



# HARVEST

what you grow



## Maximizing Profitability

How you harvest and deliver your sugarbeet crop significantly impacts your bottom line. Careful harvesting, proper beet storage, and efficient processing are complex operations—but as American Crystal shareholders who own the processing factories, successfully completing these tasks means more money in your pocket.

Sugarbeets in the Red River Valley are commonly in storage for up to 250 days before processing—so to maximize on-farm profit, each crop must be harvested as efficiently as possible and delivered to stockpiles in the best condition to minimize sugar losses.

Properly and efficiently harvesting means doing everything possible to:

- Reduce field harvest losses
- Reduce dirt tare
- Completely remove leaf and petiole material
- Deliver frost free roots to storage piles
- Place beets in storage at proper root temperatures

Attention to the guidelines and research-based recommendations that follow will give all shareholders the ability to maximize their on-farm profit and potential for success.

## Better Harvest Decisions Lead to Bigger Profits

Maximizing yield, quality, root storability and on-farm profit requires the consideration of many factors, including:

1. Headlands Versus Whole Fields for Pre-pile
2. Soil Type and Field Drainage
3. Yield Potential and Pre-pile or Stockpile Harvest
4. Hail Damage
5. Crop Nitrogen Fertility Status
6. Fungicide Use/Plant Health/Frost Protection
7. Crop Storage Suitability/Disease Severity
8. Variety

A careful analysis of the effects of each factor on yield, quality and revenue will enable you, as a shareholder, to make better harvest decisions.



Careful consideration of harvest best management practices can increase recoverable sugar per acre by 300 lbs. or more.

### 1. Headlands Versus Whole Fields for Pre-pile

All shareholders must consider the pre-pile premium payment system and its impact on beet payments. Headlands and parts of a field to be harvested during the pre-pile period will have greater revenue per acre if:

- High quality varieties are planted
- High plant populations are maintained
- Headlands are planted to another crop
- Beets are scalped instead of just flailed
- Nitrogen rate is reduced by 20 lbs./acre on headlands

### 2. Soil Type and Field Drainage

Many shareholders choose to harvest beets from fields with heavy textured soils first to avoid wet conditions that make harvesting very difficult on high clay content soils. Fields with difficult-to-cross ditches or unusually wet areas should also be considered for early harvest.

### 3. Yield Potential and Pre-pile or Stockpile Harvest

Fields with poor plant populations, diseases or other yield reducing problems should be harvested during early pre-pile or at the beginning of the full harvest period. The potential for growth, in fields with yield robbing problems, is less than in better fields if harvested late in the season.

### 4. Hail Damage

Hail can significantly impact crop yield and quality. To minimize the impact of hail on your beet payment, consider these guidelines:

- Disregard the hail event if there is 30% defoliation or less—the greater the percent defoliation, the more severe the sugar loss and the longer the recovery period.
- If hail is received 7 days or fewer before harvest, consider harvesting the field immediately. Waiting will find sugar percent declining for two or more weeks.
- If hail is received 8 to 21 days before harvest, sugar content is declining, so delay harvest until the end of stockpiling.
- If hail is received three to four weeks before harvest, there will be recovered leaf canopy, but yield and sugar content will still be increasing so delaying harvest until the end of stockpiling would be beneficial.

Enhance on-farm profit with an application of Headline 30-40 days before harvest to increase yield, improve frost tolerance, accelerate recovery from frost, and improve beet storage.

### 5. Crop Nitrogen Fertility Status

Shareholders may take samples of beets from each field before their scheduled pre-pile period to determine sugar content and loss to molasses levels. You can enhance your pre-pile premiums by choosing to harvest fields with high quality first.

The later the crop is harvested, the higher the yield and quality should be. The exception is if a severe frost kills most plant foliage, stopping yield and quality improvement. Satellite images may determine the extent each field remains green and its likelihood to be of lower quality.

