HEAP SILOS

COMPLETE INSTRUCTIONS

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HEAP SILOS

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This leaflet is based on the extensive heap silo research carried out at La Pocatière by Mr. Eric Comeau and applied by Dr. Julien Proulx and Mr. Jean-Marie Wauthy at Kapuskasing.

LOCATION OF HEAPS

Heap silos are normally constructed by starting at the prevailing windward end. This way, wind will help pull the plastic cover snugly over the pile rather than billowing underneath. Where winds are very strong, windbreaks of evergreen trees or tall fences of spaced boards are recommended. Heaps may be built on pavement (concrete or soil-cement) or on a smooth field of compacted earth. Pavement is essential for heap silos that will be used in the fall and spring when the ground is too soft to carry tractors. Align heaps parallel to the field slope for proper drainage.

SIZES OF PLASTIC SHEETS

Polyethylene plastic sheets are available in lengths of 30 m (100 ft) and widths of 7, 10 and 12 m (24, 32, and 40 ft). The size of your herd will determine which width you will need. In the summer, feed out at least 300 mm (1 ft) of silage per day; otherwise the silage will heat and spoil. The following table gives the quantity of silage per unit of silo length. The calculations were based on a silage with 28% dry matter and a wet density of 400 kg/m^3 (25 lb/ft^3).

Width of plastic		Area of cross-section of heap		Dry matter per unit of length	
m	(ft)	m^2	(ft^2)	kg/m	(lb/ft)
7.3	(24)	5.6	(60)	630	(420)
10.0	(32)	11.7	(126)	1310	(880)
12.0	(40)	18.2	(196)	2040	(1370)

PREPARATIONS

First, collect old tires to cover the pile. Each length of plastic requires between 60-80 tires. The tires are necessary to keep the plastic in intimate contact with the silage. For shipping, the plastic sheets are folded in four and then rolled. Choose a calm day, if possible, unroll the folded sheets, unfold, and reroll full width. This will make it easier to unroll the plastic over the heap as it grows.

Tie the tires in pairs with plastic baler twine to put pressure on the plastic and help keep it in close contact with the forage. The tires should be tied with a half knot and a loop to permit easy readjustment of the twine tension.

