SILAGE MAKING FOR SMALL SCALE FARMERS

FOOD AND AGRICULTURE ORGANIZATION
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Introduction

How to improve the nutrition of farmers' milking animals when each family keeps only one dairy cow? During the cold, continental winter, the major fodders available are wheat or maize straw, together with hay and concentrated feeds.

As a minimum, it is essential to provide a green fodder supplement to enhance rumen function for bovine animals. Therefore, one should develop winter fodder crops.

For smallholder farmers with limited production capacity, finding enough feed in the winter months to maintain good milk production is always a problem. Many are forced to buy hay, concentrates or silage just to keep their animals alive and are unable to benefit due to the higher prices paid for animal feed in the winter months.

What is silage?

Forage which has been grown while still green and nutritious can be conserved through a natural 'pickling' process. Lactic acid is produced when the sugars in the forage plants are fermented by bacteria in a sealed container ('silo') with no air. Forage conserved this way is known as 'ensiled forage' or 'silage' and will keep for up to three years without deteriorating. Silage is very palatable to livestock and can be fed at any time.

Why silage not hay?

Forages can be made into hay to conserve the nutrients, especially protein, before they decline in the plant. However it is often too wet to dry the successfully and special machinery, has to be used to assist the forage to dry quickly. Forage crops such as maize, are too thick-stemmed to dry successfully as hay.

Silage is considered the better way to conserve forage crops. A forage crop can be cut early and only has to have 30% dry matter to be ensiled successfully. There is no need to dry out the plant material any more than that, so wet weather is not such a constraint as it is with making hay.

Silage making is long practiced by the larger agricultural sector, but the production method relies on heavy equipment and large production, in order to dig or build storage pits and to compress the green mass, putting it beyond the reach of smallholder farmers.

Disadvantages:

- Silage is not interesting for marketing as its value is difficult to be determined.
- It does not allow longer transportation;
- The weight increases manipulation costs;
- Has considerably lower vitamin D content compared to hay.

Advantages:

- Stabile composition of the feed (silage) for a longer period (up to 5 years);
- Plants can be harvested at optimal phase of development and are efficiently used by livestock.
- Reduction of nutrient loses which in standard hay production may amount to 30% of the dry matter (in silage is usually below 10%);
- More economical use of plants with high yield of green mass;
- Better use of the land with 2-3 crops annually;
- Silage is produced in both cold and cloudy weather;
- The fermentation in silage reduces harmful nitrates accumulated in plants during droughts and in over-fertilized crops.
- Allows by-products (from sugar beat processing, maize straw, etc.) to be optimally used;
- Requires 10 times less storage space compared to hay;
- Maize silage has 30-50% higher nutritive value compared to maize grain and maize straw;
- 2 kg of silage (70% moisture) has the equal nutritive value of 1 kg of hay.

Principle of silage making

At harvest, plant cells do not immediately “die”; they continue to respire as long as they remain adequately hydrated and oxygen is available. The oxygen is necessary for the physiological process of respiration, which provides energy for functioning cells. In this process, carbohydrates (plant sugars) are consumed
(oxidized) by plant cells in the presence of oxygen to yield carbon dioxide, water and heat: sugar + oxygen ® carbon dioxide + water + heat

Once in the silo, certain yeasts, molds and bacteria that occur naturally on forage plants can also reach populations large enough to be significant sources of respiration. In the silage mass, the heat generated during respiration is not readily dissipated, and therefore the temperature of the silage rises.

Although a slight rise in temperature from 80° to 90°F is acceptable, the goal is to limit respiration by eliminating air (oxygen) trapped in the forage mass.

Some air will be incorporated into any silo during the filling process, and a slight increase in silage temperature is l kely. These temperature increases can clearly be limited by harvesting at the proper moisture content and by increasing the bu k density of the silage. Generally, it is desirable to limit respiration during the fermentation process by using common sense techniques that include close inspection of the silo walls prior to filling, harvesting the forage at the proper moisture content, adjusting the chopper properly (fineness of chop), rapid filling, thorough packing, prompt sealing and close inspection of plastics for holes.