Careful analysis of pre-pile delivery records may also indicate which fields should be lifted early or late during full harvest. Fields with a distinct yellowing of the leaf canopy will not suffer reduced yields if foliage completely covers the soil until harvest.

*Headline application not fewer than 30 days or more than 40 days before harvest gave greatest benefits.*

### 6. Fungicide Use/Plant Health/Frost Protection

Dr. Larry Smith, University of Minnesota, has conducted extensive trials documenting effects of fungicides on late season plant health, including frost protection. These research results are consistent with results in Idaho and Europe.

Headline treated beets are more tolerant to frost (Figure 1). Agriculturists' observations indicate Headline-treated beets "heal" more quickly and can then be harvested and placed in long-term storage sooner after a hard frost.



FIGURE 1: Headline-treated vs. non-treated

### 7. Crop Storage Suitability/Disease Severity

Many factors can damage beet fields and cause roots to be unfit for long-term storage, thus reducing profitability. Fields with a high percentage of roots damaged by: 1) root rot, 2) spray drift, and 3) flooding, should be harvested during pre-pile. Such fields have less potential to increase in yield and quality if left for later harvest.

You must have enough pre-pile quota to lift whole fields during the pre-pile period. Contact your agriculturist for help in acquiring more quota.

### 8. Variety

Different root shapes and growth habit necessitate different harvester settings.

## Defoliation Best Management Practices

The adjustment and operation of sugarbeet defoliators have not received enough attention in the past. Payments to shareholders can be dramatically improved by achieving these objectives for proper defoliator operation:

- Removing all petiole and leaf material from beet crowns
- Minimizing root and crown breakage
- Eliminating loss of yield from beets knocked out of the row
- Sweeping soil and beet canopy debris from the area adjacent to each beet row to facilitate lifting, especially on the row finder row
- Removing only a 1.0 to 1.5 inch diameter piece of the crown when using scalpers

*One ounce of excess weight taken per beet on a stand of 150 beets/100' equals 1.1 ton/acre of lost yield.*

### Scalping Versus Flailing

No matter which method of defoliation is used for acceptable storage, beets must be free from leaves, petioles, dirt and trash. The choice of a defoliation method—scalping or flailing—is left to the individual shareholder. Scalping is sometimes especially difficult with an uneven stand of beets where large beets and small beets are side by side in the row. The larger beet will tend to grow higher out of the ground than the smaller beet, making it almost impossible to do a good job with the scalpers (Figure 2).



FIGURE 2: Uneven stand, poor defoliation (scalping)

The goal of scalping is to remove the portion of the crown that contains the highest impurities, the lowest sugar content and the active growing point. When done properly, in most cases, you will have an increase in revenue per acre.

There are risks. Scalping too aggressively (Figure 3) can lead to significant tonnage loss and exposure of a large area of cut beet that increases the respiration rate and opens the crown parenchyma cells to infection and rot—resulting in higher sugar losses in storage.



