The 3M’s of Silage

**MANAGEMENT**

**MATURITY**

**Moisture**
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THE 3M’S OF SILAGE

THE 3M’S OF AG-BAG® SILAGE

The “3M’s of Ag-Bag® Silage” represent documented methods and technology of good silage making. Ensiling has proven to be the most efficient method of storing and preserving the nutrient value of your crops. We invite you to benefit from proven methods and profit-making concepts. Read on, it can change your future.

THE ART OF MAKING EXCELLENT SILAGE

1. Silage making is a science, that incorporates good management practices. Although many factors affect the profitability of a farming operation, forage quality is definitely on of the most important.
2. It’s an accepted fact that rapidly fermented, high moisture feed retains a higher nutrient value than any other method of harvesting and storing crops. 
3. By understanding the basics of the fermentation process and using good management practices, you can aid nature in achieving a rapid, efficient fermentation, which preserves more of the valuable nutrients in your forage crops.
4. By learning how to consistently make excellent silage, (The silage referred to in this publication is fermentable feed compacted and stored in an airtight Ag-Bag® bag) it can lead to a greater production of meat and milk.
5. A good anaerobic fermentation improves the palatability of feed. The fermentation process using the Ag-Bag® system is very similar to the digestion process in the first stomach of cattle. Well fermented silages are a natural feed for cattle. It’s very much like putting your animals on green pasture year round.

The quality of silage is largely determined by three things:

Dedication
Preparation
Execution

THE 3M #1 – MANAGEMENT

THE SOIL

The soil should be fertile and pH balanced to insure good germination. Good soil management always produces the highest quality crops.

THE SEEDS

High quality seed designed to produce well in your area, for length of season and weather considerations are a must. You can’t produce crops any better than the seeds you plant.

THE ENSILING PROCESS

Silage is a feedstuff resulting from the preservation of green forage crops by acidification. Acidification is the result of the fermentation of the forage in the absence of oxygen. Research has proven conclusively that the process of ensiling green crops is the most efficient method of storing and preserving the nutritional value of crops for feeding to ruminant animals. The breaking down of the cellulose and lignin of the plant cells by fermentation helps make the forages more digestible, thus producing more value. In some cases, the forages are more digestible than green feeding or pasturing. All types of forages can be fermented and successfully bagged.

FERMENTATION

The miracle of fermentation starts with the bacterias – enzymes – sugars – proteins and an oxygen-free environment.
1. Respiration – When a forage plant is harvested and placed in an Ag-Bag® bag it is alive and therefore, respiring actively. Even though the forages are packed extremely tight some air is unavoidably trapped in the mass. The oxygen is utilized by the aerobic bacteria existing in the crop, and by the breakdown of sugar in the plant cells.
2. Aerobic Fermentation – This phase of the ensiling process is called aerobic respiration. End products of this phase of the process are carbon dioxide and heat. These reactions are not complete and other end products are produced
such as acetic and butyric acids later used by lactobacilli and streptococci to produce lactic acid. Photolytic enzymes from the plant are also active in this phase, and they break down some of the plant proteins into amino acids. This phase of respiration is complete when the oxygen in the mass is completely depleted, and the action of the anaerobic microorganisms begin. Aerobic respiration lasts from 5 to 10 hours under good storage conditions.

**THE FERMENTATION STARTS**

**Phase 1** – This is a relatively short phase characterized by the beginning of anaerobic microorganism activity. The cell contents diffuse out of the cell due to the chopping of the plant, and are used by bacteria clinging to the plant when placed in the bag. The formation of acetic and butyric acids are characteristic of this phase. The life of organisms producing these acids is short due to the drop in pH produced by their own activity.

**Phase 2** – This phase is the initiation of the lactic acid fermentation. This activity is well underway at the end of three days and the establishment of this activity completes Phase 2.

**Phase 3** – Lactic acid production is continued in this phase and reaches its peak which should be 3.0 - 13.0 percent of the dry matter and a pH that is constant at about 4.0. No further changes occur, and the silage is fermented if the pH remains between 4.0 and 4.2 for corn silage, and 4.0 and 5.0 for other crops, and no air is allowed to enter the mass.

**Phase 4** – This is a stage of quiescence or inactivity. The material has a pH of 4.0 - 4.5 and if water and oxygen remain excluded, no further chemical changes occur and the material will remain in this preserved state almost indefinitely.

