K-STATE Research and Extension

Wheat Tempering: Mixer Alternatives

Department of Grain Science MF3076 Wheat Tempering

Maintaining a consistent wheat tempering process is important to most millers. To maximize the extraction of flour, millers mix water into the wheat as part of its preparation for the milling process. Tempering wheat to the optimal milling moisture mellows or softens the endosperm while toughening the bran.

Softening the endosperm increases flour extraction and reduces the power consumption and noise level of the rollermills during the milling process. Proper wheat tempering also reduces the ash content and improves the color of the flour produced.

Toughening the bran helps it remain in larger pieces. Large bran flakes can be cleaned more effectively by the corrugated or fluted rolls used in the break system to separate the bran and the endosperm. This reduces the small bran specks in the flour, improving the color and appearance of the finished product.

Wheat Variables

There are many variables to consider when tempering wheat: wheat hardness, protein content, the mill's ambient temperature, wheat temperature, moisture content of the dry wheat, and target moisture content of the conditioned wheat. These factors affect the time required to properly condition the wheat and the effectiveness of the method used to mix the wheat and water.

Variable	Effects
Harder Wheat	Longer tempering time
Higher protein content	Longer tempering time
Lower ambient temperature	Longer tempering time
Lower wheat temperature	Longer tempering time
Lower initial wheat moisture	Longer tempering time
Higher target wheat moisture	Longer tempering time

Delivering wheat of a constant moisture level to the mill tends to provide constant milling conditions and improve mill balance. Maintaining a constant wheat moisture level to the mill also helps to deliver consistent flour moisture to the bakery, which provides more consistent baking conditions.

A goal for any wheat tempering system is to optimize the uniformity of the wheat delivered to the mill. Millers debate the proper tempering time of wheat; however, the need for consistency in mixing is often overlooked. It is important that the quantity of water added is carefully controlled and the adjustment of wheat moisture is controlled and consistent.

To achieve consistency and uniformity in the wheat blend delivered to mill, the tempering system must include:

- an accurate flow measurement for both the wheat and the water,
- an accurate moisture measurement of the wheat, and
- effective mixing of the wheat and water.

An important part of the tempering process is the method used to mix the water and wheat.

Mixer Options

Many different mixer styles and manufacturers are available. When purchasing a tempering mixer, make the best decision based on the design-requirement restrictions for each specific installation.

Generally, tempering mixers are categorized as low-speed and high-speed mixers. Both types, when correctly designed and sized, can add between five and seven percent water in a single stage. Applying and distributing water uniformly to each kernel of grain is an important design consideration for all types of mixers. Water must be evenly distributed on the kernel surface to avoid fluctuating moisture contents from water migration. Due to the large quantity of grain processed, continuous mixing is most common. In small-scale operations, a batch mixing process can be used.

Low-speed mixers, such as the Technovator grain tempering mixer, are continuous mixing conveyors. They are similar to screw conveyors, but with angled paddles. Technovator mixers are installed at an upward angle with the grain inlet at the bottom. The angle of the paddles on the shaft can be adjusted to change the capacity and retention time in the mixer to achieve the optimal mixing time. The inclined angle of the Technovator prevents excess water from draining into the wheat bin. Standard cut-flight or ribbon-style screw conveyors can be used as tempering mixers as well. With low-speed mixers, the method of water application to the grain as it enters the machine is important to ensure it is distributed uniformly to every

kernel. Wheat kernels tend to rapidly absorb the initial water, and then the tempering time allows the water to penetrate each kernel evenly. If the water is not evenly distributed into the mixer, kernels will not be uniformly conditioned.

High-speed mixers, commonly referred to as intensive dampeners, are available from multiple manufacturers. Intensive dampeners can be used for wheat tempering or to hydrate flour and bran. When used for the tempering of wheat, intensive dampeners tend to provide a more homogeneous mixture. The higher-speed rotor improves the water absorption and distribution in the mixer. This more rapid initial absorption results in better wheat tempering and may reduce tempering time.

Due to the higher mixing speeds, intensive dampeners tend to have higher capacity with a more compact design, making them ideal for use in mill remodels and expansions when space is limited. Intensive dampeners are available in styles ranging from single, double, and triple rotor designs.

One of the more distinct tempering mixers currently on the market is the Vibronet, a vibration mixer. Wheat and water are combined in a vertical chamber and mixed using vibration energy. This process can reduce tempering time and energy consumption compared to conventional tempering mixers. The vibration energy allows even distribution of the water across the entire outer surface of the wheat kernel, allowing rapid absorption.

With these mixer types, the use of heated water or direct steam may be required to raise the temperature of the wheat to allow more uniform moisture absorption. In colder climates, warming of the wheat is desired to assist in moisture penetration and decreased tempering time.

Required Rest

When considering the optimal mixing equipment for each operation, remember the importance of mass flow through tempering bins. The best wheat mixing alternative can be neutralized by inconsistent resting time in the tempering bins. Funneling, bridging, and other flow problems from the tempering bins can result in inconsistent wheat moisture.

For tempering bins, mass flow is critical to control tempering time, which ensures constant milling conditions. Mass flow can only be achieved with the correct hopper construction and dischargers.

A swell bin installed in the process immediately after adding water allows for the initial penetration of moisture into the kernel. The absence of surface moisture — as well as completing the initial kernel expansion before the wheat is stored in the tempering bins — helps prevent the wheat from packing and bridging in the bin. The swell bin helps eliminate the practice of filling the bottom of tempering bins with dry wheat and results in better product consistency.

Properly conditioned wheat improves profitability by delivering a uniform mix of wheat to the mill. A uniform wheat mix is more likely to maintain a balanced mill flow, helping optimize extraction and improve flour quality. The method selected to mix the wheat and water is critical to optimizing the tempering process. The mixer is a vital part of the process, with many options that are often overlooked. The process also must include consistent flow and measurement of the wheat and water, along with accurate moisture measurement.

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF3076 March 2013