

GRAIN MANAGEMENT

for reliable Feed Milling



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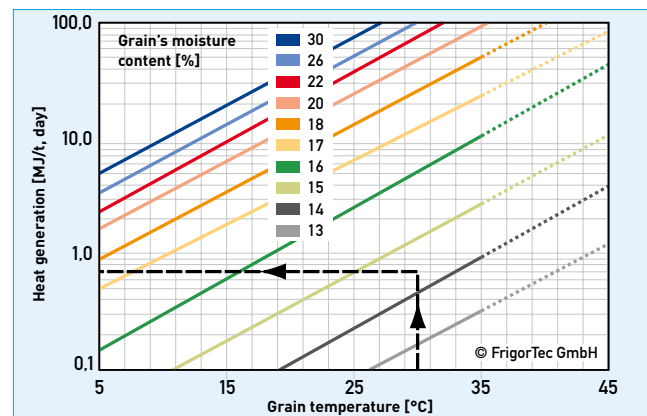


Figure 1: Heat generation during grain storage

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eliable feed milling depends on a good storage management of grain as it is responsible to maintain the quality of the grain before processing and to keep losses at a minimum. A good expertise is required and is based on the knowledge about the issues which grain faces during storage by nature and postharvest.

It is worth looking into the advantage of the temperature management during storage as low temperature are effective for grain preservation.

THE CONSTRAINTS OF GRAIN STORAGE

Prevention of Respiration Loss

Grain continues to respire after being harvested. Losses in freshly harvested grain are primarily caused by its cellular respiration and heating. The rate of the activity is dependent on the grain's moisture content and temperature as shown in Figure 1 which cause exponential increase of respiration the higher they are.

The respiration leads to loss of grain weight, increases the

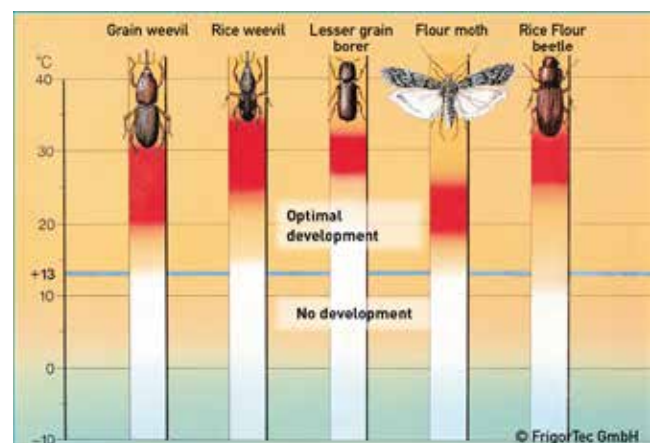


Figure 2: Weevil development according to the temperature

heat of grain and rises its water content by oxidation of grain carbohydrates or fats. The heat results in higher temperature which accelerates the respiration and damages grain quality as well. High water content reduces the storage life of the grain by favor the infestation of bacteria, mites, insects and fungi. A low temperature reduces respiration and therefore the chances of grains being damaged during storage.

Prevention of weevil development

Weevils and other insects can damage stored grain and their activity and development is influenced by the temperature of their environment. At temperature above 20 to 32 °C the development of the insects is in optimum. However, temperature less than 10 to 18°C reduce the activity. Therefore, the grain is protected when it is chilled. The Figure 2 shows the details.

Prevention of fungi and mycotoxins

The development of fungi depends on the temperature, the relative humidity and the grain's moisture content. Their growth is prevented in the storage facility by drying and cooling of grain. The respiration activity of the grain affects the condition and lead to fungus growth. Thereby the danger of fungal contamination is not only the deterioration of the grain but the increase of mycotoxin which affect the health of human and animals. Grain cooling decrease fungal growth at low temperature even if grain's moisture content is above 14 percent as shown in Figure 3.

The way of grain cooling

The grain cooler is connected to the grain storage and the conditioned air is blown into the grain bulk. The air flow passes the grain and removes the heat of the grain. The air takes heat from the grain and exits the storage. The grain cooling continues until the entire bulk is cooled to the desired temperature of around 10 to 18°C depending on the intended storage time. Then the grain cooler is turned off and the air inlet and vent openings