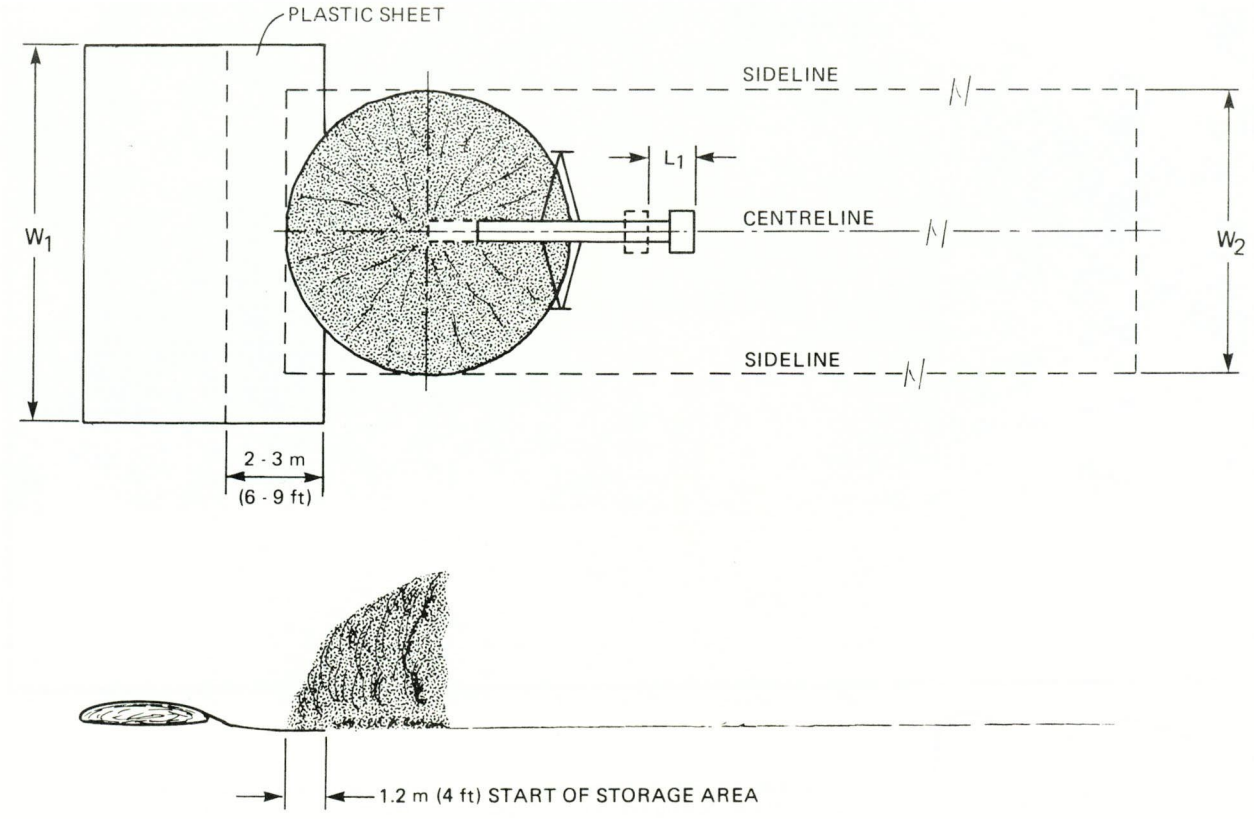


Figure 1. Laying out and starting the silage heap.

Two procedures can be used to form the heap silo: a conveyor fed from a side-unloading forage wagon, or a tractor with a front-end loader and dumping silage box.

The belt conveyor is most suitable. However, if a regular bale elevator is used it must be modified, as the chains are not strong enough and the speed is too slow. Replace the gears at the top with a roller, install a stronger chain, build up the sides of the elevator so that the silage does not tumble out and increase the speed to at least 1 m per second (185 ft per minute).

If the tractor has hydraulic couplings, it could also power the conveyor.

With the tractor front-end loader, it is possible to make heaps up to 2.4-3.0 m (8-10 ft) high. To prevent overturning of the tractor do not drive the back wheels onto the pile.

Guidelines must be traced onto the pavement surface. Trace three lines for each heap – two side lines and a centerline to guide the elevator as it is moved along (Figure 1).

The following table shows the widths of the plastic sheet and the corresponding distances between the side lines, the heights of the conveyor and the advancement of the conveyor after each silage load.

Width of plastic sheet, W_1		Distance between the side lines, W_2		Height of conveyor		Advancement of conveyor per load, L_1	
m	(ft)	m	(ft)	m	(ft)	m	(ft)
7.3	(24)	5.0	(16)	3.0	(10.0)	1.5-1.8	(5-6.0)
10.0	(32)	7.0	(23)	4.2	(14.0)	0.9-1.2	(3-4.0)
12.0	(40)	9.0	(29)	5.2	(17.0)	0.6-0.8	(2-2.5)

STARTING THE HEAP

Unroll the plastic sheet approximately 2-3 m (6-9 ft) and place it such that the silage will cover approximately 1.2 m (4 ft). Adjust the elevator height to 5.2 m (17 ft), (it can be lowered if it is very windy).

Initially, the elevator is advanced when the heap of silage reaches the side lines. Afterwards, the elevator will be advanced 0.6-0.8 m (2-2.5 ft) per load of forage for 12 m (40 ft) plastic and 0.9-1.2 m (3-4 ft) for 10 m (32 ft) plastic. It is essential to advance the elevator after each load so that the heap follows the sidelines and builds up uniformly (Figure 1).

CONTINUATION OF THE HEAP

If the height of the heap exceeds 5.2 m (17 ft), internal pressures become too great and the heap splits (Figure 2). This spoils the shape of the heap and the plastic sheet is no longer wide enough to cover it! If the sides collapse you will have to fork or shovel the silage back onto the pile.

Before the plastic can be unrolled, the surface of the heap must be smoothed out on top and sides (Figure 3) to prevent air pockets forming under the plastic. This is important to make effective use of cellular respiration and for transformation of the oxygen to carbon dioxide inside the pile. The plastic over these air pockets can buffet in the wind and pump even more air under the plastic. Also, proper grooming creates a smooth, uniform heap that is pleasing to the eye.

The heap is never packed. Instead, as the silage is being formed and groomed, the plastic sheet is unrolled immediately over the heap. This procedure is absolutely necessary to stop further entry of oxygen into the silage mass and to stop as rapidly as possible the effects of cellular respiration.