**Phase 5** – This is an undesirable phase. If the pH does not drop below approximately 4.2, or if air is allowed to enter the silage, butyric acid production is initiated, converting the soluble carbohydrates and lactic previously formed to butyric acid which is characteristic of spoiled silage. Also, proteins are broken down to amino acids and these are further degraded to other nitrogenous compounds, which may lead to a reduction in a level of digestible protein.

**FERMENTATION AND INOCULANTS**

The general knowledge of the biochemistry and microbiology of silage fermentation has increased tremendously in the last 25 years. Silage is a product of anaerobic fermentation. It involves the conversion of water soluble carbohydrates (sugars) to lactic acid, which drops the pH to a level sufficient to inhibit any further biological activity (change) in the ensiled material when maintained under anaerobic conditions.

In most circumstances, good silage is achieved by encouraging the dominance of lactic acid bacteria (the good guys), and discouraging the activity of clostridia and yeast (the bad guys). In the initial stages of ensiling, plant respiratory enzymes (bad ones) oxidize soluble carbohydrates, resulting in heat production and decreased amount of sugars available for fermentation.

**PRINCIPLES OF ENSILING**

**Aerobic phase.** As crops are put into the bags, two things start to happen: respiration and proteolysis (enzyme action), which are attributed to the activities of plant enzymes. Respiration is the complete breakdown of a substance to carbon dioxide and water, using oxygen. Harvesting of the forage crushes and chops the plant, damaging the cells and releasing many plant enzymes. Some of the enzymes, amylase and hemicellulase, break down starches, increasing the level of sugars in the plant. Of these processes, respiration is most detrimental to silage quality because:

1. Respiration causes a loss of dry matter.
2. The plant uses up existing plant sugars during respiration. The loss of sugar is crucial at this point as it affects preservation and nutritional value. Sugars are the principal food for the lactic acid bacteria that ferment the crop and a loss of sugar also reduces the energy values.
3. Prolonged aerobic conditions allow yeasts and molds to grow to high levels. Large populations of these microorganisms can predispose the silage to heating when the bag is opened for feed-out.
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Fermentation phase. Once anaerobic conditions are attained, several processes begin to happen. The plant cells start to breakdown. In wet forages this takes place in several hours. In dry forages, it can extend over a day or more. This process provides sugars to feed the naturally occurring lactic acid producing bacteria. It also releases a variety of plant enzymes, providing extra sugars. Many of the LAB (lactic acid bacteria) and enterobacteriaceae can grow in the presence of oxygen; however, they grow much faster under anaerobic conditions and are very efficient at producing acids that start to lower the pH. The most important bacteria for ensiling is the LAB (lactic acid producing bacteria), which converts sugars to lactic acid. There are primarily two kinds of bacteria: homofermentative and heterofermentative. The homofermentative produce only lactic acid. The heterofermentative produce ethanol or acetic acid plus carbon dioxide, in addition to lactic acid. With a natural fermentation, competition between the two bacteria determines the kind of fermentation. As lactic acid is stronger than acetic, it is more desirable. The use of bacterial inoculants helps assure a dominance of lactic acid bacteria.

Stable phase. The period of active fermentation lasts between two weeks and two months. For forages ensiled in normal moisture ranges (50-65%), active fermentation is over in three weeks. (The use of a bacterial inoculant will speed this up.) Once the pH is reduced to about 4.0 the bacteria quit growing and the silage is stable as long as it’s oxygen-free. Many factors effect fermentation, among them moisture, maturity, weather conditions, fertilizer, bacterial count and water soluble carbohydrates (sugars). We cannot control the weather or the bacterial counts, but with proper management and the use of Ag-Bag® Plus! we can help cope with the other factors. Fermentation is an exact science. There are many fermented products in the world today, such as pickles, beer, yogurt, wine, cheese, sauerkraut and silage. Silage is the largest fermented product by volume in the world, and is the most inconsistent in quality. The reason other products consistently have a good fermentation is because of two things.

One, a controlled environment and two, they use bacteria to aid in the fermentation. The Ag-Bag® system is the controlled environment, Ag-Bag® Plus! inoculant is the necessary bacteria and enzymes to control the fermentation.

