



Technical Paper

No. 14

THE MANUFACTURE OF WHEAT FLOUR AND ITS QUALITY ASSESSMENT

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The Manufacture of Wheat Flour and Its Quality Assessment

The conversion of wheat grains into flour for the manufacture of baked products has a long history. The earliest processing of wheat was carried out by hand and was based on the crushing the grains between two stones. As the demand for wheat flour increased, flour milling moved from the domestic scale to an industrial scale but for many centuries the basic principle remained the crushing of grain between two stones.



Hand-operated milling stones from the Romano-British period. The grain is fed through a hole in the top stone and the flour is expelled from the gap between the rotating upper and fixed lower stone for collection.

With the arrival of steel rollers in the 19th century, the process of converting grain to wheat flour for baking became more sophisticated and combined a number of different grinding arrangements with various sifting options. The flow of grain and flour products is often difficult to appreciate when visiting a modern, large-scale flour mill. The evolution of the modern flour milling processes has much to do with seeking to optimise the separation of the energy-dense endosperm from the fibre-rich outer layers of the wheat grains. This is especially true if the desired end-product from the mill is a 'white' flour, that is, one essentially free from particles of bran. The desire to remove branny materials from wheat flour has a long history as it was soon discovered in antiquity that by reducing the level of bran in the flour (usually by sifting), bread and other bakery products had greater volume and softer eating qualities.

There have always been strong links between wheat flour milling and baking, and both industries have to some extent, evolved side-by-side. As the underpinning knowledge of cereal science has increased, it has become possible to link choices of wheat varieties with flour quality and subsequently to the properties of the final baked product. In order to facilitate this link, cereal science has evolved a number of standard testing methods which are applied to the grain and the flour produced during milling in order to meet the specific requirements of bakers.

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An Outline of Wheat Milling Processes

Choosing Wheat Varieties

Wheat is grown in many countries around the world and the intrinsic qualities of wheat are associated with the varieties chosen by the farmer (which may be influenced by economics), the environment in which the wheat is grown, and the agronomic practices carried out between planting and harvesting. For the flour miller, some of the wheat may be grown relatively locally (i.e., within a country or region), though in many cases wheat will be imported from other geographical regions some distance from the mill. A key aim for the flour miller is to choose a blend of wheats (the grist) which are most likely to yield the flour with the qualities sought by and agreed with bakers.

In addition to choosing a mixture of wheats to meet a given flour specification, millers will also have to take into account the manner in which the wheat grain will fractionate during the milling processes and in the case of white flour, how this will affect the yield (the proportion of endosperm which meets the required specification). Flour millers often refer to the 'extraction rate' for a given wheat grist, that is, the proportion of the grain which they are able to convert to flour to meet a given specification.

It is not common to have a single wheat type that will yield a flour with all of the performance characteristics specified for baking. This is especially true for flours that are destined for the manufacture of fermented products. Different wheat varieties and types have different degrees of 'hardness'. This has a direct impact on the manner in which the grain fractionates and thus the manner in which the mill is set-up. The general practice for flour millers has been to blend different varieties of wheat together at the start of the milling process, even though this requires them to compromise some aspects of mill performance when dealing with a 'mixed grist'. There are some mills which are capable of separately milling single types of wheat. While this may optimise mill performance, it commonly requires the miller to blend the subsequent flours to meet the given specification. Often the deciding factor between milling a mixed wheat grist and blending individually milled wheat types, is the storage capacity available to the mill both in terms of wheat and finished flour. In many cases, mill storage capacity is limited and milling a mixed wheat grist remains the common practice.

Wheat Testing at Mill Intake

Wheat arriving at a flour mill is commonly sampled and tested before it is accepted. This enables the miller to segregate deliveries and store them before blending and milling. The number of tests which are carried out is limited and commonly performed in a few minutes. Typically, there will be a check on the appearance of the wheat and an assessment for potential off-odours and taints by a trained assessor. The density of the cleaned wheat may also be checked; this is commonly referred to as hectolitre weight or bushel weight.