Capital $ Investment in Postharvest Technology & Recovery of Invested Capital

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In today's competitive global agricultural market it takes more than knowing how to effectively produce crops to succeed in business. Marketing fruits and vegetables at acceptable profit margins may involve timing the market either early or late in the season, to receive higher prices. Many producers undertake the strategy of trying to be the first grower/shipper to market product when prices are high and customer demand is strong. To execute this strategy special cultivars of fruits and vegetables have been developed by plant breeders and seed companies to mature very early in the season and allow grower/shippers to capitalize using this marketing stategy. Marketing produce late in the season or during the off-season is achieved by utilizing appropriate postharvest handling technologies. These technologies if used properly not only extend the marketable shelf life of fresh fruits and vegetables but allow grower/shippers marketing opportunities such as:

1. shipping product to distant markets,
2. storing product until higher market prices are offered due to diminished supplies,
3. providing customers with consistent supply of product.

A good example of how market prices and available supplies vary inversely is shown below. This example demonstrates how Chilean asparagus prices in the U.S. market vary inversely with supply and how a marketing window exists late in the season.

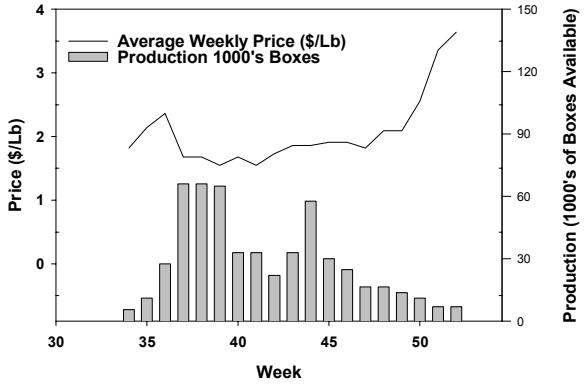

Figure 1. *Chilean asparagus prices and production availability.*

What Postharvest Technology Is Appropriate for Me ?

There are NO technological substitutes for sound postharvest management of temperature and relative humidity. However, postharvest technologies such as controlled atmosphere cold storage, are commercially available and are used effectively to reduce storage losses and extend the marketable life of many fruits and vegetables. But how appropriate is a given technology for your operations ? Implementing the use of a specific postharvest technology or handling practice may require a substantial investment of capital and knowing how much monetary value the use of a specific technology will add to your operation is an important question.

To determine if a specific postharvest technology is appropriate, cost effective and how long it will take to pay for potential increased operating and capital expenses, the following queries need to be answered:

Market Window

- Is there a market window which will potentially allow your crop, if stored, to bring a higher market price?
- Are other production areas or competing products coming to market during this potential marketing window?
- How long do I need to store my crop, to sell it during this marketing window?
- What is the expected price difference between when product is put into storage and when it will be marketed?

Postharvest Technologies

- What postharvest technologies are available to effectively store product for the length of time needed to sell during the targeted marketing window?

- What amount (percent) of product will be lost during storage using this new technology compared to selling nearly 100% marketable product immediately after harvest?

- What are the capital and operating costs associated with this technology?

Recovery Of Invested Capital (ROIC) Feasibility Studies

Once you have answered the above queries you are ready to evaluate whether or not a given postharvest technology is appropriate for your operations. The following is an example of the types of analyses you can perform to make this determination. Numerous variables will determine if a technology is economically feasible but this example will focus on the effects of:

1. crop value (on a per pound basis),
2. crop price deferential before and after storage and
3. losses incurred during storage.

The assumptions for this example are as follows. We wish to determine if the use of a portable controlled atmosphere storage chamber inside an existing cold storage is cost effective. We will assume the equipment can deliver the appropriate atmospheres and temperatures to allow us to hit our target marketing window. Remember that this is only an exercise and not a recommendation for any specific postharvest technology such as CA storage. Monetary figures are only for the sake of comparisons.

Assumptions

- 20 Pallet Spot Storage Capacity for CA Chamber (20,000 Lbs)
- $50,000 Capital Costs to Purchase
- ~ $10,000 per year total operating and finance costs:
  - $5,000 Operating Costs per year
  - $5,000 (10%) Annual Interest Rate on $50,000 Borrowed Money
- 10% Losses During Storage

Commodity Value Affects ROIC

In this example we will look at the effects of storing: 1) a low-value crop ($0.10/Lb), 2) a moderate-value crop ($1.00/Lb), and 3) a high-value crop ($10/Lb). We also want to determine what effects an increase in sales price after storage of 20%, 50%, 100% and 400% will have on ROIC.

Table 1. demonstrates that for a low-value commodity it is impossible to recover the invested capital for this technology even if prices rise by four fold (400%), after storage. In this case the net increase in profit by marketing later, is more than offset by storage losses, as well as operating and financing expenses, so that the technology will never pay for its implementation.

Table 1. *ROIC for a low-value commodity.*

Wt IN (Lbs)	Wt OUT (Lbs)	Sale Price ($/Lb)	Gross Value	Value Change	Net After Expenses	ROIC (Yrs)
20,000	20,000	0.10	2,000	0	0	0
20,000	18,000	0.10	1,800	(200)	(10,200)	∞
20,000	18,000	0.12	2,160	160	(9,840)	∞
20,000	18,000	0.15	2,700	700	(9,300)	∞
20,000	18,000	0.20	3,600	1,600	(8,400)	∞
20,000	18,000	0.40	7,200	5,200	(4,800)	∞

Examples of low-value commodities: lettuce, carrots, onions. ∞ = infinity

Table 2. demonstrates that for a moderate-value crop a price increase of nearly two fold (100%) is needed for the technology to pay for itself in 6.5 years. It also illustrates that if prices rise four fold (400%) the ROIC is reduced to 1.5 years. The ROIC of 1.5 years or seasons may actually be less if the technology can be used for other commodities. Another way of looking at this is, the more a technology can be used in one year, capital costs are spread over more pounds of product and this drives down per pound costs as well as the time to recover invested capital.

