SILOS CORDOBA

Storage and conditioning of rapeseed to maintain its quality

Recommendations for the storage and conditioning of rapeseed in a metal silo

Storage of rapeseed to maintain its quality

RECOMMENDATIONS FOR THE STORAGE AND CONDITIONING OF RAPESEED IN A METAL SILO

Rapeseed is an oilseed that, due to its seed size, offers different challenges at harvest and post-harvest: **handling, movement of grain inside the silo, aeration** and **drying** .

The **original state of the product** is the factor that most affects the preservation of rapeseed during storage.

During the “transpiration” stage, which takes place during the first 6 weeks of storage, the high respiration rate of the seeds produces hot and humid conditions that favor the development of fungi, which produce more heat and humidity, so constant monitoring is necessary. This effect can be minimized by cold, dry store of seeds.

FACTORS AFFECTING RAPESEED STORAGE

Humidity, temperature, and storage time

Rape seeds are more prone to deterioration during storage than cereals, so they must be stored at lower humidity level to prevent the development of fungi and ensure proper conservation.

For a “safe” storage, the relative humidity of the storage space must be 70% or less. Storing grains above this safe humidity level may create optimal conditions for fungal development. Therefore, if the rape is harvested wet, drying will be very important to insure safe storage conditions.

Temperature also affects rapeseed storage. If the silo is filled with hot seeds, since the rape is harvested in summer, and there is no aeration, the seeds will remain at high temperatures throughout the storage period due to the insulating characteristics of the grain.

The **combination of temperature and humidity of the seed** determines whether the storage condition is safe or not.

Fungi, insects and mites

Fungi

Field-harvested seeds come with fungal spores. It is not possible to eliminate these spores, but it is possible to create conditions that are unfavorable to their development.

Most fungi achieve maximum growth at temperatures between 25° and 28°. The lower the temperature, the less the fungi will be able to grow.

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Insects

Insects can be found in stored canola or rapeseed, but their ability to establish and infest the silage during storage is highly variable.

In general, whole seeds are more resistant than damaged seeds and only a few insects have been reported to be able to tolerate the high oil levels of canola or rapeseeds.

Mites

Mites feed on the surface and inside of the rapeseed, affecting the weight (fat loss) and the quality of the product. Their presence is associated with the presence of insects and fungi in the bulk, since they require high humidity conditions in the grain to survive.

POST-HARVEST HANDLING OF CANOLA OR RAPESEED AND ITS EFFECTS ON QUALITY

The main processes involved in the post-harvest handling of rapeseed are storage, handling and conditioning. If all these processes adequately performed, the highest quality of rapeseed will be maintained.

Storage

It is very important to store the seed:

- In good quality facilities to prevent the entry of humidity, since the rapeseed is very susceptible to heating and fungal development.
- In well-constructed facilities to prevent product loss.
- In small silos to prevent moisture migration.

In concrete-based silos it is important to check that there are no cracks through which moisture can enter.

Because rape has a high respiration period when the silo is filled, it is recommended to **equip the silo with ventilation and temperature control systems.**

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How to choose the most suitable grain storage system

Whilst the choice of grain storage methods is wide, the most popular ones are steel silos, concrete silos, storage warehouses and bag silos among others.

Features of Main Storage Systems

Features	Steel silos	Concrete silos	Warehouse	Silo bag
STORAGE	Bulk	Bulk	Bulk or bags	Bulk
RETRIEVAL	First-in, First-out	First-in, First-out	Last-in, First-out	Depending of the needs
SPACE REQUIREMENT	Vertical storage, less space	Vertical storage, less space	Horizontal storage, more space	Horizontal storage, more space
GRAIN QUALITY	Control by Temp. monitoring system , Aeration, PLC, etc.	Control by Temp. monitoring system , Aeration, PLC, etc.	Possible but not accurate	None
GRAIN LIFE	At 12% mc storage & low temperature. Long period	At 12% mc storage & low temperature. Long period	Here it will be much lesser	Un predictable
GRAIN HANDLING	Mechanized	Mechanized	Manual – Mechanized	Manual – Mechanized
DESIGN	Simple design, simple to erect	Complicate: rebar placement, concrete quality, longer com-missioning	Medium - High	Simple
OPERATIONAL COST	Relatively less, (initial investment)	Relatively less, (initial investment)	Higher	Higher
FOUNDATION COST	Medium – high	High	High	None
WASTAGE	Less than 1%	Less than 1%	Could be up to 34 %	Could be up to 34 %
INFESTATION	Practically nil	Practically nil	Open to attack by birds, rodents, termi-tes, pets, fungi, mold, fermentation, etc.	Fungi, mold, fermen-tation, insects, et.