FIGURE 3: Excessive scalping

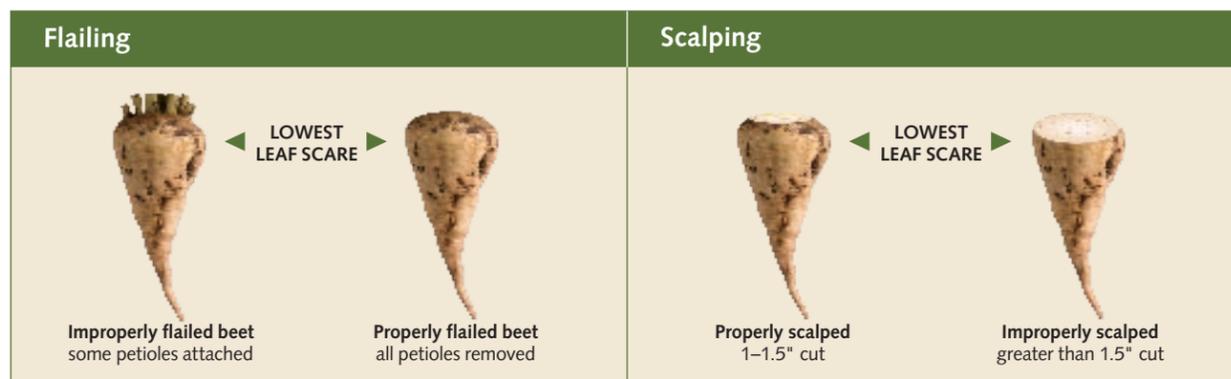


TABLE 1: The Effect of Scalping versus Non-Scalping—Dr. Larry Smith, UM

A study conducted by Dr. Larry Smith at the University of Minnesota has demonstrated the benefit of scalping. The table below shows the summarized

results of the study documenting a reduction in tons harvested, but an increase in sugar, a reduction in SLM and an increase in purity.

Treatment	Yield (T/A)	% Sugar	% SLM	Recoverable Sugar Lb./A	Recoverable Sugar %	Lb./T	Na	K	Amino N	Impurity Index	Payment Per Acre
Scalped	18.2	17.1	2.3	5395	87.1	297	467	2215	777	856	647
Non-Scalped	19.7	16.2	2.35	5459	85.5	278	580	2327	825	969	605

By using an estimate of 25 cents/lb. of sugar, this UM study showed a \$42/acre increase in the beet payment by scalping the beets.



FIGURE 4: Uniform spacing, properly flailed

### Plant Population and Spacing

Uniformly spaced plants in the row make it easier to adjust the defoliator to remove all petioles (Figure 4). Non-uniform plant spacing in the row may necessitate slower defoliator operation and still result in incomplete defoliation, lower payment per ton and less revenue per acre. Uniformity of plant spacing can be improved by checking planters on test stands, using slower planting speeds and use of pelleted or coated seed.

### Flail Shredder Use/Weed Control

Using a flail shredder ahead of the defoliator is recommended whenever the defoliator does an inadequate job of removing all petiole material. These situations include:

- Fields with very heavy canopy growths
- Fields with bad weed infestations
- When operating defoliators too fast
- When defoliating after a hard frost

### Level of Weed Control

There is no excuse for delivering weedy loads with Roundup Ready® beets.

### Variety Growth Characteristics/ Operator Adjustment

For optimum results, a defoliator should be adjusted for soil conditions and growth habit of the variety planted in each field. Due to differing growth habits, planting more than one variety in a field is not recommended.

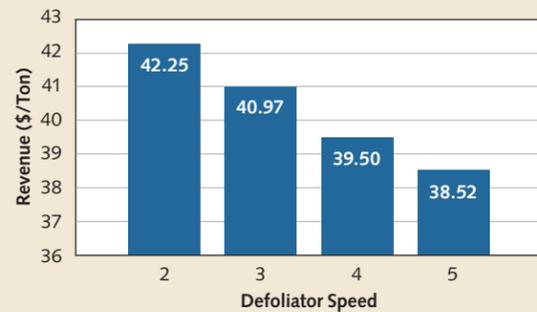
### Tips for Successful Defoliator Operation

- Slow down—excessive speed is costly. Operate at 3 mph or less.
- Poorly adjusted and dull scalping knives cause increased yield loss.
- Use steel or studded flails on front drums after a frost (Table 4, page 6).
- Adjust defoliator settings for each field or variety.
- Take time to train defoliator operators.
- Change flails as needed—they won't last the life of the machine.
- Studded flails may damage beets and increase storage losses if not adjusted properly.



## Improve profitability up to \$100 or more per acre by using slower defoliator and harvester speeds.

**TABLE 2. The Effect of Defoliator Ground Speed on Sucrose Content and Beet Payment**



### Speed of Defoliator Operation

Research conducted by Dr. Larry Smith at the University of Minnesota clearly showed significant losses in recoverable sucrose as defoliator ground speed increased from 2 to 5 mph. For each 1-mph increase in speed between 2 and 5 mph, approximately 0.25 percent sugar and 7.0 lbs. of recoverable sugar per ton were lost.

