

# New bakery ingredients from sprouted grains

Place: Padova, Italy, Europe



## Summary

The application of appropriate processing conditions allowed the production of flours from sprouted grains (e. g. wheat and buckwheat) with properties suitable for the preparation of natural and sustainable baked products without resorting to the addition of "exogenous" additives or enhancers.

## Partnership

### **Molino Quaglia s.p.a. - Italy**

Lead applicant

Molino Quaglia is a leading company in Italy for the production of common wheat flours. It was recognised in 1996 as the most advanced in the production category 400 tonnes/24 hours. It produces a line of stone milled flours with 100% Italian grains through a short production chain useful for the environment and the consumer. Techniques of integrated agriculture, preservation with the cool technique, rigorous cleanliness of wheat and flours storage's silos and use of last generation optical selector machine guarantee the traceability from the field to the bag and the maximum possible food safety. Molino Quaglia has a "little factory" for the toasting of cereals, brans and wheat germ, and an assisted germination system for cereals and legumes which uses a European exclusive license. It shows big attention to the training of professional end-users of its flours and to the development of a considerable marketing activity.

### **ARTE INNOVATIVA DEGLI ALIMENTI s.r.l. - Italy**

Initiative partner

Commercialisation of innovative food and nutritional products.

### **University of Milan, Department of Food, Environmental and Nutritional Sciences - Italy**

Initiative partner

Scopo del DeFENS è promuovere la formazione e sviluppare la ricerca per garantire alimenti sicuri, innovativi, e di qualità, prodotti mediante tecnologie sostenibili lungo tutta la filiera. Dal campo alla tavola, ma anche oltre, DeFENS si pone l'obiettivo di preservare e migliorare ambienti, sistemi, prodotti, e di fornire un approccio olistico a queste problematiche con lo scopo ultimo di salvaguardare e migliorare la salute umana e la qualità della vita.

### Step 1: Fast lane to the main idea

Sprouting - that provides partial breakdown of polymeric nutrients – represents an economically and energetically valid approach to provide “natural” alternatives to other ingredients in baking, and to improve the overall quality of the products.

### Step 2: Main innovation developed

The knowledge seed stemming from this activity is to make the best from “biological” and sustainable processes. This required to bridge the gaps between research, technology, industry, and market.

The main innovation is the development of a productive, sustainable and resource-efficient primary production system that secures supply of “all natural”, healthy and high quality cereal-based food. Indeed, the significance of this best practice relates to the use in baking processes of sprouted grains as “all natural” ingredients/enhancers in place of “exogenous” additives or ingredients (that are often used in many food applications).

### Step 3: Background and context

The practice of sprouting of cereal grains - which is an ancient tradition of Asian countries - has become popular in the Western world. Sprouting can be done without sophisticated equipment by soaking grains in water for several days, and can be halted by mild drying. Sprouting grains develop the enzymes required to break down starch and proteins - in the grain itself - into forms that can be rapidly used by yeast (e. g. during leavening) and are thought of as having relevant nutritive value. Indeed, sprouting changes amino acid composition and the soluble/insoluble fibre ratio, and increases the content of certain vitamins and minerals, while decreasing the antinutritional factors. Flour from sprouted grains can be used in many different foods (including breakfast items, pasta, and baked products) as an “all natural” ingredient and enhancer of technological performance, and to improve the taste and other sensory properties - and the nutritional value - of products.

### Step 4: Main results achieved

This initiative has led to:

- i) Optimize production of sprouted wheat, buckwheat and other cereal and pseudocereal grains with limited hydrolysis of starch and protein.
- ii) Define appropriate post-sprouting processing conditions (drying and milling) for the production of flours with new and suitable properties, including retention of nutritionally relevant species and of unique sensory traits.
- iii) Assess the suitability of flour from sprouted grains - also in significant amounts - for the production of different kinds of bread.
- iv) Outline a commercialization plan of these new products on the basis of technical (concept analysis, working model) and business (market analysis) considerations.

### Germinated "Bricks"

A number of cereals, pseudocereals, and legumes have been successfully germinated and commercialized as entire grains or flours in the shape of "bricks". These "bricks" represent innovative

and unique "all natural" products and/or ingredients with increased sensory, nutritional and technological performances, that may be used in various applications.

### Grains and Flours

After sprouting, grains are stabilized by mild drying and commercialized as whole dried grains or as flours. Dried grains are used - after rehydration - as ingredients in various recipes to exploit their improved nutritional and sensory properties, whereas flours are used in a number of baking processes as "all natural" baking enhancers (source of sugars, enzymes, etc.).

### Sprouting Cereals

During sprouting, carbohydrates are converted into sugars that can be used by yeasts during leavening, the content of anti-nutritional substances decreases, while proteins and enzymes – that can be of relevance during the baking process - are synthesized and/or activated. In addition, bioavailability of vitamins and minerals increases. Through all these events, the grain becomes a source of “all natural” ingredients. Step 5: Main beneficiaries and needs addressed

1) Consumers: Supply of healthy, natural and “sustainable” bakery products that do not contain “exogenous” additives/enhancers (indeed, nothing but the grains themselves goes into the processing line). Products appear to exceed the user requirements also in terms of sensory traits.