Dry matter and moisture

Ideally, corn silage should be harvested at the moisture content appropriate for the type of silo used. Recommended moisture contents are 65–70 percent for horizontal silos, 63–68 percent for conventional tower silos, 55–60 percent for limited-oxygen silos, and 65 percent for silo bags.

Corn silage yield and quality as influenced by growth stage.

Maturity Stage	Moisture %
Early dent	73
1/2milkline	66
3/4milkline	63
no milkline	60

Delaying harvest can reduce both the fiber and starch digest bility as the stover gets more lignified and the overmature kernels become harder and less digestible if left unbroken after ensiling. Corn that is ensiled extremely wet will ferment poorly and lose nutrients by seepage, which also has potential to damage the silo and if not contained, contaminate local water supplies. Another problem with chopping silage with too much moisture is that a larger amount of lactic acid is needed to reduce the pH. This results in a longer period of time before the silage becomes fermented, producing a lower quality silage. Silage that is too dry may result in poorly packed material, causing more mold and spoilage due to air trapped in the silage. In dry, over mature corn silage, the stover portion of the plant is less digestible and contains lower amounts of sugars and vitamin A. It will not pack well in the silo, more oxygen will be present and it will take longer to get through the aerobic phase into the anaerobic phase of fermentation. Nutrients will be used for respiration during the aerobic phase, the temperature of the silage will increase and possibly burn.

Parts of plant	Dry matter in early wax ripening phase (%)	Dry matter in early wax ripening phase (%)
Grain	33	42
Cobs	8	9
Leaf	22	19
Stem	29	24
Cob sheets	8	6

The approximate moisture level of chopped silage can be determined by means of a “grab test.”

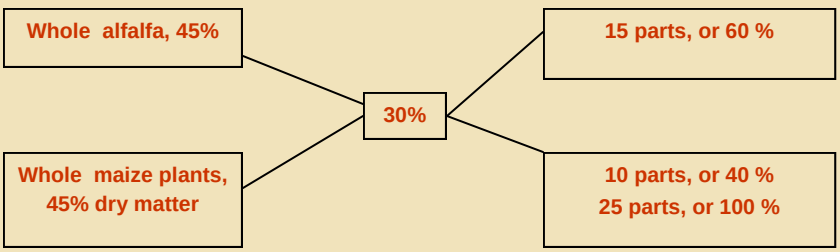
Squeeze the chopped forage tightly into a ball for 20 to 30 seconds, and then release quickly. Forage chopped into 3/8 to 1/2-inch pieces should be used.

Dry matter is the most important factor for production of good quality silage. The optimal quality silage is produced from components with dry matter contents ranging between 30 and 35%.

In the following table the percentage of moisture in different parts of the maize plant are shown, as well as the ideal time for harvest for silage preparation.

Condition of the forage ball	Approximate moisture content
ball holds its shape and there is considerable free juice	Over 75%
ball holds its shape but there is very little free juice	70 to 75%
ball falls apart slowly and there is no free juice	60 t0 70 %
ball falls apart rapidly	Below 60 %

Increased moisture or lack of dry matter in silage components should be avoided when possible, as the activity of the lacto-acidic bacteria is decreased and the activity of the butyric acid producing bacteria is increased. The optimal quantity of dry matter is achieved in the last phase of vegetation of the plants. When the weather conditions do not allow timely harvest, resulting in too wet or too dry silage materials, the desired moisture can be achieved by mixing dry and wet components. The composition of the dry and wet components is determined through use of the Pierces' square as show below:



Example: If you are producing silage from whole maize plants and freshly harvested alfalfa. In the middle of the square you indicate the desired dry matter contents of the silage (for example 30%). On the left side of the square in the upper corner, you indicate the dry matter of the fresh alfalfa and in the lower square, the dry matter of the whole maize plant (45%). By deducting the smaller numbers from the bigger ones, you get the needed percentage of each component that has to be combined in order to achieve the desired dry matter contents. In this case the fresh alfalfa should be included with 15 parts, or 60% and that of the whole maize plant, 10 parts, or 40% of total quantity, resulting in average dry matter of 30%.

