GRASS AND LEGUME SILAGES
for Dairy Cattle

Circular 605
UNIVERSITY OF ILLINOIS · COLLEGE OF AGRICULTURE
Extension Service in Agriculture and Home Economics
All the common Illinois grasses and legumes are suitable for silage:

- Bluegrass
- Bromegrass
- Redtop
- Timothy
- Sorghum
- Millet
- Barley
- Oats
- Rye
- Wheat
- Alfalfa
- Alsike clover
- Red clover
- Sweet clover
- Soybeans

Altho corn, botanically, is also a grass, it is not thought of as such in farm practice.
THE ADVANTAGES of using grasses and legumes as silage have been widely publicized — so widely in fact that many dairymen now commonly use these crops as silage. Unfortunately the publicity has played down certain facts that farmers ought to have before deciding to use their grass or legume crops in this way.

Making a grass or legume silage is more complicated than making corn silage; it requires more care and the use of preservatives in just the right amounts; and it has disadvantages that no one can get away from. Furthermore, we need to know more exactly the best stages at which to harvest these crops for silage, and the best ways of ensiling them. To get this information will take more experimental work.

It is the purpose of this circular to give a balanced, over-all view of the whole problem of grass and legume silages.

**Advantages and Disadvantages**

**Saves an entire crop.** When a grass or legume crop is converted into silage, it may be saved in first-class condition for feeding even in a rainy season. In such a season, haymaking is difficult and heavy losses are likely to occur, especially in harvesting the first cutting of alfalfa and in curing soybeans.

**Preserves surplus pasture.** During the time of lush growth in May and June, surplus pasture can be put in the silo and used as an excellent supplement to short pastures later in the season. A more steady supply of succulent feed during the pasture season can thus be obtained.

**Distributes labor more evenly.** When grass or legume silage is substituted for corn silage, labor can be distributed more evenly throughout the year.

*A disadvantage* is that more labor is needed to harvest grass
The above machine harvests the standing crop. Alfalfa and grasses, like timothy and bromegrass, which do not contain a large amount of moisture, are best handled by such machines.

or legume crops than to harvest corn. Pitching such crops first on wagons and then into the silo filler calls for a good deal of heavy labor. Some hay loaders, however, will lift green crops from the windrow onto a wagon. Forage harvesters, recently developed, will mow, chop into short lengths, and lift the crop into a wagon or truck in one operation. Labor-saving machines such as these will undoubtedly encourage farmers to grow larger acreages of grass and legume crops for silage.

Still another disadvantage is that more tons of grass or legume forage than of corn forage must be handled per ton of dry matter since the moisture content of grasses and legumes is higher than that of corn. This greater weight adds to the cost of harvesting grass and legume crops.

Makes for fuller use of silo. The silo can be filled twice each year — in the spring with grasses or legumes for summer feeding and in the fall with corn or other silage for winter feeding.

But the trouble is that grasses and legumes often require stronger silos than corn. Their high moisture content causes more pressure than corn silage. Reinforcements can often be supplied by placing extra hoops about the silo.

Uses crops costing less to produce. Most grasses and legumes are perennials. Therefore the overall cost of seed, land preparation, and labor required to produce a ton of them is usually less than that required to produce a ton of corn forage.
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A disadvantage is that a direct outlay of fifty cents to $1.00 or more per ton of crop ensiled is necessary when a grass or legume is put up with molasses or other preservative. For most silos this means an added expense of at least $50 and sometimes upward of $100 for each filling. Legume silage, however, contains from 2 to 2½ times as much protein as corn silage, and the cost of preservatives will therefore be partly offset by its greater protein content. Of course, the use of molasses or some other sugar-containing preservative adds to the feeding value of both grass and legume silage.

Contains more protein and carotene. Silage made with a grass or a legume is a better feed in some respects than corn silage. It has a higher protein content; hence less protein is required in the grain mixture. And it is higher in carotene. The carotene tends to increase the vitamin content and yellow color of the milk. The vitamin A in milk from cows fed grass or legume silage may be nearly as high as that of milk from cows on pasture.

A disadvantage is that the total feeding value of an acre of a grass or legume harvested for silage is usually much less than that of corn on Illinois farms. Sometimes the feeding value is so much less that it is more economical to continue to harvest corn for silage and to use the grasses and legumes for pasture or hay. Pound for pound, grass or legume silage has only 80 to 90 percent as high feeding value as corn silage. It contains less dry matter, and the dry matter has a lower feeding value.

