According to the International Grains Council, the world production of durum wheat was 37.7 million tons in 2008; in particular, Canada and Italy were the main producers in the world. In the same period, at the EU level, durum wheat production reached 9.3 million tons (about 24.7% of world production). Italy by itself produced 4.3 million tons: these figures, together with the French, Spanish, and Greek production, cover about the 96% of the European total.

Durum wheat is mainly used for pasta production in Western Countries (**fig. 1**) but couscous, another important product obtained from this crop, is very popular in the tradition of many countries of the Mediterranean area, together with bread, as pointed out by Guezlane (1994).

A brief overview of the main durum wheat end-products, pasta, and couscous, follows.

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## PASTA

Pasta is a basic product of the Italian tradition. Italy is the first producer in the world (**table 1**) with more than 3 million tons per year (corresponding to about 28% of world production), of which approximately 50% is exported. In Italy, pasta industry is currently represented by about 130 industrial factories (with an average capacity of 1,000 tons per day) and is a key sector of the national economy (Un.i.pi., 2008).

Italy also has the leadership of the pasta consumption (**table 2**) with 27 kg per

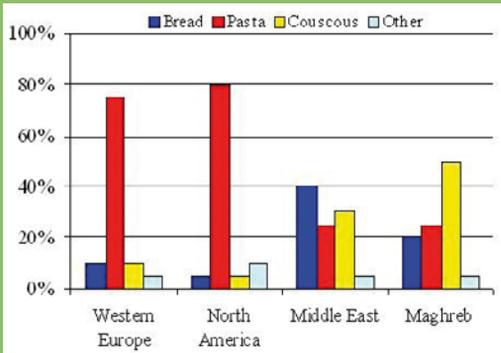


Fig. 1 - Consumption of main durum wheat food-products in the world (adapted from Guezlane, 1994).

Table 2 - Pasta consumption in the world (source: Un.i.p.i. 2008).

Countries	kg/year per capita	Countries	kg/year per capita
Italy	27.0	Canada	6.5
Venezuela	12.9	Turkey	6.0
Tunisia	11.7	Russia	6.0
Greece	10.3	Austria	5.6
Switzerland	9.5	Belgium-Lux.	5.4
USA	9.0	Estonia	5.3
Sweden	9.0	Spain	5.1
Chile	8.1	Slovak Rep.	5.0
Peru	7.5	Bolivia	4.8
France	7.5	Netherlands	4.4
Argentina	7.2	Lithuania	4.4
Hungary	7.0	Letvia	4.1
Germany	7.0	Dominican Rep.	4.0
Portugal	6.7	Australia	4.0
Brazil	6.7	Israel	4.0
Czech Rep.	6.5		

Table 1 - Pasta production in the world (source: Un.i.p.i. 2008).

Countries	tons	Countries	tons
Italy	3,228,000	Portugal	74,000
USA	2,000,000	Hungary	67,000
Brazil	1,500,000	Dominican Rep.	65,000
Russia	858,400	Romania	52,600
Turkey	600,400	Czech Republic	48,755
Egypt	400,000	Switzerland	48,215
Venezuela	350,333	Bolivia	43,000
Germany	297,000	Guatemala	38,000
Argentina	291,300	Austria	37,803
Mexico	285,000	United Kingdom	35,000
France	244,959	Ecuador	32,000
Peru	231,493	Slovak Republic	22,000
Spain	229,000	Sweden	20,200
Canada	170,000	Jordan	20,000
Poland	150,000	Costa Rica	20,000
Greece	150,000	El Salvador	13,000
Japan	144,500	Syria	9,005
Chile	139,410	Lithuania	5,976
Colombia	131,270	Panama	4,364
Tunisia	110,000	Latvia	1,845
India	100,000	Estonia	1,400

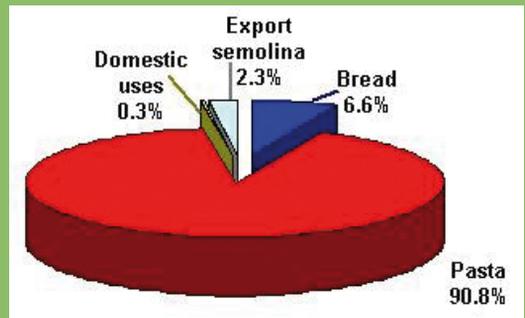


Fig. 2 - Main uses of durum wheat in Italy (source: Italmopa).

Table 3 - Technological requirements of durum wheat for pasta production.

### Physical parameters

- Impurities (foreign materials, other cereals)
- Black specks, bran particles
- Ash content
- Vitreousness
- Test weight, 1,000 seed weight
- Protein content, gluten quality, colour

capita per year; for reasons related to history, culture, and quality, pasta is strictly connected with durum wheat, universally considered the best raw material. Even for specific legal reasons (durum wheat semolina is the only raw material allowed for dry pasta products), the Italian pasta industry has always focused on the quality of durum wheat, knowing that the undisputed success of Italian pasta in the world is strictly related to using raw materials of high quality.

## Quality parameters

In the agro-food domain, quality is a term frequently used, but not easily definable, as it is intended to describe a set of features: sanitary, technological, nutritional, and sensorial.

The sanitary quality in the pasta sector is a pre-requisite that must be guaranteed for consumer's health; the technological quality refers to the fitness of raw materials for a specific industrial process whereas the sensory quality relates to consumer acceptability. Lastly, the nutritional quality is linked to the chemical composition and the presence of specific elements and/or bioactive compounds suitable to satisfy the nutritional needs of consumers and contribute to their welfare and health. These compounds have to be present in the raw material and maintained during the technological process.

### *Technological quality*

The technological quality of raw materials is of particular importance as it determines their industrial use. In Italy, about 90% of durum wheat production is used for the pasta-making process (**fig. 2**), so the quality

of durum wheat is primarily seen in terms of suitability for pasta production.

In **table 3** the kernel parameters influencing the milling process and the quality of semolina and pasta products are summarized. In Italy, a voluntary durum wheat grading system was also defined by National Standard Body (U.N.I. Standard 10709, 1998). This standard is based on physical and technological parameters and fixes the maximum limits for factors suitable to adversely affect grain quality.

Protein content, gluten quality, and colour are the main requirements of raw material in order to obtain pasta of very acceptable quality. Therefore, the characteristics of final products are linked to the properties of raw materials, that reflect in turn the influence of genotype and cultivation environment (Mariani *et al.*, 1995); in fact, the protein quality is highly dependent on the environment (locality, year, etc.), while the gluten quality and colour are mainly affected by genotype.

Besides the raw material parameters, pasta-product quality is influenced by the technological process and, hence, by milling and the

Table 4 - Textural characteristics of cooked pasta.

#### Primary parameters

firmness

consistency

elasticity

stickiness

#### Secondary parameters

chewiness

bulkiness

pasta-making process. Many improvements have been introduced in pasta processing and significant success was achieved in '70s by introducing high temperatures (HT) in the pasta drying phase. HT drying cycles have become universally accepted in pasta processing; HT conditions yield firmer, less sticky pasta than traditional low temperature (LT) drying cycles (Dexter *et al.*, 1981 and 1983; D'Egidio and Nardi, 1991).

Raw material quality, particularly protein content and gluten quality, plays a different role when using HT or LT technology (D'Egidio *et al.*, 1990). These authors emphasized that the two parameters play an almost equivalent statistical role in the case of LT drying-cycles, whereas the protein content becomes prevalent compared to the gluten quality if HT drying-cycles are used. Therefore, the choice of suitable raw materials should take into account the technological conditions adopted during each phase of the process. Moreover, other parameters of semolina (as starch damage and  $\alpha$ -amylase activity) are determinant for controlling the extent of the heat-damage induced by drying (Resmini *et al.*, 1996).

#### *Hygienic and sanitary quality*

At present, hygienic and sanitary quality is receiving much attention, thus benefitting consumer safety. Fusarium head blight is a fungal disease of small-grain cereals with a strong impact on food safety because of the presence of trichothecene mycotoxins in infected kernels. The most prevalent trichothecene in *Fusarium*-infected wheat is deoxynivalenol (DON). Trichothecenes are thermally stable, but, during milling, they distribute among the mill fractions in various proportions. Nowicki *et al.* (1988) found that retention of DON in semolina

obtained from severely infected durum wheat was about 80% lower than the concentration in clean wheat; DON concentration was further reduced to 50% during pasta cooking, due to leaching into the cooking water. Visconti *et al.* (2004) reported that DON retention (on a dirty wheat basis) for durum wheat artificially inoculated with *F. graminearum* and *F. culmorum* averaged 77% in cleaned wheat, 37% in semolina, 33% in spaghetti and 20% in cooked spaghetti. The debranning process of durum wheat before milling (Dexter and Wood, 1996; Bottega *et al.*, 2009) might allow a significant reduction of DON concentration in durum wheat kernels, being the mycotoxins accumulated mainly on the kernel external layers.

The environmental conditions (temperature, rainfall, etc.) during the grain filling period are among the factors responsible for mycotoxin contamination. In Italy, the agroclimatic characteristics of areas traditionally dedicated to durum wheat cultivation, such as the Southern regions, are generally characterized by drought and low levels of rainfall, conditions which are naturally conducive to yielding safe crops. Particular attention to fungal contamination in the early phases of grain filling and the choice of specific and cautious agro-technical practices could help to contain fungal diffusion and mycotoxin contamination.

#### *Sensorial quality*

The sensorial quality is the aspect closest to consumer concerns. It is strongly linked to eating habits and traditions. For the Italian consumers, pasta quality is based on cooking performance and resistance that are mainly represented by textural characteristics (**table 4**), generally evaluated according to sticki-

ness, firmness, and bulkiness (D'Egidio and Nardi, 1996).

#### *Nutritional quality*

The nutritional quality of pasta is strictly related to the composition of the raw material as pasta formulation is merely constituted by semolina and water. Durum wheat, like all cereals, is rich in starch, has a moderate protein content and low fat level; its mineral and fibre content is related to milling process conditions. From a nutritional point of view, pasta can be assessed as a very natural food, conforming to present dietary/nutritional guidelines, which suggest the daily consumption of foods containing high percentages (at least a share of 45% carbohydrates) of slowly digestible carbohydrates, such as starch.

In addition, different bioactive compounds can be found in durum wheat grains. Among those molecules, two main classes have received much attention: fibre and antioxidants. As for fibre, besides the natural amounts of FOS, arabinoxylans, resistant starch and  $\beta$ -glucans present in durum wheat kernels, it is more and more frequent to find works about the possibility to increase their level by adding other cereal meals (e.g., from barley or oat, sources richer in  $\beta$ -glucans). A similar approach can be adopted for antioxidant compounds: durum wheat is naturally rich in phenolic compounds (phenolic acids, alchilresorcinol, etc.), carotenoids, vitamins but their amount is drastically reduced after milling. Therefore, it is important to maintain their native level by adopting specific technological conditions or adding other cereals. Other classes of compounds, such as lignans characterised by estrogenic activity, are also considered of interest (Durazzo *et al.*, 2009).

## COUSCOUS

Couscous, one the most famous Arabian dishes, is the food-staple made from durum wheat, which is second only to pasta in world popularity and consumption. It's mainly produced in North Africa. According to Habib Burguiba, ex-leader of Tunisia, the border of Maghreb, the oriental region of North Africa, is marked by an "imaginary line", corresponding not to a geographic but to a cultural boundary: east of that line the staple-food is rice; west, the staple-food is couscous ([www.saudiaramcoworld.com](http://www.saudiaramcoworld.com)).

In North Africa couscous plays the role that semolina pasta has in Italy. Algeria is the leader of couscous production (about 1 million tons/year), above all consisting of home-made or artisanal production; in this Country couscous consumption reaches 50 kg per capita/year, while in Tunisia it is about 20 kg per capita/year. Even if the figures are much lower, couscous is becoming more and more present in some European Countries, particularly in the Mediterranean area: this trend is surely related to the growing interest towards the so-called "ethnic foods" and the increase in the population of Arabian-origin people living in Europe.

Although durum wheat semolina is considered the best raw material for couscous preparation, other cereals, such as sorghum, millet, maize or fonio are used, especially in West and sub-Saharan Africa (Galiba *et al.*, 1987; Aboubacar and Hamaker, 1999).

Couscous is traditionally prepared by a lengthy, hand mixing of semolina and salted water in a large wooden dish (**fig. 3**) until granule formation is attained. The agglomerates are firstly sieved to obtain a uniform size (generally three types are produced:

coarse, medium, and fine size), eventually steamed, then sun-dried and stored, as summarized in the flow-sheet of **fig. 4**. The drying step is strictly related to the climatic conditions that account for the production of home-made couscous during the sunny summer months (Kaup and Walker, 1986). The final cooking of this product is carried out by steaming the couscous agglomerates inside a particular device, the *couscoussière*, formed by two superimposed pots (**fig. 5**): the granules, placed on the perforated bottom of the top pot, are steamed for 30-40 minutes at least. The main disadvantages of the home-made product consist of not only its long final cooking procedure but also the development of rancidity during storage (Pagani *et al.*, 2009).

The industrial production of couscous started in '70s (Debbouz and Donnelly, 1996). The main steps of the current process, summarized in **fig. 6** and carried out in fully automated lines assuring a production up to 2,000-3,000 kg/hour (**fig. 7**), are the same as the artisan ones. After the mixing of semolina and water, the formation of aggregates is completed in special rotary sieves (*rouleur*) which, at the same time, allow the granules to be separated according to size and remove the non-hydrated semolina fraction. The couscous granules are then placed on a belt and cooked by steaming. This operation plays an important role in determining couscous quality. In fact, the effects on physical properties and cooking characteristics are strictly related to the steam temperature, the treatment time and the diffusion of steam inside the mass: in this regard, some lines use steam injectors to spray steam over and under the product, assuring a more homogeneous cooking of the product layer ([www.fava.it](http://www.fava.it)). In any case,

the pre-cooking assures a dramatic reduction in cooking time (only a few minutes). Drying (generally performed in dryers for short pasta), cooling, and final sieving complete the steps of this industrial process (Quaglia, 1988).

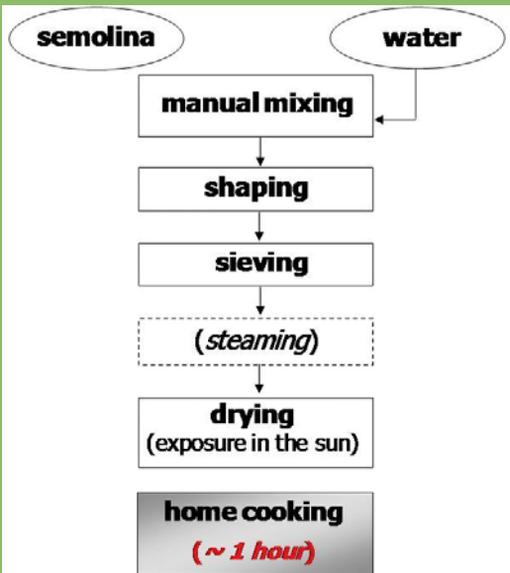
As quoted above, the product is typically sold in three different sizes: small couscous, recommended for cake preparation, principally formed by aggregates with diameters lower than 1.5 mm; medium couscous, 1.7-2 mm diameter, the most appreciated for traditional dishes; coarse couscous, with particle size up to 2.5 mm (Kaup and Walker, 1986). In any case, the native semolina particles are easily recognizable in the agglomerates (**fig. 8**).

### Quality parameters

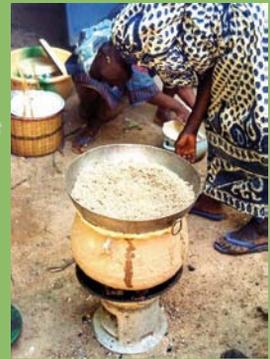
Although the consumption of couscous is increasing, few studies to date have investigated the role of raw materials and process parameters on its quality. Moreover, the definition of quality parameters is still not clear. Uniform size, pleasant colour and no unusual flavour can be used to describe the quality of the dry aggregates (Debbouz *et al.*, 1994; Debbouz and Donnelly, 1996; Ounane *et al.*, 2006). The cooking behaviour considers rehydration and cooking times, sauce absorption capacity (Debbouz and Donnelly, 1996; Ounane *et al.*, 2006) without aggregation of granules (Guezlane and Abecassis, 1991) and sensory indices related to texture, as stickiness and mouth-feel (firmness and smoothness) (Debbouz *et al.*, 1994; Kaup and Walker, 1986). Few studies suggest to complete and/or replace the sensory judgement with an instrumental approach (Guezlane and Abecassis, 1991; Yettou *et al.*, 1997).



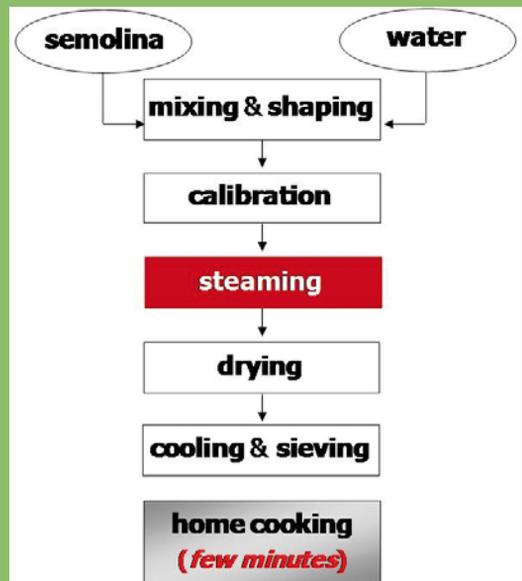
**Fig. 3** - Home-made production of cous-cous.



**Fig. 4** - Flow-sheet of artisan production of couscous.



**Fig. 5** - Example of typical pot for couscous cooking (left) and home cooking of couscous (right).



**Fig. 6** - Flow-sheet of industrial production of couscous.

### Influence of raw materials and process conditions on couscous characteristics

Home-made couscous is generally prepared by coarse semolina: this preference could be due to the higher product yield observed when this type of semolina is used, despite its lower water absorption during mixing (Debbouz *et al.*, 1994). The role of protein quantity in determining couscous quality is controversial: some authors referred to a decrease in stickiness as protein content increased (Debbouz *et al.*, 1994) while others showed no significant relationship between couscous characteristics and semolina protein or gluten quantity and quality (Ounane *et al.*, 2006).

The starch damage of semolina can play a role in controlling the water absorption index, both in cold and hot water (Debbouz *et al.*, 1994; Pagani *et al.*, 2009).

A recent work (Ounane *et al.*, 2006) established the importance of lipid fraction on couscous characteristics. In particular, polar free lipid content of semolina was positively related to product firmness, while free lipid and non-polar lipid content were negatively related to aggregate swelling. The lipid fraction can play another important role during couscous storage. In fact, phenomena of rancidity with the appearance of off-flavours can frequently be detected (Pagani *et al.*, 2009). This negative trait can be greatly reduced using a high temperature drying cycle (HT: 90°C for 1 hour) (**fig. 9**). This important result for the shelf-life of the product was in part related to the higher aggregate density and to a more effective lipase inactivation assured by HT cycles.

Other researchers (Debbouz and Donnelly, 1996) showed that the extrusion conditions (single or twin screw extruder) are also de-

terminant for physical and cooking properties: the high-temperature short-time twin screw extruders assured an intense yellow colour and a high degree of starch gelatinization, a modification responsible for higher water absorption, shorter cooking times, better appearance and sensory evaluation. These results indicate that starch fraction has a determinant role in the properties of the product but many aspects have to be better clarified.

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### CONCLUSIONS

In conclusion, pasta and couscous are two staple, traditional foods of the Mediterranean regions with simple raw materials and recipes (semolina and water are the only raw materials), inexpensive processing and preparation, long shelf-life, and versatility of preparation. Moreover, the interest in pasta and couscous is well suited to contemporary lifestyles where consumers appreciate foods characterized by their functional properties, low amounts of fat and low glycemic index. In fact both foods fully satisfy the requirements of well-being and health, nature and tradition, taste and pleasure.

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Fig. 7 - Pilot plant for production of couscous (courtesy of Fava SpA, Ferrara, Italy).

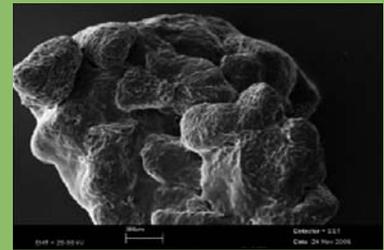


Fig. 8 - Couscous agglomerate (from Pagani *et al.*, 2009).

