

## Grass silages as feedstuff for horses

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Received 22. June 2004, accepted 13 September 2004,

### Abstract

The use of a diet based on silages or haylages is becoming increasingly more important in the prevention and control of some diseases that affect the respirator apparatus of horses. The present knowledge concerning conservation quality and the nutritive value of some of the most commonly used grass silages is studied in depth in this work. In order to evaluate the conservation quality of silages, a series of determinations is necessary that ranges from the dry matter to the chemical composition, from the gross energy to the pH and the dosage of the fermentation products (lactic and butyric acid, ammonia, etc). The nutritive value of silages is often better than that of the corresponding hays due to the earlier stage of the grass at harvesting and to the minor loss of leaves, in particular for legumes. The use of silages could therefore be a valid alternative to hay condition that these products are well conserved, have kept a nutritive value that is similar to that of the original grass, are without risks for the health of the horses (listeriosis, botulism and aflatoxin) and are available in different bale sizes according to the requirements of the stables. In conclusion, grass silages have proven to be useful feedstuff for horses, in function of their quality and the working procedures that their use would imply for the stables. An analytical evaluation of the quality of the product is essential for a correct insertion in the rations and to prevent the most important intestinal problems that affect horses.

**Key words:** Silage, nutritive value, quality, lucerne, ryegrass.

### Introduction

Grass silage is the result of a grass conservation technology whose original purpose is creating a food supply to feed herbivores during the period in which there are no or very few field supplies (cold and dry seasons). Furthermore, the production of hay depends, in particular in North European countries, on weather conditions, which are often rather instable during the haymaking period. This compromises the quality of the hay and is one of the main reasons why silages are gradually taking the place of hay in horse rations, but this is also because the nutritive value of silages is often better than that of hay due to the earlier stage of the grass at cutting and to the lower loss of leaves, in particular for legumes.

As far as the feeding of horses is concerned, the interest in conserving forages overcomes the seasonal problems in that conserved forages for horses (usually hay) that are usually stabled can be given throughout the whole year, as it is almost impossible to have permanent fresh food or through grazing and it is necessary to find a compromise between the management requirements of a stable, the feeding habits of the horses and the nutritional requirements of an animal that is sometimes subjected to heavy work loads. It is in this sense that using silages can offer a valid alternative to hay on condition that these products are well conserved, have maintained a nutritive value similar to that of the original grass, are without risks for the health of the horses (listeriosis, botulism, aflatoxins) and are available in different bale sizes according to the requirements of the stables in that once the conserved silages must be consumed in the shortest possible time to prevent aerobic deterioration. It is therefore advisable for those breeders who have a limited number of animals to make use of silages or haylages that have been prepared in prismatic bales

of about 20 kg or in small to medium sized big bales (50 kg) which should be consumed in the shortest possible time, especially during the hot season. The small bales should have a high density (about 150 kg DM/m<sup>3</sup>) to prevent the development of moulds and yeasts due to the presence of air in the interstices of the silages<sup>9</sup>.

Wrapped big bales and clamp silage used correctly for the feeding of cattle are only appropriate for large stables with specific equipment to move the big bales or to take them out of the clamp and when there is such a large number of horses as to guarantee the quick consumption of the big bale or the quick advancement of the bale removal face of the silos. From the economic point of view, it would however surely be preferable to use ensilages in big bales or in clamp due to the lower cost per unit of the product.

The forage (grass and/or legumes) conserved for ensilaging should undergo a rapid lowering of the pH, consequent to the production of lactic acid caused by fermentation due to lactobacilli, to prevent the development of moulds which are responsible for deterioration of badly preserved or badly packed products or those that are badly wrapped with the plastic wrapping. For this reason those silages that have evident signs of change (the presence of mould, the smell of ammonia, alterations in the consistency and colour, excessive humidity) or whose containers appear damaged should not be given to the horses<sup>11</sup>. Cases of botulism have in fact been encountered in horses due to the use of badly conserved big bales of silage<sup>12</sup>.

The adaptation of a regime based on feeding with silages or haylages on the other hand is becoming more and more important in the prevention and control of some diseases that affect the

respirator apparatus of horses. The dust contained in hay and in the horse-litter straw is in fact the factor that triggers chronic respirator symptomatology in allergic animals. In Finland, for example, respiratory problems are the second most common cause of illnesses in horses<sup>14</sup>. It has been shown how food based on feeding with haylage, together with a non-dusty horse-litter straw, allows the remission of clinical symptoms of horses affected by chronic obstructive pulmonary disease (COPD) to remain stable<sup>15</sup>. Comparative studies on the quantity of respirable particles connected to various types of silages have in fact shown that the level of dust in silage is much lower than that of hay<sup>10</sup>. Among the works that deal with the use of silages in horse food, most concern maize silage<sup>1, 6, 7, 8</sup> although grass and legume silages have also recently been studied<sup>2, 4, 13, 14</sup>. The purpose of this work is to supply a framework of the present knowledge of both the nutritive value and the conservation quality of the silages used for feeding horses.