Why use Ag-Bag® Plus!? There are good and bad bacteria naturally found on your plants. University research indicates that for every one lactic acid producing bacteria (good guys) there are ten spoilage causing bacteria (bad guys). This 10 to 1 ratio is not very comforting when you are trying to harvest the best possible silage. By adding Ag-Bag® Plus! inoculant, you are overwhelming the crop with fast growing, aggressive lactic acid producing bacteria. This creates an environment where the yeast, molds and clostridia are inhibited. If the sugars in the plants are low, they will not feed the natural bacteria on the crop. Ag-Bag® Plus!, the unique inoculant where each bacteria is microencapsulated. Each bacteria is coated with a sugar and an enzyme for an immediate source of energy to feed the bacteria for even faster growth. This has proven to be a more efficient way to increase lactic acid production rather than adding the sugar separately. As a rule, 1 pound of lactic acid is equal to 2 pounds of shelled corn in energy. There are many different strains of bacteria used in inoculants today. The most important thing to look for is a bacteria that is viable (alive). Ag-Bag® Plus! silage inoculant contains the most aggressive and technologically advanced bacteria on the market today, and Ag-Bag® is constantly improving the quality of bacteria and enhancing the product as new technology becomes available. The strains of bacteria that are used in Ag-Bag® Plus! silage inoculant have special qualities to enhance silage. First, there are four strains of bacteria and two enzymes. The *streptococcus faecium* works in both an aerobic and anaerobic environment and grows well during the initial stage of fermentation while oxygen is still present. The *pediococcus* bacteria grow well at low temperatures, like we have in bagged feed. The *lactobacillus plantarum* and *lactobacillus casei* are the finishers and are chosen for their fast production of lactic acid and their stability. The two enzymes, amylase and...
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cellulase, were chosen because they break down the plant cell structure, making the feed more digestible and releasing more natural plant sugars. The results are a much faster fermentation and more preserved nutrients. It normally takes 21 days for feed to complete the fermentation process, but with the use of our silage inoculant the fermentation process is usually completed in 5 - 7 days. Because of the decreased fermentation time, the faster pH, and temperature reduction, not as many nutrients are used up during the fermentation process. The results are more preserved dry matter, lower pH, lower temperature, higher lactic acid production, longer bunk life and an increased feed conversion efficiency.

Ag-Bag® Plus! can be applied as a granular or a liquid. Ag-Bag® Plus! granular comes in a 50# bucket to treat 100 tons. It is applied at ½ lb. per ton of forage. Ag-Bag® Plus! soluble is available in a foil pouch to treat 50 or 100 tons. It is mixed with water and applied as a liquid. Instructions are on the labels.

LENGTH OF CUT

The length of cut on legumes and grasses, as a good rule of thumb, is 3/4” long. This allows plenty of roughage in the diet of the animals to take care of rumen activity. Corn silage should be ½” cut to keep oversize to a minimum. Unless using a kernel processor. See manufacturer’s recommendations.

ADJUSTING THE CHOPPER

It’s very important that the shear bar have a good sharp edge and adjusted up according to the owner’s manual. Round edges cost feed quality and dollars.

The knives should be sharpened often to insure a good clean cut of the forage. Tearing the material apart causes extensive cell damage to the plant. Extra long forages do not feed well and are left in the bunk. A set shear bar, will in most cases allow you to go through the field one gear higher and cut your fuel consumption considerably. There are a lot of benefits to consider by proper machine adjustment. Remember – Dedication, Preparation, and Execution.

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BAG PLACEMENT

As with all feed storage systems, it is very important to have an appropriate base. The base for a bag feed storage system should be well-drained with a smooth surface. Suggested base materials include – sand, cement, 4-5” of ag lime, geoweb system, soil cement, agri fabric with 4-5” of crushed stone, road re-grind, 50% crushed rock and 50% rock dust, dry cement spread with a hand spreader and watered down.

PACKING THE BAG

The mechanical packing by the bagger has given a lot more freedom in making good silage. The bagger can exert as much as 15,000# pressure as the feed is being compacted. This compaction allows the silage to have a slightly longer chop (3/4”) than could be used in pit silage. The oxygen is literally extruded out of the feed. This insures a good pack on the forages every time, it’s not left to chance. The denser the packing in the bag, the less oxygen is available to cause heating, the faster the fermentation will occur resulting in higher feed quality.

SEALING THE BAG

As soon as you are done filling the Ag-Bag® bag and have moved the bagger, seal the bag immediately so the anaerobic bacteria can begin to work. Ag-Bag® recommends MasterSeal® plastic strip. Lay the bag end out flat and seal according to instructions. This is an effluent and gas tight seal, and more effective than traditional methods using baling twine or 2’ x 4’s.
VENTING THE BAG

Some feeds produce a large amount of nitrogenous oxide. This creates a gas from the respiration of the plants in the bag. It’s a perfectly normal process. In order for the gases to escape under controlled conditions, venting is a very important step in bagging. For that purpose, Ag-Bag® recommends and sells reusable vent valves instead of cutting exhaust ports that you must later tape shut.