The next step is to straddle two tires tied with rope (e.g, black plastic baler twine, which has good resistance to UV radiation) over the heap. Subsequent

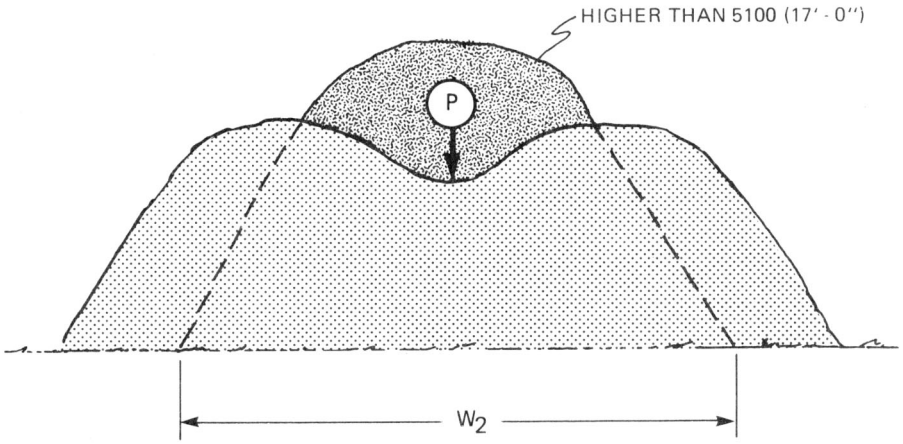


Figure 2. The heap splits if greater than 5.1 m (17 ft) in height.

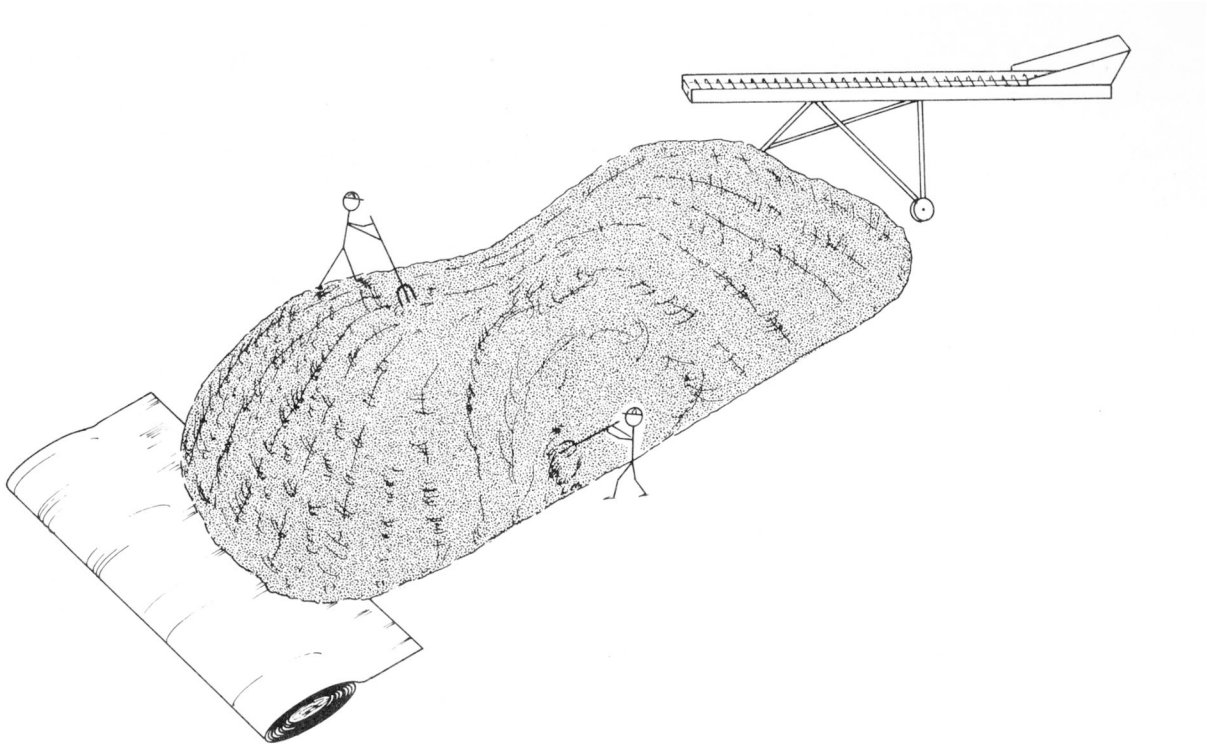


Figure 3. The heap surface must be smooth before being covered with plastic.

