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TECHNOLOGY OF STORING GRAIN IN A COOLED STATE

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Abstract. *Support of grain mass quality is the main goal of grain storage technology. The technology is selected depending on raw material quality and grain storage type. Its observance allows reducing the volume of natural losses of the product and keeping it in a healthy environment. One of the most important elements in this process will be the preservation of grain by cooling.*

As the experience of recent years has shown, grain storage has turned out to be almost the most important link in the grain business. The storage itself allows the producer to get a higher price for the grown produce. Analyzing the cost of a ton of wheat in the context of several years, there is a clear tendency for the purchase price to fall during the harvest and by the beginning of October. The fall in prices is mainly attributable to an increase in grain supply from producers who are unable to store grain and/or need financial resources. Starting in the middle of autumn, prices gradually increase, and only then comes the manufacturer's time.[1-5] One thing is clear: if the farm has somewhere to store grain, then no real or fictional conspiracy of grain traders will force the producer to sell the entire crop directly from the field. Every year more and more grain producers understand this and repair, build, buy and rent various kinds of storage facilities.[6-9]

Nevertheless, storage is also not an easy thing, it requires constant study, improvement and searches for new opportunities for a precious crop to wait for its price with minimal losses and optimal costs. Thus, the question arises not only regarding the storage itself but also its quality. In addition to traditional technologies and approaches to grain storage, which are known in our country, there are also new ones.[10] One of them - cooling (cold preservation) of grain - certainly deserves attention. It will be especially interesting for producers and processors of corn (there is no need to move grain to prevent warming), oilseeds (the process of oil oxidation is delayed), organic grain (eliminates fumigation), etc.

Cellular respiration of grain, followed by its arbitrary self-heating, causes spoilage of the harvested grain. These processes depend on the temperature and moisture content of the grain: the higher the temperature and moisture content of the grain, the more intensively it breathes. Self-heating causes dry matter loss and favours the development of insect pests and fungi. It is known that in zones with a temperate climate during the cold season, significantly fewer losses occur during storage than in the summer months. Cooling preservation allows artificially creating winter climatic conditions immediately after harvest. Due to the high humidity and heat, the risk of grain spoilage is especially high in tropical climates.[11-13] Therefore, it is especially important to use refrigerated preservation in such areas. The peculiarities of the grain structure and surface, as well as its low thermal conductivity, are the best prerequisites for cooling. Once cooled, the grain mass retains a low temperature for a long time. The benefits of using this technology are described in more detail later in this article. The grain ripening process reaches its peak at the time of harvest. But even after harvesting, the grain continues to ripen, it breathes. In this case, under the influence of oxygen, carbohydrates decompose with the release of heat into carbon dioxide and water, which leads to a loss of dry mass. Below is the chemical formula for this process:

$$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O + 1{,}567 \times 10^{-3} kWh$$

carbohydrates + oxygen - › carbon dioxide + water + heat

Initially, the technology of storing grain with cooling was developed for the preservation of wet grain before drying. Now, the dry grain is more often cooled than wet grain - mainly to prevent the development of insect pests. Figure 1 shows some of the most common insect pests and the optimal conditions for their life and reproduction.

Some pests are more common in temperate zones, others prefer tropical conditions.

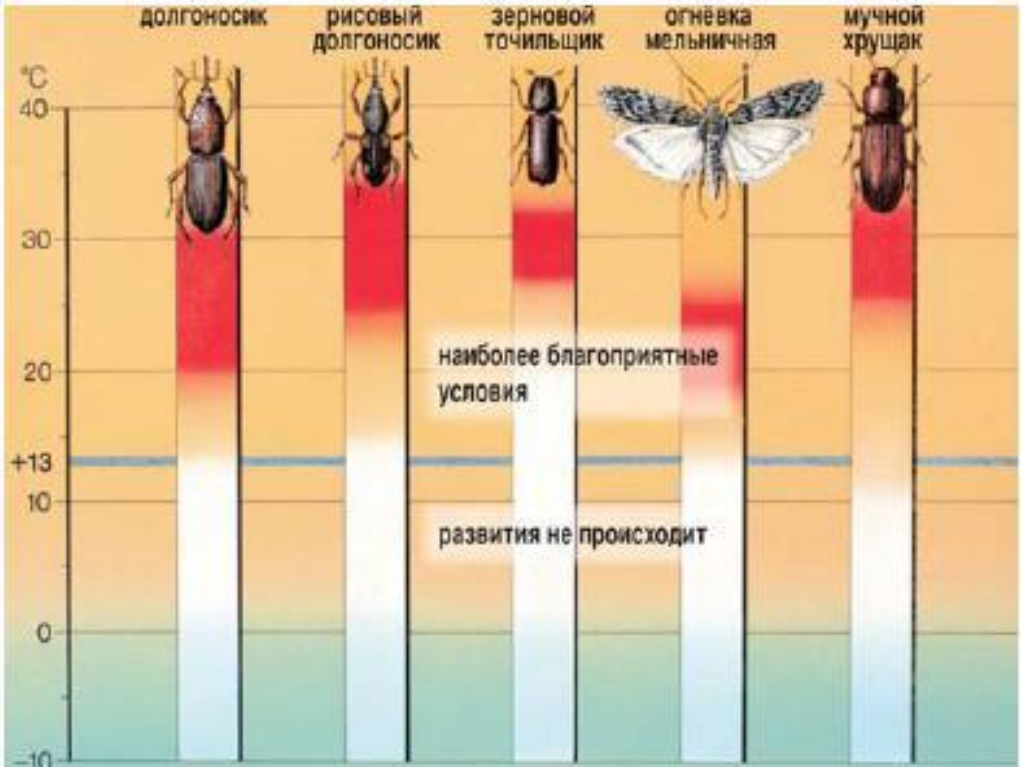

Fig. 1. **Some of the most common insect pests.**

Cooling the harvested crop to below 13 ^{0}C effectively prevents losses from insect damage. At sufficiently low temperatures, insects hibernate and do not damage the granary.

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