Postharvest Technologies for Horticultural Crops
HOS 5330

Evaluating Harvesting and Handling Procedures

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The best growers are constantly looking for ways to improve their production practices, to increase yield and maximize returns. Equally important, but often overlooked by both growers and handlers, are improvements in harvesting and handling procedures. Because of the wide variety of production practices and fruit and vegetable crops grown in Florida, no single set of harvesting and handling procedures can be prescribed for all situations. However, certain principles can be identified and used to evaluate each procedure. The objective of this article is to help you in the evaluation of harvesting and handling procedures.

Systems Analysis is one method for analyzing an operation. This method uses *analysis* to break down, from the Greek) and *synthesis* (to put together). According to Ritchey[1],

> *"Analysis is defined as the procedure by which we break down an intellectual or substantial whole into parts or components."*
>
> *"Synthesis is defined as the opposite procedure: to combine separate elements or components in order to form a coherent whole."*

Systems Analysis has several major steps:

1) Identify the system (overall operation) from beginning to end
2) Break down (analyze) the system by identifying each component
3) Break down each component by identifying individual subcomponents
4) Study how the subcomponents are inter-related
5) Study how the components are inter-related
6) Reassemble (synthesize) the system
7) Determine strengths and weaknesses of the system, based on the analysis of the system components
8) Develop recommendations for improvement of the system

The best place to start is in the actual location. First, define the system. For instance, let's assume that you plan to analyze tomatoes picked at green stage of maturity. The system would be defined as beginning at harvest in the field and ending when the packed crop is loaded for shipment. Second, define the individual components and subcomponents by writing down each step involved in handling

[1] Based on article by T. Ritchey (1996) (http://www.swemorph.com/pdf/anaeng-r.pdf)

the crop. When you are finished, the list for a crop packed in a packinghouse might look something like the following example.

In the field:

1) Tomatoes picked into field bucket.
2) Worker 1 carries bucket to flatbed truck.
3) Bucket emptied by Worker 2 into field bin; Worker 1 returns to location.
4) Filled truck transports bins to packinghouse.

At the packinghouse:

5) Bins unloaded at packinghouse with forklift.
6) Bin dumped into dump tank.
7) Tomatoes float to lift rolls, elevated and rinsed.
8) Undersize fruit removed.
9) Tomatoes sorted, graded, dried, sized, packed and palletized (sequence varies by operation).
10) Pallets taken to ripening rooms at 21 ^{o}C.
11) Once ripening initiated, ethylene treatment stopped.
12) Cold room temperature lowered to 13 ^{o}C.
13) Pallets loaded by forklift onto refrigerated trailer for shipment.

For each list of handling steps, continue to analyze each component by keeping the following basic concepts in mind related to postharvest losses:

1) Mechanical injuries. Can the number of times the product is handled be reduced? Can the amount of rough handling be reduced?
2) Temperature management. Can any steps be modified to contribute to better product temperature management?
3) Sanitation. Can the sanitation be improved? Are there sources for cross-contamination of human pathogens?

The following questions will further assist in analyzing the system.

A. Evaluating Field Operations

1) Can cultural practices be modified to improve product cleanliness and ease of harvest?
2) Are the harvest crews well-trained and handling the product properly?
3) Is the harvest machinery in good repair and operated properly?
4) Are the picking and transport containers clean and in good repair?
5) Can the time of harvest be modified to take advantage of cooler night and early morning temperatures?
6) Can the time from harvest to cooling be reduced?
7) Is the harvested product kept in the shade?
8) Is field packing or a packinghouse operation the best way to handle this product?

B. Evaluating Packing and Packinghouse Operations

1) Is the product waiting to be packed left in the shade or sun?

2) Can (should) the product be cooled prior to packing?
3) Is the machinery in good repair and operating properly?
4) Can the number and/or height of drops be reduced?
5) Are product contact surfaces clean and sanitary?
6) Is the grading, sorting, and packing crew well-trained and each individual assigned a specific job?
7) Is the work area well-lighted, safe, and clean?
8) Is the shipping container well-designed for this product?
9) Can the product be unitized at this stage, considering cooling methods to be used?

C. Evaluating Cooling Operations

1) Is the method appropriate for this commodity?
2) Is the product/coolant contact maximized?
3) Is the cooling medium temperature at a minimum?
4) Are cooling schedules utilized?
5) Is equipment properly maintained and managed? Sanitized?
6) Are cold storage rooms managed to provide a proper environment for the product and easy inventory control?
7) Can traffic be reduced?
8) Can other energy-saving measures be utilized?

D. Evaluating Shipping Operations

1) Is the product handled and shipped as part of a unitized load?
2) Are there unnecessary delays between removal of the product from cold storage and loading?
3) Is the loading area enclosed?
4) Can traffic be reduced? Safety increased?
5) Are transport vehicles inspected prior to loading?

In actual practice, some of the questions listed above do not apply to all situations. Some have relatively simple answers, while others have very complex answers that raise further questions. By using a systematic approach you can identify the strengths and weaknesses of current harvesting and handling procedures. Once identified, weaknesses can be targeted and suggestions made to improve handling efficiency and reduce postharvest losses.

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