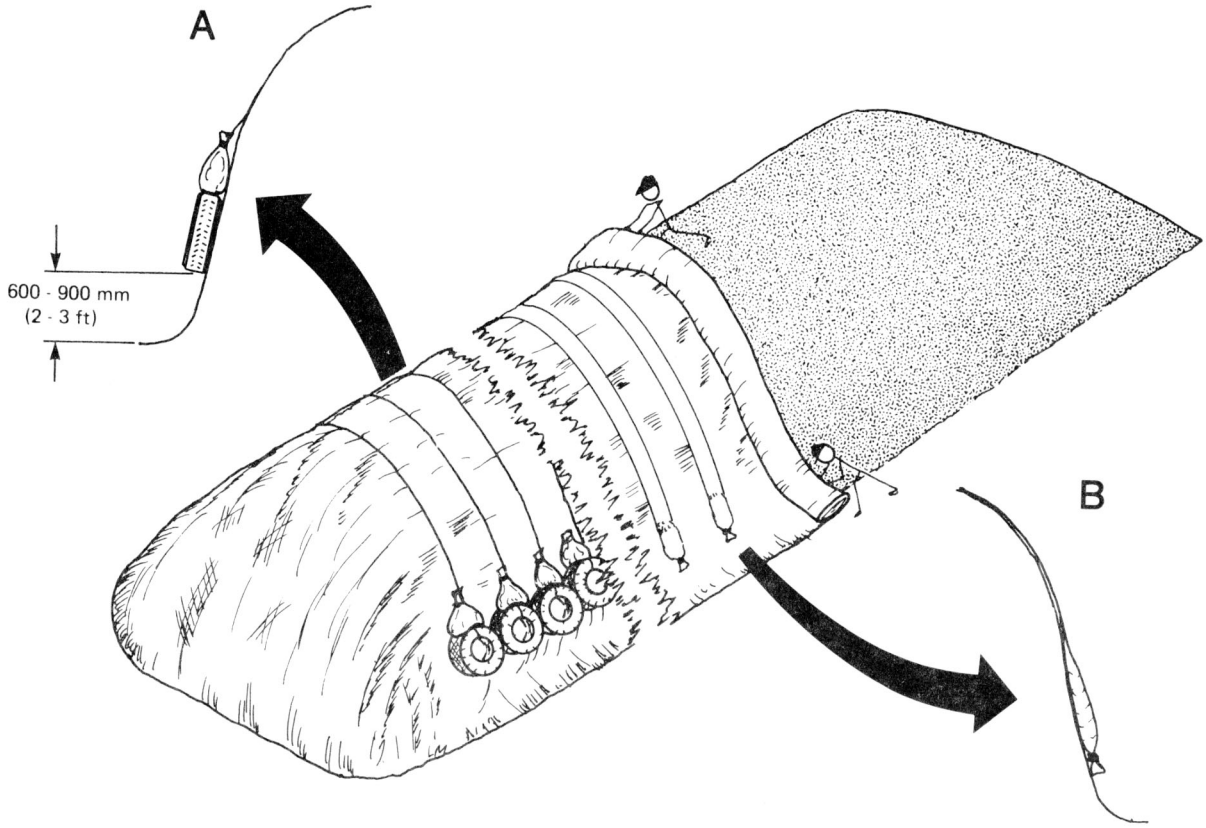


Figure 4. Tires (A) or plastic sleeves partly filled with gravel (B) are used to hold down the plastic.

tires are placed in this fashion so that adjacent tires touch each other. On each side, the tires must rest approximately 600-900 mm (2-3 ft) above the ground to allow for settling (Figure 4)

Sand bags placed above the tires provide additional weight to hold the rope tightly to the plastic. Plastic fertilizer bags filled with a couple of shovefuls of sand can also be used. The ropes that straddle the heap will stop the air from seeping along the heap if a puncture occurs in the plastic. Also, during silage removal, these ropes keep the air from penetrating further back along the heap; this is especially important when the wind is blowing directly onto the open face of the silo.

An alternative to the tire and rope system is the plastic sleeve. It has both ends filled with gravel ballast to maintain tight contact.

CLOSING AND SEALING THE HEAP SILO

There are two ways to close and seal a heap silo (Figure 5) – by tucking under the plastic along the perimeter before placing the tires on the heap, or by using sand to seal the edges.

