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# SUITABILITY OF ALFALFA AND ORCHARD GRASS FOR ENSILAGE

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**Abstract:** Alfalfa and orchard grass should have, in terms of suitability for ensilaging, the appropriate content of soluble sugars, the corresponding dry matter content and low buffer capacity. When using plants that are less suitable for silage, it is necessary to increase dry matter content in the biomass by adding sugar components and enzymes to direct the fermentation process in order to provide quality and stable silage.

**Key words:** sugars, buffer capacity, dry matter, silage, silage fermentation

## Introduction

One of the most suitable method of forage conservation is silage. Many types of silage spoil no matter how carefully and good the silage is hermeticaly sealed. For the good of preserving at least two factors are necessary: providing storage without the presence of oxygen, where success depends on the degree of conservation of biological acidification. Forage crops from blade grass group are better suited for silage in relation to forage crops from legume group.

## Materials and Methods

For this study we used the following material for the silage preparing: alfalfa (*Medicago sativa* L.) (K-22) and orchard grass (*Dactilys glomerata* L.) (K-40);

Alfalfa (*Medicago sativa* L.) - Kruševačka 22 (K-22) is a widespread cultivar. It is characterized by an upright, well leafed and moderately branched stems. It features a high quality dry matter yields (up to 20 t $ha^{-1}$) protein-rich and of excellent digestibility (18-20% of crude protein). Able to withstand drought and low temperatures. Perfectly adapted to our climatic and soil conditions, which enables the stable yields and a longer period of alfalfa field utilisation.

Orchard grass (*Dactilys glomerata* L.) - Kruševačka 40 (K-40) is high-quality and highly productive cultivar with a yield of 12 t $ha^{-1}$ of hay with 16.5% of

crude protein. Plants are medium height with a lot of vegetative tillers. It is resistant to drought and low temperatures. It is recommended for mixtures, but also for pure crop with the sowing norm of 20-25 kg $ha^{-1}$.

Alfalfa and orchard grass were harvested at flowering stage. Green mass was chopped using silo-shredder (Figure 1) to bits about 20-30 mm in length and ensiled in experimental plastic pots with 20 liters (Figure 2) with PVC foil preset onto the walls of the experimental pot, and from the top it was pressed with a layer of sand of 10 cm. In this experimental pot, 10 kg of silage is compacted by treading.

Fresh mass of both alfalfa and cocksfoot was ensiled as a pure (L-100% J-100%). During testing, the parameters of convenience and orchard grass alfalfa biomass for silage, dry matter (DM) and sugar content/buffer capacity ratio (S/BC).

**Figure 1. Ensilaging of alfalfa biomass using silo-shredder (Globoder)**

**Figure 2. Experiment ensiling alfalfa and orchard grass (Globoder)**

## Results and Discussion

Alfalfa is one of the forage crops that are very difficult to ensilage. Low sugar content causes the creation of small amounts of lactic acid which results in a high pH, which can not prevent butyric fermentation. Simultaneously, an intensive breakdown of proteins and amino acids occurs, the pH of silage increases causing the silage to spoil. In plants that are cut several times during the year, differences in ensilaging suitability were found, and are caused by the share of leaves and stems, or by the different buffer capacity and sugar content. In the number of researches, it has been found that the silomass from the first cut was more suitable for ensiling than the mass from the second or last cut, *Knežević (2009)*. Many authors *(Kolarski et al., 1989; Antov et al., 1994; Babnik et al., 1994; etc.)* have found that the proportion leaves:stems in the first cut of alfalfa was about 40:60 and in the last cut about 60:40. With the growth of the plant, a decrease in the relative proportion of leaves in relation to the stem was determined, and with this came the change in sugar content and buffer capacity. This is because the leaves contain more nutrients essential for quality in relation to the stems *(Ignjatović et al., 1998)*. With maturing (ripening) of forage crops, the suitability for ensilaging improved, meaning the concentration of sugar increased, and buffer capacity was reduced.

The average value of dry mass was 386 g $kg^{-1}$ in the flowering stage in fresh alfalfa (Table 1). During the maturing of plants, the yield of dry matter increased, meaning that when ensiling mature plants (drier material with less protein), and the process of fermentation was better but the silage had less nutritive value as a result of intensive lignification process.

**Table 1. The alfalfa biomass for ensilaging (g $kg^{-1}$ DM and meg lactic acid/100 g DM)**

| Description sample | Dry matter (DM) | Buffer capacity, meg lactic acid/100g dry matter | Monosaccharides | Total sugar content | Sugar/Buffer capacity (S/BC) ratio |
|---|---|---|---|---|---|
| chopped alfalfa | 390 | 65.6 | 80.5 | 98.7 | 1.50 |
| chopped alfalfa | 391 | 59.1 | 83.4 | 95.9 | 1.62 |
| chopped alfalfa | 377 | 70.0 | 91.1 | 104.1 | 1.48 |
| Average value | 386 | 64.9 | 85.0 | 99.5 | 1.53 |

Buffer capacity of alfalfa silomass at the flowering stage was in average 64.9 (Table 1).

The ratio of water soluble carbohydrates and pufernog capacity was in average 1:53

*Smith et al. (1974)* have determined the amount of water soluble carbohydrates in the green mass of alfalfa from the first cut in the initial flowering phase, and it was 70 g $kg^{-1}$ DM. Identical amount of water soluble carbohydrates

were found by *Dinić et al. (1995),* which is slightly lower compared to the results we obtained in our research.