Preserves feeding value in weedy crops. When weedy meadow crops are preserved as silage, their feeding value is higher than it is when they are cured as hay.

Makes control of insects and erosion easier. Both insect enemies and soil erosion are more easily controlled when grasses and legumes are grown than when corn is grown.

Destroys viability of weed seed. The ability of most weed seed to produce new plants is destroyed when the seed are included in the silage.

Removes fire hazard. When grasses or legumes are preserved as silage, there is no fire hazard such as comes from storing damp hay in hay mows.
Yield and Feeding Value per Acre

The quality of the silage and the amount which an acre of a given crop will yield are the two main questions to consider when choosing a crop for silage.

A grass or legume crop may be expected, on the average, to yield about three times as many tons of silage to the acre as of hay. To make one ton of hay ready for the mow takes $3\frac{1}{2}$ to 4 tons of green crop as it stands in the field. Only $2\frac{1}{2}$ to 3 tons of a grass or legume crop wilted before ensiling are needed to equal a ton of hay. (The difference between the weight of the crop when first cut and its weight as hay ready for the mow is in the water lost in evaporation, except that when there is rain or poor curing conditions other losses may also occur.)

The yield of the grass crops (timothy, bromegrass, and millet), in tons of hay or silage, is usually less than that of the legume crops. The exception is Sudan grass, which yields high. The cereal crops (barley, oats, wheat, etc.) are not usually preserved easily as silage.

Feeding value per acre depends, however, upon pounds of

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<thead>
<tr>
<th>Crop</th>
<th>Yield per acre</th>
<th>Protein per acre</th>
<th>Total digestible nutrients per acre</th>
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<tbody>
<tr>
<td></td>
<td>Hay</td>
<td>Silage</td>
<td>Hay</td>
</tr>
<tr>
<td>------------------</td>
<td>-----</td>
<td>--------</td>
<td>-----</td>
</tr>
<tr>
<td>Corn</td>
<td>8.6b</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Sorghum, sweet</td>
<td>9.5c</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>2.14</td>
<td>450</td>
<td>470</td>
</tr>
<tr>
<td>Soybeans</td>
<td>1.34</td>
<td>300</td>
<td>280</td>
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<tr>
<td>Clover, red</td>
<td>1.13d</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>Clover, sweet</td>
<td>1.12</td>
<td>240</td>
<td>250</td>
</tr>
<tr>
<td>Grains cut green</td>
<td>.84</td>
<td>70e</td>
<td>124e</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>.94</td>
<td>240</td>
<td>140</td>
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</table>

*a Calculated from chemical composition of green roughages. *b Average 1935-1944, as given by *Crops and Markets*, U.S.D.A. *c Average for 1933-1942 as given by *Crops and Markets*, U.S.D.A. *d Yield of clover and timothy. *e Average of barley, oats, and rye.
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digestible nutrients, not upon tons of harvested crops. The figures on page 6 show the yield and the feeding value of a number of crops when harvested for silage. These figures are based on average Illinois yields of these crops over a ten-year period and on average analyses of hay and silage.

The chief silage crop in Illinois is corn. Both its feeding value and acre-yield are high. It can therefore be taken as a good standard for measuring the yields and values of grass and legume silages. Ensiled at the right stage, it requires no preservative.

Corn and sorghum give the most pounds of total digestible nutrients per acre (page 6). Altho sorghum yields more tons of silage per acre than corn, it has a lower feeding value both per ton and per acre. The legumes contain more digestible protein than the small grains and the nonlegume hay crops. Their average yield of digestible protein may therefore be nearly equal to that of corn and larger than that of sorghum.

Forage from both grass and cereal crops is low in calcium and protein. For that reason it is not as good feed for dairy cattle as legume forage.

**Sugars or Acids Needed for Good Silage**

When corn is ensiled, enough sugars are converted into lactic and acetic acids to make up 1 to 2 percent of the silage by weight. This amount of acid checks further action by the bacteria, so that, if the silo is air-tight, the silage will keep indefinitely.
Grasses and legumes ensiled alone may not make good silage. They contain only small amounts of fermentable sugar—so little, in fact, that the quantity may be too small to produce enough acid to preserve the silage adequately. Also, grasses and legumes usually contain more protein than corn. When they are ensiled without a preservative, bacteria often act on the protein, producing an unpalatable, ill-smelling silage which cattle may refuse to eat. To assure good results with grasses and legumes it is therefore necessary to add a preservative—either molasses or dried whey, or some other substance containing sugar, or to add ground cereal grains such as corn, wheat, barley, etc., or acids.