Table 2 shows losses in revenue from improper defoliation. Crop quality and revenue decreased as defoliator speed increased. The reasons included 1) insufficient time for flails to remove petioles as they passed down the row, and 2) poor defoliation of small beets next to large ones.

### Defoliation, Root Temperatures and Canopy Management

Amalgamated Sugar Company research documented the effects of defoliation and no defoliation on root temperatures in the field in October. Some conclusions were:

- Temperatures peaked at about 4 p.m. each day
- Maximum air temp was 62°F and minimum air temp was 20°F
- Root temperatures with no canopy peaked at 58-62°F
- Root temperatures with canopy peaked at 41°F
- Topped root temperatures dropped to a low of 22°F
- Non-topped root temperatures dropped to only 28°F

### Flail Types and Configurations (Pre-frost)

Dr. Smith conducted research to evaluate effect of flail type and configuration on crop yield, quality and revenue per ton. All treatments were applied before and after frost conditions at different speeds, using all new flails on triple drum defoliators. The data from pre-frost research is shown in Table 3.

Under pre-frost conditions defoliators with all rubber flails or studded or steel flails on the front drum, followed by rubber flails on the middle and rear defoliator drums had:

- Higher sucrose content
- Higher sugar per ton
- Lower impurities (SLM)
- Higher revenue per ton

Studded flails on the second drum usually cause serious crown damage and reduced total revenue.

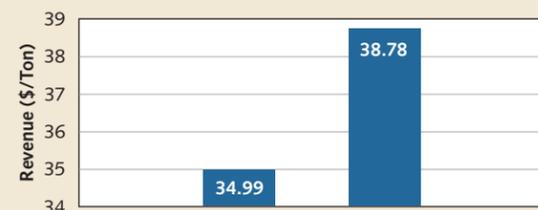
**TABLE 3. The Effect of Flail Type and Configuration on Sugarbeet Quality Pre-frost—Dr. Larry Smith, UM**



Flail Configuration	Revenue (\$/Ton)
Front Drum: Rubber	39.02
Middle Drum: Rubber	39.21
Rear Drum: Rubber	36.99
Front Drum: Studded or Steel	36.99
Middle Drum: Studded	36.99
Rear Drum: Rubber	36.99

**TABLE 4. The Effect of Flail Type and Configuration on Sugarbeet Quality Post-frost—Dr. Larry Smith, UM**

After a heavy frost the all rubber flail configuration was inferior to the configurations with studded or steel flails on the front drum.



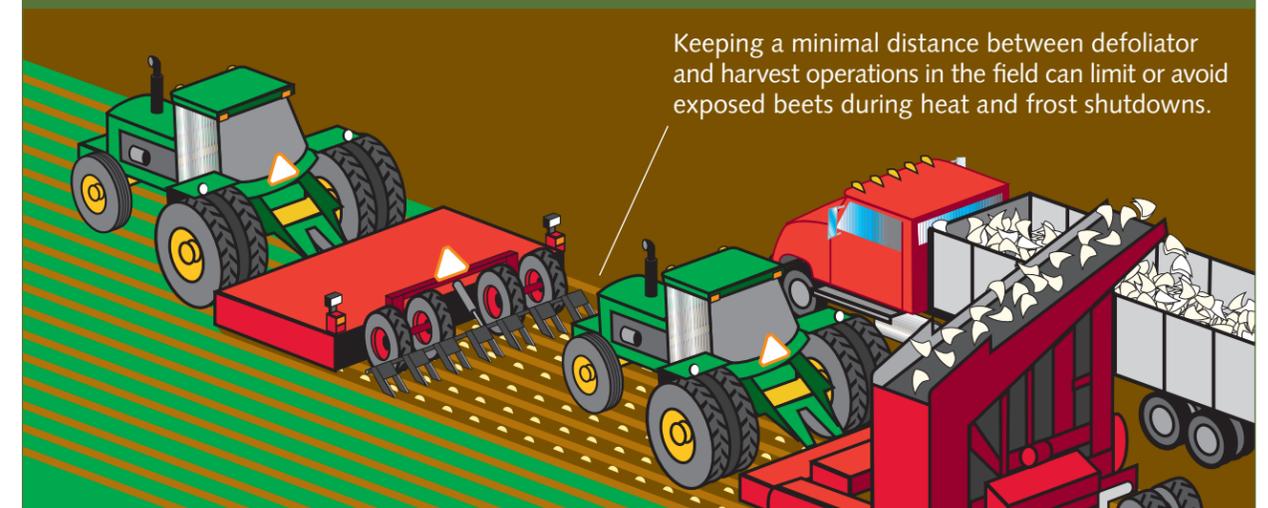
Flail Configuration	Revenue (\$/Ton)
Front Drum: Rubber	34.99
Middle Drum: Rubber	38.78
Rear Drum: Rubber	38.78
Front Drum: Studded or Steel	38.78
Middle Drum: Rubber	38.78
Rear Drum: Rubber	38.78