Preparation of silage from whole maize plants

Corn harvested for silage is an important feed crop, where cropland often is limited. The crop provides livestock producers with a high-yielding, relatively consistent source of forage and the animals with a highly digestible and palatable feed. Corn silage produces more energy per acre than any other crop

Corn silage serves as a high-energy forage for dairy cows. This is most important for high-producing herds and on farms experiencing problems with making or buying high quality hay crop forage. Corn silage, with its relatively high-energy content, is also well adapted for use in low-cost rations for fattening cattle. Corn silage requires less labor per ton to produce than many other forage crops. It can extend the harvest period for the entire corn acreage and provide an opportunity for salvage of stressed or damaged cornfields. Also, corn silage can efficiently recycle plant nutrients, especially large amounts of N and K. The most adequate moment for harvest of maize during the vegetation is the so called wax ripening phase of the maize grain.

The presence of a dark colored layer at the base of the maize grain is also an indicator for the appropriate time of harvest for silage production. Once the first grains with dark layer are noticed you should wait for 3-4 weeks more before harvesting.

At this time the average dry matter contents of the maize plant is 30-35%. After the indicated phase, the contents of dry matter decreases as the stems get broken and leafs fall off. The maize can be silaged with or without other components. The whole maize plant should be harvested by cutting it 10-12 cm from the ground.

The particles of the maize plant, when chopping it for silage should be between one and three centimeters in length, although the optimal length depends on the vegetation phase as shown in the table.

Phase of vegetable	Dry matter(%)	Length of particle (cm)
Milk	20-25	3-5
Milk - Wax	25-30	1-3
Wax	30-35	0.7-1

Combined silage

If more crops are available, it is highly recommendable to produce silage trough combining of more products or by products. The most economically feasible results are obtained when low quality components, (crops that cannot be silaged on their own, such as fruits and leafs of sugar beat and sunflower) are added to more qualitative components (maize, alfalfa etc.) up to 30%.

As an example, high quality silage can be produced from whole plant of maize (45%), maize cone and grain (25%) and fresh alfalfa (30%).

Leafs and fruits of sugar beat can be also used for preparation of combined silage, as they contain sufficient sugar percentage (4-6%). The best combination is sugar beat leafs and fruit, together with whole maize plants or maize straw. A main success condition is that the sugar beat does not have much earth in it.

When you combine sugar beat with whole maize plants for silage production, it is best to use maize plants in a later stage of vegetation.

The sugar beat contents depends on the dry matter of the maize plant and usually in the total mixture contributes with 25-30%.

Silage production from drought affected crops

When corn is so drought stressed that it may not resume growth, it should be ensiled. Corn in this condition usually has few ears and has leaves that have turned brown and are falling off. The net energy content of drought damaged corn often is 85–100 percent of normal, and it sometimes contains slightly more crude protein. Drought stunted silage often contains high fiber digestibility, so when it is supplemented with additional grain, it can be an excellent forage and sustain high milk production. One concern with drought-stressed corn is the potential for high nitrate levels in the silage. High nitrate levels are found where nitrogen rates were applied and when a drought-stressed crop was chopped within three days following a rain. Ensiling crops that are suspected to have high nitrate levels is preferred to green chopping, because fermentation will decrease nitrate levels by about 50 percent. High temperature and drought causes accumulation of nitrogen in plants, which affects significantly the conversion of the feed. The lactic acid produced when silaging reduces the nitrogen content in plants.

