## About Baled Silage

Minimizing harvest and storage losses, maintaining feed quality and maximizing profits have always been associated with silage; and for many years, progressive producers have benefited from using the chopped silage system. However, high capital costs for bagging and harvest machinery have deterred many small to mid range operations from benefiting from the silage system – until now.

AT Films ® has introduced a silage system that can be integrated into most operations with very little effort and expense. The Lastic-Tube® system provides producers with the ability to benefit from feeding high quality baled silages.

Producing high quality baled silage not only involves quality machinery and plastic, it also involves proper management. Proper management is an understanding of what makes good silage and begins when the crop is planted.

The decision to make round bale silage needs to be made before you realize that the weather will not allow for proper curing of your hay. Why? As the crop sits in the swath, the soluble sugars begin to dry and less will be available for proper silage fermentation. Rainy weather hinders fermentation further by leaching many of the soluble sugars from the swath. These two factors alone is why round bale silage is not a management strategy for rained on hay or green feed.

The following has been prepared to help you **MAKE QUALITY BALED SILAGE.**

## The Fermentation Process

Very simply, there are two main phases in the fermentation process – the aerobic phase and the anaerobic phase.

The aerobic stage occurs in the presence of oxygen. Plant enzymes and microorganisms consume the oxygen and 'burn up' the plant's water-soluble carbohydrates (sugars) producing carbon dioxide and heat. This stage can last a few hours or a few days, depending on the ensiling/packing conditions.

The anaerobic phase begins when all the oxygen is consumed. Anaerobic bacteria (bacteria that live without oxygen) start to multiply and the fermentation process begins. Ideally, the lactobacilli species multiplies most rapidly producing Lactic Acid from the fermented plant material. This Lactic Acid is what lowers the pH of the fermented material. Fermentation completely ceases after 3 to 4 weeks when the pH is so low that all microbial growth is inhibited. In order to keep the silage in this stable condition, oxygen must be excluded at all times.

**Water Soluble Carbohydrates**

Water-soluble carbohydrates play a key role in the fermentation process, such that they are the small sugars that feed the bacteria for the production of Lactic Acid during silage fermentation. Generally, a minimum of 6 to 12 percent WSC (See Table 1) are required for proper silage fermentation; therefore it is important to understand the factors, which influence the WSC content in forages. Some of these factors include type of plant, stage of growth, growing conditions, management conditions, drought, daily variations, fertilization and planting density.

**Table 1. Water Soluble Carbohydrate levels in dry matter of different crops **

| **Forage** | **% Water Soluble Carbohydrates** |
|---|---|

| | |
|---|---|
| Alfalfa - Vegetative | 9 |
| Alfalfa - Early Bloom | 7 |
| Alfalfa - Late Bloom | 7 |
| Grasses | 8 – 25 |
| Orchard Grass | 6 |
| Legume Grass Mixtures (50:50) | 13 |
| Barley - Heading Completed | 17 |
| Barley - Flowering | 18 |
| Barley - Milk Stage | 32 |
| Barley - Soft Dough Stage | 24 |
| Barley - Ripe | 5 |

Source: Silage Manual, Alberta Agriculture, Agdex 120/52-2

**Factors that influence Fermentation**

**Type of Forage**

Forage type (grass, cereal grains or legumes) and their characteristics are important in the management of the fermentation process.

Legumes, such as alfalfa and clover, are very popular forages to consider ensiling. They tend to be more difficult to ensile than other types of forages due to their low levels of water soluble carbohydrates.

Small grains work very well in a baled silage program. The available water-soluble carbohydrates tend to be high in these crops when compared to legumes.

Grasses such as Orchard Grass and Fescues are good options for baled silage. Tough, unpalatable grasses can be ensiled to improve digestibility and increase the available nutrients to the animal.

**Buffering Capacity**

Buffering Capacity is the degree to which forages resist changes in pH, therefore it influences the ease of which the forage can be ensiled. The higher the buffering capacity, the harder the forage will be to properly ensile. The organic acids in forages are mainly responsible for buffering capacity, however environmental conditions (e.g. time of harvest) will also influence buffering capacity.

***Crop Maturity***

It is ultimately up to the producer at what stage they would like to cut the crop. There are many factors pertaining to the maturity of the crop that will determine what type of silage will and can be made. The ensiling process will preserve only what nutrients you will have at the time of harvest. The grower must research and understand their plant's life cycle to determine the correct stage of harvest.

***Time of Harvest***

The crop should be swathed when the producer has a reasonably safe chance of obtaining the desired moisture level. Weather, ground conditions, time of year, maturity of crop, type of forage, etc. are all factors to consider for the proper dry down of the crop.

**Rain**

Rainfall on swaths dramatically increases the risk of fungal development and growth. As the forage lies in the swaths, a "sauna" is created between the ground and the swath -- an ideal environment for fungal development. A one to three day window of rain free weather is ideal for baled silage.