**Best Ways to Ensile Grasses and Legumes**

For best results in ensiling grasses or legumes, one of the four methods given below should be used. The emergency methods described on pages 14 to 17 are worth considering only when it is not practicable to use one of these standard methods.

**Mix green corn or green sorghum thoroughly with green soybeans.** Silage so mixed keeps well and has high feeding value. The proportion of soybeans to corn or sorghum should be one-third to one-half by weight. The crops must be well mixed as they go thru the silo filler. Putting in a load or two of corn followed by a load of soybeans is not satisfactory. Even if layering the silage does not cause actual spoilage, changing from one kind to another as the layers are reached may reduce the cows' consumption of silage or cause waste thru their refusal to eat it.

Tho green alfalfa mixed with green corn or green sorghum to make one-third to one-half of the mixture by weight produces excellent silage, it is not always possible to combine these crops because they are not likely to be ready for harvest at the same time.

Tho occasionally green sorghum, green alfalfa, or green soybeans ensiled alone may make good silage, they cannot be depended on to do so. Sorghums alone, especially the late-maturing varieties, tend to produce sour, soggy silage. The secret of making silage without a preservative is getting the right amount of dry matter in the crop as it enters the silo. Mixing dry feed with the crop (or using a preservative) is a surer way of producing a
Sorghums differ in value as silage crops, in their ability to resist lodging, and in the time they need to reach maturity. Sweet sorghums are preferred for mixing with grass or legume silage because they usually yield higher than grain sorghums or kafirs.

good silage than wilting the crop or waiting until it has reached the proper stage of development.

Mix grasses or legumes with molasses, usually blackstrap, or with dried whey. Using one of these preservatives is one of the most popular and satisfactory ways of making grass or legume silage. The risks are few and the results are likely to be
good. Moreover, adding a little more molasses than necessary will not spoil the silage; in fact it will merely add to its palatability and feeding value. The gross cost is moderate, and since only a part of the feeding value of the molasses is lost, the net cost is small. Dried whey is usually more expensive than molasses.

The least amount of molasses needed per ton of green crop ensiled is:

<table>
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<tr>
<th>Pounds</th>
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<tr>
<td>For grasses</td>
<td>40</td>
</tr>
<tr>
<td>For alfalfa or the clovers</td>
<td>80</td>
</tr>
<tr>
<td>For grass and legume mixtures</td>
<td>60</td>
</tr>
<tr>
<td>For soybeans</td>
<td>100</td>
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</table>

Somewhat larger amounts do no harm and in some cases may be useful.

The molasses may be pumped from a drum by means of a special molasses pump attached to the silo filler. (Several manufacturers of silo-filling machinery make such a pump.) Or, as the crop is placed on the apron of the silo filler, the molasses may be run onto it from an elevated drum.

The composition of corn-sugar molasses is about the same as that of blackstrap molasses and may be used in place of it in equal amounts. Dried molasses, which has about the same sugar content as liquid molasses, is easy to use but may cost considerably more than liquid molasses. Dried whey contains about the same percentage of sugar as does liquid molasses and has given excellent results. Either of these preparations may be fed into the silo filler or scattered on the cut material in the silo.

Altho good preservation has sometimes been obtained by using 40 to 50 pounds of dried whey to a ton of green crop, it is best to use the same amounts as are recommended above for molasses.

**Mix grasses or legumes with ground cereal grains.** Corn, oats, or wheat ground and added to a grass or legume improves the keeping quality and the feeding value of the silage. At least 200 pounds of the ground grain is needed for each ton of green crop. Amounts up to 250 pounds will often be beneficial.

The grain provides sugars, which will ferment. Fermentation increases the acid content of the silage, and the increased acidity, in turn, improves the keeping qualities of the silage. Tho some of the feeding value of the grain is lost as a result of fermentation, much remains.
Bromegrass is slow to recover from harvesting. When this picture was taken, the swathe (at left), cut three weeks before, had developed very little new growth. Properly ensiled, bromegrass makes good silage.

High quality silage can be made from soybeans if they are harvested when the green seed is at the hard-dough stage. At least 100 pounds of molasses per ton of silage must be added. Soybeans, however, yield only half to two-thirds as much dry fodder per acre as corn.
This crop of Sudan grass and soybeans, grown together for silage, was cut in mid-July and wilted a short time. The silage was better than some of the same crop ensiled a month later.