Silage production from frosted corn

Corn is occasionally damaged or killed by frost before it reaches the desired maturity for ensiling. If the frost is early and green leaves remain on the plant, the crop will continue to accumulate dry matter and should be left in the field until it reaches the appropriate moisture content. Plants that are killed and still immature will likely contain too much moisture for immediate ensiling. These plants will dry slowly and dry matter losses will increase as the dead plants drop their leaves in the field and sugars leach from the frosted leaves. The best option is to leave the crop in the field to dry to an acceptable level (at least 72 percent moisture for a horizontal silo), unless it appears dry matter losses are becoming too high or harvesting losses will increase dramatically.

Silage in bags

The 'new' method, whereby cut green mass is stored in large sacks made from polythene, has in fact been tested in research stations for some years. It is not, however, a complex process. Ideally, the green mass is cut into small pieces, of about 3 cm long, and these, are used to fill the bags. The material is pressed removing the air and thereby preventing decomposition once the bag has been filled and shut. The feed can be stored in this way, without losing the nutritive quality, for up to a year. This allows farmers to maintain feed levels through the winter.

The purpose of chopping and compacting forage for silage is:

- To release as much plant sugar as possible for fermentation
- To ensure that all the air is pushed out of the plant material so that when the silo is sealed, the plant material is free of air. This is when fermentation works best to produce lactic acid.

Chopping can be done by hand but this can take too much time for forage on more than 0.1 hectares, so it is preferable that a forage chopper be used.

It is important to time the cutting of the forage so that the cut forage is not sitting for more than a day waiting to be chopped and ensiled, otherwise it will become moldy or to dry.

It is important that once the forage has been chopped it is placed in the silos and compacted as much as possible to get the air out before the silo is sealed. A key feature of silage bags is that it allows conservation of available fodder in small quantities, over a long period of time. This strongly contrasts with traditional silage making techniques, where large amounts of fodder are harvested and chopped at one time. As example a farmer family might conserve a couple of bags a day over the growing season, which would allow their milking animal to be fed over the 200 days of autumn and winter. The fodder might include all parts of the corn plant, leafy grass weeds, etc., which could be also partly air-dried before chopping and ensiling. It is also possible to progressively remove leaves from maize plants as they commence to senesce.

Advantages

- Plastics silage bags are an economical alternative to traditional silage storage systems, such as pits and silos when related, harvest and storage losses are considered.
- It is an effective way for preserving feed with minimum nutrient loss. (The anaerobic environment that is created eliminates spoilage from the growth of yeasts, molds and adverse bacteria while maintaining essential proteins and nutrients).
- Allows farmers to store silage anywhere they need it. A well graded and well drained ground surface is all that is necessary.
- The silage is completely sealed in the bag. This means that all the acid is retained in the silage, unl ke that in pit silage when it seeps out through the bottom of the pit as effluent. This compensates for the longer pieces of forage and poorer compaction than that found with silage machinery, so that the quality of the silage is just as good.
- Ensiling in a bag avoids the hard work of having to remove silage, as it has to be from a pit, when it has to be dug out every day.
- Because the whole bag is fed out to the animal, it means the rest of the silage which is in the other bags is not exposed to air at removal and is therefore unspoiled. Much of the silage in pit s has been found to be spoiled due to poor sealing and exposure to air every day when the silage is removed for feeding.
- The bag is easily stored and easily portable so that any member of the family can carry it to the feed trough for the cow.

Disadvantages

There are a few disadvantages to using silage bags. Among them are:

- the importance of pest control to prevent damage on the bags,
- containment and disposal of the plastic, once silage is removed from the bag,
- the need to chop the green mass, as chopped material tends to make much better silage, because more air can be squeezed out of it during the packing process, and the small pieces cannot puncture the bag.