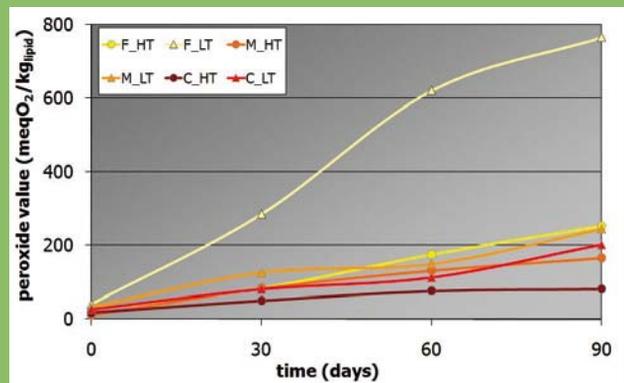


Fig. 9 - Peroxide variation of couscous during 3 months storage (from Pagani *et al.*, 2009).

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## CHIRIOTTI EDITORI

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**FOR MILLERS, PASTA PRODUCERS AND FEED SUPPLIERS**

**"TECNICA MOLITORIA"** enjoys world-wide prestige as the most complete journal dealing with all branches of pasta making, wheat milling, feed mills, silos and cereal chemistry. It is a monthly magazine in Italian language that first appeared in 1950, and now runs about 200 pages per issue. Technical and scientific articles by Italian and foreign experts, translations, descriptions of machinery, economical and legislative news and current activities are reported.

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# Silos

## Tubular and grid MAGNETIC FILTERS for cereal industries

The food purification is essential in animal and human foodstuffs industry, therefore more and more equipment have been developed in accordance with the needs of production and its results. Gauss Magneti company produces magnetic filters made by permanent magnets or electromagnets, which are suitable for this purpose.

The grains harvested and stored in silos can contain nails, nuts, iron threads, bolts and other ferrous intrusion which are harmful for men and animals that eat them or for the machines which process them. Anyhow all substances must be purified.

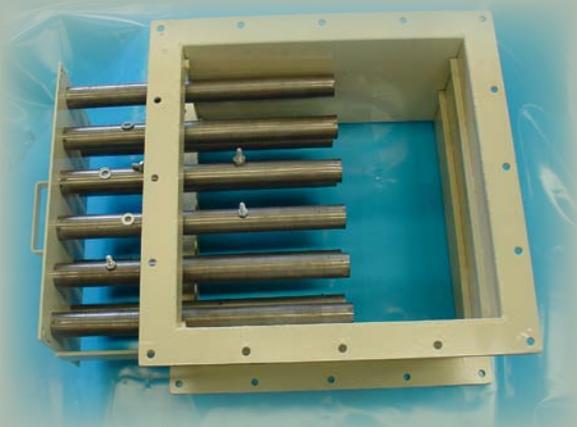
Magnetic filters are generally installed along the plant feeding pipes, vertically in-

serted along the fall of granular or powder material.

According to the needs Gauss Magneti can offer both tubular magnetic filters and grid magnetic filters.

Grids are made of a flanged stainless-steel box, in order to fit in existing pipelines, and a drawer to which some magnetic columns are screwed, according to the quantity of material to filter. The grids are made of different magnetic materials such as Ferrite or NdFeBo. Differently from tubular magnetic filters, grid magnetic filters have a lower height and are more suitable to be inserted in a plant already in use, without making substantial modifications.

Tubular magnetic filters (Gauss Magneti).



Grid magnetic filter (Gauss Magneti).



Wish you could reduce temper time and cut silo space ?



Increase profit.  
Cut energy.  
Reduce bacteria.

- low energy: 0.2 kW/t/h
- short temper time: 3-10h
- minimal wear and tear
- yield increase
- clean design

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Cereal Damping System

**vibronet**  
made in germany

vibronet Gräf GmbH & Co.KG Germany  
Tel. +49(0)6441-62031  
info@vibronet.com  
www.vibronet.com

The tubular magnetic filters are essentially made by a stainless-steel flanged tubular casing, which is inserted in the pipeline constituting a part of it. Such casing has a tight door on which the magnetic core is fixed and above it a cone is mounted in order to distribute the flux on the magnetic poles. The cone vertex is directed opposite to the material flow.

The core magnetic field can be generated both by permanent magnets or by electromagnets according to the desired field depth or to the position of the filter installation. In case of easy approach, the cleaning can be made manually by an operator by simply closing the flux of material in that pipe section, opening the door and collecting the impurities kept in the core. If the cleaning operation is difficult or must be done very frequently, an electromagnetic filter with automatic cleaning system can be installed: after

deviating the material from filter, one simply has to switch off the magnetic circuit supply and open the side discharge in which the impurities coming from the core will fall.

However the permanent magnets are highly suggested as they don't have power consumption and are theoretically endless. Moreover in case of a reduced impurity density in the material, the standstill time due to manual maintenance doesn't justify the cost for an automatic system.

Permanent Neodymium magnets are more and more used, as they have very high magnetic inductions over 10,000 Gauss (1 Tesla). The value of the magnetic field and its magnetic gradient is very high, that means a high extraction strength from impurity that guarantees its effectiveness.

(Gauss Magneti - Via Scaroni 27 - 25131 Brescia - Italy - Fax +39 030 3580846 - [www.gaussmagneti.it](http://www.gaussmagneti.it))

## CLEANERS and DRIERS for cereals

Zanin F.lli offers different models of driers and cleaners for every requirements and it continually searches for new solutions and high-quality products. This year, it presents the following machines.

Sieve separator cleaner mod. PSS function is to separate the thin bodies from the great ones present in the good product distributed on all sieve length. The product enters for gravity uniformly distributed and a transversal air flow removes the light parts both in entrance and in exit of the cleaner.

The drum cleaner PRA with suction removes in entrance the light parts and separates with the rotating drum the good product from the different typologies of impurities. The grids choice is in function of the product and of the type of granulometry to separate.

The function of the new combined cleaner Combi is to remove in short time the thin and great impurities present in the cereal and can be installed fixed or mobile. It is used before to store the product or for the shipping. The product enters

Sieve separator cleaner  
mod. PSS  
(Zanin F.lli).



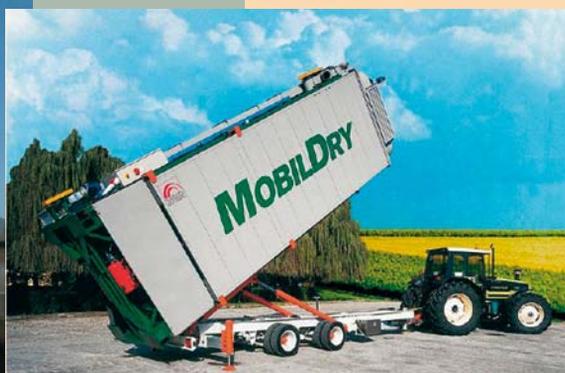
Drum cleaner PRA  
(Zanin F.lli).



Combined  
cleaner  
Combi  
(Zanin F.lli).



Energetic saving drier ERCL (Zanin F.lli).



Drier MobilDry (Zanin F.lli).

for gravity in a cylinder rotating drum with variable inclination, with interchangeable drilled grids. The good product passes through the predetermined holes and the great impurities exit at the end of the drum (the grid choice is performed in function of the products size). The product descent for gravity regulated from a weight distributor, is uniformly distributed on all width; successively with a veil descent is invested from a transversal air flow that removes the lightest parts (settled from a cyclone or filter) leaving more heavy parts in the settling hopper with free discharging or optional Archimedean screw.

The research of the energetic saving is for Zanin F.lli basic in the product design. An example is the energetic saving drier ERCL, which basic characteristics are: reduced fuel and electric energy consumption; reduced crack formation in the dried product; higher proteinous value and specific weight of dried prod-

ucts; besides the cereals remain healthy and are excellently stored in the warehouse.

MobilDry Drier is Zanin innovation in the mobile drying sector. Contrary to all mobile driers, this one adopts a roll on-off system that allows, through a piston system, to put in vertical the drying column. But the main idea is given from the hot air mobile mantles and from the saturated air, which allows to produce a hot air homogenization in entrance and an air low speed in exit, such obtaining an homogenization of the dried product.

Zanin F.lli designs and produces machines and plants in the production head office in Casale sul Sile, province of Treviso. The company mission is to maintain constant the advanced technological solutions research and the service to the customer.

(Zanin F.lli - Viale delle Industrie 1 - 31032 Casale sul Sile - TV - Italy - Fax +39 0422 785805 - [www.zanin-italia.com](http://www.zanin-italia.com))

## DRIER-COOLER with energy saving system

The Green Drier-Cooler Energy Saving system devised and patented (European patent n. 08154223.5) by Lamec complies with Directive 96/61/EC related to the prevention and reduction of pollution and energy consumptions.

This system is designed for drying and cooling with the advantage of reducing maintenance costs thanks to the fact that it does not have any motorised components: it is just fitted with solenoid valves.

The vacuum pump just requires routine maintenance. The machine is entirely manufactured in stainless steel.

The operating principle of the drier-cooler type G-DC-ES is as follows. The aggregate passes through an inlet feeding system, equipped with sealed gates that supply the drying tank, where all the gas in the aggregate is removed by the suction pump that draws the vapour through the condensers; the water is drained into the container.

The aggregate - freed from the vapour and gas and taken to the suitable storage temperature and humidity level - flows through an outlet discharge system, equipped with sealed gates, to be subsequently conveyed through to the following processes.

Evaporation is performed exclusively by vacuum without using air, therefore there are no related emissions in the atmosphere.



The G-DC-ES drier-cooler (Lamec).

The Green Drier-Cooler Energy Saving system can be supplied in two sizes, referred to a maximum production capacity of 10 and 20 ton/hour; the overall dimensions of the system range from 6 m in height x 4/5 m of floor area.

The cutting edge drying system with forced suction does not represent a development of the conventional drying and cooling systems, which exploit ambient air as the carrier, but is a technical revolution of the drying concept that fully meets all the requirements of customers and those required by regulations in terms of environmental safeguard.

The advantages offered by this innovative drying system may be summarised as follows:

- reduction in running and maintenance costs, elimination of the emissions in the air, reduction of environmental impact inside and outside the production factory;

- drying treatment of the aggregate with a set and constant humidity content, because it does not depend on the characteristics of the ambient air - which changes throughout the seasons - used in conventional drying and cooling systems;

- reduction in energy consumptions and management and maintenance costs, because the system does not have any motorised components, with the exception of the vacuum pump, which means further reductions in noise and consequent improvement in environmental impact;

- long life of the system, which is entirely made of stainless steel type Aisi 304.

(Lamec - Via Isonzo 6/a - 35013 Cittadella - PD - Italy - Fax +39 049 9400872 - [www.lamec-srl.it](http://www.lamec-srl.it))



# Cereal Milling

## CEREAL MILLING and TOASTING PLANT for small output

Established in 1973, the Mario Villani company specializes in the production of small- and large-sized stone mills as well as small-sized plants for cereals and other product processing. The production is entirely based on machines and equipments designed in-house; their utilization covers various production fields in agriculture and in foodstuffs.

The Villani Mario company has planned a small-sized discontinuous plant, to toast several types of cereals, such as barley, wheat, rice, spelt, maize, soya beans, chick-peas, chickling, broad beans, cocoa-beans, coffee beans, dried fruits and vegetables, and so on.

This plant, starting from an ambient temperature, can reach up to 230°C and is provided with drills for the control on the product and the heating liquid. A stainless steel (Aisi 304 or 316), a chamber, a double-chamber tank and the stone mill are part of this plant.

The tank is supplied with an agitator-mixer and is actioned by a speed variator gear with timer, suitable to the different processing cycles of the products. The drying of the product allows to reduce the aflatoxins.

Thanks to this small-sized plant it is possible to obtain excellent bases to produce integrators for human nutrition as well as for animal feed.

# Mulmix

UNCONTAINABLE PASSION

## A 5-star service



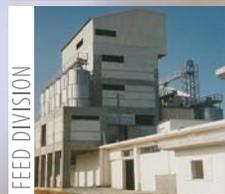
For over 40 years many have relied upon us knowing that MULMIX is synonymous with experience and proficiency in the field of cereal storage, feed mills and seed selection.

Our engineering is at your constant service with ideas and customized solutions.

Reliability, security and service are the guarantee of our plants, with results that repay your investment.

### [www.mulmix.it](http://www.mulmix.it)

Higher level plants.



# Cereal Milling

The plant is composed of two silos and the double-chamber tank with electrical or propane gas and other heating systems. The stone mill can be small-sized (type M3 and M5) or large-sized (type 600 and 800).

These machines are easily adaptable to the most dissimilar working conditions, with a simple running and easy maintenance. The motive power can be electrical, diesel, gasoline, water, aeolian, animal traction. Such plants find a large use in cereal transformation companies, cooperatives for cattle breeding, farms for holidays, farms, meat processing companies for milling spices, fishing companies for milling clamshells.

The technology adopted in their construction has been based on the purpose and principles of the millennial stone milling of grain cereals to preserve the precious mineral salts of products as well as their vitamins, active elements and germ.

Depending on the type of the product processing required, it is possible to add or remove some components of the plant.

The company technicians are at customers' disposal for preliminary studies according to end-users demand and needs, in order to manufacture functional equipments to guarantee an optimal finished product.

(Villani Mario - Via 8 Marzo 12 - 43044 Collecchio - PR - Italy - Fax +39 0521 802193 - [www.villanimario.it](http://www.villanimario.it))

## TURN-KEY complete MILLING PLANTS

Omas is an Italian young and dynamic company who has recently imposed itself by the realisation of turn-key complete milling plants.

The mechanics and automation of the production line are the cutting edges of the company, that entirely produces the machines in its three buildings located in the Padouan territory. All is designed and managed directly inside the company: machines projection, engineering, production, assembly, start-up, and after sales services. A sound commercial proposal for a high technological and appreciated combination, that drove the com-

pany towards a wide expansion during the last five years.

Today Omas is ready to face all the competitive challenges for the next ten years and is sure to offer avant-garde machines and reliable productive on time installations.

The electronic roller mill mod. EVA-8 is an automatic machine with 8 horizontal grinding rolls. This machine is composed primarily of: an electro-welded differentiated steel and cast-iron structure; eight balanced cylinders in cast-iron with 500 HB hardness; supports with a double row of barrel roller bearings; an automatic

# Cereal Milling



Stone mill plant  
(Villani Mario).



Small-sized plant for  
cereal toasting  
(Villani Mario).

# Cereal Milling

pneumatic control system for grinding rolls engaging/disengaging; a feed inlet with infrared ray proof-sticks connected to the variable speed feed rolls; differentiated drive transmission to the grind rolls using special rims rubber belt; grinding roll cleaning units with brushes or scrapers with automatic stopping.

The plansifter mod. PL, with ample sieve surfaces, is used for the sifting of ground products and is composed of: a central support frame in electro-welded metal plate suspended with a bundle of flexible sticks;

a drive shaft with adjustable eccentric counter-weights; two symmetrical sieve boxes bearing 4-6-8-10 channels screwed into a central frame; troughs equipped with 28-30 sifters; gasket-holder frames built in seasoned wood and internally/externally coated with plastic material; normal and giant standardised square sieve frames; bolting cloth cleaning ensured by free elements.

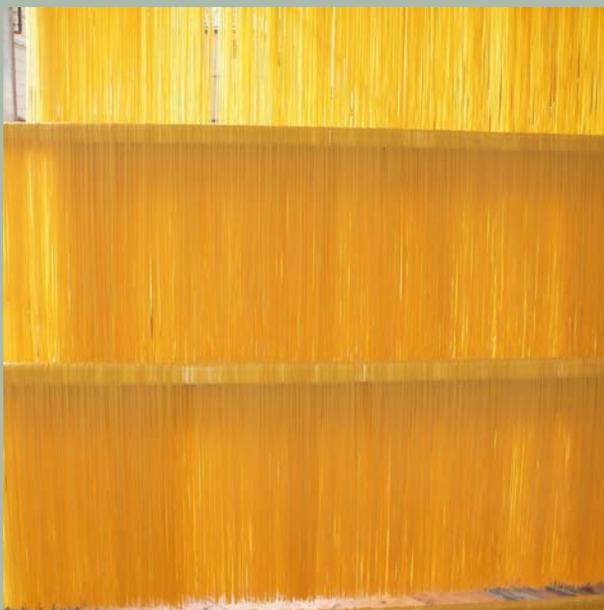
(Omas - Via Vicinale G. Momi 2/A - 35010 S. Giorgio delle Pertiche - PD - Italy - Fax +39 049 5742610 - [www.omas-srl.com](http://www.omas-srl.com))



The electronic roller mill mod. EVA-8 (Omas).



The plansifter mod. PL (Omas).



## Dry Pasta Production

### PASTA and SNACK equipment and plants

Isolteck Cusinato, an Italian company located in the town of Riese Pio X in the Veneto region, was founded in 1968 and since then it has consolidated a leading position worldwide in the pasta and pellet snacks food industry, supplying equipment and complete plants as well as dryers insulation panels and spare parts. The advanced technology and the continuous research of innovation and specialization has permitted the company, with over 40 years of activity, to launch on the industrial market of food equipment competitive products which are appraised by the manufacturers of plants and by the customers. Isolteck Cusinato offers and guarantees to

the customers a high-quality and reliable technical service and assistance: refurbishes and updates old pasta and pellet snacks production lines of any brand, besides supplying spare parts and new components for the production lines. The company has an engineering group that continuously cooperates collaborates with the R&D department and is therefore able to resolve any technical and/or technological problem of the client's production lines. The company is specialized in supplying insulation panels in stainless steel or fibreglass for pre-dryers and dryers of any model or brand. The machine workshop is able to supply compression screws and barrels for pasta

# Dry Pasta Production

production lines and other food related lines respecting the technical specifications of the customer or proposing alternative solutions and materials. Furthermore they can be supplied: complete groups of flour and liquid dosing systems, high efficiency pre-mixers that can be installed on any existing press or extruder, mixers able to work either in normal ambient, with steam injection or under total vacuum. Isolteck Cusinato puts high efficiency and duration in time as a guarantee of the high quality of its products through continu-

ous research and experimentation of new materials and new technologies, always keeping in mind the maximum respect for the environment.

Last but not least, Isolteck Cusinato has recently tested and optimized a new technology line for the production of alternative gluten-free pasta (i.e. rice pasta, maize pasta, etc.) without utilizing any type of additives or precooked flours.

(Isolteck Cusinato - Via del Lavoro 3 - 31039 Riese Pio X - TV - Italy - Fax +39 0423 754433 - [www.isolteck.com](http://www.isolteck.com))

## PASTA PLANTS for short-cut, long, nest, and special shapes

In the two-year period 2009-2010 Tecalit confirms its last years growing trend with a further increase of the turnover and an enlargement of its presence in new world areas.

The competence and the seriousness of the Guidolin family combined with the passion for the pasta and a reliable and competent technical staff have permitted Tecalit to earn the confidence of the pasta producers.

A very important result for Tecalit is the loyalty of its own customers, which, fully satisfied by the quality of the machinery and of the service, decide to back and buy again from this Italian company of Padova.

In Romania Tecalit has contributed to create an Industrial Pole specialized in the production of gluten-free foods based on corn, with a new pasta plant with capacity up to 90 ton/day. The technological devel-

opment of the machinery for the production of corn pasta has permitted to reach high reliability also for lines with high capacity of production.

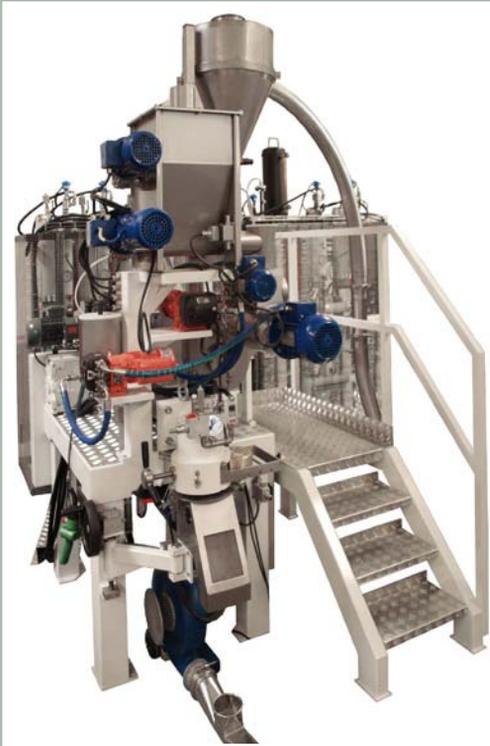
In Russia Tecalit is working for the manufacturing and the installation of 4 new important plants with lines for short-cut and long pasta.