**Geography**

The number of light hours is important to producing high quality forage – not temperature. Increased sunlight hours will increase water-soluble carbohydrate concentrations; whereas higher ambient temperatures will increase the amount of lignin (the organic substance which acts a binder for the cellulose fibers in certain plants and adds strength and stiffness to cell walls) formed in the forage.

**Moisture Content**

**Optimal Moisture**

Moisture is the most crucial element when making baled silage, and should be considered in all decisions made during the process. It is difficult to obtain a quality product if the product is not swathed, wilted to 55% and baled in a timely fashion. Just as in making dry hay, all efforts to avoid rain and turning the crop should be taken.

AT Films Inc. recommends that all forages destined for baled silage should be wilted to 55% moisture. This is, on average, 10% dryer than a chopped silage program. Two factors to keep in mind when evaluating moisture levels are baler performance and fermentation. Most balers will perform better at lower moisture levels, but keep in mind the fermentation process needs adequate amounts of moisture to complete its cycle.

***Wilting***

Wilting is necessary for all silage systems as the Lactic Acid bacteria that are essential for the fermentation process are more tolerant to lower moisture levels than are the undesirable clostridial organisms. Drying time for this system can range from a few hours to a few days. Crop conditions, weather, types of swather used are all variables that will determine dry down time. Moisture levels less than 35% will increase the risk of browning, burning, carmelization and fungal development. Moisture levels above 55-60% will increase effluent production and freezing in colder climates.

## Moisture Testing

Microwave testing is the most reliable method to determine moisture levels without sending the sample to a laboratory. Chopped silage moisture testers (complete with it's own dryer and burner unit) are also reliable; however the forage must be manually chopped in order to place the silage into the tester. Moisture probes are generally unable to penetrate into the baled stems to achieve the correct moisture readings.

## Gathering Samples for Moisture Tests

As a crop wilts, the rate of wilt varies within the windrow or swath. To obtain a representative sample, smaller samples should be gathered from the top, middle and bottom of the swath and from various locations within the field.

## Microwave Moisture Test

1. Chop the forage sample with a cleaver or axe to break the stems.
2. Place a clean paper plate on a scale and zero the scale.
3. Weight out 100 grams of forage on to the paper plate.
4. Place in the microwave oven with a full glass of water.
5. On a medium setting, microwave the chopped forage sample for 4-5 minutes.
6. Remove the forage from the microwave and weigh the sample and plate. Record the weight.
7. Return sample and plate to the microwave and cook for another 2 minutes on a medium setting.
8. Re-weigh after the two minutes and compare the previous weight.

9. Repeat steps 6 and 7 until there is no change in weight.
10. Subtract the dry sample weight from the initial 100 grams. The result is the moisture content (in percent) of the forage sample.

Example: The 100 gram sample of forage weighs 30 grams after drying; therefore the moisture content is 70% (100 grams – 30 grams = 70 grams or 70% moisture) i.e. too wet for baled silage!

Remember 55% is the optimum moisture.

**Harvest**

**Hay Conditioners**

All forages should be cut using a hay conditioner (crimp haybine) to facilitate wilting and increase the amount of water-soluble carbohydrates available for the fermentation process. It must be noted that crop moisture will pass more quickly through the 60% to 50% window when conditioned as compared to being swathed.

**Raking**

Raking is not recommended as it may increase the amount of soil or detritus (dead plant material) being introduced into the freshly grown forage, increasing the risk of fungal development.

**Baling**

**Type of Baler**

All major farm equipment manufacturers are selling new generation balers designed specifically for silage bales; however if you want to utilize your existing machinery, AT Films recommends that you contact your local machinery dealer to inquire on your baler's abilities. The fact remains, it is more difficult to attain the proper packing density in long stem forage. Whichever baler you choose, it must have the ability to produce dense even bales in order to exclude as much oxygen as

possible.

Many of the new generation balers will offer a variety of options. Recently, the re-cut option has become a viable option. Forages can be reduced to 2 to 4 inches successfully on average. Re-cutting the forage into a bale will have a pronounced effect on the success of a baled silage system. When the particle length is reduced, the density of the bale increases dramatically. This will have a direct, positive effect on the fermentation process.

**Making proper bales**

Eliminating oxygen from any type of silage system is necessary. Silage bales should be produced with the same diameter and shape every time. Be sure to increase your baler's packing density if your hand penetrates the side of the bale without effort.

Baling speed is also important for producing dense round bales, the slower the speed, the denser the bale. How? The lower speed will cause less forage to enter the chamber, however the number of rotations of the bale within the chamber will remains the same. This extra packing time will result in denser bales.

**Bale Accumulators**

Transportation of the bales from the field to the tubing area is a key step in this system. Heavy, wet bales must be handled with care to maintain the density of pack and uniform shape.