With careful planning, all of these obstacles can be overcome. Most loses of silage during the process occur due to:

- Seepage losses when dry matter is less than 32 %.
- Unnoticed bird/rodent damage to the bags resulting in spoilage loss.
- Too wet (gaseous/seepage losses) or too dry silage (spoilage).



Storage

It is important to pick a suitable location for the storage bags. Obviously, one would wish to keep them relatively close, in an area that has adequate drainage and easy access. Keeping the bags away from other feed sources, may reduce damage from birds and rodents. Stacking the carefully in a room can protect them against rats, mice and other pests. Although open storing in a way disabling rodents to form layers, and covering with a thin plastic foil to prevent damage from birds is sometimes most effective. The surface area selected for storage of silage bags has a large impact on silage quality and ease of feeding from the bag. Based on experience the surfaces rated as follows:

- Concrete Pad. Provides excellent surface for silage bag, easy removal of feed with little or no damage, can achieve exceptional drainage of water away from bags, discourages pests and makes inspection for damaged bags very easy.
- Asphalt surface. Less expensive than concrete. Has most of the same advantages of concrete. Precautions to maintain surface adequate during the hottest hours on summer days.
- Gravel. Is good surface for placing silage bags. Weed and pest control are quite good. However the crushed rock surface does not support traffic very well.
- Dirt surface. This can work if there is adequate drainage away from bags. Weed control must be practiced and it is very helpful to have a second location of silage for use when it is extremely wet, especially in spring.

Packing

Packing the silage bag correctly is the most important factor that will affect silage quality. Therefore, the following recommendations should be followed when selecting the packing materials.

- Select a good bag. Strong high density plastic bags (from fertilizer bags to shopping bags) are available, with capacity from 50 - 5 kg of fresh chopped green fodder. Bags with no obvious holes can be purchased in packs of from ten to hundred;
- The quality of bags used is important. High- rather than low-density plastic reduces the potential for tearing. The seal must be without holes and this may relate to factory practice. If holes are present along the seal, sticky tape or tar/mastic may be used to repair seals as the bags are tied.
- Inner bags (if more bags are used) also tend to get damaged, but thicker bags are always less damaged, to the extent that two rather than three layers of bags are sufficient.
- Plastic fertilizer bags make very good silos. The fertilizer bag will last for at last three seasons.

Maintenance

As damage on the bags can happen for various reasons, birds, rodents, and other animals can puncture the plastic. This lets air in the bag and can result in spoilage. Children and cattle can do the same. For maintenance of the stored bags containing the silage the following recommendations should be followed:

- Inspect the bags on a regular basis and if possible mend holes;
- Do not allow dogs, cats and other animals to climb the bags;
- Number and date the bags for easy identification and recall of materials bagged;
- Do not leave the silage bags opened over night;
- Inspect frequently and seal holes at once;
- If damage is extensive, the silage needs to be re-bagged as soon as possible;
- If maintenance is appropriate after three – five weeks, excellent lactic acid fermentation will result and bags kept well for six months, with no or little fungal spoilage.
- After emptying, the bags must be carefully washed, dried and stored in a safe place for use the following year.

Filling

While filling your silage bags:

- Do not allow the feed to become contaminated with dirt;
- Ensile at proper maturity and moisture (58% - 68%);If moisture levels are higher, reduce the packing pressure to avoid creating mushy, silage, or better yet, wait until the forage is drier; If moisture levels slip below 65%, increasing the packing pressure can help;
- Pack not later than 24 hours after harvest.
- Fill rapidly and pack uniformly. Each bag should be filled in one or two hours at maximum. This is needed to maintain forage consistency;
- The silage must be packed as densely as possible, in order to avoid air pockets that can interfere with proper fermentation. Air pockets can develop more frequently when longer chop lengths are used.
- Monitor particle length. A shorter chop length of 3/8-cm will pack better, but may not retain enough physical fiber for the ration.
- The fodder can be hand chopped, or chopped through a cutter;
- 5 – 50 kg of chopped green fodder is carefully packed into a bag, in order to avoid making any holes in the bag;
- the bag is gently but firmly squeezed by hand to expel air, and while compressed, the bag is closed;

Rodent control

Silage bags, especially silage from fodder maize attract rodents. Once in, rodents could easily hide between bags, chewing through the plastic bags, and resulting in aerobic spoilage.