Instructions for using the Ag-Bag® vent valve:
Take the cover off the vent tool. Insert the tool, with prongs up, into the cover by lining up the notches. Taking the threaded side of the valve, line up the notches and slide it over the top of the pronged end of the tool. (See illustration below.)

After you have located the spot where you want the vent to be installed, press the prongs of the tool into the plastic to create a hole. Push the tool through the hole and pull out leaving the threaded end sticking out. (See illustration below.)

Turning the valve lid to the left, screw on tightly. (See illustration below.)

Slide the lid open enough to allow the gases to escape. Within 1-2 days, close lid and leave valve in until that end of the bag is fed out. NOTE: If exceptional gassing up occurs, you may leave the vent open for an additional day. Or, if you notice the bag puffing up again after shutting the valve, open up again until the gases recede, then close.

BANK YOUR BAGS

To avoid wind damage, use old rubber tires or other weighted material at the ends of the bag to keep loose plastic from flapping in the wind. The wind can cause plastic fatigue leaving small holes to allow oxygen to enter the feed. A little extra care at the start can make a difference in the feed quality - hold that loose plastic down.

DO’S AND DON’TS

1. DON’T get dirt in the feed going into the bag.
2. DON’T allow holes or damage to the bags to remain open.
3. DON’T place bags in a poorly drained area.
4. DON’T allow dogs, cats and other animals to get on the bags.
5. DON’T put feed up too dry or too mature.
6. DON’T put excessively wet forage in the bag.
7. DON’T allow the bagging machine to remain hooked up to the bag for long periods of time with feed still left in the hopper or tunnel.

1. DO protect the storage area from livestock.
2. DO inspect on a regular basis and mend holes with Ag-Bag® tape.
3. DO place bags on a well-drained, hard, level surface.
4. DO have your feed tested – to be able to mix and balance your ration.
5. DO ensile your crop at proper moisture and maturity.
6. **DO** number and date bags for ease of testing and recall of material ensiled.

7. **DO** place bags in accessible area for easy feed removal.

8. **DO** place bags side-by-side for blending of feeds.

9. **DO** remove more than 1' of feed per day from the face of the bag to prevent aerobic instability and heating problems.

### 3M #2 – MATURITY

#### HEAD CHOP GRAINS

A new process to harvest grains pioneered by Ag-Bag® International and their satisfied users is “head chopping” small grains using a “direct cut” head on a forage harvester and cutting off the top 4” of the plant. This allows the grower to make a high energy and high moisture feed. At the time of harvest the grain is in the heavy dough stage and is still green.

Set the chopper on finest chop available and if possible use a recut screen and/or kernel processor to further (mill) the grain. This head chop grain feed will be within ½% of full protein of dry grain, it will have TDN from 64%-72% and will add about 12% fiber to your feeding rations. (An excellent way to harvest grain without the use of a combine.) It is recommended to use Ag-Bag® Plus! on this feed. The moisture level is low and requires the added bacteria to give a longer shelf life upon opening and feeding.

#### SNAPPED EARLAGE

This method of harvest allows you to snap the ears of the corn plant, cob and all. It’s then run through the chopper with a recutter screen and/or kernel processor to process the feed to be put directly into the Ag-Bag® bag and should be fermented without further grinding of the grain.

The moisture level will be between 30-45% and may require the application of Ag-Bag® Plus! inoculant to speed up the fermentation of the snapped earlage. This helps slow down aerobic deterioration after opening the bag. It’s then ready to feed to your animals after the 21-dayfermentation cycle. If Ag-Bag Plus is used, the grain will be ready to feed in a shorter time of 7-10 days.

### FEEDING OUT OF THE BAG

Because of a higher residual sugar content in bagged feed, aerobic deterioration will occur if the bag is left open. It happens with all silage as it is exposed to oxygen. The small face of the bag gives you better feed out control.

Cut the Ag-Bag® bag open down the top center of the bag and lay it out flat on the ground. Moving the loader to one end of the plastic, drive loader tires onto the plastic using it as a base. With the loader bucket, loosen the silage starting at the top of the bag. As it loosens and falls on the plastic, use the loader bucket to scoop it up. Keeping the loader bucket as close to the ground as you can while not disturbing the plastic on the ground. The plastic will work to keep the silage from spilling. As you continue to remove the feed from the bag, shake the remaining feed to the center of the plastic.