Galvanised sheet metal silos are currently the best alternative for grain storage thanks to their versatility, easy assembly, hygienic handling and low storage cost.

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Handling

The particle size of the product poses a real challenge in terms of product transport and storage. This consideration is especially important if losses are to be reduced, whether due to product loss or grain breakage.

Due to the small size of the seed, it is necessary to ensure that the grain handling machinery does not have openings through which the product can escape.

The augers and threads must be used at maximum capacity to prevent grain from seeping between the thread and the pipe.

Rapeseed has a lower density than wheat, so a 100 T wheat-based silo can store up to 87 T of rapeseed (Specific rape weight: 620 kg/m^3).

Conditioning

Through **drying** and **aeration** the grain is kept in safe storage conditions.

Early harvest and subsequent plant conditioning may contribute to reduce losses in quality and quantity (yield) since the seed remains exposed to inclement weather for less time.

An exhaustive sampling of the silo is advisable to determine the temperature and humidity conditions of the total mass of grains for their correct, final storage.

For proper conservation of rapeseed, it is important to **monitor the moisture condition of the seed**, to see when the storage operation is concluded. For proper temperature monitoring, the installation of **thermometry systems** is recommended as they ensure its quality and allow us to know the development of temperature over time.

The conditioning systems are divided into:

- Aeration systems
- Drying systems with natural air or low temperature
- High temperature drying systems

Aeration systems control the moisture of stored seed and are used to cool recently harvested seeds and to maintain and standardise seed temperature during long-term storage. These systems, when properly sized, can also be used to temporarily keep grain moist prior to drying or to cool and finish drying hot grain coming out of the high temperature dryer.

Aeration systems designed for rapeseed must take into account the particular susceptibility of the seed to damage by self-heating and the physical characteristics of the seed.

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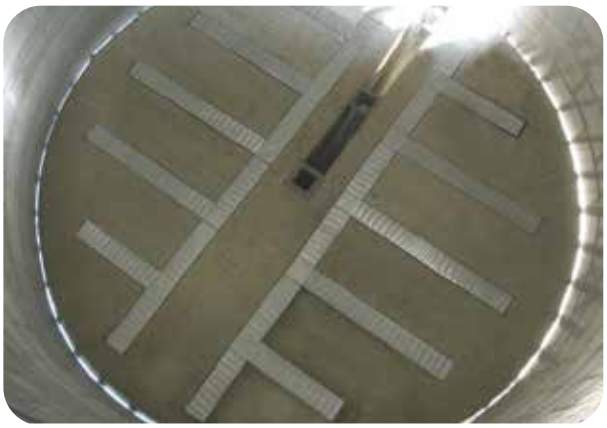
It is important to highlight that the grain size of the rapeseed requires good aeration design for two reasons:

1. The grids through which the ventilation air is introduced into the silo must have holes that are small enough to prevent the product from escaping.
2. The small intergranular space greatly increases the resistance to the passage of air through the product, which increases the pressure drop of the air flow. This results in the need to use high pressure fans on many occasions.



Natural air/low temperature (AN/BT) systems are characterised by drying in silo with natural air, or air heated up to 7° C above ambient temperature.

The performance of these systems is highly influenced by climatic conditions since, if they are very dry, the drying will be completed in a short time, but the lower layers will be overdried and, if they are very humid, the drying will take a long time to reach the upper layer of the bulk. In this case, and to gain independence from the climatic conditions, supplementary heat can be used.

High temperature drying allows harvest humidity to be lowered to safe storage values much faster than natural air or low temperature drying systems. This occurs because hot air has a much greater capacity to extract water than natural air, and also because high temperature dryers use air flow rates much higher than that of other systems, although they should not exceed 90°C (unlike cereals that easily exceed 110°C).

Both, the **buffer silos** before drying and the **tempering silos** after drying must be equipped with fans and roof extractors.

Comparison of rapeseed drying temperature versus corn

Rape seed Drying Capacity

Rape | Drying temperature 90° (+-5%) / Ambient temperature 20°C / Ambient humidity 60%							
From 10% to 7% Cooling (T/h)	From 16% to 7% Cooling (T/h)	From 13% to 9% Cooling (T/h)	From 16% to 9% Cooling (T/h)	From 19% to 9% Cooling (T/h)	From 22% to 9% Cooling (T/h)	From 16% to 10% Cooling (T/h)	From 20% to 10% Cooling (T/h)

Corn Drying Capacity

Corn | Drying temperature 120° (+-5%) / Ambient temperature 20°C / Ambient humidity 60%							
From 17% to 14% Cooling (T/h)	From 20% to 14% Cooling (T/h)	From 24% to 14% Cooling (T/h)	From 20% to 15% Cooling (T/h)	From 19% to 9% Cooling (T/h)	From 25% to 15% Cooling (T/h)	From 28% to 19% All heat (T/h)	From 28% to 20% All heat (T/h)

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Rape storage plants by Silos Córdoba worldwide:

2005 | Vitaflora Slovakia

Plant conceived for the storage of wheat and rape.
The total capacity of the plant is 95.700 m³ for the storage of 72.000 T of cereal. The project includes:

- √ 17 silos model 20.63/15 of 5.906 m³ capacity each.