In North and South America Tecalit customers have received important awards, thus confirming the partnership with the Italian manufacturer and backing to buy again the new machinery to satisfy the increase of the market demand.

Tecalit is a manufacturer of pasta plants for short-cut pasta, long pasta, nest pasta and special shape pasta and it stands for a 360° service alongside the customer with specialized technicians able to grant a precise and competent assistance.

Tecalit speciality is the realisation of new turn-key pasta plants taking care of the

# Dry Pasta Production



Extruder mod. ECI  
(Isolteck Cusinato).



Long pasta  
line PDT-HT  
"Progressive  
Drying  
Technology"  
(Tecalit).

# Dry Pasta Production

project from the feasibility study to the assembly, the start-up and the after sale service.

The company has recently realised also important works for the accessories to the pasta plant, such as thermal power plants, system to render potable the water, big

short-cut pasta storage and system to store clean and transport semolina and flour.

Finally Tecalit is able to give assistance and spare parts for any kind of pasta line.

(Tecalit - Via Leonardo da Vinci 34 bis - 35018 S. Martino di Lupari - PD- Italy - Fax +39 049 5953771- [www.tecalit.it](http://www.tecalit.it))

## Installed the largest SHORT-CUT PASTA STORAGE plant in the world

Cusinato is in great shape. Unlike some other companies that have experienced a difficult period over the last two years, in 2008 – at the beginning of the world market crisis – Cusinato was working to create new offices and enlarge the production area, continuing to believe in the future and making investments, creating a name for themselves at an international level.

In fact, 2009 was one of the most satisfying years of the last five-year period for Cusinato, with an annual sales increase of 40% in the pasta manufacturing industry. Much of this success comes from customers that Cusinato have cared for and collaborated with for some years and to whom the quality and reliability of the company is well known.

In fact, these clients have chosen Cusinato for the enlargement or the doubling of their storage plants. Here are some of them: in Italy Pastificio Castiglioni, Pastificio Dalla Costa Alimentare, Pastificio di Chiavenna, Pastificio Felicetti, Pastificio Guido Ferrara, Pastificio Valdigrano di Flavio Pagani; in Venezuela Pastas Capri;

and in Spain Pastas Alimenticias Romero and Productos Alimenticios Gallo.

The construction of the largest pasta storage plant in the world is starting in Spain in 2010. Cusinato is proudly and skilfully handling the enlargement of the existing plant, adding another 30 silos, bringing the total storage capacity to 945,000 kg of pasta, distributed throughout 90 silos. This important project once again confirms Cusinato as a leader in the production of storage plants for short-cut pasta.

The new customers from North Africa were a pleasant surprise and another cause of satisfaction: this is a growing market in which Cusinato intends to increase its presence over the next few years. Indeed, Cusinato recently handled the installation of storage systems in Morocco (Dari Cous-Pate) and Tunisia (L'Epie D'or).

The company is also pleased to announce the development of a new system: an accumulation and storage system for delicate or long pasta shapes. The new system can handle pasta nests and long, short pasta shapes with the care that so far was restricted to short-cut pasta.

# Dry Pasta Production



Short-cut pasta press  
(Tecalit).



Short pasta storage plant of the Spanish Productos Alimenticios Gallo (Cusinato).

# Dry Pasta Production

All of these successes, that have marked the history of Cusinato, and those that will come in future years, are a confirmation of the company's soundness and the effectiveness of the policy adopted, which is based on the main principles of soundness, reliability

and quality, allowing them to continue serving the market even in the most difficult times, improving the products continuously. (Cusinato Giovanni - Via Monte Pelmo 8 - 35018 San Martino di Lupari - PD - Italy - Fax +39 049 9440174 - [www.cusinato.com](http://www.cusinato.com))

## PASTA LINE for standard or special short-cut shapes and nests

Anselmo (see pages 26 and 27) has developed and successfully tested innovative special lines for pasta production. In the pasta market there are typically three recognized production technologies: long pasta (spaghetti, linguine, bucatini, etc.); short cut pasta (penne, fusilli, rigatoni, bow, etc.); special shapes (nests, jumbo shell, paccheri, etc.).

Before the new special pasta lines developed by Anselmo, the three pasta families were produced using devoted lines. In other words, the pasta producer who desired to produce spaghetti, short-cut and special shapes, was forced to buy three pasta lines.

Nowadays special shapes, being high added-value products, are becoming more and more attractive for pasta producers, due to high competition in standard shapes. However special shape production is still limited due to the investment involved in devoted production lines: lines which can be very expensive, difficult to be saturated and difficult to manage.

The innovative production lines of Anselmo have been developed in order to overcome the above challenge without using

new equipment but only combining well-known equipment in a different way.

Therefore the Anselmo Combined production lines, have been developed with the following major targets: to produce in one single line both standard and special shapes; to produce standard and special shapes with maximum quality level; to reduce production line costs (compared to devoted lines); to increase reliability (compared to devoted lines).

The new Anselmo lines have a production capacity range of 500-2,000 kg/h and in the same line it is possible to produce 100% of shapes and 50% of nests or other special shapes.

The solution proposed by Anselmo is the development of lines, which are special short-cut lines where it is possible to produce nests or special short-cut pasta as well.

The product in fact is dried on conveyor bands, similar to the ones used to dry short-cut pasta.

Anselmo is therefore able to offer a production line which can produce:

- 1) standard short shapes;
- 2) nests of extruded or laminated pasta;

# Dry Pasta Production

3) stamped short shapes (bows, orecchiette, etc.);

4) big short shapes (jumbo shell, cannelloni, etc.).

All this with a cost-effective investment, by means of which the pasta producers will not run the risk of immobilizing capital for a line, which for several years, could not be saturated with the production of just one special product.

With this line it is possible to produce normally short-cut shapes, as well as having the possibility to launch some new high added value products on the market such as nests, jumbo shell, paccheri, pennoni, etc., with the simple cost of new dies. In other words the line gives the possibility to approach new products sales development with a very short pay back of the investment.

The set up time is similar to the tradi-

tional lines (20 minutes max). This system also offers space saving in production: having only one multipurpose line, the pasta producers which have no space for two devoted lines, can avoid huge investments in buildings. When the space is available, the cost of building per production unit will be however reduced and, even more important, the pasta producer will preserve his possibility to modulate his investments accordingly with the market demands.

In the Anselmo solution, a special packaging machine, completely integrated in the production process, is able to run all the above reported pasta shapes.

Two lines are already installed in two different pasta factories and can be visited during production.

(Anselmo - Via Fossano 33 - 12041 Bene Vagienna - CN - Italy - Fax +39 0172 654811 - [www.anselmoitalia.com](http://www.anselmoitalia.com))

## Manufacturing line for ORIENTAL NOODLES shaped in bundles

Noodles are strips or threads obtained from a dough made from a mixture of wheat flour, water and salt. They are one of the most consumed foods in Asia, from China to Korea, from Japan to Thailand, from Malaysia to Indonesia. Human migration and the opening of the Chinese market have made noodles an indisputably widespread and popular food all over the Far East. The demand for noodles is now becoming significant also in Western Countries.

The words “pasta” and “noodles” are some-

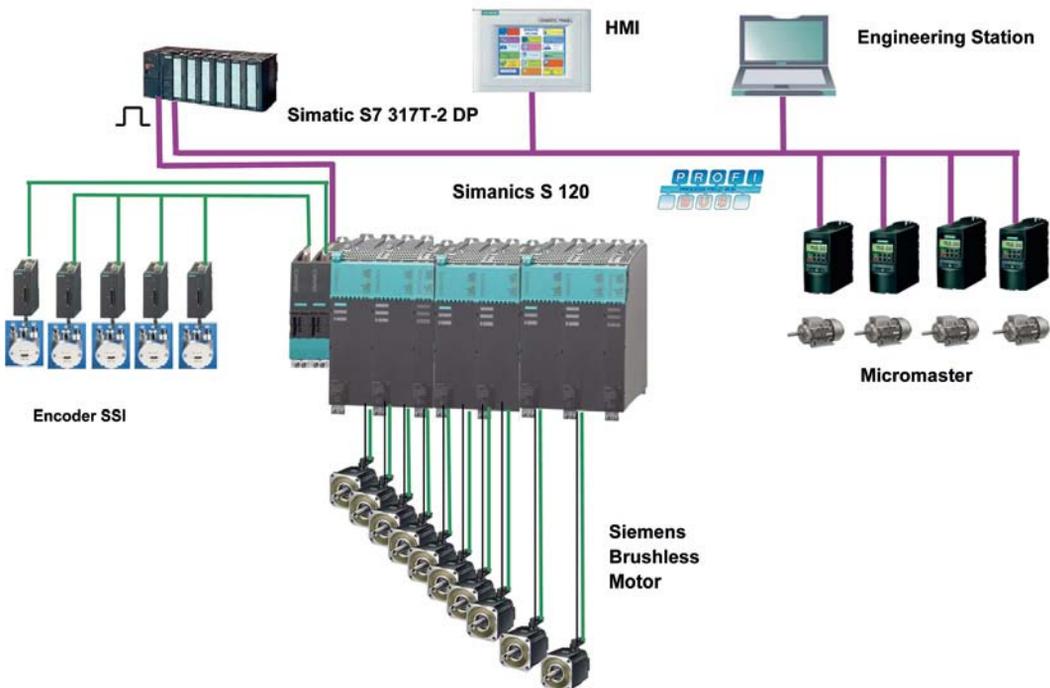
times used as synonyms, but these two products are quite different, not only in the raw materials used (durum wheat semolina for pasta versus soft wheat flour for noodles) but also in their manufacturing process. In recent years, noodles have been proposed in numerous variants depending on the target market and on the preferences of the consumers. On the market we can find noodles made from wheat, rice, potato or buckwheat, either dried or fried, and they can be prepared and seasoned in various ways.

# Dry Pasta Production



Oriental noodle manufacturing line (Pavan Group).

## M0065000 MOTION CONTROL



Motion control display of the noodle line (Pavan Group).

# Dry Pasta Production

The Pavan Group, world leader in the design and construction of automatic food processing equipment has recently built and installed, for a major multinational customer, an oriental noodles manufacturing line with a capacity of 1,500 kg per hour.

The line produces dry, precooked noodles shaped in bundles having a single weight of 67.5 g. The process includes mixing, lamination, cooking cutting, drying in cups, cooling and packaging of the finished product. The innovative point of the Pavan solution is the entire automation of all processing stages: the traditional manual noodle making process has been automatised maintaining the sensorial characteristics of the handmade product. Also the packaging system has been customized according to the client requirements: the square folded bundles are stacked and packed compactly in 400 g bags.

Concerning drives and automation, in order to meet customer needs Pavan choose a Siemens motion control system based on Sinamics S120. Well known in the industry market and appreciated for its versatility, Sinamics S120 represents the ideal drive for many applications: it can be used in standalone mode (AC/AC) for decentralized or single-axis applications or in a booksize version (AC/DC) for centralized configurations where it is important to manage energy recovery from the motors. Pavan was looking for a system that had a high degree of integration of hardware and software automation not only to optimize both programming and assembling time, but also to have a single platform to manage and maintain. TIA (Totally Integrated Automation) Siemens

concept is based on Drive, PLC and HMI platform integration with diagnosis capabilities at different levels: from the PLC software to communication network status down to drive diagnosis and configuration.

With high production capacity and huge masses and dimensions the error margins on the Pavan noodles pasta line were reduced to almost zero. The full line consists of various processing stations: each processing step must be synchronised with the others with absolute precision: that is why Pavan has chosen to use Siemens 1FK7 servo motors connected via Drive-CLiQ to Sinamics S120. The digital communication bus enables motor name plate self-reading. This feature avoids assembly or replacement errors: motors model and serial number can be automatically identified preventing operator errors on site during production phase.

The dynamic skills of the latest generation Siemens drive overcome some well-known limitations of previous technologies and make possible new concepts of mechanical applications. In the food sector this means an increase of productivity and reduction of line down time. Thanks to the Siemens PLC S7 300 T the mechanical line configuration is now independent from production, which means optimized product changeover times, increased production and line efficiency. Even the overall plant dimensions could be reduced and optimized thanks to the improved production characteristics of the line and increased motion range of line mechanical units.

(Pavan Group - Via Monte Grappa 8 - 35015 Galliera Veneta - PD - Italy - Fax +39 049 9423303 - [www.pavan.com](http://www.pavan.com))



# Fresh Pasta Production

## PRODUCTION and THERMAL TREATMENT line for FRESH FILLED PASTA

The technological choices used by Toresani - Pavan Group - for this line allows to obtain a high capacity (2,000 kg/h) keeping the maximum flexibility of the products and the fillings with full automatization.

The line comprises 3 mixers and 3 forming machines with a thermal treatment suitable for producing fresh pasta, even three-coloured, with both traditional and prolonged shelf life thanks to a special thermal treatment of the packaged product.

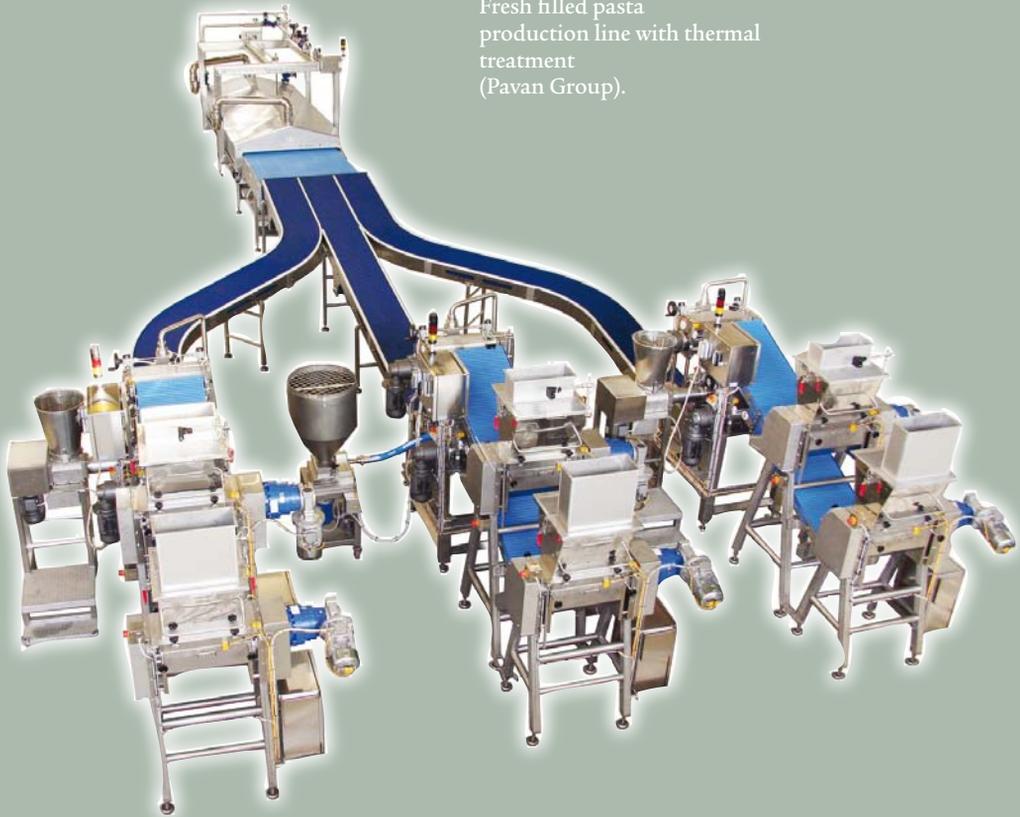
Some technical features are as follows:

triple system to prepare the dough (suitable for three-coloured pasta) and to form ravioli (700 kg/h each); system with padded-pumps for the filling feeding; low-steam and low-energy consumption pasteurizer; superficial drying and pre-drying section with humidity and temperature control and adjustment; upgraded cooler for product outlet at 4°C; thermal treatment (heating and cooling) of the packaged product.

(Pavan Group - Via Monte Grappa 8 - 35015 Galliera Veneta - PD - Italy - Fax +39 049 9423303 - [www.pavan.com](http://www.pavan.com))

# Fresh Pasta Production

Fresh filled pasta  
production line with thermal  
treatment  
(Pavan Group).



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Tel. +39 (0)59 285413 - Fax +39 (0)59 2861979 [www.gvf.it](http://www.gvf.it) - e-mail: [info@gvf.it](mailto:info@gvf.it)



# Colour Sorting

## COLOUR SORTING machines with led technology

The company ASM (Advanced Sorting Machines) has more than 25 years of experience in the field of optical-electronic color sorting, and has launched in the market on 2008 a new series of color sorting machine called Futura HP Led Technology. This series represents the highest level achieved in the field of optical-electronic color sorters. CCD technology vision features, powerful next-generation microprocessors which handle millions of calculations per second in an integrated hardware. Software was designed to obtain high yields of selection. All the mechanical parts, like chutes and ejectors, are designed for increased sorting quality

and capacity. Futura HP Led Technology is a colour sorting machine with led illumination system which features: no illumination replacement parts, same brightness from -30° to 50°C, and no overheating problems.

The Futura HP series color sorting machines are recommended for cleaning all type of cereal such as wheat and rice. It is possible to clean the wheat from dark seeds, ergot, diseased kernels, discoloured germ, and all type of contaminants. This sorting machine is suitable in the cleaning sections of all modern milling plants as it can reduce energy consumption costs and standardize the product quality.

# Colour Sorting



Futura HP Led Technology sorting machine, with accepted (A) and rejected (B) products (ASM).



Pixel 5F sorters at the CO.RI.SO. plant - Euricom Group - in Pavia (Sea).

# Colour Sorting

This new series of color sorting has been extremely successful in Europe and around the Mediterranean area. The group Pastas Gallo - which is the first producer of pasta in Spain - has installed two sorting machines in the cleaning section of durum wheat at its wheat mill of Barcelona. This sorting allowing the same semolina quality every day and an immediate quality improvement. Even the well-known group La Rose Blanche in Tunisia, which is one of the most important producers of pasta in the North of Africa, chose HP color sorting for both lines of

durum and soft milling. The same success has been reached in Italy, where the group Pasta Antonio Amato has chosen two color sorting Futura HP for the durum wheat cleaning section.

Futura HP series is available in four models, from one to four chutes, to meet all production requirements and has a technical support service in all European Countries and the Mediterranean basin.

(ASM - Via del Lavoro 10/12 - 40050 Argelato - BO - Italy - Fax +39 051 897386 - [www.sortingasm.com](http://www.sortingasm.com))

## OPTICAL SORTERS with CCD sensors for rice and wheat

The Sea company was established in Bologna in 1970; the first machine manufactured on an industrial-scale was dedicated to rice processing, both white and parboiled, separating spotted and darker grains from good ones. Since then, Sea has been producing optical sorters, exclusively, gaining a top grade specialization in this field.

The very first machines were equipped with monochromatic optical sensors. Now the electronic evolution along with a passion for continuous research and innovation, have resulted in highly advanced sorting solutions for different applications.

The new Pixel series, recently introduced on occasion of the Ipack-Ima trade show in Milan, uses a control system with mul-

tipple CCD sensors which allow inspecting products with higher resolution at higher processing speed. Special care was taken in the choice of the optical lense brand, with the signing of an agreement with a worldwide leader in optical lenses.

The latest developed series offers the best efficiency and production capacity, reduced operational costs, and provides the possibility for a series of customization. Pixel is available in 5 configurations, from one to five feeding chutes, which can be used separately for single sorting pass or divided into different sections for automatic reprocessing.

The smaller ejector step, and the optical resolution up to 0.1 mm on the newest models permit more accurate sorting, and reduced false rejects as well as minimum

air consumption. The possibility to store multiple sorting programs and the flexible use of the Pixel, allow one or multiple commodity processing and permit a very quick return of the investment. Thanks to the exclusive use of the most advanced digital technology, it is now possible to separate harmful elements from conforming ones with extremely high precision.

Beside traditional applications, Pixel was also successfully introduced into the milling industry to sort durum and soft wheat. When it comes to pasta and bread making, the use of optical sorters becomes a must, permitting to increase the quality of grains and consequently to produce higher grade flour and semolina.

The evolution of Sea machines follows the user requirements who submit, from time to time, their problems related to the separation of diseased grains (mouldy and affected by mycotoxin), foreign seeds (e.g. ergot), and impurities (such as stones and glass fragments).