Operators can easily be trained in the proper feedout techniques recommended by Ag-Bag® and minimize blowing plastic and feedout loss. (See diagram on pg.12)

The bag should be sized to fit your operation. Minimum daily face removal should be at least 1 foot back into the bag each day after opening. This will prevent heating of the feed from oxygen breakdown. For specific feeding rates, please view the chart below to estimate the tons of feed you need to use each day.

Harvesting at the right stage of maturity, harvest to get optimum total digestive nutrients (TDN), and harvest crops that average between 60-70% TDN is ideal to get maximum milk or meat production per acre.

### WHAT’S THE VALUE OF CORN SILOAGE?

Some universities and research centers say that corn harvested as mature corn silage is the king of all crops as far as producing the most pounds of TDN per acre. A 20-ton-per-acre crop of corn silage, which would be near an equivalent of a 120 bushel an acre grain crop, would produce about 6 tons of dry matter per acre.
**AT WHAT MATURITY DO WE CUT ALFALFA?**

Cut when the plant still is over 20 percent protein. This is no later than the late bud stage (before any flowers appear). Go to the field and grab that flowering point. You can tell when the bud is getting very hard. In fact, at the very late stage you actually can see that small, little will become the flower. Start as early as midbud if you have a lot of hay to put in, especially with first crop. Once blossoms show, quality drops off very rapidly. Don’t wait until the perfect time…it never seems to come. If it isn’t raining and the weather looks acceptable, go ahead and cut.

**Proper Bag Feed Out Technique**

*For Large Operations*

- Cut the Ag-Bag bag open down the top center of the bag and lay it out flat on the ground.

  *Prevent the plastic from hanging up in the loader bucket, drive the front wheels onto the plastic.*

- Tip the top of pile. This will loosen it up.

  *Lower the bucket 1 inch above the plastic.*

- Skim doze directly from the front.

  *Lift the plastic edges and shake product back to the center of the bag.*
Suggested Daily Feed Out Rates

<table>
<thead>
<tr>
<th>Winter Rates - October - April</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag Size</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>8'</td>
</tr>
<tr>
<td>9'</td>
</tr>
<tr>
<td>10'</td>
</tr>
<tr>
<td>11'</td>
</tr>
<tr>
<td>12'</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Summer Rates - May - September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag Size</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>8'</td>
</tr>
<tr>
<td>9'</td>
</tr>
<tr>
<td>10'</td>
</tr>
<tr>
<td>11'</td>
</tr>
<tr>
<td>12'</td>
</tr>
</tbody>
</table>

Bag Capacity Per Running Foot

<table>
<thead>
<tr>
<th>Bag Size</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>8'</td>
<td>1</td>
</tr>
<tr>
<td>9'</td>
<td>1-1/4</td>
</tr>
<tr>
<td>10'</td>
<td>1-1/2</td>
</tr>
<tr>
<td>11'</td>
<td>1-3/4</td>
</tr>
<tr>
<td>12'</td>
<td>2-1/4</td>
</tr>
</tbody>
</table>
## Cut Crop at the Proper Stage of Maturity

<table>
<thead>
<tr>
<th></th>
<th>% Crude Protein</th>
<th>% TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corn Silage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tassel</td>
<td>10.7</td>
<td>64.4</td>
</tr>
<tr>
<td>Milk</td>
<td>8.0</td>
<td>69.0</td>
</tr>
<tr>
<td>Glaze or Early Dent</td>
<td>8.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Full Dent</td>
<td>8.0</td>
<td>68.9</td>
</tr>
<tr>
<td><strong>Alfalfa Silage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bud Stage</td>
<td>22.1</td>
<td>61.7</td>
</tr>
<tr>
<td>1/10 to 1/3 Bloom</td>
<td>20.4</td>
<td>63.4</td>
</tr>
<tr>
<td>1/2 to 3/4 Bloom</td>
<td>18.2</td>
<td>58.9</td>
</tr>
<tr>
<td>Past Bloom</td>
<td>12.3</td>
<td>49.8</td>
</tr>
<tr>
<td><strong>Oat Silage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boot Stage</td>
<td>15.3</td>
<td>65.8</td>
</tr>
<tr>
<td>Late Milk to Early Dough</td>
<td>8.5</td>
<td>65.0</td>
</tr>
<tr>
<td>Late Dough</td>
<td>8.3</td>
<td>63.5</td>
</tr>
<tr>
<td><strong>Grass Silage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Bloom</td>
<td>20.4</td>
<td>73.2</td>
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<tr>
<td>Spike</td>
<td>14.0</td>
<td>67.6</td>
</tr>
<tr>
<td>Milk</td>
<td>12.1</td>
<td>65.0</td>
</tr>
<tr>
<td>Dough</td>
<td>10.6</td>
<td>60.0</td>
</tr>
<tr>
<td>Mature</td>
<td>5.3</td>
<td>52.7</td>
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<tr>
<td><strong>Wheat Silage</strong></td>
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<tr>
<td>Immature</td>
<td>24.0</td>
<td>63.5</td>
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<tr>
<td>Flower</td>
<td>16.0</td>
<td>63.0</td>
</tr>
<tr>
<td>Late Flower</td>
<td>6.7</td>
<td>51.3</td>
</tr>
</tbody>
</table>

