Definitions of Silage Terms

Silage

Silage is the product of acid fermentation of green forage crops compressed in air-tight structures (silos), or in unprotected masses, the exterior layers of which rot and act as a seal to preserve the bulk of the fermented crop. If undisturbed, so that air does not reach it, silage will keep indefinitely. The term should not be confused with soilage which is green fodder cut daily and fed fresh to animals confined to barn or dry lot.

Silage Quality

Quality in silage has been based on three different groups of criteria which may or may not be in accord. The first group includes color, odor, and texture. The second group includes certain chemical entities as determined by analytical procedures. Most important of these are: water content, acidity expressed as pH, volatile base content, volatile acid content (chiefly acetic and butyric), and lactic acid. The third group comprises such tests as palatability to livestock, digestibility, and value for milk production or other useful purposes.

Group I—There is rather general agreement that good quality of silage is indicated by greenish or greenish-brown color, pleasant mildly acid odor (not fishy, rancid, moldy, musty, or putreced), and freedom from sliminess and excess moisture.

Group II—Water content—60-72%, optimum 65%; pH—3.8-4.5; Butyric acid—not more than 2.0%; Lactic acid—3 to 5% or more. Figures for the last three are on the dry basis; reduced to 4.5; Butyric acid—not more than 2.0%; Lactic acid—3 to 5% or more. Reduced to the average “as fed” basis (29% dry matter) they would be approximately 0.15, 0.6, and 0.9 to 1.5%, respectively.

Group III—The measures of quality in this group need no description but, with the exception of palatability, can be determined only by carefully conducted feeding and digestion trials. For this reason they do not lend themselves to widespread use in the field. It should be noted here in connection with palatability that cattle sometimes eat silage with apparent relish, which from otherwise faulty structures such as upright silos, horizontal silos with no protective covering, etc. Such decomposed material is not silage at all and should be considered as the result of conditions which permit passage of water from either rainfall or melting snow through the mass of ensiled forage. As distinguished from leaching, seepage may be defined as the result of pressures in the mass of ensiled forage. Seepage loss is the run-off from ensiling of high moisture crops. Solid content of this “silo juice” is usually around 5 to 7%, and consists mainly of minerals, sugars, pectin, and water-soluble nitrogenous compounds. This loss is kept at a bare minimum by wilting in the field to less than 70% moisture, the addition of so-called “conditioners” to absorb the moisture, and freedom from sliminess and excess moisture.

Top spoilage—Top spoilage is the rotted layer which has been formed as the result of conditions which permit passage of air and water through the top of the silo. Overheated silage—Overheated silage is brown in color with a rather pleasing “tobacco” odor. It may be slightly mercaptan at cattle but has undergone so much heating that dry matter losses are excessive. It is similar in character to the silage of European countries.

Silage Moisture Limits

In wet silage losses in the ensiling process are due to seepage (or run-off), top spoilage, and fermentation. These can be kept at a bare minimum by using certain precautions. The resulting loss can be controlled but some loss is more or less inevitable.

Additional terms that may be included in the discussion of silage quality include:

- Fermentation loss—The major fermentation loss is gaseous (carbon dioxide and ammonia) plus a very small amount of liquid which is the product of fermentation.
- Seepage loss—Seepage loss is the run-off from ensiling of high moisture crops. Solid content of this “silo juice” is usually around 5 to 7%, and consists mainly of minerals, sugars, pectin, and water-soluble nitrogenous compounds. This loss can be kept at a minimum by wilting in the field to less than 70% moisture, the addition of so-called “conditioners” to absorb the moisture, and freedom from sliminess and excess moisture.

Example 1—A corn breeder wishes to reduce the number of replications in his yield trials from 4 to 3. He plans to use a randomized block design with 10 varieties for most work, and he requires sufficient precision to detect at the 5% level of significance a true difference of 25% in 80% of his experiments. His present coefficient of variation is 12% and his present plot size is 10 hills (2 rows of 5 hills each). From previous experiments he estimates \( \beta = 0.72 \). What size of plot should he use?

In the proposed design, 18 degrees of freedom are available for estimating error. Hence \( t_1 = 2.101 \) and \( t_2 = 0.862 \). Substituting in the formula we obtain

\[
x^2_{0.72} = 2(2.101 + 0.862)^2(12)^2/3(25)^2 = 1.349
\]

Example 2—The relationship between predicted value of replications, and true difference to be detected is written

\[
d^2 = (t_1 + t_2)^2 C^2 / r x^b
\]

If \( C \) and \( b \) are known and if levels of specified in advance, then \( d \) depends only on \( s \) and can be plotted as a function of these variables. The graph of \( d \) plotted against \( s \) for several combinations of plot size of replications can be determined readily for values of \( d \).—W. H. HATHEWAY, Assistant, Colombian Agricultural Program of The Foundation, Bogota, Colombia.

Published July, 1961

Log \( x = 0.12986 / 0.72 = 0.1804 \)

\( x = 1.52 \).

Since present plot size is 10 hills, plot size of 16 hills in size would be required.