Each product has its own story and requires highly customized solutions. That is why Sea engineers are dedicated to the development of specific software for the camera image reconstruction and processing.

For peace of mind, Sea offers the interactive remote technical service via Internet, allowing constant control and updating of the software, always ensuring that the best performances are achieved.

Sea offers quality and reliability to its customers, which always translates into band protection and increased profitability.

(Sea - Via Ercolani 30 - 40026 Imola - BO - Italy - Fax +39 0542 643567 - [www.seasort.com](http://www.seasort.com))

## MIXING SYSTEMS AND COMPONENTS FOR PLANTS

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# MIX

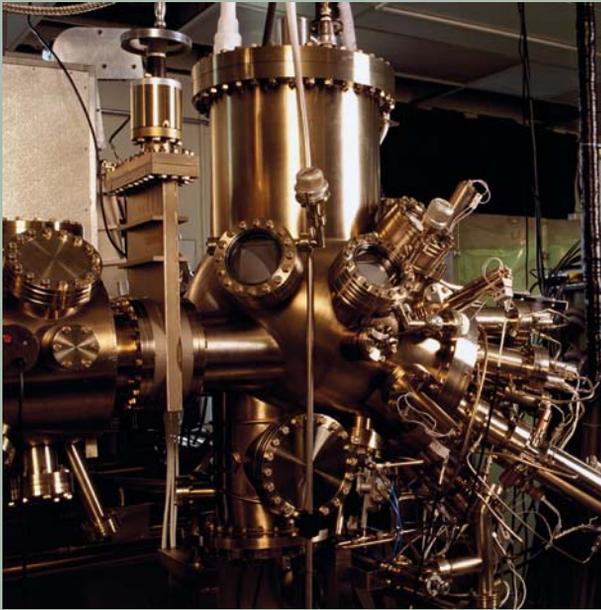


MIX srl - 41032 CAVEZZO (MO)

ITALY - Via Volturmo, 119/A

Tel. +39.0535.46577 - Fax +39.0535.46580

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# Dosing, Mixing & Handling

## Volumetric and loss-of-weight DOSING UNITS

The necessity of dosing powders or granules, in the past years, has proportionally increased, according to the requirements of producers to improve the quality of finished products and the capacity of their production lines. The demand of the market of new batches has determined an updating of dosing systems, a research of innovative ideas in order to give customers new and reliable solutions each time.

For this reason, Cavicchi Impianti, steady on investigation for advanced technological results, has designed the batching unit Megan, a new unit from the already wide and known range of dosing units produced. These are three basic models:

Megan 1/75 with spiral from  $\varnothing$  30 to 57 and hopper up to 75 liters; Megan 2/200 with spiral from  $\varnothing$  60 to 76 and hopper up to 200 liters; Megan 3/300 with spiral from  $\varnothing$  80 to 100 and hopper up to 300 liters. They may be completely dismantled: the most important parts are equipped with easy blocking systems so they can be taken apart in a very brief time for a most accurate cleaning of each internal part. This essential feature is mostly appreciated where thorough cleaning, several times a day, is indispensable.

Each and every model may be tailor-made to satisfy customer requirements, depending on required location of the unit along

# Dosing, Mixing & Handling



Megan dosing unit and its internal parts (Cavicchi Impianti).



Mixer MXC0420 and stirred bunker MXN0600 (Mix).

# Dosing, Mixing & Handling

the production line, type of material, and batching system.

This unit is quite flexible, it may be built with hoppers of different capacities, can be other than Cavicchi Impianti ones, and may use differently designed spirals according to the numerous types of bulk materials.

The Megan models, just as all other Cavicchi Impianti dosing units, may be equipped with weighing cells for batch dosing or loss-of-weight on continuous cycle processing lines. The load cells are connected to the loss-of-weight capacity

adjuster unit and interfaced with the process control system of the customer. In this way, the continuous dosing is constant, accurate and directly controlled from the main keyboard for the entering of weights and settings.

The possibility of dosing almost all sorts of materials, the fast adaptability of the unit to customer requirements, and remarkably reduced maintenance costs, are other advantages of the Megan dosing unit.

(Cavicchi Impianti - Via Matteotti 35 - 40055 Villanova di Castenaso - BO - Italy - Fax +39 051 780647 - [www.cavicchiimpianti.com](http://www.cavicchiimpianti.com))

## MIXERS for Atex areas

The company Mix has launched on the market the Atex ploughshare mixer MXC0420 with 330 liters useful capacity, and the Atex ribbon stirred bunker MXN0600 with 550 liters useful capacity, suitable for mixing/homogenizing icing sugar and additives (in powder).

Such equipments are comprehensive of: discharge doors (that rebuilds the round line of the mixing chambers) pneumatically driven with Mix sealing system; inspection doors with easy access; compact drive units; packing seals for the rotor shaft with air purge; earthed rotor and unipotential chamber; thermic probes for the packing seal temperature control, suitable for weighting cells; parts in contact and not in contact with product in stainless steel Aisi 304 (fully certified). The mixer supply includes: vertical inlet door for product filling through a special hopper, venting spigot with base for integrated Atex bag filter, prearrangement for

choppers, inlet door with by-pass between mixer and stirred bunker (to discharge possible over-pressure). The stirred bunker supply includes an Atex screw conveyor.

This innovative range of Mix products is designed for the food industry in particular, and generally for all those applications where it is necessary to improve the mixing standards, and it is essential to avoid the lowering of the mix quality during the production processes.

The planning and the manufacturing are in compliance with the European directive 2006/42/EC and the European directive Atex 94/9/EC.

The quality in planning and manufacture is guaranteed with the system of business management in compliance with the UNI EN ISO 9001:2000 standard.

(Mix - Via Volturno 119/a - 41032 Cavezzo - MO - Italy - Fax +39 0535 46580 - [www.mixsrl.it](http://www.mixsrl.it))

## VALVES and COMPONENTS for pneumatic transport

Olocco has been manufacturing valves and components for pneumatic transport and metering since 1950 in the continual search for quality and technological innovation. Olocco has had the quality certification UNI EN ISO 9001 since 1995, through the CSQ. This being a very important target as well as a fundamental launching pad to keep the company standard at the top of category.

In line with these objectives the product range has been certified according to directives 94/9/CE Atex II 1D/2 GD c IIB T4, as well as the rotary valves which have a flame and explosion proof until 10 bars certification in accordance with the European norm Explosion Isolation Systems - EN15089. General requirements of an insulation system to prevent flame propagation through pipes connecting different areas of a plant are highly restrictive. This certificate is the result of severe tests, and a further demonstration of a constant effort to improve the quality of the products and the use of safe equipment which will

become more and more important in the near future.

Olocco avails itself of the very latest highly advanced technology in the design and production of its components. A valid team is involved in ongoing research to renew and to improve the quality of its product range, thanks to modern CAD 3D and FEM systems. The production department, which is the true flagship of Olocco, boasts modern machining centres (recently improved with a new boring/milling unit) and CNR lathes. The advanced technology of these machines is a guarantee of high precision and impeccable finishing for customers. All products are carefully tested before leaving the factory and the whole production cycles and final assembling follow quality parameters according to ISO 9001. Currently Olocco has a worldwide market thanks to a network of competent and reliable exclusive representations.

(Olocco - Via del Santuario 41 - 12045 Fossano - CN - Italy - Fax +39 0172 692578 - [www.olocco.it](http://www.olocco.it))

## Renewed SLIDE VALVE with easy maintenance

A worldwide crisis has not changed GVF Components goals: rationalization of the commercial net to be closer to customers, to best understand their needs and a continuous updating with new technologies.

Since GVF Components was founded, the product quality, the high level standard of the suppliers, the technical staff efforts have been the basis of the managing philosophy that considers the customer the

# Dosing, Mixing & Handling

core of the business. GVF Components activity goes straight on, aiming at the market needs.

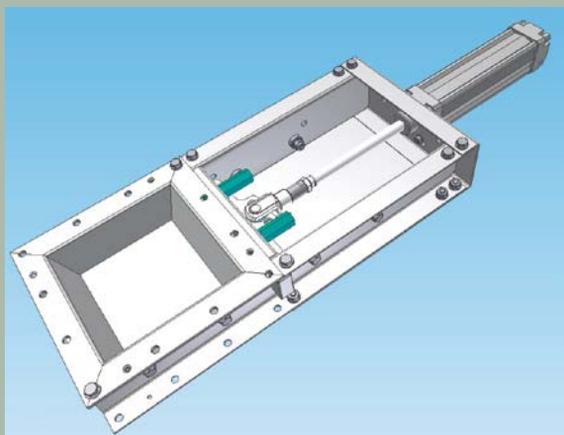
Recently, it has been renewed the SV slide valve. The new SV has kept the standard advantages of the SV; however, for example, the maintenance has become easier and more flexible: in fact it is now possible to carry out maintenance with the valve installed, and there is no need to disassemble it from the plant. This advantage has turned out to be a saving of time (and money) and enhances the efficiency of production processes.

Recently, GVF Component has also launched the new website with new contents and new products; this aims at keeping customers and web-visitors always informed about the activity and the new products of the company and help them to work easier. This is the GVF Components Valve World, a world full of solutions and ideas which allows a long lasting relationship between the maintenance staff and the final user.

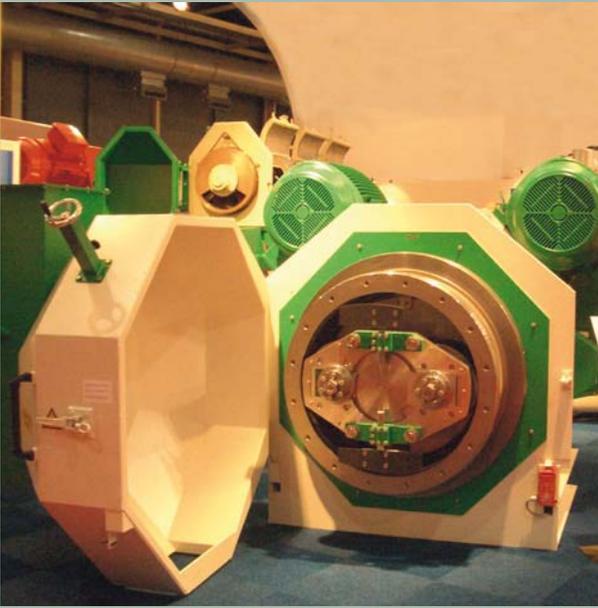
(GVF Components - Via Gazzotti 263 - 41122 Modena - Italy - Fax +39 059 2861979 - [www.gvf.it](http://www.gvf.it))



Rotary valve certified for Atex areas (Olocco).



Pneumatic slide valve SV200 (GVF Components).



# Feed Mill Equipment

## Wear and tear SPARE PARTS for HAMMER MILLS

OBR Bulgarelli is specialized in the production of spare parts and wear and tear components for hammer mills.

The long experience reached in the field allows the company to offer solutions, technologies and quality products for several sectors, where it is necessary to grind and refine several products (for example cereals, pastures, wood, plastic, compost, and other materials to recycle).

The company mission is addressed to the market offering quality components with an excellent competitive ratio.

All materials and steel are of certified quality: raw materials first undergo to a qualifying control and then are sent to the departments for the transformation.

The production is completely in-house carried out by qualified and skilled workers, until the final control of each product.

The range of products includes: hammers, sheets, riddles, sieves, pins, and several accessories for flour and feed mills.

(OBR Bulgarelli - Via Parri 3 - 42045 Luzzara - RE - Italy - Fax +39 0522 970909 - [www.obr.it](http://www.obr.it)).



# Analysis

## System to CHECK MYCOTOXIN contamination

Considering mycotoxins health hazard and the EU law in force that sets maximum concentration limits in food and feed for many of these molecules, controls for these contaminants are becoming quite relevant lately. This question regards the whole food chain, from feed producers to the large-scale retail trades. The need to detect mycotoxins by easy methods has led to the development of numerous analytical test kits, now very accurate and precise. Tecna, working in this field for more than 10 years, has recently developed its second generation test kits to detect mycotoxins, results of a research completely devoted to this matter and compliant with the laws in force.

The new Celer line was born from the Tecna experience as producers of ELISA test



The Celer FUMO kit for fumonisin detection (Tecna).

kits to detect contaminants both in food and feed and has been placed side by side to the I'screen line, whose bestseller product is I'screen Afla M<sub>1</sub>.

The Celer line, thanks to the extreme repeatability in the production of the different kit components, allows the lab technicians to run the test in single (one well for each sample instead of two) maintaining high accuracy and precision. The easy and fast sample preparation, ready to use reagents and very short assay times (15-20 minutes) distinguish the test kits in the line, which are suitable for cereals but also for feed and other complex matrices.

This new line, which is constantly being added to, now includes Celer AFLA (for total aflatoxins), Celer AFLA B<sub>1</sub> (specific for aflatoxin B<sub>1</sub>), Celer ZON (for zearalenone), and Celer FUMO (for fumonisins).

The Celer FUMO kit, with a very simple sample preparation (grinding, extraction with methanol/water, filtration and dilution) and an assay time of 20 minutes, allows the detection of fumonisins in cereal with a measuring range from 0.75 to 60 ppm. This measuring range is compliant with the limits set by the law for human and animal nutrition (only baby food limits are excluded).

Celer kits, easy to use and fast, represent a reliable screening tool for mycotoxins control. Tecna laboratories, besides an internal deep product validation, regularly take part in proficiency schemes - both Italian and international - to verify product performances and the state of the art in the field.

Recent is the participation with Celer FUMO in the ring test organized within the Micocer project by the Italian Institute of Health in cooperation with the CRA

(Council for Research in Agriculture). Tecna Celer FUMO, as well as another brand ELISA test kit, was used by the participants to measure fumonisins in four incurred maize samples and one reference material. The obtained recovery values were between 95 and 122% and showed a very high repeatability and reproducibility for a screening method.

Results of this proficiency prove that, even for fumonisins control, the ELISA method has reached a high degree of reliability and that Celer is an Italian brand combining quality and cheapness.

(Tecna - Area Science Park - Padriciano 99 - 34012 Trieste - Italy - Fax +39 049 3755343 - [www.tecnalab.com](http://www.tecnalab.com))



## RAMBALDO ANTONIO

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## Supplier News

### RICCIARELLI new industrial ACTIVITIES

Ricciarelli Packaging Machinery is an ancient company, founded in 1843 in Pistoia (Tuscany, Italy), and since then it has always been mainly an equipment manufacturer company in the food industry, in particular in the packaging for pasta, where it is still one of the world leaders.

Since the beginning the core business for Ricciarelli has always been the concept, design, production and setting up of plants, machines, and industrial equipment in the pasta industry, particularly in packaging, downstream automation with palletizing systems and automatic warehouses.

In 2009, Ricciarelli managed to complete

the purpose of supplying the new packaging machines with Siemens Simotion systems, offering the advantages granted by Siemens all over the world.

However, for quite a long time now, the company has also diversified its activities in other process phases before/after the pasta packaging process, as well as in other food industries, such as sweets, snacks, pet food, and so on, in all the international markets.

Moreover, due to its high innovative, technical and design capabilities, Ricciarelli provides its own clients with typical products and services of mechanical, electrical and electronic industries. Within this last

range of activities, since 2006 the company and its industrial group have been investing in research, industrial and commercial activities in technological industries which are particularly promising, such as that of cogeneration and production of electricity (power plants), in particular from renewable sources.

The design, supply, installation, and maintenance activities of power plants, for which Ricciarelli often has the role of general contractor, have already yielded important results in terms of plants built (more than 30 MWe) and managed, and orders indicate an increasing trend in the future.

The potential market where the company is mainly investing in these energy opera-

tions is the traditional clients' one, that is in the different food industry sectors, and in particular in the pasta production; but in a future perspective the company, following its tradition, is also interested to other industrial contexts, both national and international, where Ricciarelli customers are interested in the energy market and operations.

Ricciarelli is proud to provide a very good mix of great technical competences and capabilities, due also to its very qualified partners, with limited costs and financial reliability.

(Ricciarelli Packaging Machinery - Via Mariotti 143 - Z.I. Sant'Agostino - 51100 Pistoia - Italy - Fax +39 0573 933223 - [www.ricciarellispa.it](http://www.ricciarellispa.it))

## CIMAS GROUP opens a manufacturing plant IN TUNISIA

The staff of the Cimas Group has announced the start of production activity at their new plant Cimas Industrie in Tunisia, which is based in the Economic Activities Park in Bizerte.

This business initiative is the missing link in a chain of successes that have distinguished the activity of the Group over the years, ever since it was first established in Italy way back in 1840.

The reasons which induced Cimas to make this choice are the following: the growing demand on Arab markets for Cimas products, which now can be met on the spot offering quality equipment at a competitive

price; an excellent after-sale service, since it has been organised a spare-parts store that ensures the possibility of carrying out any type of activity rapidly, from delivery of goods to customers' premises to ordinary and extraordinary maintenance carried out by specialised technicians residing in Tunisia; tax advantages for the Arab customers, who will be able to purchase spare parts and systems from Cimas Industrie exempted from customs duties; transport costs that are definitely competitive by comparison with Europe. Specifically, goods can be shipped to Algeria and Libya by truck.

(Cimas - Via Val di Rocco 42 - 06134 Ponte

# Supplier News



The external and internal of Cimasa plant.



Giuseppe Pellicola, founder of Molitecnica Sud.

Felcino - PG - Italy - Fax + 39 075 5913063  
- [www.cimasitalia.it](http://www.cimasitalia.it)  
(Cimas Industrie - Parc d'Activités

Economique de Bizerte - 241 Avenue Habib  
Bourguiba - 7000 Bizerte - Tunisia - Fax  
+216 72 420689)

## MOLITECNICA SUD: a family passion for MILLING EQUIPMENT manufacturing

The Molitecnica Sud company is a factory specialized in designing, building, and maintenance of plants for: flour and feed mills, bakery and pasta factories, storage, metalworking, and ancillary equipment. The long experience acquired in the realization of several plants and the constant research to find new technological solutions, allow the company to offer different types of plants for the food industries and specially flour mills and feed mills with the turn-key formula.

Molitecnica Sud also boasts a specialised know-how in the custom solutions for plants to be fitted in reduced spaces: compactness, high productivity, output, hygiene, reduced energetic consumptions, easy and safe functionality, are the qualifying characteristics of such systems.

The Molitecnica Sud is the direct and natural evolution of a life full of passion, desire, work and sacrifice: the founder of Molitecnica Sud, Giuseppe Pellicola (whose nickname is Peppino), in fact, has always worked in the milling business. Since he was a young man he was a milling technologist in several milling plants in Altamura, until - driven by the desire to produce what he had always cared for - he decided to undertake, in the late 70's, this new work: manufacture milling equipment.

The activity began in a small factory of 150 square meters, where, thanks to the help of his sons, he started to design and build milling machinery.

Thanks to Peppino's ability to establish a friendly relationship with customer, based on confidence and professionalism, the company soon reached significant targets. Due to a significant increase in demand, in 1981 the company moved into a bigger plant of over 500 m<sup>2</sup>, which was expanded to 1,200 m<sup>2</sup> in the 90's.

Today Molitecnica Sud is headed by the four sons of Giuseppe Pellicola who remains as a guide. The presence of his sons, Domenico, Luigi, Alfonso, and Carlo has always been important within the company. Their ability to make good use of Peppino's knowledge combined with their ability to specialize the company in other areas was the reason for the development of Molitecnica Sud which has enlarged the business.

The construction of the new factory is an example: the new plant of 3,500 square meters (on a total surface of 12,000 square meters), will implement the historic headquarters.

(Molitecnica Sud - Via dell'Avena 27 - Z.I. - 70022 Altamura - BA - Italy - Fax +39 080 3146832 - [www.molitecnicasud.com](http://www.molitecnicasud.com))



## Ancillary Equipment

### Simple REMOVAL of OIL SEALS with patented seal puller

Access to fitted oil seals, such as shaft seals, is often very difficult and changing them is problematical.

Power take-off shafts are also generally protected from contamination by a sheath tube, in such a way that dismantling cannot be undertaken using conventional auxiliary tools.

This situation has been solved by the new and patented seal puller, Simatool SP 50, developed by Simatec and distributed in Italy by Agrinova located in Savigliano, near Cuneo.

In 3 stages, sealing rings of many different types can be removed within 10-30 seconds: 1) the tool is placed on the seal-

ing ring and given three blows; 2) using a self-tapping screw, the sealing ring is positively fixed to the tool by three turns; 3) the seal is removed from its original seating by three blows.