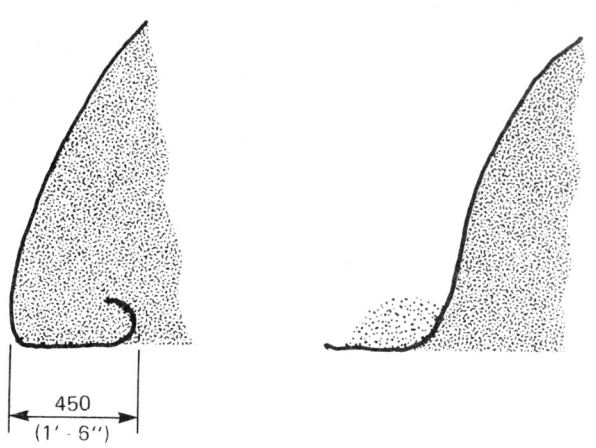


Figure 5. Seal the silo by tucking under the plastic or weighting with sand.

The first method requires a certain amount of physical strength and attention. You must tuck approximately 450 mm (18 in.) of the plastic under by hand, while filling the fold with silage. Alternatively, you can use a plastic shovel to push the plastic under the heap. If you use the shovel, be sure to shove the plastic far enough and take care not to tear it.

If you choose the second method, be sure to add enough sand to seal the silo properly and add more when necessary to replace any washed away by rain.

The sand can be an obstruction during silage removal since it must not get mixed in with the silage. Also, you must get rid of the sand come springtime if the heaps are on concrete pads.

If a heap is still unfinished at the end of the working day, it is absolutely necessary that air not be allowed to enter the silo (two or three tires thrown on top of the surplus plastic are not sufficient to seal the silo overnight! Seal it by pulling the plastic forward – and ballast it with fertilizer bags filled with sand (Figure 6).

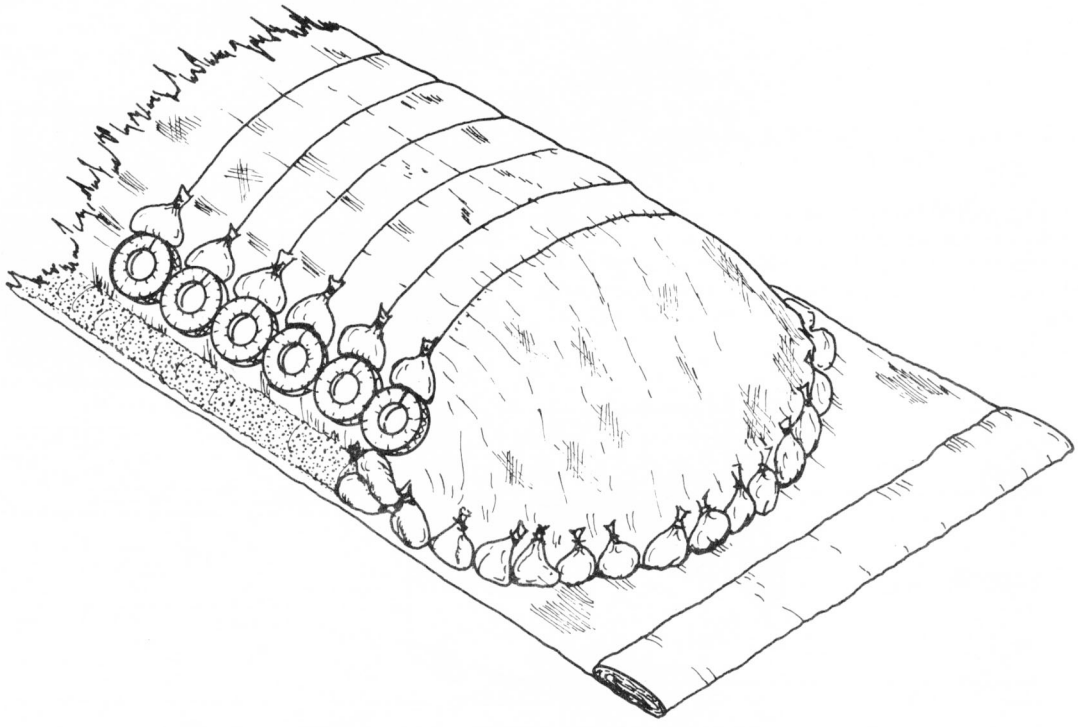


Figure 6. Temporarily closing the heap requires adequate ballast.