### Harvesting

Alan Dexter, and Allan Cattanaach (NDSU/U of MN) and American Crystal Sugar Company agriculturists have conducted extensive evaluations of beet harvesters in the field. Only minor differences were observed between harvester brands when they were properly adjusted. Speed of harvester operation, however, had a major effect on beet yield and revenue per acre.

- Increasing speed of harvester operation from 3-4 to 5-6 mph resulted in a loss of 1.0 ton per acre and an increase of 1.3% tare under ideal digging conditions (Table 5).
- Revenue declined by \$42 per acre as harvester speed increased.
- Sugarbeet sucrose percent, loss to molasses, and impurity levels were not significantly affected by speed of harvester operation.

### Tips for Successful Harvester Operation



- Keep harvester operation at 4 mph or less.
- Use properly operating row finders and/or RTK guidance.
- Adjust grab rolls, scrubber chains, digging depth, pinch point settings, etc. as conditions change, and when moving to another field.
- Check field losses regularly.
- Use Safe-T pulls, or similar safe pulling devices during wet harvests.
- Deliver beets free of excess dirt, stones and trash.
- Contact the harvester manufacturer or your agriculturist for assistance.

**TABLE 5. The Effect of Harvester Speed of Operation on Yield and Quality—Dexter and Cattanaach**

Harvest Speed (mph)	Sucrose (%)	Tare Dirt (%)	SLM (%)	Yield (T/A)	RSA (lbs.)	Revenue Per Acre(\$)
3-4	18.2	4.7	1.2	17.2	5732	677
5-6	18.3	6.0	1.3	16.2	5475	635
Slow Speed Advantage	0.1	1.3	0.1	1.0	257	42



## Harvest Loss Appraisal: Saving You Thousands of Dollars in Losses

The harvest loss appraisal technique was developed as a tool for shareholders to use in the field. This quick analysis has saved growers thousands of dollars by measuring tonnage not going into the truck and allowing for corrective action. A single, unharvested, one-pound beet per 10 feet of row equates to a 1.2 ton/acre loss. It doesn't take much beet loss to add up to big dollars.

*Beet loss is like an iceberg—90 percent of it is under the surface.*

You can't always look behind the lifter and know you are doing a good job. It's important to adjust your harvester to the conditions in each field.

To find out how to conduct a harvest loss assessment, go to the American Crystal Sugar Company website:

[www.crystalsugar.com/agronomy/goldstandards/harvest/harvestloss.appraisal](http://www.crystalsugar.com/agronomy/goldstandards/harvest/harvestloss.appraisal)

## Make More Money

Increase your profit by using the tools and information available on the American Crystal Sugar Company website:

- Harvest calculator: determines field harvest order
- Pre-pile/stockpile calculator for payment comparisons
- Harvester and defoliator checklists
- Gator field loss tool
- "Your Way to Grow" presentations
- Beet harvester adjustment slide rule