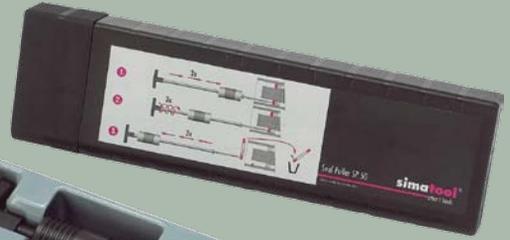
Dismantling of the gearbox casing is no longer required. Even conventional sealing rings fitted in just about any situation can be removed quickly and simply.

New sealing rings are pressed into their seatings using the universal filling tool Simatool FT 33 or knocked in with a hammer.

(Agrinova - Via Togliatti 52 - 12038 Savigliano - CN - Italy - Fax +39 0172 33408 - [www.agrinova.it](http://www.agrinova.it))

# Ancillary Equipment

The Simatool SP 50 kit (Agrinova).



SP 50 example of seal removing (Agrinova).



FT33 example of fitting tools (Agrinova).



MPM Food Plants srl

Via del Credito, 24 - 31033 Castelfranco Veneto (TV) Italy  
Tel. +39 0423 721238 Fax +39 0423 722620 - www.mpmfoodplants.it

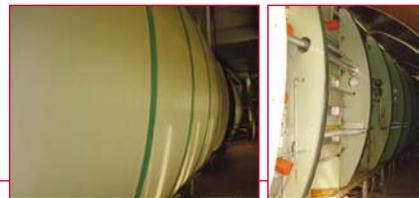
## SHORT PASTA PRODUCTION LINE Kg/h 1.400

**BUHLER PRESS TYPE TPCU** complete with:  
- automatic water-raw materials dosing plant.  
- automatic cylinder and head thermoregulation circuits of the temperature.

**BUHLER SHAKER PRE-DRYER** on 7 tiers complete with automatic thermoregulation.

**BUHLER AUTOMATIC PRE-DRYER** type **TRNA** on 9 tiers, 8 modules with metal conveyor belts.

Automatic dryer **TTNA** on 7 tiers, 14 modules with metal conveyor belts.  
Unloading sifters.



Storage bins loading bucket elevator.  
Dry pasta storage bins on 4 tiers with metal conveyor belts completely automated.  
Unloading conveyor belts.  
Packing machine loading conveyor belts.

Note: the line would be supplied completely overhauled and warranted mechanically for 12 months. The control panels and the automation system would be new.



## Flour & Pasta Packaging

### PACKAGING machines and PALLETIZING robots

Morelli Handling and Robotic Systems produces high speed palletizers and packaging machines for the worldwide food industry market. Palletizing cells, based on anthropomorphic high speed robots, are able to receive and manage both bags and cartons from several lines, in different formats, and put them over pallet with a complete integration with warehouse systems, also with LGV system. Every robot, with its unique tank gripper system, can simultaneously take carton, heat shrink bundles, trayfuls, using a brushless servo system that uses different gripper strength for every kind of product. The tank gripper can also take inter-layer folds and pallets, for the double

pallet schemas up to 2,400 mm; it manages different types of pallets and works with carton box of different sizes.

Every palletizing cell is managed by a single control position, where the operator can see - graphically in a 3D representation - the palletization pattern and progress, the production statistics, and much more. Furthermore every palletizer schema can be easily changed also during production, adjusting carton position and gripping parameters.

The high-speed packaging machine with its automatic format change system, can easily switch to cartooning system of pillow bags, double square bricks in upright or lying position, carton box filling, big pil-



## Turnkey plants & machinery for

Dry, fresh & nest-shaped pasta • Stackable potato chips • Pellet/Snack 3D • Breakfast cereals • Ready & frozen meals



# Pavan Group

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# Flour & Pasta Packaging

low bags of 3/5/10 kg over pallets or in carton, and so on. All cartons are pre-glued before product insertion and can be closed by a top coverer machine.

Using anthropomorphic robots, with different gripper tool designed specifically for customer needs, these machines can reach a versatility and operational flexibility nev-

er seen before, thus managing food, pasta, rice, sugar, and every type of product that need particular care during packaging process.

(Morelli Handling and Robotic Systems - Via D. Nerozzi 1 - 51031 Agliana - PT - Italy - Fax +39 0574 718549 - [www.morellirobot.com](http://www.morellirobot.com))

## Robotic PALLETIZER and WRAPPING machine

Imp.a.c., leader in the automatic systems production area all over the world, counts in its wide range of machines a robotic palletizing system with articulated arm, the best solution for medium/high speed packaging lines requiring precision, consistent working capacity and automatic robotic dispensing of pallets and carton sheets in order to save valuable floor space. The Imp.a.c. Roboflex 1802, assembled with innovative technologies and successfully tested on an international stage, has been provided with special pliers suitable for seizing bundles, empty pallets and carton sheets. This machine can be equipped with four to six-axe robotic arms, and can be utilized for every kind of packages and bags; from 1 kg packages to 50 kg bags, and provides high production standards satisfying all customer requirements.

An extraordinary quality of this system is its versatility: it is possible to have several infeed lines and also to palletize different products on different pallets.

All software programs are created by Imp.a.c. technicians. By changing its working program, Roboflex 1802 is able to handle a wide range of products, reducing the operator duties to the supervising functions.

In order to complete the full pallet store phase, the company suggests the utilization of the Imp.a.c. PR/A wrapping system. This machine has a production capacity of 40 pallet/hour, ideal feature for high productions. The wrapping process guarantees stability and protection for the full pallet.

Imp.a.c. wrapping systems can also utilize holed films, particularly suitable for products requiring transpiration in order to avoid inner moisture and overheating. Furthermore Imp.a.c. manufactures two reliable devices for the holed film handling in the wrapping process, such as the film pre-stretch unit, to obtain a max stretch ratio of 300%, and the film welding unit to remove imperfections on board.

These operating systems are both able to communicate through Ethernet port with other production line machines and, if necessary, with the manufacturer for assistance. They can also automatically utilize various working programs which can be easily modified by the user with the touch-screen. In order to improve the instrumentation management, Imp.a.c. implements the Profibus/Devicenet technology on all machines, so as to simplify the operators access and maintenance.

# Flour & Pasta Packaging



Anthropomorphic packaging and palletizing robots (Morelli Handling and Robotic Systems).



Robotic case/bundle palletizer with articulated arm, mod. Roboflex A-1802 (Imp.a.c.).



Automatic wrapping machine with turning platform, mod. PR/A (Imp.a.c.).

# Flour & Pasta Packaging

The company's main aim is the continuous improvement of the automatic systems, using first class components in mechanic, pneumatic, electric, and electronic areas. The utilization of high quality components assures reduced maintenance, high productions, and a substantial energy saving. Imp.a.c. products are conceived in a modu-

lar way, in order to match the user needs and to combine high efficiency to low consumption, and reduced costs (TCO, Total Cost of Ownership); for these reasons they are put in the higher sector of downstream packaging. (Imp.a.c. - Via Ghisolfi e Guareschi 9 - 43015 Noceto - PR - Italy - Fax +39 0521 627988 - [www.impac.it](http://www.impac.it))

## Stripping SEALING JAWS for horizontal pasta packers

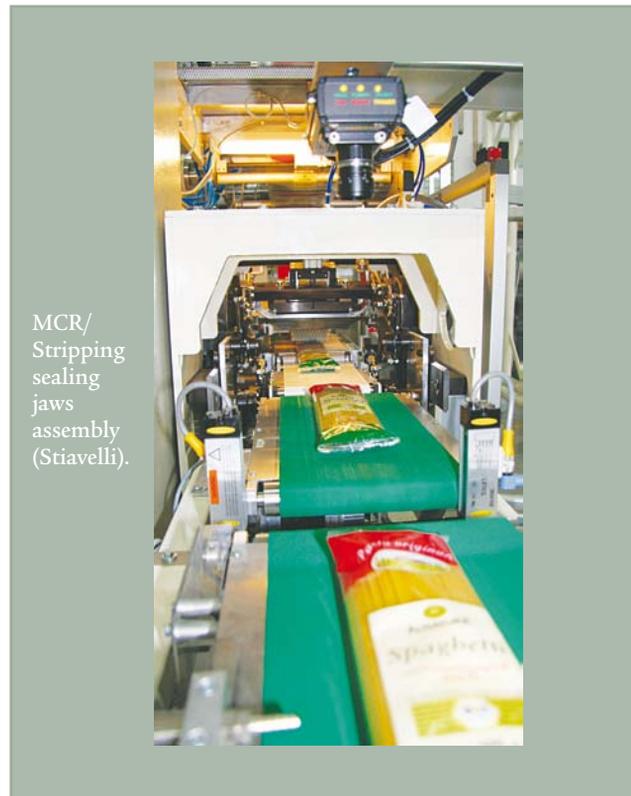
The special MCR/Stripping sealing jaws assembly developed by Stiavelli for its horizontal packers for long goods is one of the best solution available on the market, at the moment, to the growing problem related to the production of bags with pasta scraps in the horizontal seals.

One of the unequalled features of these jaws, which are controlled by an independent brush-less motor, is the possibility to work in two different conditions: MCR traditional operation and new Stripping action which cleans the seal area just before sealing, thus remarkably reducing the production of bags with scraps. The shift to either operation is mechanic.

The maximum percentage of bags with scraps with stripping operation jaws is max. 1% (this data applies to 500 g bags of dried spaghetti diameter 1.7 mm).

Another unique characteristic of the Stripping jaws is the possibility to be retrofitted onto all the old Stiavelli electronic horizontal packers. Pavan Group - to which Stiavelli belongs - has successfully carried out such a job for some of its most important customers.

(Stiavelli - Via G. Amendola 7 - Località Torricchio - 51010 Uzzano - PT - Italy - Fax +39 0572 444642 - [www.stiavelli.it](http://www.stiavelli.it))





# Downstream Packaging

## Pinch-top FLOUR PACKAGING system

Concetti Group is one of the international leaders in designing and manufacturing complete turn-key lines for the weighing, filling and palletizing of different types and sizes of bags, either from PE tubular reel or pre-made open-mouth bags made of paper, coated paper, paper with liner, PE, PET, aluminate, raffia, and coated raffia.

Concetti has introduced its newest solution for flour packing, aimed at those who are aware that the valve-type bagging systems might potentially expose flour to contacts with external elements (powders, parasites, pathogens, insects, and so on) during both the stocking and the transport process, and therefore want to pay the

highest attention to the European sanitary regulations.

This new solution by the Concetti Group, based on the very reliable IGF class of bagging machines for bigger sizes, features an hermetic bag closure that protects the filled bags from any contamination while, at the same time, keeping some technical peculiarities of the valve-bag filling, such as dimensions and the geometric regularity of the bag and the stability of the pallets shaped with the Concetti Group palletizer, or with other existing palletizing systems. In the IGF-PT, in order to ensure consistent filling of non free-flowing materials like powders or flours, the product is fed

# Downstream Packaging

into an electronic net weighing system through single screw feeders. The automatic bag-feeder forwards the empty bags one at a time and places them under the filling spout. The pneumatic spout features an adjustable discharge section in order to handle different bag-mouth widths

and to shape the upper bag edge for the subsequent closing.

During the transfer of the full bag from the filling to the closing area, the bag is gripped along the upper edge so that it can be inserted into the closing section. The bag is conveyed upright through rollers and flat-



Pinch-top closure system IGF-PT with hermetic closure (Concetti Group).



Horizontal packaging machine Synchroflow (Nuova Dizma - Pavan Group).

# Downstream Packaging

belt conveyors located on the lower part of the machine. The height of the conveyors is automatically adjusted by the program according to the bag length. IGF-PT bag-closing can be done by pinch-top system.

As ever, IGF features a closed mono-block structure made of specially-designed steel sections and comes complete with inspection doors and protection devices, in compliance with the EC standards currently in force. The system is characterized by its particularly compact size that makes installation easy even in existing situations. Upon request, the IGF-PT can be equipped with the following options: bag-vibrating system during filling, alphanumeric characters and bar codes printing device, optional stainless steel for the parts in contact with the product, labelling machines for pre-printed and computer labels, and many other options in order to work non-standard formats.

The Concetti Group confirms its keen attention to market trends as well as its focus on customer satisfaction, which continues to be the driving force in the investments

made to develop new solutions. It closely follows all the project development phases, from the initial stages through the customized in-depth technical studies, guaranteeing the customer a complete turn-key service.

A strict observance of the highest standards of quality has allowed the company to earn the UNI EN ISO 9001:2000 quality certification.

Concetti can effect assessments, project design and production of industrial installations plants including bagging, conveying and palletizing systems with Atex certification.

Companies around the world have chosen Concetti as a partner because it can virtually satisfy any customer requirement on the global market.

The Concetti Group confirms once again its "produce and make produce" mission; a tradition renewed by Concetti time after time.

(Concetti Group - S.S. 75 Centrale Umbra km 4,190 - Fraz. Ospedalichio - 06083 Bastia Umbra - PG - Italy - Fax +39 075 8000894 - [www.concettigroup.it](http://www.concettigroup.it))

## Flexible FLOW-PACK PACKAGING machine

Synchroflow is the new horizontal packaging machine presented by Dizma, well-established company in the flow-pack sector, now belonging to Pavan Group. Synchroflow is a modern and flexible machine, representing the evolution of model Mini sold all over the world, fit to pack both food and non-food products. Synchroflow is fully electronic and works with a continuous working cycle and PLC con-

trolled brushless motors. It is installed on a cantilever frame for easy cleaning and maintenance.

The servo-assisted operation allows for extreme customisation of the product to be packed: each configuration is memorised and can be easily loaded using the touchscreen operator panel. This ensures fast format changeover. Synchroflow is available in various versions depending on

# Downstream Packaging

the required degree of customisation and reaches a speed of 400 packs per minute. This machine is proposed at a competitive price as compared with traditional machines of the same market segment, and its

construction features ensure high quality and flexibility of use.

(Nuova Dizma - Pavan Group - Via Monte Grappa 8 - 35015 Galliera Veneta - PD - Italy - Fax +39 049 9423239 - [www.dizma.it](http://www.dizma.it))

## PACKING MACHINES for food products

Dolzan Impianti has been specialising since 1962 in designing and manufacturing packing machines for the food industry.

In order to suit the requirements of any food and feed industry, a complete range of packing solutions is offered, including: double flat top/bottom bags, twin machines, multihead weighers, high degree vacuum systems, auger fillers more and more reliable, and much more.

The wide range of machines that Dolzan Impianti is in a position to offer to meet any requirements is available on the company website.

Besides, the staff is always at disposal to answer all inquiries, as the Dolzan Impianti slogan is: "Choose us and we'll take care of all the rest".

(Dolzan Impianti - Via Roma 260 - 35015 Galliera Veneta - PD - Italy - Fax +39 049 9470138 - [www.dolzan.com](http://www.dolzan.com))

## Automatic FLOUR PACKING machinery

Italpack, based near Rimini on the Adriatic coast of Italy, has, during the last 27 years, become a leader in the field of automated packaging machinery. Now proudly serving flour mills, both large and small, in more than 60 Countries worldwide, this is a case study of a typical Italpack installation.

McNeel Millers Ltd. part of the Kenblest Group is a modern, efficient Bühler mill having a daily capacity of 140 tonnes. The mill is situated in Thika, Kenya approx. 40 km north east of the capital Nairobi.

Although the mill had been operating since 1996, the vast majority of the bagged-

off wheat and maize flour was in 50-90 kg industrial open mouth sacks and until recently, little or no focus had been placed on the small consumer "home baking" slice of the market which is predominantly in paper bags of 1 and 2 kg.

McNeel Millers turned to Italpack for advice, safe in the knowledge that they had already supplied dozens of flour packing lines throughout Africa. After consultations it was agreed that the Thika plant required: flexibility (in terms of pack sizes available and ability to change from 1 to 2 kg rapidly); capacity (the packing line had

# Downstream Packaging



A packing plant designed and supplied by Dolzan Impianti.



Home baking flour paper bags obtained with the Italpack flour packing line.

# Downstream Packaging

to easily cover the required daily capacity forecast); automation (the new packing line needed to be fully-automatic); heavy-duty (it was essential that the new line was built to heavy-duty specifications); simplicity (the machine had to be simple to use and simple to maintain); health & safety (the equipment had to adhere to strict health & safety regulations).

With the above key-criteria as a benchmark, Italpack's export sales manager Mark Wild set out a commercial and technical proposal that not only met the request, but significantly exceeded it.

The final result is an efficient, state of the art, automatic packing line that functions perfectly and runs 6 days per week on either a 2 or a 3 shift schedule. The final installed and commissioned Italpack packing line consists

of a ground-level silo with a product transfer system to the in-feed point on the packing machine, the automatic packing machine itself with hot-melt glue bag closing unit, date printer, check weigher and feedback unit and twin baling stations to neatly wrap up the standard East African 24 kg bales prior to them being transported for distribution.

Mr. Mayur Shah, managing director at Mc-Neel Millers is delighted at the end result: "what we have achieved is precisely what we had in mind; that was to develop our packaging section into a compact, automated and cost-efficient operation which allows us to be competitive in the domestic market for the home-baking retail packs". (Italpack - Via Andrea Costa 106 - 47822 Santarcangelo di Romagna - RN - Italy - Fax +39 0541 621956 - [www.italpack.net](http://www.italpack.net))

## Pinch-top BAGGING line for FLOUR

15 years after its launch, Umbra Packaging still considers itself to be at the start of its journey, despite having achieved important results in various sectors and underlining what someone, perhaps Saint Augustine, said: "little if I consider myself, much in comparison".

One of the fields in which the company has been most successful is the milling industry. It is precisely here that, starting from an innovative project based on a machine which is able to process various formats of open-mouth bags, the technicians set themselves the objective of leaving the final bag dimensions unchanged from those of the valve bags already used by the mills. This prerogative becomes a fundamental

requirement in order to avoid the need for a change to subsequent palletization, thereby leaving the volumes which can be loaded during transportation unchanged.

In these years, the company has grown alongside the food industries and the machines have evolved alongside the varied and ever more pressing market requirements, even seeking, where possible, to anticipate them, all thanks to close collaboration with the suppliers of components and with the main bag manufacturers.

The milling industry's need to have packages which are completely sealed and therefore cannot be contaminated from outside steered the choice of the type of bag on offer towards the pinch-top variety: a multi-

# Downstream Packaging

layer paper bag, with a pre-glued upper edge, which is first folded and then sealed due to the reactivation of the glue on the edge through heating. For perfect closure, a specific closing system with “step” movement has been perfected.

Given the importance of the milling sector for Umbra Packaging, the company has not limited itself to adapting standard machines designed for generic uses for this particular application, but has come up with projects which are completely dedicated to this sector, creating tools which can meet specific requirements and are in no way limited so as to allow for future developments in products or consumption of materials. This has led to research into new dosing systems which can be used with any format, able to concentrate a high weighing speed with the total absence of retention and therefore contamination between the products in one instrument.

Today, the interchangeable discharge cone, a distinctive element of these bagging machines, still remains one of its strengths, guaranteeing a format change in just a few seconds and ensuring that all types of bag can be processed, both with and without gussets.

Collaboration with specialised companies has led to the creation of bag vibration devices which enabled the product to be allowed to separate and be packed down inside them, an element which is of vital importance when searching for the ideal bag format for each mill.

The automatic empty bag store, with its system for leafing through each individual bag, is able to ensure the correct separation of the bags, allowing, where necessary, perfect labelling on the empty bag. In the meantime, a new device has also been added, in addition to the abutting device already present



The UPS EVO bagging machine for pinch-top hermetic closure (Umbra Packaging).

# Downstream Packaging

on previous machines. The new device centres the bags on the separator, allowing the bag to be prepared, perfectly aligned and centred for the subsequent filling phase.

It is precisely this continuous search for perfection in the aesthetics of the filled bag which has led the company to adopt various solutions which conserve the quality of the gussets, allowing excess air to be removed and ensuring the constant effectiveness and height of sealing.

As for Umbra Packaging, it is not conceivable to handle bags which differ greatly from each other in terms of materials and/or size with conventional devices (such as chain or belt conveyors), without running the risk of said bags losing their verticality or suffering aesthetic variations after sealing, the decision was made to make use of a type of electromechanical handling, able to hold the bags firmly on both the upper selvedge and the bottom, moving them “in steps” with a movement system controlled by brushless motors managed using the latest generation of Siemens axis control (Sinamics). Compliance with and the evolution of hygiene-related regulations means that flour must be treated with machinery having a “food grade” finish and, obviously, paints diluted with ethyl alcohol are used on all the machines, in addition to stainless steel contact parts and, along with electrical and pneumatic wiring on special grids, these make the whole system certifiable for food use.