### Characteristics of Grass Silages

As already mentioned, the use of silages is becoming more widespread, even in the horse sector, but on one condition: that the knowledge relative to the quality of conservation and the nutritive value of these products, (which vary considerably according to the type of farming and the vegetative state, to the degree of drying, to the ensiling technique etc.) should be studied in detail by the breeders and experts. The ensiling of grass silages, in particular with respects to haymaking, allows remarkable advantages to be obtained first of all because of a diminishing of the meteorological risks thanks to the fact that the cut silage remains in the field for a shorter time and secondly because of the possibility of cutting in earlier periods than for haymaking. It is however necessary to respect precise rules in order to ensure an optimal conservation quality with the minimum loss of nutritive elements and therefore a nutritive value of the silage similar to that of the original grass.

Successful ensiling depends, amongst others, on some of the characteristics of the grass at harvesting: the contents of dry matter (DM), the concentration of fermentable sugars and the buffering capacity. The DM content should not be too low in that a high moisture determines losses due to percolation and favours undesirable fermentation, in particular *Clostridium* fermentation. The concentration of fermentable sugars should be equal to at least 3% of the water from the ensiled grass, that is, sufficient to favour a rapid lactic acid bacteria activity. The buffering capacity represents the resistance of silage to become acidic. The higher this capacity, the higher the quantity of lactic acid that the lactic acid bacteria must produce to lower the pH and therefore the higher the quantity of sugar that these bacteria must have available to continue to produce lactic acid. These characteristics of the grass which can be changed by prewilting, together with a perfect ensiling process, are able to ensure a good conservation quality and a nutritive value that is similar to that of the original grass.

An ensiled forage, which has undergone fermentation without the presence of air, undergoes decay which gradually changes the chemical composition leading to a qualitatively different product for which it is necessary to carry out a series of determinations that range from the DM to the centesimal composition, from the gross energy to the pH and to the dosage of the fermentation products: lactic acid, volatile fatty acids (acetic, butyric, etc.),

alcohol (methanol and ethanol), ammonia and soluble nitrogen. Italian ryegrass and lucerne, if correctly ensiled, could constitute a valid alternative to hay and/or dehydrated lucerne meal.

**Italian ryegrass:** Italian ryegrass is a grass that is particularly rich in water-soluble carbohydrates (WSC) and is characterised by a low level of DM. The WSC contents at the cutting moment and at four levels of wilting are shown in Table 1. As can be seen, prewilting determines a reduction, due to the respiration of the WSC, of the DM, but at the same time there is a progressive increase in concentration of the WSC % of the fresh matter (FM) due to evaporation of the water. In cut grass the WSC (3.6%) represents a substratum that is sufficient for fermentation.

**Table 1.** Concentration of water-soluble carbohydrates (WSC) in Italian ryegrass.

DM grass (%)	15 (Grass at cut)	20	27	30	50
WSC % DM	23.5	21.2	20.8	19.9	19.0
WSC % FM	3.6	4.2	5.6	6.0	9.5

It emerges that Italian ryegrass silage at 20% DM already has a good conservation quality. However, ensiling at 27 and 30% improves the conservation quality. The most pre-dried silages (around 50% of DM) are instead characterised by a restriction of the fermentation, with a low production of lactic acid and a higher pH. Italian ryegrass can already be considered a good crop for silages both in big bales and in clamp at prewilting to 20-22% of DM. If one takes into consideration that when ensiling at about 20% of DM, the quantity of the percolate that is produced is remarkable and equal to about 100 L/t, Italian ryegrass can be successfully ensiled at about 25-27% with the double purpose of avoiding an excessive formation of percolate and improving the conservation quality.

**Lucerne:** Lucerne has a higher degree of DM than Italian ryegrass, which allows a quicker pre-drying to take place. This legume is however characterised by a low sugar content (1.8-6% DM) and a discrete buffering capacity which makes ensiling more difficult. The lowest degree of prewilting that allows a good conservation to be obtained has been identified as about 36% of DM, with silages that are characterised by a greater production of lactic acid, a lower pH and a lack of butyric acid or only present in traces, compared to those that are less dried. The use of lactic acid bacteria inoculations has permitted good silages to be obtained even with slightly lower pre-wilting (around 33% DM) (Table 2).