- Monitor the silage bags on a regular basis for any rodent, bird or livestock damage;
- Do not use elemental sulfur or chemical means for rodent/pest control, as life expectancy of the plastic is reduced when exposed to chemicals;
- Frequently some form of construction may be required. This might be within an existing store such as large cement or clay storages jars;
- Alternatively, storage (shelves) can be constructed with legs in order to keep the store off the ground, shaped in a way to prevent rats and mice climbing (such as mushroom shaped legs used for grain stores, or protected legs with metal horizontal discs or downward facing cones).

Sealing the bag

If bags are used, leaning heavily on the forage material in the bag then tying the remaining plastic as close to the material as poss ble and as tightly as possible, will compact the silage and then seal it from air. Make sure there is enough plastic to tie, up, so that it does not come free from the twine. Tobacco twine or hay baling twine is best for tying up the bag and it should be twined around the top of the bag several times to ensure the bag is completely sealed. Remember to seal tightly. Several methods can be used to seal the bags:

- For larger bags. Stretch the remaining plastic as far as it will reach, then place a wooden board on the plastic and wrap it around the board back toward the bag, like re-sealing a bag of potato chips;
- For smaller bags, the neck of the bag was twisted then turned over and tied with twine;
- You can also practice nailing of wooden boards to the one used to wrap the end of the plastic bag. Just roll the board and plastic two or three times and place a second board on the top. Nail the two boards together slightly alternating the angle of the nails.

Contents

- Fodder with high sugar content, will conserve well;
- Fodder with low sugar content is more likely to rot than ferment;
- Many crop residues lose much of their soluble carbohydrates during the final stages of grain ripening, and while the residue is left to dry in the field;
- The drier the silage, the more dry matter is packed into a given volume but the more susceptible is to air movement and dry matter losses;
- Densities also tend to decrease as particle size increases.

Evaluation corn silage

Once the silage has undergone an adequate fermentation, usually in 3 weeks. Evaluation of the silage pH and fermentation acids can provide feedback on whether the fermentation occurred under ideal conditions using a pH sensitive paper. In general, pH values for corn silage should be in the 3.5 to 4.3 range, lactic acid levels should be in the 4–6% range, acetic acid 2% or less, propionic acid 0–1%, and butyric acid less than 0.1%. Ammonia N levels should be less than 5%. Other factors that can be used to evaluate the silage include temperature, smell, and the appearance of the silage. Silage temperatures should generally be within 15 to 200F of the ambient temperature. Higher temperatures indicate that oxygen is penetrating into the silage and resulting in aerobic decomposition. The silage should also not have a rancid odor, associated with clostridial fermentation in wet silages. A vinegar odor can also be associated with wet silages that have high levels of acetic acid. An alcohol odor is associated with fermentation by yeast, which results from slow feed out rates and air penetration in the silage face. There should also not be any visible mold in the silage, which is often an indication of high dry-matter content at ensiling or poor sealing.
Making a field assessment:

Step 1: Collect a sample of silage that is representative of what is to be fed to the animals.
Step 2: Make an assessment of the silage on physical appearance and texture.
Step 3: Make an assessment of the silage on the basis of color.
Step 4: Make an assessment of the silage on the basis of the aroma of the silage.