For the structure of the new bagging machines, the use of thick, press-formed sheet metal is preferred to the usual tubular forms. This choice, together with first-rate components, was made in order to guarantee working reliability 24 hours a day, 365 days a year with extremely low maintenance costs.

The modularity of the structure also allows the possible future implementation of the line with further bag-closing devices. The design of the new bagging machines is characterised by wide sliding doors, which enhance the feeling of great accessibility offered by the line, extremely relevant given the fact that the new regulation regarding the “ergonomics” of the systems is coming into force.

The manufacturer, certain of the level of reliability of the machinery produced, offers a 24-month warranty on the whole supply. Furthermore, from 1<sup>st</sup> January 2010, a new service and research company called Umbra Packaging Engineering and Service has been open, with the task of periodically visiting customers to check the condition of the systems, propose any servicing and, should the need arise, present any improvements and innovations for the system already in operation.

Most systems, furthermore, can be equipped with a management and process control system, composed of a hardware part based on an industrial PC which acts as a master for a dialogue network based on Ethernet cabling with the relative interfaces positioned inside the panels of the individual machines, Ethernet cards for each PLC and Profibus cards for connection to the weighing system.

The software part envisages the management of the various packaging-related operations, for both operational and statistical purposes, with the aim of improving product traceability, improving the efficiency of the production cycle with a consequent reduction in running costs.

(Umbra Packaging - Viale Dei Pini 46/48 - 06086 Petrignano di Assisi - PG - Italy - Fax +39 075 80978127 - [www.umbrapackaging.it](http://www.umbrapackaging.it))



## Exhibitions & Meetings

### Siab exhibition for fresh PASTA, BREAD, PASTRY, and PIZZA

Siab-International Techno-Bake Exhibition is already revving up with a view to the appointment scheduled from **22<sup>nd</sup> to 26<sup>th</sup> May 2010** in **Verona**. Technologies, raw materials and semi-finished goods for the production of bread, pastry, pizza and pasta will be highlighted once again with all their excellence to an audience of sector specialists. The operative machine at VeronaFiere is already in full swing, with several new initiatives including the organisation of a series of international stop-offs by the event dedicated bakery, pastry, confectionery, fresh pasta and pizza and technologies, raw materials and semi-finished goods for their production.

The objectives of the event not only focus on even better internationalisation but also and especially on consolidating the success of the 8th edition of Siab in 2007, when the Verona show attracted more than 400 exhibitors over an exhibition area of more than 50,000 square metres. The 2007 edition was also favourably received by more than 50,000 visitors from Italy and abroad with impressive flows of professional operators – thanks also to collaboration with ICE, the Italian Foreign Trade Institute – from Central-Eastern Europe, Latin America, Asia and the Mediterranean area.

# Exhibitions & Meetings

Siab 2010 confirms its impressive trade sector coverage: machinery & plant for specialist and industrial production of bread, fresh pasta, pizza and pastry; auxiliary machinery in the field; raw materials and semi-finished goods; packaging machines and materials; furnishing and equipment for shops. Other segments equally focus on logistics, distribution and transport, as well as consulting services involving dif-

ferent professional categories and organisations.

More than just an exhibition: the innovations for the next edition at VeronaFiere also envisage focus and analysis meetings dedicated specifically to pastry and packaging fields.

(VeronaFiere - Viale del Lavoro 8 - 37135 Verona - Italy - Fax +39 045 8298288 - [www.siabweb.com](http://www.siabweb.com))

## A.B. Tech Expo 2010 for BAKED PRODUCTS, fresh PASTA, and PIZZA

For many companies, the year 2009 has marked a period of intense reflection and hard thinking on the new strategies needed to face up to market shakeups. The hoped-for turnaround expected in the year 2010 must find companies ready to project their products and solutions far and wide, to incite business people who have decided to upgrade their baking facilities, and their outlets and to streamline their production cycles, to invest in new equipment.

A.B. Tech Expo, which is to open in **Milan** from **23<sup>rd</sup>** thru **27<sup>th</sup> October 2010**, is just the platform needed to relaunch business. The event stands out as one of the foremost international trade fairs to offer makers of machinery, ovens and installations, ingredients and furnishings for bakery, confectionery, pastry, fresh pasta and pizza industries, the top-class venue that meets their expectations.

The city of Milan is a financial capital and

the powerhouse of Italy's economy. It is within easy reach from anywhere in Italy and the rest of the world and boasts superior and plentiful hospitable accommodation.

Synergy generated by the team up with Fiera Milano Group, the co-operation with HOST, the International Exhibition of the Hospitality Industry, enabled the presence at the recently held event of three in-show baking areas (bakery, pastry and pizza), the first of a series of initiatives that A.B. Tech Expo is organizing in association with Fiera Milano and its network abroad. The scope is to work within a broader framework that offers exhibitors opportunities to raise their visibility both before and after the show, and to bring them in contact with contiguous markets to encourage and facilitate business interpenetration.

(F&M Fiere & Mostre - Via M. Donati 6 - 20146 Milano - Italy - Fax +39 02 40922499 - [www.abtechexpo.com](http://www.abtechexpo.com))

## Calendar of international EVENTS IN ITALY

- 24-27 April 2010 - Bologna:** 1<sup>st</sup> Pasta Trend, int. exhibition and congress for the pasta production and supply chain. Avenue Media - Via Riva Reno 61 - 40122 Bologna - Italy - Fax +39 051 6564350 - [www.pastatrend.com](http://www.pastatrend.com) - e-mail: [info@pastatrend.com](mailto:info@pastatrend.com)
- 22-26 May 2010 - Verona:** Siab, int. exhibition on technologies, raw materials and semi-finished products for bread, pastry, pizza, and pasta. VeronaFiere - Viale del Lavoro 8 - 37135 Verona - Italy - Fax +39 045 8298288 - [www.siabweb.com](http://www.siabweb.com) - e-mail: [info@veronafiere.it](mailto:info@veronafiere.it)
- 23-26 May 2010 - Trieste:** XI Rheology congress. Segreteria XI Convegno Nazionale di Reologia - c/o prof. Romano Lapasin, DICAMP - Università di Trieste - Piazzale Europa 1 - 34127 Trieste - Italy - Fax +39 040 569823 - [www.sir-reologia.com/convegno2010](http://www.sir-reologia.com/convegno2010) - e-mail: [convegno2010@sir-reologia.com](mailto:convegno2010@sir-reologia.com)
- 8-11 June 2010 - Rimini:** Packology, packaging and processing technology exhibition. Rimini Fiera - Via Emilia 155 - 47921 Rimini - Italy - Fax +39 0541 744829 - [www.packologyexpo.com](http://www.packologyexpo.com) - e-mail: [info@packologyexpo.com](mailto:info@packologyexpo.com)
- 9-10 June 2010 - Bologna:** Ipack-Ima congress "Technologies for food security". Ipack-Ima - Corso Sempione 4 - 20154 Milano - Italy - Fax +39 02 33619826 - [www.ipackima.it/sicurezza%2Dalimentare/index.htm](http://www.ipackima.it/sicurezza%2Dalimentare/index.htm) - e-mail: [iflores@ipack-ima.it](mailto:iflores@ipack-ima.it)
- 24-26 September 2010 - Napoli:** Tiam, Mediterranean agro-food technology exhibition. Ipack-Ima - Corso Sempione 4 - 20154 Milano - Italy - Fax +39 02 33619826 - [www.tiam.it](http://www.tiam.it) - e-mail: [ipackima@ipackima.it](mailto:ipackima@ipackima.it)
- 12-13 October 2010 - Verona:** Save, int. conference and fair of vertical solutions and applications of automation, instrumentation, sensors. EIOM - Viale Premuda 2 - 20129 Milano - Italy - Fax +39 02 55184161 - [www.exposave.com/english/home.asp](http://www.exposave.com/english/home.asp) - e-mail: [antonio.rampini@eiomfiere.it](mailto:antonio.rampini@eiomfiere.it)
- 23-27 October 2010 - Rho (Milano):** A.B. Tech Expo and A.B. Tech Pizza, int. exhibitions on bakery, pastry, confectionery, pizza, and fresh pasta. F&M Fiere & Mostre - Via M. Donati 6 - 20146 Milano - Italy - Fax +39 02 40922499 - [www.abtechexpo.com/en/en\\_home.htm](http://www.abtechexpo.com/en/en_home.htm) - e-mail: [visit.abtech@fieremostre.it](mailto:visit.abtech@fieremostre.it)
- 28 February - 3 March 2012 - Rho (Milano):** Ipack-Ima, processing, packaging, and material handling for milling, pasta and food industry. Ipack-Ima - Corso Sempione 4 - 20154 Milano - Italy - Fax +39 02 33619826 - [www.ipackima.it/en/default.as](http://www.ipackima.it/en/default.as) - e-mail: [ipackima@ipackima.it](mailto:ipackima@ipackima.it)

## PastaTrend for the DURUM WHEAT PASTA supply chain

From 24<sup>th</sup> to 27<sup>th</sup> April 2010, Bologna will be the capital of the made-in-Italy greatest symbol, by hosting PastaTrend, the first event entirely dedicated to durum wheat and pasta supply chain. This event proposes itself as a guiding light and touchstone for the whole world surrounding pasta: from genetics research to the most advanced technologies, from raw material processing to the finished product coming in thousands of different shapes and sizes.

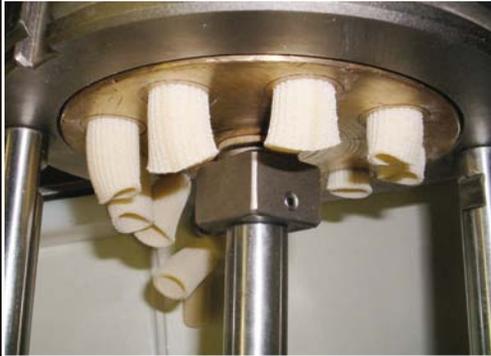
PastaTrend will not only stand for trade show and exhibition venue. It will first and foremost offer refresher training and refresher courses, thanks to a large variety of congresses and symposium events. The event calendar is shaping up day after day, offering the most comprehensive information. The opening international conference "The socioeconomic role and market potential of Italian-style pasta in the world" by Nomisma will be held on the 24<sup>th</sup> of April. There will also be a focus on the issue of the year: "Safety in raw material procurement in the pasta supply chain".

But there is more. From April 24<sup>th</sup> to 27<sup>th</sup>, several events will take place: the International symposium "Genomics of plant genetic resources"; the workshop "What future for pasta?" by Aistec; a meeting organized by the Italian Association of milling industry technicians; the international conference "Facing volatility of

the international grain market: an analysis of contractual instruments" by Bologna Commodity Exchange in cooperation with The Grain and Feed Association of London and the Department of Agricultural economics and Engineering of the University of Bologna. These are just some of the conferences and events - 30 in all - that will take place at Palacongressi of BolognaFiere, at the same time as PastaTrend.

"All this makes this sector particularly interesting, as it is the driving force of a sector-based economic performance that is growing, despite the crisis - explains Paolo De Castro, the President of the Committee on Agriculture and Rural Development in the European Parliament. Figures are positive but this is not a miracle; it is due to the fact that this productive part of the Italy can count on very high level agricultural genetics, on advanced technologies and equipment as well as on exceptional skills in the presentation of its finished product to the world. PastaTrend gets off to a good start and proposes itself as a guiding light and international touchstone for the whole supply chain and for those countries, from China to the United States, that consider pasta as the primary cornerstone of a healthy diet."

(Avenue Media - Via Riva Reno 61 - 40122 Bologna - Italy - Fax +39 051 6564350 - [www.pastatrend.com](http://www.pastatrend.com))



# Suppliers Directory

**2010**

# Supplier Directory

			Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>AGRINOVA SNC</b> Via Togliatti 52 12038 - SAVIGLIANO CN 0172/715488 0172/33408 info@agrinova.it www.agrinova.it	cereal milling equipment - ancillary equipment - bucket elevators - brushes - sieves - stitching - sleeves - belts - clothing, gaskets - pipes, piping	•					•
Name Street City Tel. Fax e-mail web	<b>ALFREDO BRAGLIA SPA</b> Via Fermi 33/A 42030 - FOGLIANO RE 0522/520121 0522/520125 info@officinebraglia.it www.officinebraglia.it	cereal milling equipment - feed equipment - mixers, blenders - sifters - dust collectors, cyclones - screws, worms - bucket elevators - hammer mills - silos - sieves - feed mixers - hoppers - rice milling - conveyors - vibrators - pneumatic conveyors				•		•
Name Street City Tel. Fax e-mail web	<b>AM COSTRUZIONI MECCANICHE</b> Via P. Da Volpedo 12 20052 - MONZA MB 039/835118 039/835118 info@ampacking.it www.ampacking.it	filling machines - weighers, scales - hffs horizontal form fill seal machines					•	
Name Street City Tel. Fax e-mail web	<b>AMANDUS KAHL GMBH &amp; CO KG</b> Dieselstrasse 5-9 D 21465 - REINBEK - GERMANIA 0049/40727710 0049/4072771100 info@amandus-kahl-group.de www.amandus-kahl-group.de	feed equipment				•		•
Name Street City Tel. Fax e-mail web	<b>ANSELMO SPA</b> Via Fossano 33 12041 - BENE VAGIENNA CN 0172/654755 0172/654811 anselmo@anselmoitalia.com www.anselmoitalia.com	pasta machines			•			•
Name Street City Tel. Fax e-mail web	<b>ASM SRL</b> Via Del Lavoro 10/12 40050 - ARGELATO BO 051/6630419 051/897386 info@sortingasm.com www.sortingasm.com	graders, sorters				•	•	•
Name Street City Tel. Fax e-mail web	<b>AXOR SRL</b> Via Maestra Grande 20 - Fraz. XII Morelli 44042 - CENTO FE 051/6842166 051/6842282 info@axor-italia.com www.axor-italia.com	pasta machines - pasta presses			•			
Name Street City Tel. Fax e-mail web	<b>BACO SNC</b> Via Bosco di Sacco 17 30010 - LIETTOLI DI CAMPOLONGO VE 049/5848955 049/9744147 info@ba-co.it www.ba-co.it	cereal milling equipment - ancillary equipment - pipes, piping		•				•
Name Street City Tel. Fax e-mail web	<b>BARRA PROJECT INTERNATIONAL SRL</b> Viale Giulio Cesare 8 24124 - BERGAMO BG 035/270820 035/270830 barra@barraproject.it www.barraproject.com	ancillary equipment - extractors						•
Name Street City Tel. Fax e-mail web	<b>BECCARIA SRL</b> Via Sperino 46 12030 - SCARNAFIGI CN 0175/274737 0175/274748 beccaria@beccaria.it www.beccaria.it	cereal milling equipment - feed equipment - hammer mills - silos - feed mixers - extractors - pneumatic conveyors	•			•		•
Name Street City Tel. Fax e-mail web	<b>BELLINTANI ZENO SAS</b> Via Schiappa 64 - San Siro 46027 - SAN BENEDETTO PO MN 0376/612180 0376/612147 bellintanizeno@libero.it www.bellintani.it	feed equipment - bucket elevators - hammer mills - feed mixers	•			•		•

# Supplier Directory

			Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>BERETTA IMPIANTI</b> Via Vittorio Emanuele 26 27059 - ZAVATTARELLO PV 0383/589775 0383/589775	conveyors - pneumatic conveyors	•					•
Name Street City Tel. Fax e-mail web	<b>BEVINI SRL</b> Via Dell'elettronica 5/7 - Loc. Graziosa 41018 - SAN CESARIO SUL PANARO MO 059/9530911 059/9535041 adelmo.bevini@bevini.it www.beviniimpianti.it	material handling and storage - bucket elevators - conveyor belts	•					•
Name Street City Tel. Fax e-mail web	<b>BIOCONTROL SYSTEMS SPA</b> Via Pontina Vecchia Km 34 00040 - ARDEA RM 06/9148831 06/9147118 bcs_it@biocontrolsys.com www.biocontrolsys.com	automation and controls - analysis equipment						•
Name Street City Tel. Fax e-mail web	<b>BONA SRL</b> Via Volterra 17 20052 - MONZA MB 039/741117 039/741172 bonasrl@fastwebnet.i	analysis equipment						•
Name Street City Tel. Fax e-mail web	<b>BORGHESI SRL</b> Via Paradello 7 45037 - MELARA RO 0425/89689 0425/89636 info@borghigroup.it www.borghigroup.it	cereal milling equipment - ancillary equipment - sifters - dust collectors, cyclones - bucket elevators - silos - sieves - hoppers - rice milling - pipes, piping - fans, blowers	•	•		•		•
Name Street City Tel. Fax e-mail web	<b>BRAMBATI SPA</b> Via Strada Nuova 37 27050 - CODEVILLA PV 0383/373100 0383/373078 info@brambati.it www.brambati.it	pasta machines - coffee equipment - feeders, proportioners, dosers - silos - extractors - peelers - cutters - cutting machines - roasters - crackers			•	•		•
Name Street City Tel. Fax e-mail web	<b>BÜHLER SPA</b> Via Rivoltana 2/D - Palazzo A 20090 - SEGRATE MI 02/703111 02/70311444 buhler.milan@buhlergroup.com www.buhlergroup.com	cereal milling equipment - feed equipment - pasta machines - confectionery bakery equipment - coffee equipment - pasta driers - alevographs - dampers - sifters - pellet mills - scourers - driers - farinographs - roller mills - washers - moisture testers - hammer mills - planifier - pasta presses - purifiers - silos - extruders - granulators - granulating machines - cocoa processing machines - refiners - rice milling - degerminators	•	•	•	•		•
Name Street City Tel. Fax e-mail web	<b>CAMLOGIC SNC</b> Via Dell'Industria 12 42025 - CAVRIAGO RE 0522/941172 0522/942643 camlogic@camlogic.it www.camlogic.it	ancillary equipment - level indicators						•
Name Street City Tel. Fax e-mail web	<b>CAREDI SRL</b> Via Sant'elena 52 31057 - SANT'ELENA DI SILEA TV 0422/94073 0422/94812 info@caredi.it www.caredi.it	silos - trieurs	•			•		
Name Street City Tel. Fax e-mail web	<b>CAVICCHI IMPIANTI SRL</b> Via Matteotti 35 40055 - VILLANOVA DI CASTENASO BO 051/6053164 051/780647 cavicchi@cavicchiimpianti.com www.cavicchiimpianti.com	material handling and storage - feeders, proportioners, dosers - hoppers - recycling plants - conveyors - pneumatic conveyors	•					•
Name Street City Tel. Fax e-mail web	<b>CBC SRL</b> S.S. 75 C.U. Km 4,190 - Z.I. 06083 - OSPEDALICCHIO BASTIA UMBRA PG 075/808151 075/8081508 sales@conceffi.com www.conceffi.com	packaging equipment - depalletizers - sacks filling machines - palletizers - de-palletizer					•	