Another advantage of adding ground grain is that it helps absorb and hold the excess juices which may otherwise be lost from the silo when high-moisture crops are ensiled direct from the field without being wilted. Crops having a dry-matter content of less than 25 percent when they are ensiled usually lose some of their juices as seepage from the silo. The loss reduces the feeding value of the silage and the decomposing juices release bad odors.

Adding 200 pounds of corn-and-cob meal to a ton of green alfalfa which has a dry-matter content of 22 percent will raise the dry-matter content of the mixture to about 28 percent, a level which will prevent seepage. But adding ground grain to a crop already high in dry matter, either because of advanced development or because of partial drying or wilting in the field after cutting, may be distinctly harmful. If, for example, green alfalfa has a dry-matter content of 30 percent and 200 pounds of ground corn is added per ton of alfalfa, the silage will probably mold. This is because the dry matter in the mixture would be raised to the critical level, 35 percent.

Whether a farmer who can grow good crops of silage corn is justified in using ground corn as a preservative for grass or legume silage is questionable. If he has to buy the corn, he will
Oats should be harvested for silage when the grain has reached the early dough stage. Because of the hollow stems, the forage should be chopped into short lengths and packed well. A preservative must be added.

have to make a large cash outlay for 200 pounds of ground corn per ton of green crop (3½ bushels of shelled corn).

When corn is grown for use with grass or legume silage, the grain from a third to a half acre of corn will be needed to preserve the silage from an acre of an ordinary grass or legume crop, such as a first cutting of alfalfa. To preserve first-cutting alfalfa averaging 6 to 7 tons to the acre requires 20 to 25 bushels of corn. The ears of mature corn usually make up 60 to 80 percent of the feeding value of the crop, the rest of the nutrients being in the leaves and stalks. In many cases, harvesting the corn crop for silage and using some preservative other than corn for grass and legume silage would result in more economical and better use of the crops.

**Mix grasses or legumes with an acid.** Acid-preserved silage keeps well, but stock usually eat it with less relish than silage treated with molasses or ground grain. It may be made by either the A. I. V. method (named for the originator, A. I. Virtanen, of Finland) or the phosphoric-acid method.

The A. I. V. method requires the addition of strong mineral acids — usually a mixture of sulfuric and hydrochloric acids. It is patented, and permission to use it must be obtained from the holder of the patent rights. The amounts of acids needed are given by the company furnishing the material.
**The phosphoric-acid method** requires adding enough acid to the crop as it is ensiled to make the silage strongly acid (pH 3.5 to 4.0). The amounts recommended per ton of green forage are:

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<thead>
<tr>
<th></th>
<th>Pounds</th>
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<tbody>
<tr>
<td>For grasses</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>For alfalfa and the clovers</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>For soybeans</td>
<td>20</td>
<td></td>
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</table>

Mix the phosphoric acid with water at the rate of one part of phosphoric acid to five parts water by volume. Always pour the acid into the water. *Never pour the water into the acid.* The mixture may be allowed to flow by gravity from an elevated tank or drum into the blower, or it may be permitted to drip onto the forage just in front of the knives of the silo filler.

The phosphoric-acid method has all the advantages of the A. I. V. method and others of its own. Because strong acids are destructive of clothing and harmful to eyes and skin, phosphoric acid is less dangerous than those used in the A. I. V. method. It also provides additional phosphorus in the cow’s ration and increases the value of the manure as fertilizer. It has been used successfully by many farmers. Moreover, the acid may be mixed with the crop by being introduced into the silo filler, provided the machine is rinsed thoroughly with water at the close of each day’s run. (The acids used in the A. I. V. method must be added by means of special equipment and should not be introduced into the silo filler.)

The acid should be purchased from a reliable company which guarantees it to be safe for animals. Some commercial phosphoric acid contains fluorine in large enough quantities to harm cattle eating phosphoric-acid silage over a long period.

For the precautions necessary to the feeding of silage preserved with acids, see *Feeding Grass and Legume Silages*, page 19.

**Methods That Can Be Used in Emergencies**

**Moisture must be carefully adjusted.** Grass or legume crops can sometimes be ensiled satisfactorily without either a preservative or another green crop. Neither the preservative nor the second green crop should be omitted, however, except in an emergency. If one or both must be omitted, the crop can still be ensiled if the moisture in it is reduced until the dry matter makes up only 30 to 35 percent of the
weight of the crop. The crop should, however, contain as near this amount of dry matter as possible.