THE NEXT DAY

The heap will settle shortly after being built. Slackened plastic that has accumulated under the tires must be restretched to maintain close contact with the silage (Figure 7). This must be repeated two or three times until the heap becomes stable. If the plastic has been tucked under the heap instead of sealed with sand, the same procedure applies. It must be tucked further underneath to smooth out the folds under the tires.

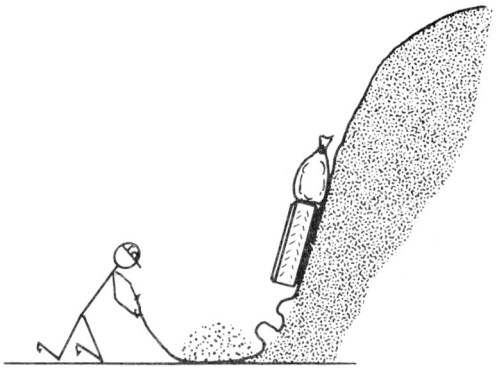


Figure 7. The plastic must be restricted after the heap settles.

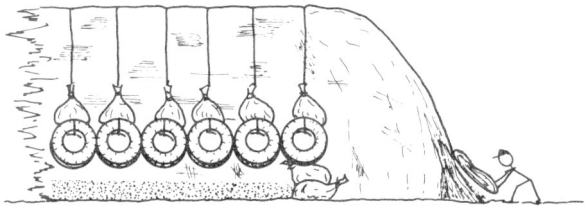


Figure 8. Support the nearest tires when reopening the heap.

When lifting and rolling the plastic back to continue the heap, it is important to have a tight rope with tires over the heap to prevent the air from leaking into the filled part of the silo. Position a few sandbags underneath the tires at the front of the heap to ensure that no air seeps in (Figure 8).

When the heap is finished, place tires at both ends as shown in Figure 9.

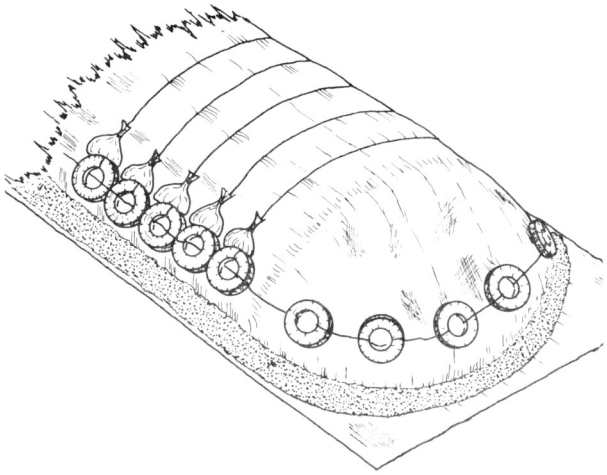


Figure 9. Tying down a completed heap.

HOW TO JOIN TWO SHEETS OF PLASTIC

To make heaps longer than one plastic sheet, lap the ends of two sheets and then roll to ensure a proper seal (Figure 10). This should only be attempted when you feel confident about your heap silo technique.

Carefully align the two plastic sheets with each other so that the second sheet runs straight with the first, not to the left or the right. The fold (joint) must be laid over the direction of the prevailing winds. Then place a tire belt over the fold as shown in Figure 11.

Usually, a heap made from one plastic sheet is preferable, because it is easier to manage.

MAINTAINING A HOLE-FREE PLASTIC

Small animals and rodents can puncture the plastic sheet, allowing air to penetrate the unpacked silage mass. This will cause substantial spoilage. Check the heap regularly for any signs of damage, and repair immediately with adhesive plastic tape.