# Supplier Directory

Cereal Equipment

Flour Milling

Pasta Production

Feed Milling

Packaging

Ancillary

Name Street City Tel. Fax e-mail web	<b>CHIARINI E FERRARI IMP. TECN. SRL</b> Via 1 Maggio 8 40015 - ANZOLA DELL'EMILIA BO 051/734270 051/733704 info@chiarinieferrari.it www.chiarinieferrari.it	conditioners							
Name Street City Tel. Fax e-mail web	<b>CIMAS SPA</b> Via Val Di Rocco 42 06134 - PONTE FELCINO PG 075/5918339 075/5913063 commerciale.cimas@cimasitalia.it www.cimasitalia.it	silos							
Name Street City Tel. Fax e-mail web	<b>CIMBRIA HEID ITALIA SRL</b> Via Ronzani 5/3 40033 - CASALECCHIO DI RENO BO 051/575635 051/576910 info@cimbria.it www.cimbria.com	cereal milling equipment - graders, sorters - trieurs							
Name Street City Tel. Fax e-mail web	<b>CLEXTRAL - AFREM</b> 1 Rue Du Colonel Riez F 42700 - FIRMINY - FRANCIA 0033/477403131 0033/477403123 clxsales@clextral.com www.clextral.com	cereal milling equipment - pasta machines - packaging equipment - ancillary equipment							
Name Street City Tel. Fax e-mail web	<b>CMB SRL</b> Via Torino 6/B 36063 - MAROSTICA VI 0424/780176 0424/472196 info@cmb srl.com www.cmb srl.com	feeders, proportioners, dosers							
Name Street City Tel. Fax e-mail web	<b>CMF SNC</b> Via Venezia 3 25037 - PONTOLIO BS 030/7376774 030/7470892 cmf.brescia@tin.it www.cmf-italia.com	feed equipment - scourers - driers - flakers - roller mills - sacks filling machines - toasters							
Name Street City Tel. Fax e-mail web	<b>COLOMBO PIETRO SNC</b> Via Marco D' Oggiono 21 - C.P. 63/64 23848 - OGGIONO LC 0341/576251 0341/579005 info@colombopietro.it www.colombopietro.it	Ancillary EQUIPMENT - screws, worms							
Name Street City Tel. Fax e-mail web	<b>COMECF SRL</b> Strada Provinciale Per Alessandria 7 27032 - FERRERA ERBOGNONE PV 0382/998943 0382/998005 staff@comecf.it www.comecf.it	cereal milling equipment - material handling and storage - driers - silos - engineering, consultant							
Name Street City Tel. Fax e-mail web	<b>CONCETTI SPA</b> SS 75 C.U. Km 4,190 - Franz. Ospedalichio 06083 - BASTIA UMBRA PG 075/801561 075/8000894 advertising@concetti.com www.concettigroup.it	packaging equipment - stitching - depalletizers - sacks filling machines - palletizers - palletizing robots							
Name Street City Tel. Fax e-mail web	<b>CPS SRL</b> Via Montecassino 47 - Località Larghe 40050 - FUNO DI ARGELATO BO 051/6647979 051/6647978 info@cpscucitrici.it www.cpscucitrici.it	stitching - sacks filling machines							
Name Street City Tel. Fax e-mail web	<b>CUSINATO GIOVANNI SRL</b> Via Monte Pelmo 8 35018 - SAN MARTINO DI LUPARI PD 049/9440146 049/9440174 info@cusinato.com www.cusinato.com	pasta machines - material handling and storage - screws, worms - bucket elevators - silos - sieves - sifters - hoppers - conveyor belts - pipes, piping - vibrators							

# Supplier Directory

			Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>DELLAVALLE SAS</b> Via Per Suno 2 28040 - MEZZOMERICO NO 0321/97097 0321/97401 nuovambn@tin.it www.emmebienne.com	aspirators, suction units, exhaust units - dust collectors, cyclones - scourers - bucket elevators - plansifter - bleachers - graders, sorters - rice milling	•					
Name Street City Tel. Fax e-mail web	<b>DOLZAN IMPIANTI SRL</b> Via Roma 260 35015 - GALLIERA VENETA PD 049/5969375 049/9470138 dolzan@dolzan.com www.dolzan.com	packaging equipment - vacuum packaging machines - filling closing machines - vffs vertical form fill seal machines					•	
Name Street City Tel. Fax e-mail web	<b>DS&amp;M SRL</b> Via Indipendenza 1/B 41100 - MODENA MO 059/285151 059/281518 info@dsem.it www.dsem.it	feeders, proportioners, dosers - weighers, scales - weight checker	•					•
Name Street City Tel. Fax e-mail web	<b>ELCU SUD IMPIANTI SRL</b> Via Polonia 15 20157 - MILANO MI 02/39002143 02/33200125 elcu@elcu.it www.elcu.it	stitching - sacks filling machines					•	
Name Street City Tel. Fax e-mail web	<b>ELETTROTECNICA ZAMBELLI SRL</b> Via Amendola 8 47039 - SAVIGNANO SUL RUBICONE FC 0541/941104 0541/941152 zambelli@zambellionline.com www.zambellionline.com	automation and controls - switch boards						•
Name Street City Tel. Fax e-mail web	<b>ESETEK INSTRUMENTS SRL</b> Via Arturo Reali 24 00047 - MARINO RM 06/9385909 06/93802520 info@esetek.it www.esetek.it	analysis equipment - moisture testers						•
Name Street City Tel. Fax e-mail web	<b>ESSEBIEMME PLAST SRL</b> Via Fosso Guidario 101/B 55049 - VIAREGGIO LU 0584/340202 0584/359987 essebiemme@virgilio.it	pasta machines - ancillary equipment			•			•
Name Street City Tel. Fax e-mail web	<b>EUROPACK SRL</b> Via Lago D' Iseo 10/A 36015 - SCHIO VI 0445/576860 0445/579511 info@europackitaly.com www.europackitaly.com	palletizers					•	
Name Street City Tel. Fax e-mail web	<b>FAS TECHNOLOGY SRL</b> Statale Padana 11 N. 1 24050 - MOZZANICA BG 0363/82173 0363/321064 info@officinasoli.com www.officinasoli.com	cereal milling equipment		•				
Name Street City Tel. Fax e-mail web	<b>FAVA SPA</b> Via 1 V Novembre 29 44042 - CENTO FE 051/6843411 051/6835740 info@fava.it www.fava.it	pasta machines - pasta driers - emulsifiers - pasta presses			•			•
Name Street City Tel. Fax e-mail web	<b>FLITECH SRL</b> Via S. Pertini 5 46020 - PIEVE DI CORIANO MN 0386/395057 0386/395056 info@flitech.it www.flitech.it	screws, worms - conveyors						•

# Supplier Directory

			Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>FORNASIER TIZIANO &amp; C SAS</b> Via Maglio 29/A 31010 - PONTE PRIULA SUSEGANA TV 0438/445354 0438/759210 info@fornasiertiziano.com www.fornasiertiziano.com	automation and controls						•
Name Street City Tel. Fax e-mail web	<b>FOSS ITALIA SPA</b> Corso Stati Uniti 1/77 35127 - PADOVA PD 049/8287211 049/8287222 fossitalia@foss.it www.foss.it	analysis equipment - fermentators, fermenters - analyzers - spectrophotometers						•
Name Street City Tel. Fax e-mail web	<b>FRAGOLA F.LLI SPA</b> Via Del Caminaccio 2 06088 - SANTA MARIA ANGELI PG 075/805291 075/8042717 commerciale@fragolaspa.com www.fragolaspa.com	feed equipment - pellet mills - crumblers - silos	•			•		
Name Street City Tel. Fax e-mail web	<b>G&amp;S SRL</b> Via Visco 20 35010 - LIMENA PD 049/8841894 049/8846567 info@geassrl.it www.geassrl.it	silos	•					
Name Street City Tel. Fax e-mail web	<b>GAUSS MAGNETI SRL</b> Via Scaroni 27 - Fornaci 25131 - BRESCIA BS 030/3582801 030/3580517 info@gaussmagneti.it www.gaussmagneti.it	magnets						•
Name Street City Tel. Fax e-mail web	<b>GBS GROUP SPA</b> Corso Stati Uniti 7 35127 - PADOVA PD 049/8949494 049/8949400 info@gbsgroupspa.com www.gbsgroupspa.com	cereal milling equipment - feed equipment - scourers - roller mills - washers - purifiers - silos - degerminators - cleaners	•	•		•		•
Name Street City Tel. Fax e-mail web	<b>GELEN TECHNIK BV</b> Peter Schreursweg 38 NL 6081 - HAELEN, NX - OLANDA 0031/475592315 0031/475592767 info@geelencounterflow.com www.geelencounterflow.com	refrigerating units - driers				•		
Name Street City Tel. Fax e-mail web	<b>GENERAL DIES SRL</b> Via Strà 182 37030 - COLOGNOLA AI COLLI VR 045/7650600 045/7650245 info@generaldies.com www.generaldies.com	Feed Equipment - pellet mills - hammer mills - feed mixers				•		•
Name Street City Tel. Fax e-mail web	<b>GIEFFE SYSTEMS SRL</b> Via Ponte Taro 28/B 43015 - NOCETO PR 0521/621221 0521/620883 info@gieffesystems.it www.gieffesystems.it	ancillary equipment - pasta presses - vacuum pumps			•			•
Name Street City Tel. Fax e-mail web	<b>GIORDANO LUCA &amp; C. SAS</b> Via Laghi Avigliana 1- Fraz. San Chiaffredo 12022 - BUSCA CN 0171/940001 0171/940907 luca.giordano@isiline.it www.giordanosnc.com	cereal milling equipment	•					
Name Street City Tel. Fax e-mail web	<b>GRESPAN LUCIANO COSTR. MECC.</b> Via Roma 144 31020 - CASTRETTE DI VILLORBA TV 0422/608848 0422/608083 info@grespan.it www.grespan.it	feed equipment - silos	•			•		•

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>GVF COMPONENTS SRL</b> Via Gazzotti 263 41100 - MODENA MO 059/285413 059/2861979 info@gvf.it www.gvf.it	ancillary equipment - scrapers - level indicators - valves					•
Name Street City Tel. Fax e-mail web	<b>IMAGIN SOLUTIONS SRL</b> Via Treviglio 3116/A 24045 - FARA GERA D'ADDA BG 0363/399403 0363/397990 info@imaginsolutions.it www.imaginsolutions.it	driers	•				
Name Street City Tel. Fax e-mail web	<b>IMMAC SRL</b> Via Strada Nuova 25 27050 - CODEVILLA PV 0383/373044 0383/73835 info@immacsrl.com www.immacsrl.com	cereal milling equipment - material handling and storage - aspirators, suction units, exhaust units - roller mills - plansifter		•			•
Name Street City Tel. Fax e-mail web	<b>IMPAC SRL</b> Via Ghisolfi E Guareschi 9 43015 - NOCETO PR 0521/620841 0521/627988 info@impac.it www.impac.it	pallet wrapping, hooding machines - depalletizers - carton erectors - stackers - sacks filling machines - palletizers - palletizing robots - overturning equipment - conveyor belts				•	•
Name Street City Tel. Fax e-mail web	<b>INTECH SRL</b> Via Cav G B Bordoagna 5 25012 - CALVISANO BS 030/9968222 030/9968444 intech@intechsrl.it www.intechsrl.it	sifters - feeders, proportioners, dosers - silos - sieves - extractors - pneumatic conveyors - weight checker	•				•
Name Street City Tel. Fax e-mail web	<b>IROM ITALIA SRL</b> Via Volturmo 80 20047 - BRUGHERIO MI 039/878673 039/884828 iromit@libero.it	cereal milling equipment - analysis equipment - moisture testers - graders, sorters - rice milling	•				•
Name Street City Tel. Fax e-mail web	<b>ISOLTECK CUSINATO SRL</b> Via Del Lavoro 3 31039 - RIESE PIO X TV 0423/754411 0423/754433 info@isolteck.com www.isolteck.com	pasta driers - driers					•
Name Street City Tel. Fax e-mail web	<b>ITALIANA TEKNOLOGIE SRL</b> Via Giovanni Segantini 14/2 60019 - SENIGALLIA AN 071/6609224 071/6607921 info@italianateknologie.it www.italianateknologie.it	pasta machines		•			
Name Street City Tel. Fax e-mail web	<b>ITALO DANIONI SRL</b> Via Mecenate 78/B 20138 - MILANO MI 02/504095 02/5062646 info@danioni.com www.danioni.it	grinders		•	•		
Name Street City Tel. Fax e-mail web	<b>ITALPACK SRL</b> Via Costa 106 47822 - S. ARCANDELO DI ROMAGNA RN 0541/625157 0541/621956 italpack@italpack.net www.italpack.net	packaging equipment - feeders, proportioners, dosers - sacks filling machines - filling closing machines - shrink tunnels - vffs vertical form fill seal machines				•	
Name Street City Tel. Fax e-mail web	<b>ITALPAST SRL</b> Via Della Chiesa 10 43036 - FIDENZA PR 0524/524450 0524/523468 info@italpast.com www.italpast.com	pasta machines - pasta driers - fresh pasta machinery - pasta presses - fresh pasta pasteurizers		•			

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>ITALPROJECT SRL</b> Via Leonardo Da Vinci 6 35015 - GALLIERA VENETA PD 049/9475211 049/9475200 sales@italproject.net www.italproject.net	packaging equipment - wrappers - cans, pots - blisters - cases, crates - lids - unstackers - labellers - carton erectors - stackers - gluing machines - palletizers - palletizing robots - weighers, scales				•	
Name Street City Tel. Fax e-mail web	<b>ITALSAVE SRL</b> Via Vecellio 13 - Sarano 31025 - SANTA LUCIA DI PIAVE TV 0438/460640 0438/460672 info@italsave.it www.italsave.it	paints, lining, coating - assistance, maintenance	•				•
Name Street City Tel. Fax e-mail web	<b>ITALVIBRAS SPA</b> Via Ghiarola Nuova 22/26 41042 - FIORANO MODENESE MO 0536/804634 0536/804720 italvibras@italvibras.it www.italvibras.it	vibrators					•
Name Street City Tel. Fax e-mail web	<b>LA MECCANICA SRL</b> Via Padre Nicolini 1 Loc. Facca 35013 - CITTADELLA PD 049/9419000 049/5972171 lameccanica@lameccanica.it www.lameccanica.it	feed equipment - pellet mills - hammer mills - feed mixers - coolers			•		•
Name Street City Tel. Fax e-mail web	<b>LA MONFERRINA SRL</b> Via Statale 27/A 14033 - CASTELL'ALFERO AT 0141/296047 0141/296134 info@la-monferrina.com www.la-monferrina.com	pasta machines - fresh pasta machinery - pasta presses - fresh pasta pasteurizers - pancakes making machines - dough sheeter		•			
Name Street City Tel. Fax e-mail web	<b>LA PARMIGIANA SRL</b> Via La Bionda 33 43036 - FIDENZA PR 0524/528688 0524/524465 laparmigiana@laparmigiana.com www.laparmigiana.com	pasta machines - fresh pasta machinery - pasta presses - fresh pasta pasteurizers - dough sheeter		•			
Name Street City Tel. Fax e-mail web	<b>LAMEC SRL</b> Via Isonzo 6/A 35013 - CITTADELLA PD 049/9400603 049/9400872 info@lamec-srl.it www.lamec-srl.it	feed equipment			•		
Name Street City Tel. Fax e-mail web	<b>LANDUCCI SRL</b> Via Landucci 1 51100 - PISTOIA PT 0573/532546 0573/533067 landucci@landucci.it www.landucci.it	pasta machines - dies - cutting machines - washing machines		•			•
Name Street City Tel. Fax e-mail web	<b>LARIORETI SAS</b> Via Piloni 4 23900 - LECCO LC 0341/250499 0341/254350 info@larioreti.com www.larioreti.com	conveyor belts					•
Name Street City Tel. Fax e-mail web	<b>LTA SNC</b> Viale Dell'industria 11 36016 - THIENE VI 0445/370993 0445/813114 info@ltaitalia.it www.ltaitalia.it	pasta machines - pasta driers		•			
Name Street City Tel. Fax e-mail web	<b>LTM SAS</b> Via Pozzetto 17 31033 - CASTELFRANCO VENETO TV 0423/490761 0423/740447 ltm@mlink.it www.damas.com	graders, sorters	•				•

# Supplier Directory

			Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>MARINELLI SRL</b> Via Leontini 9 93012 - GELA CL 0933/924448 0933/912533 info@marinelli-impianti.it www.marinelli-impianti.it	cereal milling equipment		•		•		
Name Street City Tel. Fax e-mail web	<b>MARINI IMPIANTI SRL</b> Via Dei Carretti 39 25040 - COLOMBARO DI CORTEF. BS 030/984491 030/984329 marinisrl@tin.it www.paginegialle.it/marinisrl-01	feed equipment - feeders, proportioners, dosers - silos		•		•		
Name Street City Tel. Fax e-mail web	<b>MAZZETTI SAS</b> Via Dei Bersaglieri 3 - Z I Stelloni 40010 - SALA BOLOGNESE BO 051/6815024 051/6873465 mazzetti@mazzettisas.com www.mazzettisas.com	sifters - scourers - destoners - sieves - trieurs - sifters - textiles						•
Name Street City Tel. Fax e-mail web	<b>METALPLAST SRL</b> Via 5 Maggio 19 20157 - MILANO MI 02/3556335 02/33200318 italy@mpmetalplast.it www.mpmetalplast.it	stitching					•	
Name Street City Tel. Fax e-mail web	<b>MF TECNO SRL</b> Via G. Marconi 11 06083 - BASTIA UMBRA PG 075/7827487 075/7827493 info@mftecno.it www.mftecno.it	feed equipment - packaging equipment - stitching - depalletizers - sacks filling machines - palletizers - palletizing robots				•	•	
Name Street City Tel. Fax e-mail web	<b>MILL SERVICE SPA</b> Via Pelosa 78 35030 - SELVAZZANO DENTRO PD 049/8978743 049/8978780 info@ms-italia.com www.ms-italia.com	cereal milling equipment	•	•				•
Name Street City Tel. Fax e-mail web	<b>MIMI SRL</b> Viale Italia 186/188 14053 - CANELLI AT 0141/820311 0141/831610 mimi@mimisrl.it www.mimisrl.it	packaging equipment - pallet wrapping, hooding machines - packaging sealing machines - shrink tunnels					•	
Name Street City Tel. Fax e-mail web	<b>MIOZZO SRL</b> Via E. Fermi 15 35010 - SALETTO DI VIGODARZERE PD 049/767451 049/8845941 miozzo@miozzosrl.com www.miozzosrl.com	pipes, piping						•
Name Street City Tel. Fax e-mail web	<b>MIX SRL</b> Via Volturmo 119/A 41032 - CAVEZZO MO 0535/46577 0535/46580 info@mixsrl.it www.mixsrl.it	ancillary equipment - feed mixers - granulators - granulating machines - filters - level indicators - nozzles						•
Name Street City Tel. Fax e-mail web	<b>MOLITECNICA SUD SNC</b> Via Dell'avena 27/29 Z I 70022 - ALTAMURA BA 080/3101016 080/3146832 info@molitecnicasud.com www.molitecnicasud.com	cereal milling equipment		•				
Name Street City Tel. Fax e-mail web	<b>MORELLI HANDLING &amp; ROBOTIC SYSTEMS SAS</b> Via D. Nerozzi 1 51031 - AGLIANA PT 0574/751082 0574/718549 info@morellirobot.com www.morellirobot.com	palletizers - palletizing robots					•	

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>MORIONDO SNC</b> Casella Postale 20/B 20045 - BESANA BRIANZA MI 0362/995110 0362/996300 moriondo@moriondo.com www.moriondo.com	pasta machines - fresh pasta machinery - pasta presses - fresh pasta pasteurizers - micro-wave cooking		•			
Name Street City Tel. Fax e-mail web	<b>MPM FOOD PLANTS SRL</b> Via Del Credito 24 31033 - CASTELFRANCO VENETO TV 0423/721238 0423/722620 info@mpmfoodplants.it www.mpmfoodplants.it	pasta machines		•			
Name Street City Tel. Fax e-mail web	<b>MTD SRL</b> Via Volta 2 - Z I Settimo 37026 - PESCANTINA VR 045/7157266 045/7157360 info@mtdsrl.it www.mtdsrl.it	feed equipment - pellet mills			•		
Name Street City Tel. Fax e-mail web	<b>MULMIX FACCO SRL</b> Via Palladio 7 35010 - MARSANGO PD 049/9638211 049/9630511 mulmix@mulmix.it www.mulmix.it	feed equipment - driers - hammer mills - silos	•		•		
Name Street City Tel. Fax e-mail web	<b>MUNDIALNYL</b> Via Salardi 19 22100 - COMO CO 031/523089 031/523482 mundialnyl@mundialnyl.it www.mundialnyl.it	pasta driers - frames - textiles					•
Name Street City Tel. Fax e-mail web	<b>NEW PROJECT SRL</b> Via Zaghini Terra Rossa 75 47822 - S. ARCANGELO DI ROMAGNA RN 0541/758644 0541/757007 info@newproject-italia.it www.newproject-italia.it	packaging equipment - sacks filling machines - vffs vertical form fill seal machines				•	
Name Street City Tel. Fax e-mail web	<b>NICCOLAI TRAFILE SPA</b> Via Cardarelli 19 - Z.I. Sant'Agostino 51100 - PISTOIA PT 0573/92731 0573/934394 niccolai@niccolaitrafile.it www.niccolai.com	pasta machines - dies - dough sheeter - cutting machines - washing machines		•			•
Name Street City Tel. Fax e-mail web	<b>NOL TEC SRL</b> Via Milano 14/M 20064 - GORGONZOLA MI 02/9516875 02/9511473 info@nol-teceurope.com www.nol-tec.com	pilot plants - level indicators					•
Name Street City Tel. Fax e-mail web	<b>NORMICOM SRL</b> Via Dei Brughii 23/25 20060 - GESSATE MI 02/9504747 02/9504775 info@normicom.it www.normicom.it	material handling and storage - mixers, blenders - sifters - feeders, proportioners, dosers - crushers - grinders - mills - sieves - sifters - feed mixers - level indicators - material handling - reactors - valves - vibrators - pneumatic conveyors					•
Name Street City Tel. Fax e-mail web	<b>OBR DI BULGARELLI &amp; C SNC</b> Via Parri 3 42045 - LUZZARA RE 0522/976972 0522/970909 obrbul@libero.it www.obr.it	cereal milling equipment - feed equipment - ancillary equipment			•		•
Name Street City Tel. Fax e-mail web	<b>OCRIM SPA</b> Via Massarotti 76 26100 - CREMONA CR 0372/4011 0372/412692 info@ocrim.com www.ocrim.com	cereal milling equipment - roller mills - washers - hammer mills - purifiers - silos - degerminators - pneumatic conveyors - cleaners	•	•	•		