Accumulators for medium and large square bales can work well for placing the bales in one general area of the field. Trials have found that some accumulator's work and some do not with wet bales. It is recommended that you consult the manufacturer of your accumulator and discuss their experiences with this system.

**Bale Retrievers**

Many styles of big bale retrievers are on the market. Our experience

has shown that a fork loader and a flat deck truck work the best in maintaining bale uniformity.

**Tubing**

AT Films ® recommends that all bales should be tubed within 4 hours of baling – 8 hours maximum. Fermentation begins as soon as the bale is created; therefore it is critical to eliminate oxygen as soon as possible to produce quality silage. Bales should not be left in the field, and half filled tubes should not be left open over night.

***Loader Requirement***

A loader or skid steer with a conventional set of hayforks works best for inserting bales into the Lastic Tuber™. Squeeze type bale movers have been used with limited success. In any case, please consult with the manufacturer of your loader to ensure it will safely handle the weight of the wet bales.

***Transport to the Feeding Area, or Customer***

One of the biggest advantages of the Lastic-Tube® system when compared to a chopped silage system is the ease of transport. The bales can be loaded on a flat bed truck and transported over many miles with little or no loss of feed value. The baled form of silage prevents oxygen from mixing into the majority of the silage mass while in transport. Maintaining an anaerobic environment ultimately extends the shelf life of the silage product.

**Storage Yards**

The Lastic-Tube® storage yard should be flat, well-drained, hard level surface that is located in an area for easy removal and feeding. Every attempt should be made to protect the area from domestic livestock, farm dogs, cats and wildlife.

**Lastic-Tube® Mounting Instructions**

1. Silage bag pan out of position.
2. Using the hydraulic controls, move all hydraulic fingers to the inner most position.
3. Open Lastic-Tube® box.
4. Examine the Lastic-Tube® and position box so that the "Leading Edge" is placed away from the machine.
5. Place Lastic-Tube® on the fingers and insert between bag pan.
6. Loosen bag ties - do not remove them.
7. Begin to stretch Lastic-Tube® until taut.
8. Push bag pan back into position.
9. Eliminate any wrinkles or areas where the Lastic-Tube® is not placed evenly over the hydraulic fingers.
10. Remove bag ties.
11. Stretch tube to the approximate diameter of the bale.
12. Load first bale into the machine.
13. Take the "Leading Edge" of the tube and pull approximately 5 feet of tube beyond the edge of the bale.
14. From each end, roll the edge of the Lastic-Tube® towards the middle. Twist and secure with supplied wax cord. Turn twisted plastic over previous knot and secure again.
15. Continue Tubing.

**When To Stop**

Yellow caution tape has been placed in four locations approximately 9 feet from the end of the Lastic-Tube®.

When caution tape appears and you are tubing 4 foot wide bales:

1. Place one more bale into the Lastic-Tube®.
2. Push bale into the Lastic-Tube® using the bale pusher.
3. Remove the machine from the Lastic-Tube®.
4. From each end, roll the edge of the Lastic-Tube® towards the middle. Twist and secure end with supplied wax cord. Turn twisted plastic over previous knot and secure again.

When caution tape appears and you are tubing 5 foot wide bales:

1. Push bale into the Lastic-Tube® using the bale pusher.
2. Remove machine from the Lastic-Tube®.
3. From each end, roll the edge of the Lastic-Tube® towards the middle. Twist and secure end with supplied wax cord. Turn twisted plastic over previous knot and secure again.

***Removal From Lastic-Tube®***

Removal of the ensiled bales from the Lastic-Tube® can be done simply with hay forks or squeeze. Every attempt should be made to seal the tube again if the time between feed outs is more than two days.

**Care and Management**

Filled tubes should be monitored closely within the first thirty days and periodically in the weeks to follow for damage caused by animals. Holes and tears must be patched with non-porous materials, such as Patch Tape or Patch Paint, to maintain the oxygen-limiting environment.

Venting eliminates unnecessary stress on the Lastic-Tube®. To vent, place a 3 to 4 inch (8 – 10 cm) piece of Patch Tape vertically near the end of the Lastic-Tube®. Using a utility knife, place a 1 - 1 ½ inch (3 – 4 cm) slit horizontally through the Patch Tape and Lastic-Tube®. Leave

the hole open until the pressure of the escaping gas cannot be detected by touch. Reseal the vent with another 3 to 4 inch (8– 10 cm) strip of Patch Tape. Do not leave vented tubes open over night as oxygen may be introduced back into the system as the ambient temperature drops. Do not breathe in the escaping, toxic gases.

Have the feed tested to ensure proper nutrition is fed to your cattle. Samples should be gathered from various bales within the Lastic-Tube® to gain a proper representation of the entire feed source. A silage probe should be used to gather a cross section of the bale. Remember to patch the holes with Patch Tape