Notice when cut at the right stage of maturity, the TDN values are all above 60-70% in feed value.
### The Influence of State of Maturity on Corn Yield

<table>
<thead>
<tr>
<th>Silking</th>
<th>1 Day</th>
<th>12 Days</th>
<th>25 Days</th>
<th>49 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Silage Weight (lbs. per acre)</strong></td>
<td>16,000</td>
<td>25,000</td>
<td>34,000</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>Dry Matter (lbs. per acre)</strong></td>
<td>5,400</td>
<td>8,300</td>
<td>11,700</td>
<td>13,600</td>
</tr>
<tr>
<td><strong>Stalks and Leaves</strong></td>
<td>93%</td>
<td>72%</td>
<td>53%</td>
<td>37%</td>
</tr>
<tr>
<td><strong>Ears and Husks</strong></td>
<td>7%</td>
<td>28%</td>
<td>47%</td>
<td>63%</td>
</tr>
</tbody>
</table>

### How Harvesting Alfalfa Affects Digestibility, Consumption, Milk Production and Grain Requirements

<table>
<thead>
<tr>
<th>Cutting Date</th>
<th>Dry Matter Digestibility</th>
<th>Daily Digestible Forage Consumption in lbs. per 1000-lb. Cow</th>
<th>Milk Production - Fat Corrected Lbs.</th>
<th>Amount of Grain Required - Lbs. Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Bud</td>
<td>66.8</td>
<td>23.0</td>
<td>42.5</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>65.0</td>
<td>21.6</td>
<td>39.2</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>63.1</td>
<td>20.2</td>
<td>34.0</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>61.3</td>
<td>18.8</td>
<td>31.4</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>59.4</td>
<td>17.4</td>
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<td></td>
<td>57.5</td>
<td>16.0</td>
<td>23.4</td>
<td>15.7</td>
</tr>
<tr>
<td>Full Bloom</td>
<td>55.8</td>
<td>14.7</td>
<td>19.5</td>
<td>18.2</td>
</tr>
</tbody>
</table>
3M #3 – MOISTURE

Ag-Bag® International recommends that forages be harvested at moisture levels ranging from 55-68%. This insures best fermentation and digestibility of TDNs. Wilting of most forages will be necessary to attain the desired moisture. Note: For round or square bale silage, we recommend 45-55% moisture. Head chop grain should be harvested in the 30-40% moisture range. Snapped Earlage should be in the 30-45% moisture range. High moisture shelled corn should be in the 28-30% moisture range. One (1) ton of dry hay will equal three (3) tons of baglage (Rule of Thumb).

MOISTURE AND QUALITY

In addition to stage of maturity at the time of harvest, moisture (either too much or too little) is one of the most important factors that determines the quality of the final product of the ensiling process. Other things being equal, losses with wilted silage are much lower than when the forages are ensiled as direct cut material at high moisture levels. Silage cut above 70% moisture tends to increase the amount of clostridia in the forages. The clostridia starts to use up the proteins and soluble sugars, lessening the quality of the feed. This higher moisture feed can cause some acidosis in the cattle - since ensiling bacteria are more active in wetter feeds as the moisture wilt. Try to start bagging at 70% moisture (as soon as it doesn't make water) and balance your swathing with speed of bagging and hauling.

MOISTURE TESTING

There are lots of moisture testers on the market today. Some are electronic, others have probes, some cook the moisture out of the feed and leave the residue to weigh for accurate dry matter. Contact Ag-Bag® International for ordering a moisture tester. Another method used by some experienced Ag-Bag® users is the Squeeze Ball Test. To do this, grab a handful of chopped material and form a ball. Squeeze the material hard for 30 seconds. If you squeeze water out of the feed, it is above 75% moisture. If no water comes out when pressed and the material holds a tight ball and some moisture remains on your hand, it is from 65-70% moisture. If the ball comes apart slowly, it is close to 60% moisture. Under 50% moisture, the ball springs apart and does not stay together. Below this level (50-55%), the moisture is getting marginal for good fermentation.