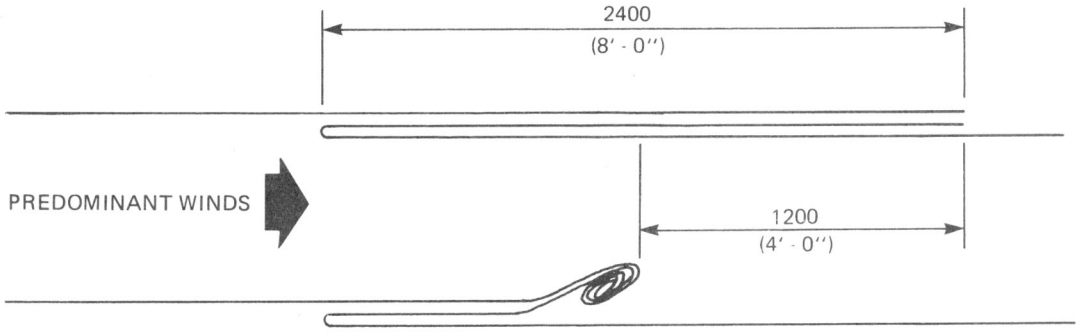


Figure 10. Join two sheets of plastic by overlapping and rolling.

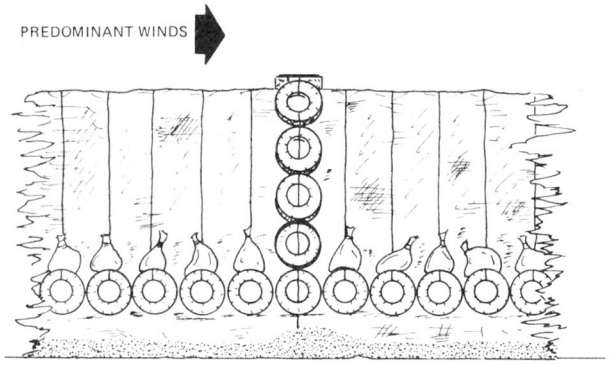


Figure 11. Place a belt of tires over any joints.

The best protection against rodents is to keep the location very clean and the grass very short. During the winter, keep a space around the heap free of snow.

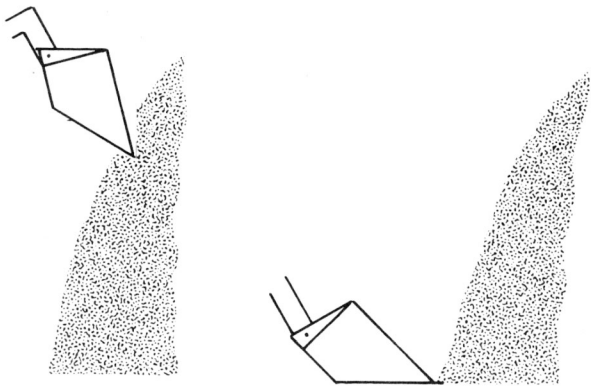
For bird protection, cover the heap with a net. Hold the net in place with tires and nylon ropes. Remove the net just before the winter to make it last several years. Bird damage can be minimized if flies are controlled in and around the heaps.

For protection against animals (dogs, foxes, coyotes, etc.), install an electric wire fence all around the site.

SILAGE REMOVAL

During the winter it is preferable to remove the silage from the windward end of the heap – this way there will be less snow to clear away.

Normally, silage is removed with a front-end loader. At first, the silage is pulled down the face of the silo with the edge of the bucket (Figure 12a). Then the silage is scooped up and loaded. Silage must not be scooped from the face as shown in Figure 12b. This would permit more air to enter, resulting in unnecessary spoilage.



(a) CORRECT WAY (b) WRONG WAY

Figure 12. Removing silage from the heap.

SILAGE QUALITY

Heaps can make silage of excellent quality. However, quality will depend on mastering the heap silo techniques. The details of this technique carry a lot of importance. Anyone can succeed in making good silage as long as the general silage making principles, together with the technical details of heap construction, are precisely followed. For example:

- Chop forage as finely as possible, i.e., 12 to 20 mm (1/2 to 3/4 in.) if the material is on the dry side of 30-35% dry matter. Length of cut from 25-50 mm (1-2 in.) is okay for young fresh forage.
- Avoid picking up any soil along with the forage to prevent the inoculation of *Clostridia bacteria* which leads to butyric acid fermentation.
- Harvest the forage at 25-35% dry matter when not using a preservative such as formic acid or formaldehyde.
- Close and seal the heap as soon as possible to minimize cellular respiration and bring the heap from the aerobic to the anaerobic stage quickly.
- Ensile at an early growth stage (boot to early heading for grasses and bud to early flowering for legumes) to ensure that there will be enough fermentable sugars in the plant to manufacture lactic acid in the heap.

Heap silage can be fed to dairy cattle, beef cattle and sheep. Performance of animals fed heap silage is similar to that of animals fed silage stored conventionally, provided the rations are will balanced.