



Harvest and Storage

Introduction

Harvesting should aim to operate as a 'just in time' approach for as long as possible. This will ensure that stocks on farm are kept to a minimum, allowing maximum growth and minimising sugar losses after harvest. Crops with the poorest yield potential should be harvested first; leave the better crops for later lifting.

Foliar diseases should be controlled in season to maintain a healthy leaf canopy and benefit from late-season growth as well as protecting against frost.

Harvester operators should be fully trained and familiar with equipment. Maintenance is critical and harvesters should be fully serviced and worn parts renewed where necessary. Carry out regular assessments during harvester operations, to minimise physical loss and to ensure beet is handled gently to prevent bruising and sugar loss.

Assessing root damage levels for yield loss

Remember, as well as the physical loss of yield, root damage will also accelerate the rate of sugar loss in storage. Trials have shown that in cases of severe root damage, this may be 3x greater than in undamaged roots, especially when temperatures are warmer. Make sure damage levels are low in crops destined for longer term storage.



Key points

- Planning is key; your harvesting programme should be developed in conjunction with your harvesting contractor, haulier and British Sugar Agricultural Manager
- Operate a 'just in time' harvesting and delivery approach for as long as possible
- When selecting which field to harvest first consider: soil type, field access and crop potential, to balance the benefits of early lifting whilst optimising yield performance
- Handle beet gently to prevent bruising and sugar loss
- Crop growth can increase yield by up to 40% from September to December

Storage

Preparations for storage should go hand in hand with planning for harvest, this allows for maximise yield to be retained and delivered.

Physical yield can be lost through poor site selection, with loaders unable to recover beet. Increased sugar losses can be driven by incorrect clamp design or construction.



Whole root losses

The first point of loss with harvesting is getting the roots into the machine and then keeping them in. This is termed whole root losses and is comparable to combine header and sieve loss.

As with combine losses it is important to check behind the harvester and some simple calculations can be used.



Note: 50cm rows = 20 m 45cm rows = 22 m

Modern harvesters with large tyres and staggered wheel patterns, do make finding these losses more difficult. A fork or beet knife will likely be required to find the roots that have been rolled into the ground.

Whole root losses are typically below 0.5 t/ha, however incorrect settings or mechanical failure can lead to much larger losses. The example below shows a yield loss of 8 t/ha, showing that it is important to continue to monitor.



Root breakage

Root breakage is often our highest area of physical loss when harvesting sugar beet, as the loss is likely on every beet being harvested unlike the whole root losses.

Monitoring root breakage can be done in the clamp scoring the diameter of the root break to understand how much root has been lost, as the table below demonstrates.

Measure the diameter of root damage in at least 20 representative roots, ideally 100 roots per sample

Root breakage diameter (cm) for every 10% of roots in each sample	Yield loss (t/ha)
2-4	0.5
4-6	1.0
6-8	2.0
8-10	3.0

Root breakage is most often caused by two functions of harvesting that occur in contrasting conditions. In dry hard soils, the likely cause is the process of lifting, with lifting units being unable to penetrate the soil and move sufficient soil, snapping the root off in the ground. This can be seen below and is easy to identify.

Wet conditions can also deliver high root break with aggressive cleaning required to remove soil but equally damaging beet.



Crowning losses

Over-crowning causes the highest levels of yield losses, with approximately 1 t/ha lost for every 5% of beet over-crowned. Dry growing seasons can produce crops of variable size, making the job of lifting beet with entire crowns and minimal foliage more challenging.

British Sugar issue a topping standards guide to help maximise beet yields and reduce the amount of green material delivered into factories. The latest guide is shown below.

Topping Standards Guide (issued by British Sugar)



Too much green material

Risk of rejection - adjust harvester to remove more green material



Acceptable

Beet with minimal amounts of green material



Optimum defoliation

Yield maximised - all leaf material removed and root fully intact



All green material and some root removed

Loss of yield potential - adjust harvester to remove less root material



Excessive root loss

1cm slice of root material removed from all beets can result in 12% yield loss - adjust harvester to remove less root

Harvester Set-up

Harvesters should be carefully monitored during lifting and adjusted to optimise machine settings in line with ground and crop conditions. This helps with optimising lifting and meeting topping standards. The following tables provide guidance on possible setting changes in different conditions.

Harvester Set-up: DRY SOIL CONDITIONS

Type of loss/damage	Suggested setting changes
Whole root losses	<ul style="list-style-type: none">Set lifting mechanism deeperDecrease forward speed, to maintain share depthIncrease forward speed for soil & root flow onto turbines or roller bedsCheck conditions of shares – if worn, replace or repair if possible
Root tails broken off at lifting	<ul style="list-style-type: none">Reduce forward speedSet lifting mechanism deeper
Root damage –in the cleaning mechanism	<ul style="list-style-type: none">Set lifting mechanism deeperFit turbine gate platesReduce turbine speedFit ringed turbines and/or more helper tinesConsider increasing or decreasing forward speed