Physical Appearance and Texture	Silage Characteristics and Interpretation
Leafy, soft texture	Likely to have high ME. Crude protein is probably high. ME for leafy tropical pasture silages is lower than for temperate pasture silages at the same growth stage.
Leafy, but leaves more fibrous	Lower digestibility and ME. More typical of tropical grasses.
Stemmy, fibrous; seed heads present	If high proportion of stems/or seed heads are present, ME and crude protein are likely to be low. Crop cut too late.
Proportion of legume present in silage	As the proportion of legume increases, silage crude protein content (and often ME content) will increase.
Presence of mould or rotten silage	Air has entered the silage. DM has been lost and silage quality (ME content) will have declined during storage.
Very wet; effluent seeping from stack or ponding in bottom of wrapped bales.	Moisture easily squeezed out of he silage. Forage was ensiled at too low a DM content. There is a high risk of poor fermentation and significant losses (quality and quantity).
Very dry, even brittle	Silage was ensiled at too high a DM content. The forage was probably poorly compacted and there is a high risk of overheating during storage, increased silage losses, reduced ME and protein degradation.
Color	**Silage Characteristics and Interpretation**
Very dark olive green	Weather damaged, and/or very wet silage with a poor fermentation. Sour or putrid aroma. Usually occurs if high legume content, or immature grass that may have been fertilized with a high rate of nitrogen.
Dark olive green/brown	Normal color for wilted legumes, which are usually a darker color han grass silages.
Light green to green/brown	Normal color range for grass, cereal and maize silages. Normal color range for wilted grass silages. Heavily wilted silages wi h restricted fermentation tend to be greener.
Pale green/straw yellow	Typical of late-cut grass and cereal silages. Can occur with low DM silages, and weather-damaged grass silages. Bottom layer of wet silage can be yellow with fruity aroma.
Light amber brown	Some heating has occurred during storage or due to aerobic spoilage during feedout. Some loss in digestibility and heat damage of protein. More common wi h wilted silages.
Brown	More extensive heating. May also be some black patches of silage on the surface. Significant loss in digestibility and high proportion of protein is heat damaged and unavailable to the animal. Inadequate compaction, delayed sealing or poor air exclusion. Usually accompanied by significant proportion of waste (moldy) silage.
Dark brown	
Aroma	**Silage Characteristics and Interpretation**
Mild, pleasantly acidic, sour milk or natural yoghurt smell	Normal lactic acid fermentation – desirable. Heavily wilted silage with little fermentation, especially from crops with low sugar content. Stronger aroma as DM content falls.
Very little smell, but slight sweet aroma	Yeasts have played an active role in the fermentation. Ethanol levels high. These silages are often unstable during feed out.
Sweet, fruity alcoholic aroma	Poor fermentation dominated by bacteria producing acetic acid. Common with low DM, low sugar .
Sour vinegar smell	Poor fermentation dominated by clostridia bacteria that produce high levels of butyric acid. Silage wet and sometimes slimy. Rub silage between fingers, warm the hand for a few seconds and then smell. The presence of butyric acid is easily detected.
Rancid butter, putrid aroma	
Strong tobacco or caramel smell, with flavor of burnt sugar	Heat damaged silage, dark brown in color. Often palatable to stock but nutritive value very low.
Musty or moldy aroma with only mild fermentation aroma	Moldy silage due to poor compaction and sealing. Also evident in aerobically spoiled silage, which can be warm and have a compost aroma.

Feeding silage to cattle

Silage should be fed as soon as poss ble, preferably within a few hours. After feeding, the feed bunks must be cleaned out to prevent any remaining silage, which will spoil, contaminating the next feed out.

Silage can be provided to animals in number of different recipes based on its composition and the breed and use of the animals. In general silage should be used up to 25 kg per day for 55o kg animal and up to 5 kg for sheep and goats.

The following recipes are used most commonly to obtain the best results when feeding a 550 kg animal:

Alfalfa hay 7 kg followed by Maize silage 17 kg
Alfalfa hay 2 kg, meadow hay 3 kg, maize silage 15 kg, rye grain 1 kg
Alfalfa hay 2 kg, meadow hay 3 kg, maize silage 12 kg, oil beat fresh , 15 kg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