



STORAGE: COOLING ON THE EDGE FOR THE BEST RESULTS

Storing brassicas is a normal part of the job for many growers. But take a good look at various aspects of the storage process and you may find room for improvement. How is your CO₂ percentage, your air circulation, how consistent is your temperature? Cooling and storage experts Johan Nijssen of Agrofocus and Ton Besseling of the Besseling Group explain.

BIG DIFFERENCES

Agrofocus consults and provides support in the construction of commercial buildings and installations. Cooling and storage specialist Johan Nijssen of Agrofocus is regularly asked to evaluate quotes. That's no surprise, since a layman is generally in no position to judge. "If a grower has asked for three quotes, I usually see that none of the three is accurate," he says. "You would expect that when you give the exact measurements of the storage space, the quotes wouldn't differ much. You'd be surprised. They may differ in capacity by as much as 40 percent."

Choosing the right coolant is also difficult for an outsider, particularly since every situation is different. But for Nijssen it's clear as day. "For large installations ammonia makes sense, but propane/CO₂ is also an option. Ammonia is toxic and requires expensive safety measures, so it costs too much for smaller installations. There you have to make a choice for one of the many synthetic coolants."

Johan Nijssen of Agrofocus acts as a consultant for storage and construction projects. But even when all the equipment needed for storing headed cabbage has been installed, a lot can still go wrong. Nijssen can give any number of examples. Trouble can start on the field: growth problems are a bad sign, and a growth spurt at the end is really disastrous. "Preventing problems in the cold store starts with proper harvesting," Nijssen says. "And if a cabbage looks suspicious, whatever you do, don't put it in! Damaged brassicas give off extra ethylene and are susceptible to disease. That only makes things worse in the cold store."

AN EXTRA BOX

Proper storage begins with keeping to the right stacking arrangement, Nijssen explains. Pushing the rows together is a bad idea, because then there's no room between them for the cold air. The space between the rows and the front and back of the storage space (in the direction of the air flow) should be at least 40cm to 60cm wide, otherwise the cold air won't get all the way to the back. "The worst is if that one extra pallet box gets put on top, right in the air flow from the evaporator. Then all the cabbage in front of the evaporator freezes, while the produce in the back doesn't get cooled." For long-term storage the temperature should be kept as close as possible to 0°C. That can be risky, because temperatures that drop just a few tenths of a degree under zero can cause ice crystals to form in the cabbage.



< **Good storage conditions start with the right stacking arrangement.**

put meters in the middle of the boxes at various points. But then you need to get remote readings.” Headed cabbage should cool off fast. Agrofocus calculates cooling capacity based on a seven-day cool-down period. “Even for customers with a low harvesting capacity we assume the store will be full in a few days, because the situation can change so easily. And we’re taking into account that autumn temperatures keep going up. If you harvest the cabbage at three degrees warmer, that means you’ll need a few more kilowatts of extra capacity. For the total investment costs it doesn’t make much difference.”

CA STORAGE

Long storage of cabbages, especially pointed cabbages, under CA (controlled atmosphere) conditions is a common Dutch practice. Where cabbage was originally stored at 1 percent oxygen (O_2), the current standard is 0.5 percent plus 1 percent carbon dioxide (CO_2). The low O_2 content keeps the cabbages from “breathing” as much, so they keep longer. But there are limits: an even lower O_2 content makes the cabbage oversensitive to CO_2 . “You need the right combination of both to put the cabbage to sleep,” observes Ton Besseling, director of the Besseling Group, a company in Oosterblokker, North Holland, that specialises in the design and production of CA equipment and the manage-

ment of storage processes, including cooling, but in particular CA storage. CA begins as soon as the cabbage has been cooled down to 0°C. The O_2 is then lowered in one day to 1 percent by pumping in nitrogen, made with a generator that removes oxygen from the air. Besseling specialises in doing this with as low energy usage as possible: “For an installation for which we need 3 kilowatts, some other manufacturers need 12.” Besseling also focuses on ease of maintenance: “With some machines you already get anxious if you think you might have to replace the fan.” CO_2 content is regulated with a CO_2 adsorber. Besseling’s adsorber has a ‘scrubber lung’ which means that almost no oxygen can enter the cold store. The process is controlled from one central measuring station, with air being drawn off from each storage cell and transported to the station.

SEALED

A modern cold store is gas-tight. When it has been filled, the cooling mechanism is turned on. Cooled air shrinks, causing air pressure to drop, which means that the store can implode. The difference in air pressure is absorbed by pressure valves. In CA storage, small pressure differences are offset with a large air bag or “breather bag,” which acts without allowing air from outside into the cold store. The aim of CA storage is to keep outside influences to a minimum. Large differences in air pressure are regulated with special overpressure and underpressure safety valves. Besseling advises taking readings from the CA store every other day. “If that seems like too much, then definitely at least once a week. Don’t get too comfortable, just because it’s been going well for years. You don’t want to be caught off guard.” In standard storage the percentage of CO_2 can get too high, and that can cause black pits on the ribs of the leaves. Nijssen says: “As long as you

TIPS

- Have your cooling system maintained and your meters checked every year.
- Use boxes that have been thoroughly cleaned. Disinfection is a good extra step.
- The busy time around the harvest is when most mistakes are made. Make sure that everything is ready in advance and everyone knows what to do. It’s a good idea to set up a protocol.
- Paint the stacking pattern on the floor. That helps prevent mistakes in filling the store.
- Putting in too many boxes will reduce the quality of the entire store. It’s better to sell some of the crop straight from the land or rent storage space.
- Cover the top boxes with perforated plastic sheets to prevent them from becoming too cold and losing too much moisture.
- Keep the spaces between the rows open.

For CA storage:

- Check the set values with a hand meter. Don’t only rely on the automatic system.
- Check the meters with a span gas.
- Proper circulation is especially important in CA storage, because O_2 and CO_2 have different densities.

Nijssen remarks: “It’s a good idea to track the temperature of the cabbage, because you’re right on the edge in terms of cooling. If you measure at several different points in the cold store, you can catch temperature variations. Cabbage that is one degree warmer, anywhere in the store, won’t keep as long. If you measure a difference, you can cool longer and circulate the air longer after a cooling cycle.

“Preventing problems in the cold store starts with proper harvesting”

If you think it’s too much work to jab a product thermometer into a cabbage at various points in the store, then you can also

come into the store a few times a week to inspect the produce, there will be enough ventilation. But when the store stays closed for weeks, the CO_2 can really go up. A PVC pipe through the wall behind the evaporator and a ventilator grill on the opposite wall of the store can prevent that problem. If I was a headed cabbage grower, I know I would want to measure CO_2 levels. A meter costs about 450 euros and you can read the levels right off. With bigger spaces that’s easy to install as part of the ventilation system. No matter how good the technology gets, the grower will still have to keep a finger on the pulse to achieve perfect storage results.” ■