DIRECT CUT

Some forages can be cut directly off the stump. EXAMPLE: a) An alfalfa crop that is very grassy or past 10-20% bloom. b) Most crops that are mature rather than very lush and young. c) Most grain crops in the dough stage can be direct cut if you are going to use whole plant or make Head Chop. For best results and better control of your moisture level in the various forage crops, it is best to swath and wilt. The ideal moisture level is 65-68% in forages and in corn silage. In colder climates it is advisable to lower the moisture level to 55-60% for those bags to be fed in extremely cold weather.

PLANNING YOUR MOISTURE

It requires some experience to maintain swather distance ahead of the chopper. There are many variables, i.e., First Cut, wet ground, doesn't dry out as rapidly, rainy conditions. Second Cut, hot and dry, may only require 2-3 hours wilt. Try to start bagging at 70% moisture (as soon as it doesn't make water) and balance your swathing with speed of bagging and hauling.
THE BEST BAG TO USE

Ag-Bag®’s bag is engineered to be the most scientifically prepared to deal with all the elements. The bag is made from polyethylene resins with ultraviolet inhibitors and special whiteners. Tri-extruded, or bonded, together in 3 layers, the bag’s white outer layer is extreme white to reflect the heat of the sun. In this layer are special ultraviolet inhibitors to give long life against the sun’s rays. The clear inner layer is added for strength and elasticity.

Insist on using genuine Ag-Bag® bags for the best feed quality results.

It is critical to maintain an oxygen-free environment in the bag. To repair a tear or puncture in the bag, use the repair tape from Ag-Bag®. If a large tear happens, use spray adhesive around the tear area, apply a piece of used bag over the hole, and seal the patch with repair tape. Careful, periodic bag examinations will prevent spoiled feed. Bag management is a must to maximize your profits.

Ag-Bag International, Ltd.
**THE 3M’S OF SILAGE**

**Dairy Terms to Know**

**Acid detergent fiber (ADF):** Fiber measurement extracted with acidic detergent in a technique employed to help appraise the quality of forages. Includes cellulose, lignin, ADIN, and acid-insoluble ash. ADF is highly correlated with cell wall digestibility. The higher the ADF, the lower the digestibility or available energy.

**Acid detergent insoluble nitrogen (ADIN):** Protein or nitrogen that has become chemically linked to carbohydrates to form an indigestible compound. Also referred to as an insoluble crude protein.

**Adjusted crude protein (ACP):** Protein content adjusted for the amount of heat-damaged protein. Used in place of CP when ADIN makes up more than 10% of the CP content of a feed.

**Amino acids:** Building blocks of proteins. Used extensively for milk and muscle protein synthesis, as well as glucose synthesis in the liver.

**Ammonia:** A colorless nitrogen compound produced as protein and nonprotein nitrogen degrades or breaks down in the rumen. It can be used to synthesize bacterial protein.

**Anion:** A negatively charged ion or particle, such as chloride or sulfate. Anionic salts are nutritionally important in dry cow rations to aid in the prevention of milk fever.

**Ash:** The mineral matter present in feed. It is measured by burning the sample at 500°C until all organic matter is burned and removed.

**Cation:** A positively charged ion or particle.

**Cellulose:** The principle carbohydrate constituent of plant cell membranes. It is made available to ruminants through the action of cellulolytic bacteria in the rumen.

**Carbohydrates (CHO):** Includes the sugars, starch, cellulose, gums, and related substances. Carbohydrates are the largest component in the dairy cow diet and contribute 60 to 70 percent of the net energy used for milk production. Their abbreviation, CHO, indicates that they contain carbon, hydrogen, and oxygen.

**Concentrate:** A broad classification of feedstuffs that are high in energy and low in crude fiber (less than 18 percent). Included are cereal grains, soybean oil meal, cottonseed meal, and by-products of the milling industry such as corn gluten and wheat bran. A concentrate may be low or rich in protein.

**Crude fiber (CF):** That portion of feedstuffs composed of polysaccharides such as cellulose, hemicellulose, and lignin. These serve as structural and protective parts of plants (high in forages and low in grains). CF is no longer considered a viable measurement.

**Crude protein (CP):** Total protein in a feed. To calculate the protein percentage, a feed is first chemically analyzed for nitrogen content. Since proteins average approximately 16 percent nitrogen, the percentage of nitrogen in the analysis is multiplied by 6.25 to give the percent CP.