The moisture in a crop to be ensiled can be reduced either by mowing the crop on a good drying day and letting it stay on the ground for several hours, or by mixing dry materials with it.

**Determining dry-matter content.** A number of mechanical testers for quickly determining the moisture in green crops have been put on the market. If one of these is not available, sample tests made in the oven a few days before the silo is to be filled may be helpful.

A series of tests will show (1) approximately the time needed for wilting, if that is the method to be used, or (2) the amount of dry material that must be mixed with the green crop. To make such a test

Select a representative portion of the crop from three or four parts of the field. Harvest a few square yards with scythe or sickle.

Chop fine and mix samples together thoroughly.

Weigh out 2½ or 3 pounds of the mixture carefully (within 1/10 pound, or one ounce).

Spread the mixed sample in a thin layer in baking pans lined with newspaper.

Dry in the oven of the kitchen range. For the first hour keep the temperature low enough not to char the paper (250°F.). After the first hour keep the temperature at 225°F.

Continue to dry, preferably overnight, until after several weighings there is no further loss in weight.

The dry weight multiplied by 100 and divided by the fresh weight will give the percentage of dry matter.

Wilting in the field (2 to 4 hours before ensiling) is sometimes necessary for grasses and legumes. It keeps juices from seeping from the silo and reduces the amounts of preservative needed. Here wilted alfalfa is shown being picked up from the windrow for silage.
This sweet clover, which was wilted in the field until the moisture was reduced to about 70 percent, made good silage. Eighty pounds of molasses per ton was added to the clover as it was put into the silo. Unwilted sweet clover makes watery, ill-smelling silage.

Wilting the crop. Two to 4 hours is usually long enough to wilt a heavy first cutting of alfalfa, which may contain only 20 to 24 percent of dry matter. Sweet clover or soybeans may need to be wilted for 5 to 6 hours. Soybeans at the blossom stage may have only 20 to 22 percent of dry matter; but when yellow leaves start to drop, the plants may be dry enough not to need wilting.

Moisture, however, is lost rapidly on a good drying day, and a crop may become too dry if it is mowed too long before silo-filling.

When no preservative is used, the wilted crop must be thoroly packed in the silo. It is best to chop the crop fine and to complete the filling within two days, running in 2 to 3 loads of unwilted crop last. The added weight and moisture of the unwilted crop will prevent excessive spoilage in the surface layers.

Adding dry material. Corn stover, hay, straw, or ground cobs can be added to the grass or legume until the total dry matter makes up 30 to 35 percent of the mixture. This is a fairly satisfactory way to get fairly good keeping conditions. This method may be used when it is desirable to go ahead with silo-filling even tho the humidity is so high that wilting may be impossible or very slow.

It may be necessary to add 300 to 400 pounds of dry material per ton of green crop. The amounts can be calculated by estimating the
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dry-matter content of stored stover, hay, straw, and corn cobs at 85 percent (the dry-matter content of stover standing outside in shocks may be only 65 to 70 percent).

The silage will probably keep better if enough dry material is added to bring the total dry matter up to the recommended level, it may not be of high quality. Furthermore the materials added are not likely to increase the feeding value of the silage greatly. In fact, good hay may lose some of its value because of the nutrients destroyed in fermentation.

Other Methods

Several other ways of treating grasses and legumes for ensiling have been tried.

In carefully conducted tests, a commercial bacterial culture, either with or without salt, failed to improve the silage. Salt has but little value as a preservative for silage. Lactic acid cultures, too, have proved unsatisfactory.

When applied at rates of 10 to 20 pounds per ton of green crop, urea (or a commercial, powdered form of urea known as “262”) seems to have some preservative action. Applied in larger amounts, it may make the silage unpalatable.

Best Time to Harvest Different Crops

As already pointed out, it is most important when making grass or legume silage to cut the crop when it contains the right amount of dry matter, 25 to 35 percent. If cut before they are mature, most grasses and legumes contain too much water for good silage; either large quantities of juice will seep from the silo or the silage will be a soggy, unpalatable mass with bad odors. When crops are ensiled too ripe or too dry, the silage molds.

Alfalfa, alsike clover, red clover. For these legumes a medium-to-late haying stage is best; that is, when they are well advanced in bloom. Unless special precautions are taken (see page 18), these crops should not, as a rule, be ensiled when very wet with rain or dew; the leaves hold so much water that silage made from them then will be too low in dry matter.