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>OFFICINE LOPORCARO SAS</b> S S 96 Km 78.800 70022 - ALTAMURA BA 080/3101167 080/3101307 info@loporcaro.it www.loporcaro.it	cereal milling equipment	•	•			
Name Street City Tel. Fax e-mail web	<b>OFFICINE MAZZOLARI SRL</b> Via Aldo Moro 14 - Z. I. Cignone 26020 - CORTE DE' CORTESI CR 0372/926002 0372/926107 info@grazianomazzolari.it www.grazianomazzolari.it	services					•
Name Street City Tel. Fax e-mail web	<b>OFFICINE MINUTE SRL</b> Via Roma 139 31020 - VILLORBA TV 0422/919178 0422/911192 info@officineminute.it www.officineminute.it	driers - silos	•				
Name Street City Tel. Fax e-mail web	<b>OLOCCO &amp; C SNC</b> Via Del Santuario 41 12045 - FOSSANO CN 0172/692579 0172/692578 olocco@olocco.it www.olocco.it	ancillary equipment - pipe fittings - valves - pneumatic conveyors	•				•
Name Street City Tel. Fax e-mail web	<b>OMAS SRL</b> Via Vicinale Momi 2/A - Arsego 35010 - SAN GIORGIO DELLE PERTICHE PD 049/5742422 049/5742610 omas@omas-srl.com www.omas-srl.com	cereal milling equipment - ancillary equipment - roller mills - pneumatic conveyors - cleaners	•	•			
Name Street City Tel. Fax e-mail web	<b>OMB SRL</b> Via Mariano 3 41040 - CARLO DI FORMIGINE MO 059/556316 059/572762 info@ombvibrators.com www.ombvibrators.com	motors - vibrators					•
Name Street City Tel. Fax e-mail web	<b>OR SELL SRL</b> Via Lametta 140/146 41010 - LIMIDI DI SOLIERA MO 059/652504 059/652330 rinaldi@orsell.it www.orsell.it	analysis equipment					•
Name Street City Tel. Fax e-mail web	<b>OVERALL PROJECT SRL</b> Via 28 Luglio 338 47893 - BORGO MAGGIORE RSM 0549/909392 0549/909392 info@overallproject.com www.overallproject.com	automation and controls					•
Name Street City Tel. Fax e-mail web	<b>PAGANI IMBALLAGGI SNC</b> Via G. Morandi 32 21047 - SARONNO VA 02/96701343 02/96701377 info@paganiimballaggi.com www.paganiimballaggi.com	pallet wrapping, hoarding machines - depalletizers - bundling machines - sacks filling machines - palletizers - palletizing robots - sealing welding machines				•	
Name Street City Tel. Fax e-mail web	<b>PAGLIERANI SRL</b> Via Santarcangiolo 5 47825 - TORRIANA RN 0541/311111 0541/675460 info@paglierani.com www.paglierani.com	pallet wrapping, hoarding machines - depalletizers - bundling machines - sacks filling machines - palletizers - filling closing machines - palletizing robots - sealing welding machines				•	
Name Street City Tel. Fax e-mail web	<b>PARTISANI SRL</b> Via Buli 2 47122 - FORLI' FC 0543/796165 0543/723237 info@partisani.it www.partisani.it	cereal milling equipment - stones - cleaners	•	•			

# Supplier Directory

			Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>PASTA EQUIPMENT SRL</b> Via Dell'artigianato 90 22070 - FENEGRO CO 031/937755 031/3520528 info@pastaequipment.it www.pastaequipment.it	fresh pasta machinery			•			
Name Street City Tel. Fax e-mail web	<b>PASTA TECHNOLOGIES SRL</b> Via Martiri Delle Foibe 13 35019 - ONARA DI TOMBOLO PD 049/9485146 049/9485147 info@pastatechnologies.com www.pastatechnologies.com	pasta machines			•			
Name Street City Tel. Fax e-mail web	<b>PAVAN SRL</b> Via Monte Grappa 8 35015 - GALLIERA VENETA PD 049/9423111 049/9423303 sales@pavan.com www.pavan.com	pasta machines - pasta driers - fresh pasta machinery - pasta presses - fresh pasta pasteurizers - map packag- ing machines - extruders - dough sheeter - micro-wave cooking			•		•	•
Name Street City Tel. Fax e-mail web	<b>PERONTECNICI SRL</b> Via M. Polo 17 35020 - ALBIGNASEGO PD 049/681093 049/691488 perontecnici@perontecnici.it www.perontecnici.it	conveyor belts						•
Name Street City Tel. Fax e-mail web	<b>PERTEN INSTRUMENTS AB</b> Via Carlo Ravizza 5 20149 - MILANO MI 340/9374005 02/9984065 fdavini@perthen.com www.perthen.com	ancillary						•
Name Street City Tel. Fax e-mail web	<b>PETKUS TECHNOLOGIE GMBH</b> Via Curiel 5, Corte Tegge 42025 - CAVRIAGO RE 0522/943612 0522/943625 pellizzi@petkus.it www.petkus.de	driers - silos - conveyors - cleaners	•			•		
Name Street City Tel. Fax e-mail web	<b>PIZETA SRL</b> Via Europa 27 35015 - GALLIERA VENETA PD 049/9470669 049/9471739 info@pizeta.com www.pizeta.com	pasta machines - sifters - dust collectors, cyclones - screws, worms - feeders, proportioners, dosers - bucket elevators - mills - plansifter - silos - sieves - tapes, rib- bons - stirrers, shakers - extractors - extruders - dough loaders - proofers - rollers - filters - weighers, scales - air compressors - compressors - conveyor belts - plc - textiles - conveyors - vibrators - pneumatic conveyors	•		•			
Name Street City Tel. Fax e-mail web	<b>PLASTICS &amp; SEALS SRL</b> Via Bene Vagienna 19 12060 - LEQUIO TANARO CN 0172/696391 0172/696383 info@plastics-seals.it www.plastic-seals.it	containers					•	•
Name Street City Tel. Fax e-mail web	<b>PLP LIQUID SYSTEMS SRL</b> Via 1° Maggio 4 29018 - LUGAGNANO VAL D'ARDA PC 0523/891629 0523/891013 info@plp-liquidsystems.net www.plp-liquidsystems.net	recycling plants				•		•
Name Street City Tel. Fax e-mail web	<b>PRO-TECH ITALIA SRL</b> Via Luigi Nino Malerba 47 16012 - BUSALLA GE 010/9642386 010/9760839 info@pro-techitalia.com www.pro-techitalia.com	pasta plant - material handling and storage - bucket elevators - silos - hoppers - conveyor belts			•			•
Name Street City Tel. Fax e-mail web	<b>R-BIOPHARM ITALIA SRL</b> Via Dell'artigianato 19 20070 - CERRO AL LAMBRO MI 02/98233330 02/9834100 info@r-biopharm.it www.r-biopharm.com	analysis equipment						•

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>RAMBALDO ANTONIO</b> Via Tessara 9/11 35010 - S. MARIA DI NON CURTAROLO PD 049/557094 049/9623322 info@rambaldoantonio.com www.rambaldoantonio.it	Ancillary Equipment					•
Name Street City Tel. Fax e-mail web	<b>RE PIETRO OFF. MECCANICNICHE</b> Via Galilei 55 20083 - GAGGIANO MI 02/9085025 02/90842014 info@repietro.com www.repietro.com	scourers - bucket elevators - rice milling	•				
Name Street City Tel. Fax e-mail web	<b>RICCIARELLI SPA</b> Via Mariotti 143 - Z I Sant' Agostino 51100 - PISTOIA PT 0573/44571 0573/933223 info@ricciarellispa.it www.ricciarellispa.it	pasta machines - pasta driers - packaging sealing machines - vacuum packaging machines		•		•	
Name Street City Tel. Fax e-mail web	<b>RIMA PACK SNC</b> Via Viazza Sinistra 2 40050 - MEZZOLARA DI BUDRIO BO 051/805604 051/805020 rimapack@libero.it www.rimapack.it	stitching - sacks filling machines				•	•
Name Street City Tel. Fax e-mail web	<b>ROSTA SRL</b> Via Bergamo 6 20020 - LAINATE MI 02/93655101 02/93655200 rostaitalia@rostaitalia.com www.rostaitalia.com	ancillary equipment - coupling					•
Name Street City Tel. Fax e-mail web	<b>S.COM SRL</b> Via Pierobon 31 35010 - LIMENA PD 049/8848090 049/8848070 info@sicom-italy.com www.sicom-italy.com	cereal milling equipment - roller mills - plansifter - purifiers - silos - extractors - pneumatic conveyors - cleaners	•	•			•
Name Street City Tel. Fax e-mail web	<b>SAGA SRL</b> Via Don Bosco 31 20139 - MILANO MI 02/55212634 02/55212634 info@sagasnc.com www.sagasnc.com	feed mixers - sacks filling machines - weighers, scales			•		
Name Street City Tel. Fax e-mail web	<b>SARP SNC</b> Via Montebelluna 43 - Loc. S. Andrea O. M. 31033 - CASTELFRANCO VENETO TV 0423/482633 0423/482468 sarp@sarp.it www.sarp.it	pasta machines - fresh pasta machinery - fresh pasta pasteurizers - freezing tunnels - proving tunnel		•			
Name Street City Tel. Fax e-mail web	<b>SCHULE F.H. MUHLENBAU GMBH</b> Dieselstrasse 59 D 21465 - REINBEK - GERMANIA 0049/40727710 0049/4072771710 schule@amandus-kahl-group.de www.schulefood.de	plansifter - bleachers - cleaners			•		
Name Street City Tel. Fax e-mail web	<b>SCOLARI SRL</b> Via Padana Superiore 178 25035 - OSPITALETTO BS 030/6848012 030/6848032 info@scolarisrl.com www.scolarisrl.com	cereal driers	•				
Name Street City Tel. Fax e-mail web	<b>SEA SRL</b> Via Ercolani 30 40026 - IMOLA BO 0542/361423 0542/643567 info@seasort.com www.seasort.com	cereal graders, sorters					•

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>SECAM SRL</b> Via Curiel 17/19 20017 - MAZZO DI RHO MI 02/93901220 02/93901292 info@secamsrl.com www.secamsrl.com	packaging equipment - pallet wrapping, hooding machines - stitching - sacks filling machines - filling closing machines - weighers, scales - weight checker				•	
Name Street City Tel. Fax e-mail web	<b>SEFAR ITALIA SRL</b> Via Nazioni Unite 44 10093 - COLLEGNO TO 011/42001 011/3827253 info@fd.sefar.it www.sefar.it	ancillary equipment - frames - textiles					•
Name Street City Tel. Fax e-mail web	<b>SELEMATIC SPA</b> Via Quattro Giornate Di Eboli 5/7 84025 - EBOLI SA 0828/340904 0828/340906 info@selematic.it www.selematic.it	packaging equipment				•	
Name Street City Tel. Fax e-mail web	<b>SEVEN SRL</b> Via Dell'industria 2 35012 - CAMPOSAMPIERO PD 049/8874518 049/8874517 seven@sevensrl.it www.sevensrl.it	cereal milling equipment - ancillary equipment - pipes, piping					•
Name Street City Tel. Fax e-mail web	<b>SIAT SRL</b> Via Circonvallazione Ovest 53 40050 - CASTELLO D'ARGILE BO 051/977027 051/977252 info@siat.it www.siat.it	brushes					•
Name Street City Tel. Fax e-mail web	<b>SILESFOR DP SRL</b> Via Galvani 26 35030 - RUBANO PD 049/8975307 049/631499 silesfor@silesfor.com www.silesfor.com	silos	•				
Name Street City Tel. Fax e-mail web	<b>SILOS SAMARANI SRL</b> Via Gramsci 5 26013 - CREMA CR 0373/256838 0373/720352 info@silosamarani.it www.silosamarani.it	silos	•				
Name Street City Tel. Fax e-mail web	<b>SIMA SNC</b> Via Marmolada 15 - Z I Nord 31027 - SPRESIANO TV 0422/881034 0422/888533 simasnc@interfree.it www.simaimpianii.net	ancillary equipment - aspirators, suction units, exhaust units - dust collectors, cyclones					•
Name Street City Tel. Fax e-mail web	<b>SIRCATENE SPA</b> Via Rossini 17 - Località Campù 23873 - MISSAGLIA LC 039/9200551 039/9200814 info@sircatene.com www.sircatene.com	chains					•
Name Street City Tel. Fax e-mail web	<b>SIRCEM SPA</b> Via Diaz 15 84018 - SCAFATI SA 081/8631205 081/8630301 sircem@sircem.it www.sircem.it	pasta machines - feeders, proportioners, dosers - bucket elevators - silos - filters - industrial pc - control panels - pneumatic conveyors		•		•	
Name Street City Tel. Fax e-mail web	<b>SMERI SRL</b> Via Balduccio Da Pisa 12 20139 - MILANO MI 02/5398941 02/5692507 smeri@smeri.com www.smeri.com	instruments					•

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>SPIROTECH SRL</b> Via Brescia 61 25012 - CALVISANO BS 030/9968222 030/9968444 info@spirotech.it www.spirotech.it	cereal milling equipment - feed equipment - screws, worms	•	•	•		
Name Street City Tel. Fax e-mail web	<b>STAD SRL</b> Via Per Reggio 30/P 42019 - ARCETO DI SCANDIANO RE 0522/851360 0522/765854 info@stadsrl.com www.stadsrl.com	weighers, scales				•	
Name Street City Tel. Fax e-mail web	<b>STIA PASTA TECHNOLOGY SRL</b> Via Milano 85 80142 - NAPOLI NA 081/201128 081/5536347 info@stiapastatec.com www.stiapastatec.com	pasta machines - pasta presses - extruders			•		•
Name Street City Tel. Fax e-mail web	<b>TECALIT SRL</b> Casella Postale 81 35018 - SAN MARTINO DI LUPARI PD 049/9460985 049/5953771 tecalit@tecalit.it www.tecalit.it	pasta machines - pasta driers - pasta presses		•			•
Name Street City Tel. Fax e-mail web	<b>TECHNIPES SRL</b> Via Del Gelso 12 47822 - S. ARCANGELO DI ROMAGNA RN 0541/624970 0541/625902 technipes@technipes.com www.technipes.com	pallet wrapping, hooding machines - stitching - sacks filling machines - palletizers - filling closing machines - weighers, scales - weight checker				•	
Name Street City Tel. Fax e-mail web	<b>TECHNO D SNC</b> Via Marche 19 27029 - VIGEVANO PV 0381/348294 0381/090590 info@techno-d.it www.techno-d.it	packaging sealing machines				•	
Name Street City Tel. Fax e-mail web	<b>TECHNOBINS SRL</b> Via Curiel 5 - Corte Tegge 42025 - CAVRIAGO RE 0522/943002 0522/494105 techbins@tin.it www.technobins.it	material handling and storage - silos	•				
Name Street City Tel. Fax e-mail web	<b>TECHNOSILOS SNC</b> Via Piana 67 47032 - CAPOCOLLE DI BERTINORO FC 0543/449143 0543/449187 technosilos@technosilos.com www.technosilos.com	material handling and storage - sifters - feeders, proportioners, dosers - silos - sieves - hoppers	•				•
Name Street City Tel. Fax e-mail web	<b>TECNA SRL</b> Via Milano 52 22070 - BREGNANO CO 031/774293 031/774308 tecna@tecnasaima.it www.tecnasaima.it	fresh pasta machinery - pasta presses - fresh pasta pasteurizers - dough sheeter		•			
Name Street City Tel. Fax e-mail web	<b>TECNA SRL</b> Area Science Park - Padriciano 99 34012 - TRIESTE TS 040/3755341 040/3755343 tecna@tecnalab.com www.tecnalab.it	analysis equipment					•
Name Street City Tel. Fax e-mail web	<b>TECNOGRAIN CARLINI SRL</b> Via Aldo Moro 23 46010 - S. SILVESTRO DI CURTATONE MN 0376/478584 0376/478530 info@tecnograin.com www.tecnograin.com	refrigerating units	•				•

# Supplier Directory

		Cereal Equipment	Flour Milling	Pasta Production	Feed Milling	Packaging	Ancillary
Name Street City Tel. Fax e-mail web	<b>TECNOIMPIANTI SNC</b> Via Maggiore 81 35045 - OSPEDALETTO EUGANEO PD 0429/679060 0429/670222 tecnimpianti@tecnimpiantisnc.it www.tecnimpiantisnc.it	feed equipment - driers - extractors	•		•		
Name Street City Tel. Fax e-mail web	<b>TECOM DI DEL VACCHIO</b> Via Emilia Est 1420/3 41100 - MODENA MO 059/282353 059/282363 info@te-com.it www.te-com.it	ancillary equipment - pipe fittings - valves - pneumatic conveyors					•
Name Street City Tel. Fax e-mail web	<b>TEKNO UNO TRATT. ACCIAI SRL</b> Via Lombardia 12 37012 - SAN VITO BUSSOLENGO VR 045/7157088 045/7157287 srl.teknouno@tin.it www.teknouno.com	feed equipment - ancillary equipment			•		•
Name Street City Tel. Fax e-mail web	<b>TENCHINI SNC</b> Strada Dell' Orsina 4 29100 - PIACENZA PC 0523/594180 0523/594185 tenchini@libero.it www.paginegialle.it/tenchinisnc	feed equipment - pellet mills - hammer mills - crumblers			•		•
Name Street City Tel. Fax e-mail web	<b>TESTO SPA</b> Via Flli Rosselli 3/2 20019 - SETTIMO MILANESE MI 02/335191 02/33519200 info@testo.it www.testo.it	automation and controls - flowmeters - hygrometers - pressure gauges - thermometers					•
Name Street City Tel. Fax e-mail web	<b>TOSA SRL</b> Loc. San Bovo - Via Statale 32 12054 - COSSANO BELBO CN 0141/88285 0141/88550 info@tosa.it www.tosa.it	pallet wrapping, hooding machines				•	
Name Street City Tel. Fax e-mail web	<b>TRESSE PROGETTI SRL</b> Via Delle Industrie 10/A 31050 - PONZANO VENETO TV 0422/960811 0422/960850 home@tresseprogetti.eu www.tresseprogetti.it	automation and controls					•
Name Street City Tel. Fax e-mail web	<b>TUBIMONT SRL</b> Corso Asti 2/1 12050 - GUARENE CN 0173/228414 0173/33272 tubimont@tubimontsrl.191.it	feeders, proportioners, dosers					•
Name Street City Tel. Fax e-mail web	<b>UMBRA PACKAGING SRL</b> Viale Dei Pini 46/48 06086 - PETRIGNANO DI ASSISI PG 075/809780 075/80978127 info@umbrapackaging.it www.umbrapackaging.it	depalletizers - stackers - sacks filling machines - palletizers - palletizing robots - conveyors				•	
Name Street City Tel. Fax e-mail web	<b>VACUUM PUMP SPA</b> Via Olgiate Magora 26 23883 - BEVERATE BRIVIO LC 039/932911 039/5320139 info@vacuumpump.it www.vacuumpump.it	map packaging machines - vacuum packaging machines - bundling machines - shrink tunnels				•	
Name Street City Tel. Fax e-mail web	<b>VENETA IMPIANTI SRL</b> Viale Delle Industrie 5/6 - Z I Ronchi 35010 - VILLAFRANCA PADOVANA PD 049/9070318 049/9070325 info@venetaimpianti.com www.venetaimpianti.com	aspirators, suction units, exhaust units					•



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