2) Industry: Our solution has bridged the gap between development and implementation of new technologies, with a strong business innovation trait and a market-driven approach, in view of increasing growth and job creation. The involvement of end users including public authorities (both at local and regional level) has represented a key-point to achieve this goal.

3) Society: By using resources more efficiently, and by fostering ecosystem services and the recovery of biological diversity, alongside competitive supply chains, our innovative solution may contribute to accelerate the transition to a sustainable European bio-economy.

### Bread with Germinated Flours

Addition of little amounts of flour (5-10%) from sprouted grains allowed to obtain different types of “all natural” wheat-based bread, without adding any exogenous enhancers (enzymes, additives, emulsifiers, etc.), and had no detrimental effects on the appearance of bread. Sensory analysis assessed that bread containing flours from sprouted grains developed unique aroma traits. Step 6:

#### Human resources involved in the project

This project wants to be a blend of science and professionalism of craftsmanship and distinctive elements of the involved companies, which intends to satisfy the most demanding requirements of the market.

Partners contribution consisted of:

A) Molino Quaglia: Strong experience and expertise related to milling and baking processing, and to the development and management of innovative industrial plants.

B) UNIMI: Technicians and researchers; evaluation of physical, molecular and sensory properties of

germinated grains and baked products, along with some basic nutritional indexes and with indexes apt at describing the extent of macromolecule hydrolysis. Validation from a scientific point-of-view of the quality of flours and bread from germinated seeds.

C) ARINNA: Market size definition (qualitative and quantitative), and identification of market barriers.

#### Step 7: Main difficulty or obstacle

The most challenging obstacle in this project related to the grains stabilization after the sprouting process, and, in particular, to the definition and the tuning of the drying conditions. Indeed, low drying temperatures resulted in the best performances of grains as "natural" ingredients/enhancers in baking, whereas for the development of peculiar sensory traits - to be found in the final preparations and products - higher drying temperatures are required.

#### Step 8: Environmental impact

This activity allowed optimizing the efficient use of resources, in terms of significant reduction of water use in sprouting (as compared to other processes) as well as in lower energy requirements for the subsequent drying steps. Thanks to the new process, in fact, it is possible to reduce energy consumption by >20% with respect to other current technologies. Furthermore, as concerns water usage, it has been possible to switch from a dispersion of flour in water in a 1:3 ratio to a 1:0.5 ratio. This, in turn, allows to save about 50% of the energy required for the subsequent drying steps.

#### Equipment for Grain Sprouting

An innovative system for the simultaneous germination and fermentation of grains has been set at Molino Quaglia. It uses a European exclusive license, and allows to reduce energy consumption by >20% with respect to other current technologies. As for water usage, it has been possible to switch from a dispersion of flour in water (1:3 ratio) to a 1:0.5 ratio. This also allows to save about 50% of the energy required for the subsequent drying steps.

Step 9: Sustainability, transferability and duplicability  
Appropriate sprouting/drying/milling cycles can be applied to a broader range of grains, so that this approach can be customized for many other applications and products (from baking to brewing, from energy drinks to potential sources of bioactives). One of the great advantages of this project is the relative easiness of "scaling up". Scaling up does not appear to involve design or operational difficulties, as only the size of the equipment and the volume of the treated material changes. Sustainability is also one of the main issues, as completion of the project satisfies the user requirement for natural and sustainable ingredients, along with substantial energy savings. The "natural" trait may be further enhanced, for instance by using in-house developed milling procedures that rely on stone grinding of grains.

#### Equipment for Grain Sprouting

In the sprouting processing chamber, grains are germinated and stabilized by thermal drying. Sprouting results into modifications of grains that affect the sensory, nutritional, and technological properties of the resulting flours. This process can be eventually applied to a broad range of grains (wheat,

buckwheat, rye, barley, rice, quinoa, amaranth) and legumes, and customized for many other applications (from baking to brewing, from energy drinks to potential sources of bioactives). Step 10: Dissemination

The Communication Plan involved activities and actions to attract the following big categories of target groups: i) Consumer associations; ii) Trade and Professional associations dealing with healthy food; iii) Local public authorities. In particular, participation in trade fairs represents an opportunity to present innovative products produced in the frame of this project in such a way as to involve industry experts and representatives of significant distribution and consumers. A second step in dissemination is bound to industrialization, with reference to the transferability and the replication of the interventions developed within this project to other production contexts.

#### Trade Fairs

Participation in Italian and international trade fairs (SIGEP, Salone del Gusto, Food ingredients Europe) represents an opportunity to present innovative products (flours, sprouted cereals and legumes, bread) produced in the frame of this project in such a way as to involve industry experts and representatives of significant distribution and consumers.