Inoculation in fact usually acts by accelerating the production of lactic acid and by favourably directing the fermentation with a quicker lowering of the pH in the big bales that have been inoculated than those that have not been treated. In practice, the lactic acid bacteria, having activated the relative fermentation, make the use of the sugar that is present in grass more efficient, and they play a protective role as far as *Clostridium* activity is concerned, with a lower production of ammonia nitrogen. However, weather conditions permitting, it is better to wilt at over 36% in order to obtain silages with an optimal conservation quality.

Inoculation with lactic acid bacteria has also proved to be

**Table 2.** Chemical composition of the 200 days lucerne silages uninoculated and inoculated with lactic acid bacteria <sup>3</sup>.

DM at ensiling	325	325	380
	uninoculated	inoculated	uninoculated
DM (g/kg)	336	336	398
pH	5.25	4.85	4.94
Lactic acid (g/kg DM)	40.8	58.3	40.9
Acetic acid (g/kg DM)	19.3	29.6	12.8
Butyric acid (g/kg DM)	0.1	0.0	0.0
Methanol+ethanol (g/kg DM)	6.7	6.8	7.2
NH <sub>3</sub> -N (g/kg total N)	85	59	34
Soluble N (% total N)	75	76	80

efficient in limiting the negative effects of aeration, even in particularly critical conditions such as those that derive from a prolongation of the initial aerobic stage following the delayed closure of the silo. This latter occurrence is typical of farm situations in which the collection of the big bales takes place in the evening and the wrapping is carried out the following day. This situation can also occur in clamp silage when the filling and closure are not performed quickly enough. In these cases, with the prolongment of the aerobic stage due to the delay in wrapping or closure, there is a greater oxygenation of the mass, which determines a greater increase in temperature and more intense respiration processes due to the sugar with a subtraction of a part of this sugar for lactic acid fermentation. Respiration therefore causes greater losses of DM, which derive from the production of carbon dioxide and increase where fermentation of sugar and lactic acid takes place and deamination and decarboxylation of the amino acids are carried out by *Clostridium* and enterobacteria.

#### Use and Nutritive value of Grass Silages for Horses

Apart from evaluating the conservation quality, in order to be able to insert silages in suitable rations to satisfy the energy requirements of horses at rest or those that are used for various types of work, it is necessary to determine the voluntary intake and the digestibility and to calculate the nutritive value. With this purpose in mind Bergero et al.<sup>2</sup> carried out trials using perennial ryegrass hay silages packed in prismatic bales of a weight of about 20 kg and fed to ponies of a mean weight of 325 kg.

The perennial ryegrass haylage appeared to be in a good state of conservation and a palatability by the horses superimposable to that of the hay, with a voluntary intake that varied between 85 and 98 g DM per kg metabolic weight for the horses at rest and those subjected to a medium work load, respectively. The digestibility coefficients were similar to those reported in literature for a good hay with an analogous chemical composition. The nutritive value for the three tests, in terms of net energy, was between 0.62 and 0.54 UFC/kg DM. This variability can be put down to the differences in production loss due to the different vegetative stages at which the perennial ryegrass was ensiled. From this we can deduce that the chemical composition of these commercial silages should be checked periodically and the nutritive value should be recalculated at regular intervals in order to guarantee that the requirements of the horses are satisfied.

For purely indicative purposes, we would like to recall that the feeding of slightly dried lucerne farm silages that were consumed normally by dairy cattle were however not appreciated by horses because of the excessive humidity of the big bales that were used (with a mean DM content of 31.3%) which determined an intense

and anomalous fermentation (pH 5.45 and NH<sub>3</sub> 9.68 g/kg DM) and this led to a constant refusal by the horses to eat it. However, the use of very dry legumes (DM more than 50%) should be more successful due to the lower content of fermentation products and a better conservation quality. For this purpose, Hill and Ellis<sup>5</sup> observed how even horses that had no previous experience of being fed with lucerne-based products accepted silages of this legume, which is characterised by a lower mechanical resistance to chewing and to the formation of bubbles and a consequent reduction in salivation. This could have implications on the digestion of lucerne silages just as less intense chewing can lead to a lower degree of shattering of the food particles.

To conclude, grass silages have proved to be feedstuff that can be used in the feeding of horses in function of their quality and the working conditions that their use would involve in the stables. An analytic evaluation of the quality of the products, before their use, is essential to correctly insert them in the food rations and in order to prevent the most important intestinal problems that occur in horses.

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