Cereal grains. Barley, oats, rye, and wheat should be ensiled as

1 Minnesota Agricultural Experiment Station, Bulletin 360.
2 Massachusetts Agricultural Experiment Station, Bulletin 425.
3 In tests made by the Massachusetts Station, however, urea proved entirely unsatisfactory as a preservative for silage.
soon as the seed has reached a stiff-dough stage. Earlier harvest may be desirable in dry, hot weather.

**Grasses.** Grasses intended for silage — bluegrass, bromegrass, redtop, timothy, and millet — should be harvested in late bloom. Sudan grass should be harvested before it heads.

**Soybeans and cowpeas.** A good haying stage is best; that is, when the pods are filled with green seed in the hard-dough stage and when, if cured for hay, the dried seed would be more than half their full size.

**Sweet clover.** This crop is best ensiled in full bloom, but in order to permit another crop to follow on the same field, it is sometimes cut at an earlier stage and allowed to wilt for 2 to 5 hours before being ensiled.

**Precautions Are Needed**

**Make preliminary dry-matter tests.** Tests made methodically a few days ahead of silo-filling may safeguard against poor quality of silage or complete loss.

**Put crop in silo as soon after mowing as possible.** Changes in the weather, machinery breakdowns, or other delays will lower the quality of the silage if much of the crop is mowed in advance of silo filling.

**Wilt the crop when necessary.** Seepage from the silo and too much juice in the bottom of the silo can often be prevented by wilting the crop. Wilting is not recommended, however, when it is practicable to harvest the crop at the right stage of maturity to avoid seepage and excess juice. It results in large variations in moisture content and lowers the grade of the silage.

**Do not ensile a crop wet with rain or dew.** When such crops as alfalfa and the clovers are ensiled without having been wilted and with much water clinging to the leaves, the silage will probably become soggy and unpalatable. Even tho some dry materials are added, the quality of the silage is not likely to be as good as it is when the crop is put into the silo without additional moisture.

**Use air-tight silos.** If silage is to keep well, air must not get to it. Grass or legume silage can be satisfactorily stored in either a tower silo or a well-built trench silo. The walls and doors of the tower silo must keep the air out. A trench silo must be protected by a cover that will both keep out the air and weight down the silage. Straw and a thick layer of dirt make a good covering. Stacks of silage left unprotected will suffer considerable waste, as a thick layer on the outside will rot. Peavine silage, which is commonly stacked, is an exception.
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Feeding Grass and Legume Silages

Silage made from a grass or legume may be fed in the same way as corn silage. When it is fed for the first time, however, the cows may need several days to become accustomed to it. Since it is more laxative than corn silage, it is best to feed it in small amounts at first.

Although satisfactory results have been obtained when grass or legume silage is used as the only roughage, most investigators who have tested it in feeding trials recommend that some additional dry roughage be fed. When A. I. V. or phosphoric-acid silage is fed, it is best to use liberal amounts of legume hay, which is high in lime, or to add 4 ounces of ground limestone to each cow's daily ration. The hay or the limestone will neutralize the acid. Silage which is so acid as to be unpalatable may be treated after removal from the silo with 10 ounces of air-slaked lime or finely ground limestone per 100 pounds of silage.

As a rule, grass and legume silages are 10 to 20 percent lower in total digestible nutrients than corn silage (see page 6). Therefore when substituted for corn silage, they must be fed more liberally, or other feeds must be supplied in larger amounts. Also since the composition and feeding value of different lots of grass or legume silage vary more than different lots of corn silage, and since their dry-matter content changes rapidly before harvest, the ration must be adjusted in such a way as to take care of this variation.

Since grass or legume silage usually contains more protein than does corn silage, the percentage of protein in the grain mixture may be reduced when these silages are fed liberally. If, for example, a grain mixture containing 16 percent total protein proved satisfactory when corn silage was fed, it is probable that a mixture containing 14 percent total protein will be satisfactory when grass or legume silage replaces corn silage.

Refilling Silos

A silo partly filled with grass or legume silage can be used also for corn silage provided all spoiled silage is first taken out and the surface of the silage left in the silo is made even and solid.

Grasses and legumes may also be put in a silo already partly filled with corn silage.
TURNING LEGUMES AND GRASSES into silage is a good way to expand their use on many Illinois farms, where they are planted mainly to improve cropping systems and protect soils against erosion.

Where the land is highly productive and erosion is not a problem, farmers naturally prefer to grow more corn. On such farms it is probably more practicable to use corn for silage than to grow legumes and grasses for that purpose.