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## **The technology of drying and storage of grain**

Before storing the grain mass should be dried. Otherwise, a part of the crop will be lost due to decay and reproduction of pathogenic microorganisms. Dry grain prevents reproduction of pathogenic bacteria to provide longer storage of grain.

The grain drying technology is based on a chain of related thermo physical operations which should be carried out in the proper sequence. The first operation of any grain drying technology is to transfer heat from the drying agent to grain surfaces that results in liquid evaporation from the surface. Then internal liquid is squeezed onto the surface and should be also evaporated. At the final stage the drying agent absorbs all the evaporated liquid and releases it into the atmosphere.

The grain heating rate and temperature of the drying agent directly affect the quality of dry grain. Liquid evaporation is intensified at high temperatures of the agent. However, extremely high temperatures and over drying have an adverse effect on the grain quality: germination and emergence rates are reduced, gluten quantity and quality are decreased, cracks occur on the surface.

### **Grain cooling technology**

While all of the food processing world (included each different production fields) knows from long time the necessity to treat the product by drying process and storage, since 15 years ago people has understood that these two processes alone can't be enough to grant a good quality level of cereals and oleaginous products for a long time.

The old conservation systems, in fact, were based basically on chemical substances whose specific objective was to avoid the presence of harmful parasites, but which did not benefit to the conservation of the different raw materials in an optimal condition.

Moreover, it's necessary to consider the torrid climate of last summers which have

been a very hard test for all those products simply "stocked" in warehouses or silos, but certainly not "conserved". Literally, conservation means "to maintain in an efficiency state, able to be used". Therefore, we consider the integrity of product and the protection of its natural equilibrium as an efficiency index.

The grain cooling technology developed by Tecnograin, based on several research studies, strongly confirmed the effectiveness of this technique for several reasons, even from an economic point of view. Moreover, these studies permitted the constant evolution of our grain cooling machines, every time more and more sophisticated and improved.

Our company promotes the "ars conservandi", which is the art of a "pure", and therefore optimum, conservation of the product and its qualities at lower management costs, both for an exclusively conservative use and for the grain drying process (cooling does not cause pollution because it's a natural activity).

By cooling the mass of the grains (the grains being poor conductors of heat) from 35°C to 15°C with an outer temperature ranging from 25°C to 30°C, the metabolism of insects, bacteria and moulds is stopped, as well as their development and proliferation.

If this is applied after the harvest-time, whether the product is dried or not, this allows having conservation for long time, out of infestations and at an unchanged quality level.

Moreover, maintaining the temperature inside the storage silos or the warehouse at values ranging between 13°C and 15°C, inhibits the grain respiratory processes, thus avoiding the absorption of oxygen, carbon dioxide, water loss and development of heat, eliminating or at least limiting the loss of weight and its auto-heating.

Blowing in dehumidified air allows the control of the mass humidity, besides softening the action of compaction made by the condensation water on caryopsis, dusts and fungi, unlike the use of a normal fan.

Let's imagine to enter in a full of grain storage silo. After putting down the product, we would note a rapid and inevitable increase in degrees caused by the heat produced by the grain respiration, to which we must add the heat produced by the additional

respiration of the micro-organisms by which it is attacked. The first fact produces, as a consequence, a decrease of the dried substance, the second one instead allows, due to thermic conditions, a rapid reproduction of parasites, which will consume the cereal creating the conditions for a harmful micro flora.

"Rebus sic stantibus" (things being as they are), the natural equilibrium of the product will be worse and worse, until a bad health. Moreover, the one kilogram of grain weight loss multiplied by the whole crop storage in the silo will lead to a real loss of product, which is about 2-3% of the total amount. But the worse and not resolvable damage will have already be done.

By using grain cooling machines in the right way, these effects are stopped or avoided. This is managed by computerized and programmed control of the grain cooling process, allowing us to optimize the electricity consumption, and this control can also be coupled with the grain drying process.

Finally, the product will be more elastic, more resistant, with no crack, with a more lively looking, and its protein content (in particular its essential amino acids content) will be improved.

Today, we are able to cool all that is produced by the drying process system in 24 hours.

#### Literature:

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