Harvester Set-up: WET SOIL CONDITIONS

Type of loss/damage	Suggested setting changes
Whole root losses	<ul style="list-style-type: none">Set lifting mechanism deeperIncrease or decrease forward speed
Root tails broken off at lifting	<ul style="list-style-type: none">Adjust depth of lifting mechanism – raise/lower
Root damage – in the cleaning mechanism	<ul style="list-style-type: none">Reduce turbine speedIncrease forward speedCheck lifting accuracy
Excessive soil adhering to harvested roots	<ul style="list-style-type: none">Increase turbine speedRemove gate platesFit pig-tail tines instead of railed gatesRaise lifting mechanismIncrease turbine gate gaps

Harvester Set-up: CROP CONDITIONS

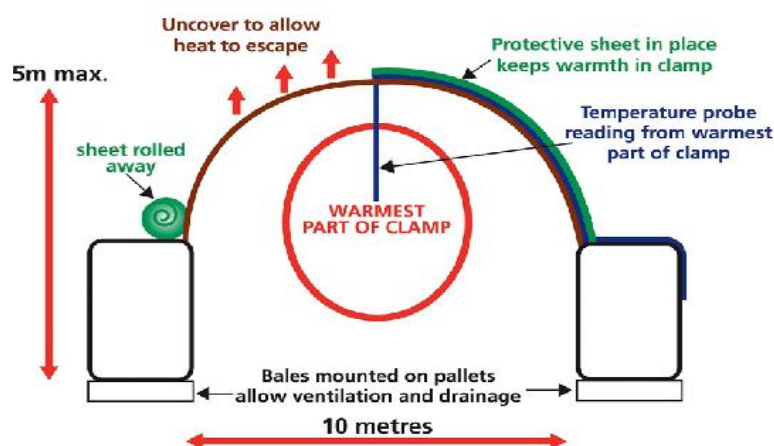
Type of loss/damage	Suggested setting changes
Small Beet	<ul style="list-style-type: none"> Fit gate plates Close turbine finger wheel gaps Close oppel wheel or shear gap if beet are left in field
Gappy Beet / Protruding crowns	<ul style="list-style-type: none"> Reduce scalper arm pressure, to prevent roots being knocked over Increase topper height to allow for larger beet
High weed infestation	<ul style="list-style-type: none"> Increase gap between turbine and gates Increase angle of roller bed Replace flails on topper Ensure topper knives are sharp, if blunt, sharpen or replace Side discharge tops and green material

Storage

Average losses in clamps are circa 0.1% of total sugar volume per day but BBRO storage trials have shown that best practice techniques can result in just 0.039% of total sugar volume loss per day. If storage is managed poorly, the result can be very serious and lead to load rejections and beet becoming unsaleable with a total loss of value. Sugar beet stores best where it has minimal damage from harvesting.

Cross section of a traditional clamp

TEMPERATURE INSIDE CLAMP NEEDS TO BE COMPARED TO AIR OUTSIDE
WITHIN 5°C OF AIR OK
5 TO 10°C ABOVE AIR CAUTION
MORE THAN 10°C ABOVE AIR OVERHEATING URGENT ACTION NEEDED TO COOL CLAMP



All clamps

Build clamps in an open area to aid ventilation and cooling. Choose a firm, well drained site suitable for loading/unloading. Never push beet up the face of the clamp. This will break beet, compact the clamp and in turn restrict air movement, allow heat to build up and increase rate of sugar loss.

When planning a Maus clamp, calculate the estimated tonnage and length of clamp to avoid overspill into unsuitable areas.

Early season clamps

Early in the season beet should be in a clamp for no more than a few days, and certainly less than two weeks. These clamps should not be covered or have retaining walls.

Short-term clamps are designed to give maximum surface area and therefore cooling to reduce sugar loss through respiration. Clamps should be made up of individual loads and be no more than 2m high. Avoid pushing up clamps with buckets/blades as this will increase damage and respiration.

Trailers should stop at the edge of the beet clamp as a level surface is not required, this will reduce further beet damage.



Late season clamps

Late season long-term clamps should be no more than 2.5m high with a level surface so there are no frost pockets.

Build clamps ~~should be built~~ using straw retaining walls. Ideally, place bales on pallets with the open end facing outward to aid ventilation.

Clamp sheets ~~are~~ made of polyfelt which offer protection and also allow the beet to breathe. Only use if the ground temperature is forecast to be below -3°C.



In-field storage considerations

The main risk to in-field storage is frost. The chart below shows the level of root damage that might be expected for different levels of frost.

Temp °C	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15
Days															
1															
2															
3															
4															
5															
6															
7															



No damage



Crown and minor root damage



Extensive root damage

A-shaped clamp – for self-propelled cleaner loaders

Where a self-propelled cleaner loader is used, clamps should be built in an ‘A’ shape of the correct width to allow the machine to operate effectively. Planning for a Maus clamp should be done pre-drilling to ensure sufficient headland is drilled for the harvester to access.

Clamps are normally built on the headland but consideration needs to be given for machinery to access the clamp easily.

A-shaped clamps are best built with a harvester rather than a trailer to avoid rutting in the clamp base.