Table 3. demonstrates that ROIC when using a postharvest technology can be very fast for high-value commodities. For high-value commodities, the net percentage increase in price before and after storage does not need to rise drastically to fully recover invested capital in a short period of time. A 50% increase in prices before and after storage in this example has an ROIC of about 1 year or 1 turn of product.

Table 2. *ROIC for a moderate-value commodity.*

Wt IN (Lbs)	Wt OUT (Lbs)	Sale Price ($/Lb)	Gross Value	Value Change	Net After Expenses	ROIC (Yrs)
20,000	20,000	1	20,000	0	0	0
20,000	18,000	1	18,000	(2000)	(12,000)	∞
20,000	18,000	1.2	21,600	1,600	(8,400)	∞
20,000	18,000	1.5	27,000	7,000	(3,000)	∞
20,000	18,000	2	36,000	16,000	6,000	6.5
20,000	18,000	4	72,000	52,000	42,000	1.5

Examples of moderate-value commodities: asparagus, blueberry, strawberry.

Table 3. *ROIC for a high-value commodity.*

Wt IN (Lbs)	Wt OUT (Lbs)	Sale Price ($/Lb)	Gross Value	Value Change	Net After Expenses	ROIC (Yrs)
20,000	20,000	10	200,000	0	0	0
20,000	18,000	10	180,000	(20,000)	(30,000)	∞
20,000	18,000	12	216,000	16,000	6000	6.5
20,000	18,000	15	270,000	70,000	60,000	1
20,000	18,000	20	360,000	160,000	150,000	<1
20,000	18,000	40	720,000	520,000	510,000	<1

Examples of high-value commodities: golden raspberries, specialty herbs.

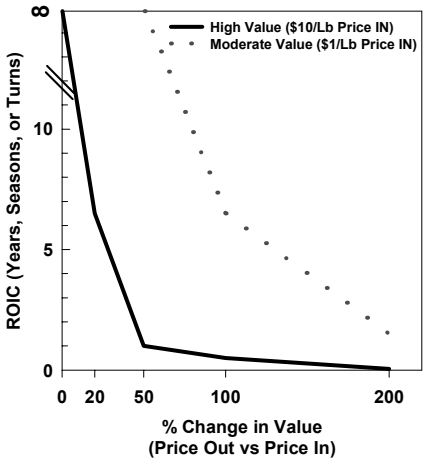

Figure 2. *Commodity base value and price after storage both affect ROI*

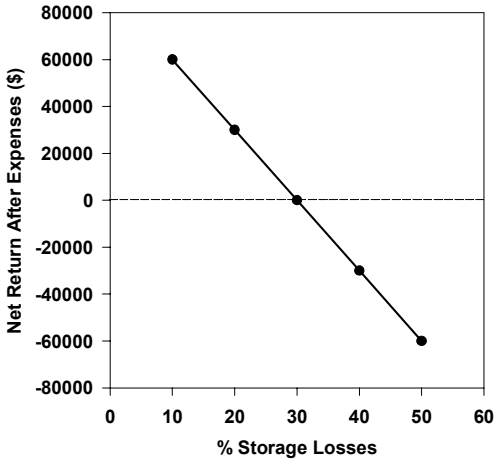

Figure 3. *Storage losses affect ROIC*

As shown in Figure 2, ROIC is affected by price changes before and after storage, as well as commodity value. Low-value commodities are not shown since they can almost never recover invested capital unless prices after storage skyrocket or if the technology is used on more than one time period per year. Use of new technology has the greatest potential for ROIC when used on high-value crops but also the greatest risk, if assumptions about storage losses or marketing conditions are incorrect

Storage Losses Affect ROIC

In the previous example we have a assumed a constant postharvest loss during storage of 10%. The example in Table 4 demonstrates the effects of increasing postharvest losses on net returns and ROIC. In this example the post storage sales price has been held constant at 50% above the initial crop storage price. Percent losses during storage are the variable and as losses increase there is less salable crop after storage and this reduces profitability and delays ROIC. When storage losses are greater than 30%, the operation begins to actually lose money and it would have been better to have marketed the crop immediately after harvest. Figure 3 is a graphical demonstration of the effects of losses during storage versus ROIC from data presented in Table 4. It is important to have realistic expectations of post storage losses that will be incurred.

Conclusion

There are many postharvest technologies which extend the marketable life of fruits and vegetable. However, many are inappropriate economically due to the large capital investments needed to implement these technologies as well as market forces. Use of appropriate postharvest technology when used effectively can greatly enhance profitability but one must keep in mind that any single technology is never a substitute for the many integrated steps involved in proper postharvest management.

Table 4. *Losses During Storage Effects on ROIC.*

Wt IN (Lbs)	% Losses	Wt OUT (Lbs)	Sale Price ($/Lb)	Gross Value	Value Change	Net After Expenses	ROIC (Yrs)
20,000	0	20,000	10	200,000	0	0	0
20,000	10	18,000	15	270,000	70,000	60,000	1
20,000	20	16,000	15	240,000	40,000	30,000	2
20,000	30	14,000	15	210,000	10,000	0	∞
20,000	40	12,000	15	180,000	(20,000)	(30,000)	∞
20,000	50	10,000	15	150,000	(50,000)	(60,000)	∞