**Degradable intake protein (DIP):** Protein or nitrogen that is degraded in the rumen by microorganisms and incorporated into microbial protein or freed as ammonia.

**Dry matter (DM):** That part of feed which is not water.

**Ensilage:** Forage preserved by fermentation in a bag, silo, pit, bunker or stack, usually in chopped form. Also called silage.

**Fiber:** The cellulose portion of roughages (forages) that is low in TDN and hard to digest by monogastric animals.
THE 3M’S OF SILAGE

DAIRY TERMS TO KNOW

Forage: The vegetative portion of plants in a fresh, dried, or ensiled state which is fed to livestock. Grasses and legumes cut at the proper stage of maturity and stored to preserve quality.

Green chop (fresh forage): Forages harvested (cut and chopped) in the field and fed directly to livestock. Also called zero grazing or soilage.

Hay: Dried forage (grasses, alfalfa, clovers) used for feeding farm animals.

High-moisture silage: Silage containing 70 percent or more moisture.

Legume: Clovers, alfalfa, and similar crops that can absorb nitrogen directly from the atmosphere through action of bacteria that live in their roots and use it as a nutrient for growth.

Lignin: A compound which, with cellulose, forms the cell walls of plants. It is practically indigestible.

Lipid: Any one of a group of organic substances that are insoluble in water though soluble in alcohol, ether, chloroform, and other fat solvents, and have a greasy feel. They are rich sources of dietary energy.

Nonprotein nitrogen (NPN): Used by rumen microorganisms to synthesize protein.

Neutral detergent fiber (NDF): A measurement of fiber after digesting in a nonacidic, nonalkaline detergent as an aid in determining quality of forages. Contains the fibers in ADF, plus hemicellulose.

Nitrogen balance: Nitrogen in the food consumed minus nitrogen in feces and nitrogen in urine (nitrogen retention).

Nitrogen-free extract (NFE): Consisting of carbohydrates, sugars, starches, and a major portion of materials classed as hemicellulose in feeds. When crude protein, fat, water, ash, and fiber are added and the sum is subtracted from 100, the difference is NFE.

Nonfiber carbohydrates: The highly digestible carbohydrate fraction of feeds consisting of starch, sugar, and pectin. Subtracting percent (DM basis) NDF, CP, ether extract (fat) and ash from 100 provides as estimate of NFC percent in feeds. \( \text{NFC} = 100 \times (\% \text{NDF} + \% \text{CP} + \% \text{fat} + \% \text{ash}) \)

Protein equivalent: A term indicating the total nitrogen content of a substance in comparison with the nitrogen content of protein (usually plant). For example, the nonprotein nitrogen (NPN) compounded, urea, contains approximately 45 percent nitrogen and has a protein equivalent of 281 percent (6.25 x 45 percent).

Ration: The amount of feed supplied to an animal for a definitive period, usually 24 hours.

Relative feed value (RFV): Developed primarily for use with legume or legume/grass forages, RFV combines digestibility and intake estimates into one number for an easy and effective way to identify and market quality hay. RFV is expressed as a percent compared to full bloom alfalfa at 100 percent RFV.

Roughage: Consists of pasture, silage, hay, or other dry fodder. It may be of high or low quality. Roughages are usually high in crude fiber (more than 18 percent) and relatively lower in NFE (approximately 40 percent).

Saturated fatty acids: A completely hydrogenated fat, each carbon atom is associated with the maximum number of hydrogen; there are not double bonds. Saturated fatty acids are solid at room temperature. Tallow is an example of a saturated fat, although approximately 50 percent of the fatty acids are unsaturated. Saturated fats tend to have less detrimental effects on rumen fermentation than unsaturated fats.

Silage: Green forage, such as grass or clover, or fodder, such as field corn or sorghum, that is chopped and compacted into a feed storage bag, silo, or bunker to create an anaerobic or air-free environment and undergoes an acid fermentation (lactic and acetic acids) that retards spoilage.
THE 3M’S OF SILAGE

DAIRY TERMS TO KNOW

**Total mixed ration (TMR):** A blend of all feedstuffs (forages and grains) in one feed. A complete ration that fits well into mechanized feeding and the use of computers to formulate least-cost rations.

**Unsaturated fat:** A fat having one or more double bonds, not completely hydrogenated.

**Urea:** A nonprotein organic nitrogenous compound. It is made synthetically by combining ammonia and carbon dioxide.
THE 3M’s OF SILAGE

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