ICARDA
Science for Better Livelihoods in Dry Areas

Successful silage:

Keeping forages for a long time while maintaining good quality

Silage is a technique for the conservation of green forages, using anaerobic fermentation process that develops on any moist forage high in sugars and placed in anaerobic condition. The resulting lactic fermentation is the basis for the stabilization of biomass while maintaining its nutritive value

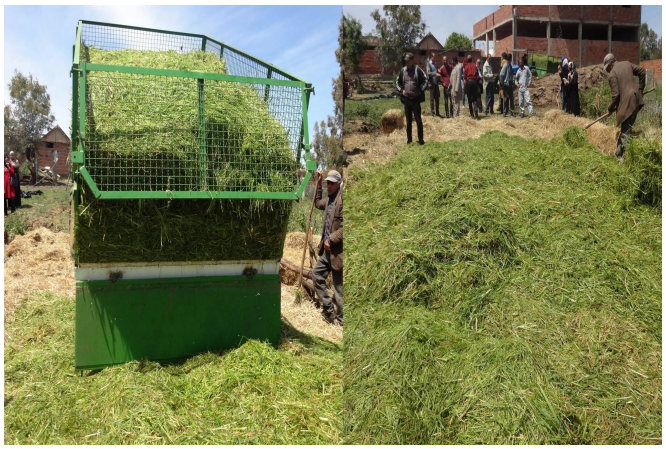
The conservation process and its deviations

After mowing, the green fodder is chopped and stored in silos. Then it goes through two phases:

- **Phase 1 (aerobic):** The action of plant enzymes starts immediately after the silo is sealed and induces a loss of organic matter and sugars and increases biomass temperature
- **Phase 2 (anaerobic):** The action of bacteria that takes place at the end of phase one; If sufficient omount of sugars are available, the fermentation will favor lactic acid production leading to a drop in pH value (3.8-4.2) and stabilization of the forage.

Deviations to be avoided during storage:

- **Butyric fermentations:** Caused by butyric bacteria which are found in the soil in the form of spores and which develop after lactic bacteria in case of insufficient acidity. They create an unstable biomass and damage in forage quality
- **Air (oxygen) in the forage stack:** The presence of air pockets in the silage stack due to low pressing or deficient packaging can lead to secondary fermentations and to molds development responsible of significant organic matter losses and poor quality



How to make silage?

1. Preparation of plots and machinery

- It is preferable to ensile medium and large plots, well leveled and close to the silos location
- Well preparein advance the machinery (tractor, choppers), the plastic to cover the silo in advance (5 kg / ton of plastic, 8 m width) and the machine spare parts

2. Choice of appropriate harvesting stage

- Grasses: early heading
- Corn: hard paste stage (30 to 50% DM)

3. Forage chopping

- A fine chopping (1 to 3 cm) allows a better packing of the silage, avoids air pockets and consequently the production of good quality fodder (high nutritive value and palatability)
- It is preferable to use a drum knife machine (1 to 3 cm fine cutting chopper) or a double-cutter machine (5 to 10 cm)

Benefits:

- Losses of the nutrients are usually much smaller when plants are preserved as silage than when they are are concerved as hay
- Grass silage can be made when weather is not favorable for making good hay
- Many weeds are controlled or weakened when forages are harvested and conserved as silage
- The storage of wet fodder for a long time while keeping high palatability and nutritive value, similar to the green forage
- Maintaining the herd on a well-defined surface area
- Reduce gap in feed deficit by stabilizing the production over medium and long durations
- The increase in total DM intake compared to a ration based on dry fodder and consequently reduction of concentrate feeds use

IRESA Institution de la Recherche et de l'Enseignement Supérieur Agricoles

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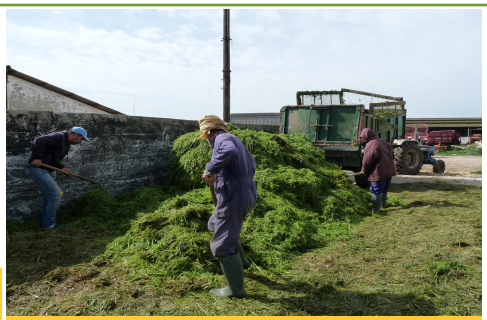


4. The silo

- Silo Location: The silo must be installed in an easy access area, as close as possible to the barn (fast and easy feeding). In case of several barns, the silos must be distributed in a way that optimizes the transportation while covering all barns needs
- Type of silo: Medium-sized pile with fast closing (maximum one or two days after harvesting). The selected location should allow protection from the rain (appropriate slope) and easy clearing of seepage

5. Packing the silo

- The load of the chopped forage starts by the lower part of of the silo to allow air removal. Contamination of the forage stack by soil must be avoided by controlling the cleanliness of the tractor wheels and through shortening the packing time and avoiding excessive seepage losses

6. Tight packing of the silo

- The pit is built layer by layer on a mulched surface using straw. The load is always done according to the central axis to finally lead to a convex shape of the pit. The sealing is ensured by covering the pit by plastic sheets set in strips in the direction of the width of the silo. The plastic is stabilized by using available loads like straw bales, old tires and mud. The plastic strips overlap on 20-30 cm to ensure a good seal

Rapid assessment of the silage quality

• Color

Color	Appreciation
Yellow to green yellow	Very good conservation
Light brown	Good silage, it is a silage which has heated because of a bad packing or a delay in sealing the silo
Dark green	Due to an excess of moisture, this silage is of poor quality, not to be used
Black	Rotten silage, deficient sealing, not to be used
Black stained with white	Moldy silage due to aerobic fermentation (air penetration), unsuitable for feeding, toxicity

• Smell

Smell	Appreciation
Sour without stinging on the nose	Good silage, well developed lactic fermentation
Sour and stinging on the nose	Medium-quality silage, acetic fermentation due to slow work or excessive moisture and/or lack of sugar
Honey or white tobacco	Heated Silage; Smell appreciated by the animals but with low nutritive value
Nauseous	Rotting silage due to butyric fermentation, inappropriate for

• The touch

A viscous silage means a very bad quality due to butyric fermentation; the color is generally dark green to black; this type of silage is not comestible

• pH

pH for silage having 25 to 30% DM	Appreciation
3.5 to 4.2	Very good
4.3 to 4.5	Good to medium
> 4.6	Bad

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About ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is one of 15 centers supported by the CGIAR. ICARDA's mission is to contribute to the improvement of livelihoods of the resource-poor in dry areas by enhancing food security and alleviating poverty through research and partnerships to achieve sustainable increases in agricultural productivity and income, while ensuring the efficient and more equitable use and conservation of natural resources.