2005 | Jurex Slovakia

Plant conceived for the storage of wheat and rape.
The total capacity of the plant is 37.083 m³ for the storage of 27.800 T of cereal. The project includes:

- √ 2 silos model 9.17/8 of 661 m³ capacity each.
- √ 6 silos model 12.22/14 of 2.010 m³ capacity each.
- √ 20 hopper silos model 4.58/7 of 157 m³ capacity each.
- √ 6 silos model 14.51/6 of 3.427 m³ capacity each.

2007 | Acor Spain

Plant conceived for the storage of rape and sunflower seeds for biodiesel production. The total capacity of the plant is 266.666 m³ for the storage of 200.000 T of cereal. The project includes:

- √ 16 silos model 27.50/22 of 16.468 m³ capacity each.
- √ 5 hopper silos model 8.40/11 45° for receipt of 817 m³ capacity each.

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2009 | Constanza Romania

Plant conceived for the storage of wheat, barley, rape, corn, sunflower...
The total capacity of the plant is 218.960 m³ for the storage of 164.000 T of cereal. The project includes:

- √ 17 silos model 24.45/22 of 12.880 m³ capacity each.
- √ Filling up is done at 1.200 T/h.

2010 | Belchimtrans Belarus

Plant conceived for the storage of rape.
The total capacity of the plant is 18.708 m³ for the storage of 14.000 T of cereal. The project includes:

- √ 4 silos model 18.33/14 of 4.677 m³ capacity each.
- √ Filling up is done at 100 T/h and unloading at 50 T/h.
- √ This project includes elevators, chain coveyors and sweepers.

2012 | Tiryaki Turkey

Project conceived for the storage of wheat and canola.
The total capacity of the plant is 250.168 m³ for the storage of 200.000 T of cereal. The project includes:

- √ 19 silos model 18.33/22 of 7.110 m³ capacity each.
- √ 11 silos model 14.51/22 of 4.395 m³ capacity each.
- √ 27 truck loading silos mod. 4.65/6 of 147 m³ capacity each.
- √ 4 45° conic silos model 9.17/12 of 1.063 m³ capacity each.
- √ The conveying machinery has been delivered by Silos Cordoba.
- √ Loading and unloading is done at 300 T/h.

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2013 | Adunati Romania

Plant focused on the storage of wheat, corn, rape and sunflower.
The total capacity of the plant is 8.046 m³ for the storage of 6.000 T of cereals. The project includes:

- √ 6 silos model 12.22/9 of 1.341 m³ capacity each.
- √ Dryer for maize model SCM 2-6 with a total capacity of 5 MT per hour able to reduce moisture content from 24% to 14%. Furnace use biomass.

2019 | Tonkeris Kazakhstan

Expansion of Tonkeris facility, conceived for the storage of wheat, barley, rapeseed, flax and sunflower. The total capacity of the plant is 43.882 m³ for the storage of 33.000 T of cereals. The project includes:

- √ 4 silos model 17.57/13 of 4.003 m3 capacity each.
- √ 4 silos model 22.92/13 of 6.573 m3 capacity each.
- √ 6 hopper silos model 5.35/9 (45°) of 263 m3 capacity each.
- √ 4 hopper silos model 7.64/10 (60°) of 659 m3 capacity each.
- √ 2 hopper silos model 1.85/2 (60°) for automatic weighing packer.
- √ Loading and unloading is done at 100 T/h.
- √ The conveying machinery – chain conveyors, belt conveyor, screw conveyors, bucket elevators – has been delivered by Silos Córdoba.
- √ Cereal sampling probe (DV company, made in Italy) supplied by Silos Córdoba.
- √ Grain analyzer Foss (Denmark).
- √ 2 units receiving pit for truck.
- √ Cleaning system consist of: rotatory drum cleaner 100 t/h, grain cleaner, aspiration and cyclone.
- √ 2 units vertical grain dryer machine 40 t/h.
- √ 2 bulk expeditions for train and also a third option for train expedi tion: 2 lines of packing grain in sacks including industrial automatic weighing packer and sewing machine.
- √ Electrical panel.
- √ Elevator tower 8×8, h=30 m.