Agronomic Spotlight

Seminis grow forward

Broccoli Harvest Management

- Harvest and postharvest activities for a broccoli crop require careful planning.
- A single broccoli crop is harvested two to five times during the season and may be harvested for multiple market segments.
- The costs of harvest and postharvest activities can account for up to 60% of total production costs.

Harvest and Packing Procedures

Broccoli grows best under cool conditions, and in many parts of the U. S., the crop is planted early in the spring for an early-summer harvest. A second crop can be planted in mid-summer for a fall harvest. In some areas, such as the coastal regions of California, broccoli is grown year-round.[1,2]

Several harvest methods are used including harvesting and bunching 8-inch long heads, crown-cuts of heads with shorter stems, harvesting florets, and harvesting for broccoli slaw or processing/freezing.[1] Individual fields are harvested two to five times during the season in three- to four-day intervals. The number of harvests depends on the market price and product quality, and a single field may be harvested several times for different purposes.[1,2,3,4] Harvested heads should be checked for worms and graded for head size and bead tightness (Figure 1).[2]

Figure 1. Crown-cut broccoli packed in a shipping carton. Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org.

Optimally within four hours of harvest, broccoli should be quickly cooled to preserve quality and shelf-life. Top-icing of packed boxes, hydro-cooling, liquid-icing, and forced-air cooling are all methods used to lower the temperature of broccoli heads or florets. With liquid-icing, an ice-water slurry is injected into filled boxes to distribute ice throughout the box (Figure 2).[3] With top-icing approximately one pound of ice is added to the top of a packed box (Figure 3) shortly after harvest and again at the time of shipping, usually within two days[4,5]. Once cooled, broccoli should be stored at 32 °F with relative humidity levels above 95%. These storage conditions typically result in a shelf-life of 21- to 28-days.[2,3]

Figure 2. A liquid-icing system for broccoli. Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org.

Figure 3. A carton of broccoli that has been top-iced. Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org.

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Cost Considerations

Costs associated with harvest and postharvest activities usually account for 40 to 60% of the total production costs. Costs will vary by region and depend on availability of labor, state and local regulations, and methods of harvest and packing (Table 1).[5]

TABLE 1. ESTIMATED HARVEST AND POSTHARVEST COSTS BY REGION 2010-2011.[5]

Typical Yield (boxes/acre)	South Carolina		North Carolina		New York		Virginia		California	
	440		440		450		570		800	
	$/acre	% of total	$/acre	% of total	$/acre	% of total	$/acre	% of total	$/acre	% of total
Harvest	1,400	32	1,684	34	1,395	37	1,736	26	3,624	39
Postharvest	496	11	584	12	451	12	1,941	29	1,752	19
Subtotal	1,896	43	2,268	46	1,846	49	3,677	55	5,376	58

Labor

Harvest and packing operations are labor intensive, and they require careful planning and management efforts. Workers are needed for harvesting, machine operation of harvest equipment, grading, and packing.[5] Hourly rates vary, but experienced machine operators are usually paid at a higher rate than the general labor used for harvest, grading, and packing.[1] A typical harvest operation requires 14 non-operator workers and one operator worker. It takes an average of 75 person-hours to harvest 450 boxes per acre.[5] When planning for applicable labor expenses, costs for state and federal payroll taxes, worker's compensation, and other possible benefits should be included.[1] Some growers choose to use a farm labor contractor or the guest-worker visa program. With these options expenses such as housing, meals, transportation, and other required aspects may need to be included in the labor costs.

TABLE 2. SAMPLE BUDGET SHEET OF ESTIMATED HARVEST AND POSTHARVEST COSTS PER ACRE.[2]

Variable costs	Quantity per Acre	Unit	Price ($) per Unit	Total Cost ($)
Ice	2750	Pound	0.18	495
Cartons	550	Box	2.00	1,100
Labor				
Operator	4.95	Hours	15.00	74
Harvest	21	Hours	12.00	252
Pack and grading	15	Hours	12.00	180
Fuel	25*	Gallons	3.50	88
Total variable costs				2,189

* Estimated fuel used for harvest/postharvest operations. This value was altered from the value presented in the cited work that estimated fuel use for the entire season.

Another labor-related expense is the cost of field sanitation, including portable toilets, handwashing stations, separate sources of drinking water, etc. Attention to worker hygiene is necessary to prevent the contamination of produce with human pathogens, and to comply with applicable laws and regulations.[1]

Non-labor Costs

Other variable costs associated with harvest and packing processes include fuel for harvest machinery and transportation, packing boxes (approximately $1 to $2 per box), and cooling and storage costs (approximately $1 to $2 per box) (Table 2).[1,2]

Sources:

[1] Tourte, L., Smith, R., Murdock, J., and Sumner, D. 2017. Sample costs to produce and harvest broccoli: Central coast region. University of California Agriculture and Natural Resources, Cooperative Extension and Agricultural Issues Center, and UC Davis Department of Agricultural Resource Economics.

[2] Orzolek, M., Lamont, W., Kime, L., Harper, J. 2012. Broccoli production. Agricultural Alternatives. Penn State Extension. UA280.

[3] LeStrange, M., Cahn, M., Koike, S., Smith, R., Daugovish, O., Fennimore, S., Natwick, E., Dara, S., Takele, E., and Cantwell, M. 2010. Broccoli production in California. UC Vegetable Research and Information Center. Vegetable Production Series. Publication 7211.

[4] Reiners, S., Bellinder, R., Curtis, P., Helms, M., Landers, A., McGrath, M., Nault, B., and Seaman, A. 2017. Cornell integrated crop and pest management guidelines for commercial vegetable production.

[5] Atallah, S. and Gómez, M. 2013. Eastern broccoli crop budgets. Cornell University. EB 2013-14.

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