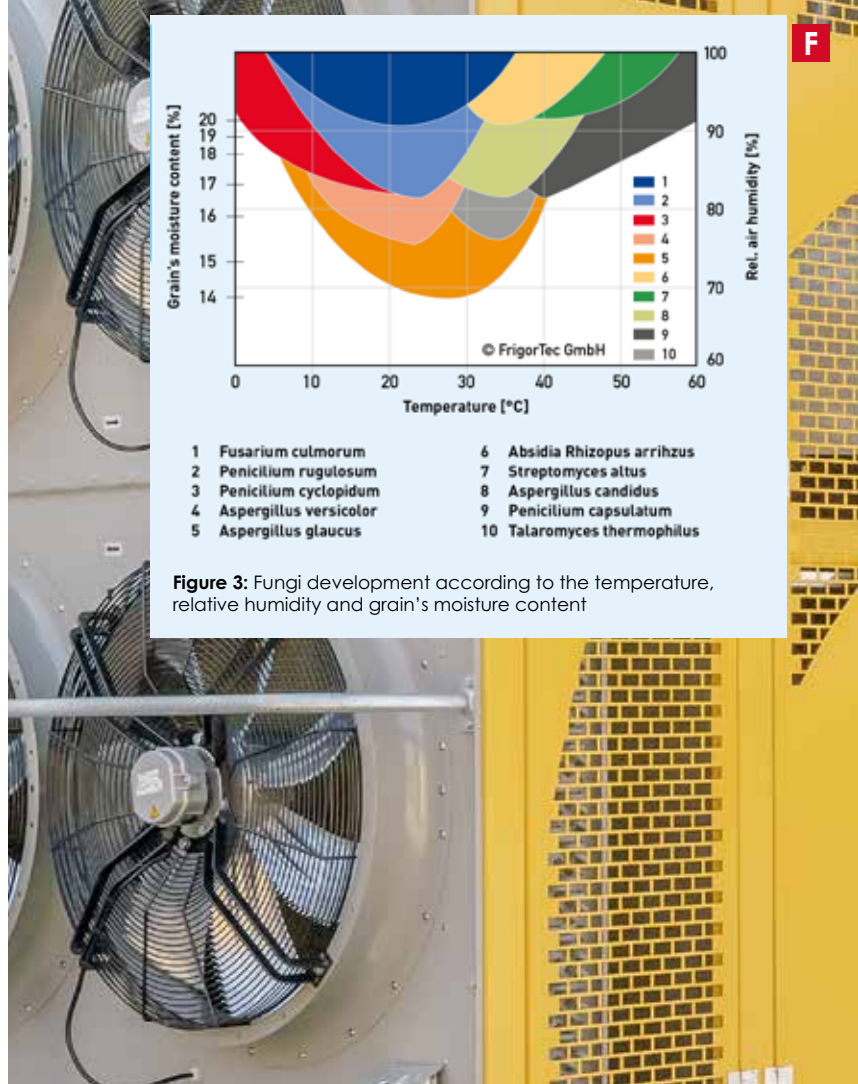


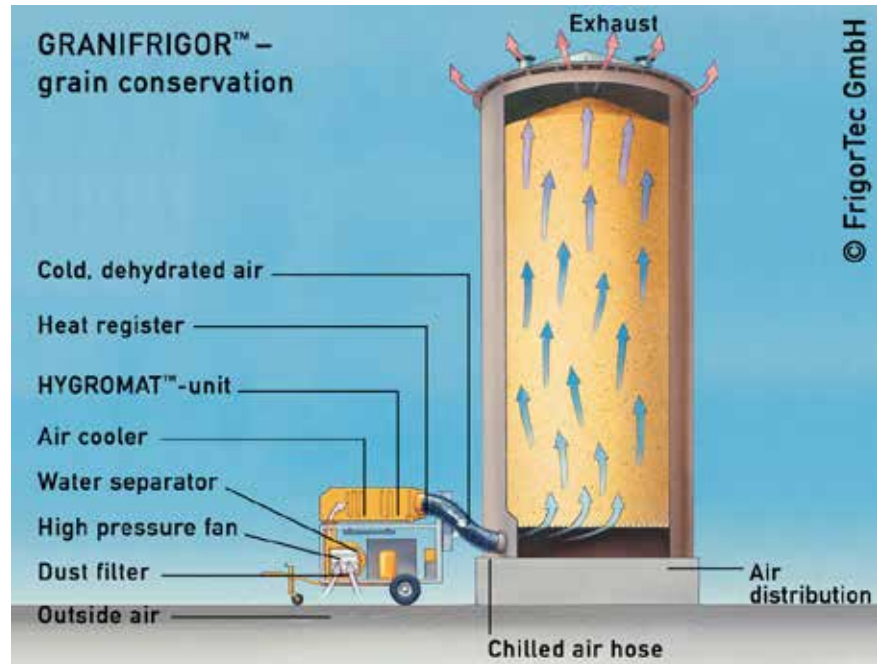
Figure 3: Fungi development according to the temperature, relative humidity and grain's moisture content

are closed. The cooled grain is kept in the storage until unloading or refreshed again if the temperature will increase during storage. Principles of the application of silo in Figure 4.

The basics for efficient operation of the grain cooler

In order, to achieve the full advantages of the grain cooling process the operator has to consider several basics. The grain type is an essential part as well as the condition of the grain and the properties. All of them and the use of them will determine how the setup of the programming must be set. The storage site in reference to its geographic location and climate condition lead to the way the operation will take place. The type of storage like capacity and dimension do influence the operation and the outcome of the grain cooling result. Last but not least the model size and type of grain cooler play an essential role. All that leads to the requirement of an experienced grain manager to achieve best results. That expertise is not given and many start with bulk handling as newcomer. Therefore, FrigorTec did develop the fully automatic control for the grain cooler GRANIFRIGOR™.

Grain cooling is a comprehensive solution for postharvest management that preserves a grain bulk. It brings benefits which keeps quantity and quality and the processing of a grain in the



most economic condition at a feed mill. Its implementation in particular warm and humid climates leads to an essential improvement of grain handling, loss reduction and good management practice. This year it is 60 years as commercial solution by FrigorTec. The latest development of the fully automatic control overcomes the lack of experience and expertise of grain management and leads to the success of grain cooling by GRANIFRIGOR™.