OVERCOMING THE CHALLENGE OF REMOVING FIELD HEAT: PROS, CONS AND ECONOMICS OF DIFFERENT COOLING TECHNOLOGIES FOR BROCCOLI

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Broccoli can be a high-income crop for New York vegetable growers, with particular promise when better-adapted varieties become available in the next several years. For growers considering raising broccoli, it is worthwhile to understand some of the peculiarities of the crop and the logistics needed to be competitive.

Broccoli can have excellent shelf life if it is cooled quickly. However, it has the highest respiration rate of any vegetable. That high respiration rate means that it is difficult to cool, and that it will degrade quickly unless it is kept very close to freezing. Broccoli tolerates very little dehydration before becoming limp and unmarketable, so the cooling method must not remove water. Broccoli growers must plan on being able to cool the broccoli to below 40°F within 2-4 hours of harvest and keep it both cold and hydrated until it reaches the customer.

The simplest and cheapest cooling method, a spray of cold tap water, can provide limited initial cooling. It leaves some water with the product so that it can be moved into a forced-air cooler for final cooling without drying. This method is one of the slowest for removing field heat, and may be unsatisfactory in the summer or with large volumes. To avoid dehydration in a cold room, some put a sprinkler on the top bin, fed by a long hose in the cold room to cool the water below the source. In all cases, the water must be potable and handled to avoid spreading bacterial contamination.

Icing is a traditional and effective method, but can be the most expensive. In the most basic incarnation, icing involves shoveling chipped ice on top of the harvested broccoli. In New York, it may be difficult to get enough ice locally. Ice needs to be carefully managed in order to comply with GAPs food safety requirements both as the ice is handled and as the meltwater moves across surfaces.

Customer requirements will determine whether to ice. Some buyers demand a substantial amount of ice in each box, whether it is needed or not. Others prefer to avoid the meltwater mess and prefer little or no ice. Be sure to know your buyers expectation, and identify how to meet it at the lowest cost.

The most common icing method for large-scale producers who ship long distances is the slurry ice system. A water-ice slurry is injected into each box. The water drains, leaving ice within and around each head. The excess heat is removed with the drained water, so the remaining ice does not need to remove field heat. This method uses about 10 lb of ice per box, where bulk icing uses about twice as much. The main benefits of this icing method may not be worth the relatively high cost for g rowers delivering within 12 hours drive of customers.

Hydrocooling is commonly used with broccoli. Usually, hydrocoolerss have large mechanical chillers, but ice cubes and blocks can cool the water if installing a chiller is too expensive for a short harvest season. Dip tanks with conveyors are relatively inexpensive and work well with boxes that can be submerged. The main drawback is that there is not enough water circulation within in the box, so the water in contact with the broccoli warm up. Some buyers are also questioning whether sanitation of the cooling water can be maintained. Rain-tower hydrocoolers provide excellent circulation and the most rapid cooling. These units are suited to handling 1 to 5 tons per hour. The main drawback is that the very large flow rate (>1000 gpm) can bruise the heads on top.

Vacuum cooling is effective in drawing heat from the entire broccoli head, even in palletized boxes. This method relies on removing heat by vaporizing water. That water must be added so that the broccoli doesn't lose moisture and wilt. This procedure, called hydro-vac, is not complicated. Equipment can be leased for the season, which limits capital outlay. It is most effective with at least 12 pallets per cycle, and can cool about one cycle an hour.

Success with broccoli will require effective cooing. The most cost-effective method depends on the volume, utility supply, which other crops need cooling, and customer requirements. Cooling cost can be from $1 to $4 per box, so finding the right method can easily determine success or failure.