*Podkowka and Podkowka (1995)* have determined, in the initial flowering phase of alfalfa, the amount of water soluble carbohydrates 61.8 g $kg^{-1}$ DM, where the percentage of dry matter was 194 g $kg^{-1}$. Buffer capacity was 98 meg of lactic acid /100 g SM.

In the data of *Mišković et al. (1991),* it was stated that the buffer capacity of alfalfa silomass ranged from 390 to 570 mE $kg^{-1}$ DM.

Suitability for ensilaging is not a constant feature, so its rating should be based on the specific conditions in each case.

A number of factors also affect the suitability of orchard grass. Forage crops from the group of blade grasses are better suited for silage in relation to forage crops from the group of legumes.

**Table 2. The orchard grass biomass for ensilaging (g $kg^{-1}$ DM and meg lactic acid/100g DM)**

| Description sample | Dry matter (DM) | Buffer capacity, meg lactic acid/100g dry matter | Monosaccharides | Total sugar content | Sugar/Buffer capacity (S/BC) ratio |
|---|---|---|---|---|---|
| chopped cocksfoot | 397 | 38.6 | 81.0 | 102.2 | .64 |
| chopped cocksfoot | 427 | 40.0 | 95.8 | 111.1 | 2.77 |
| chopped cocksfoot | 448 | 40.2 | 108.0 | 125.0 | 3.10 |
| Average value | 424 | 39.6 | 94.9 | 112.7 | 2.83 |

Among the forage crops, considering S/BC, alfalfa takes the last place, while this ratio in orchard grass and blade grasses is somewhat better. It is known that there are differences in sugar content among cultivars within species. *Dent and Aldrich (quoted McDonald, 1985)* found that early orchard grass cultivars had higher sugar content than late cultivars.

The harvesting of blade grasses should be done when the inflorescence is formed (at the earing stage). Younger plants have higher content of soluble sugar, and the dry matter content should, also, be taken into account. If the plants are harvested in the earlier growth stages, the so called effluent and excess water occurs due to increased water content.

By analyzing the suitability of alfalfa for ensilaging, compared to orchard grass and vice versa, we noted that the buffer capacity is far greater in alfalfa and that the rest of the results were better in orchard grass (Table 2).

The carbohydrate feed are added to the green mass of crops that are difficult to ensilage. When added, the ratio of S/BC and DM content is increased, thus improving the creation of lactic acid, and thus the acidity of silage. For this purpose, the following carbohydrate feed are used: ground corn, ground grain, fresh and dry sugar chopped beet, etc. The problem of ensiling crops unsuitable for silages with addition of carbohydrate feed was addresed by *Dinić et al. (1988),*

*Čobić et al. (1989), Jelač et al. (1991), Lin et al. (1992), Dinić et al. (1996), Knežević (2009).*

Ground corn is a supplement that can be easily produced and provided on each farm, is easily dosed and distributed in plant mass and has a positive effect on the total value of silage. Also, it reduces humidity of ensilaged material and drainage of juices. Recommended dosage is 4-7%.

In recent years there is a tendency to stimulate lactic acid fermentation in the ensiling. This is achieved by adding a homofermentative lactic acid bacteria (*Lactobacillus* spp., *Streptococcus* spp., etc.), with the obligatory addition of carbohydrate feed for biomass unsuitable for ensiling. By this procedure, sugars are more rational utilized in the production of lactic acid and undesirable microflora is suppressed.

## Conclusion

In plants that do not have sufficient content of fermenting sugar and have low BC in silage and DM content above 250 g $kg^{-1}$, it is necessary to determine the sugar content and BC, find the S/BC ratio, critical pH value and the minimum content of DM, which guarantees the absence of butyric acid and stability of the silage. This problem is solved by ensiling the more suitable plants or by adding carbohydrate feed and inoculates of lactic acid bacteria.

## Pogodnost lucerke i ježevice za siliranje

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## Rezime

Lucerka i ježevica sa aspekta pogodnosti za siliranje treba da imaju odgovarajući sadržaj rastvorljivih šećera i odgovarajući sadržaj suve materije i niski puferni kapacitet. Od biljaka koje su manje pogodne za spremanje silaže, potrebno je biomasi povećati sadržaj suve materije dodavanjem šećernih komponenti i fermenata u cilju usmerenja procesa vrenja, kako bi se obezbedila kvalitetna i stabilna silaža.

## References

ANTONOV G., ČOBIC T., KUNC V., ANTOV A., KASAPOVIĆ C. (1994): Examination of losses in nutritive matter in alfalfa in hay production by baling. Modern agriculture, 6, 81-86.

BABNIK D., RESNIK-ČEPON M., VERBIC J. (1994): Nutritive value of leaves and stems in different lucerne varieties. Krmiva 36, 4, 169-175.
ČOBIC T., VUČETIĆ S., LAZIĆ V., DRAGIŠIĆ P., OVDIJENKO A. (1989): Use of additives in alfalfa eniling. Proceedings, 19-20, Institute for animal husbandry, 293-302, Novi Sad.
DINIĆ B., STOŠIĆ M., KOLJAJIĆ V. (1988): Influence of different ratio of alfalfa and corn on quality of silage. Proceedings Institute of agriculture Osijek. Production and utilization of forage crops. VI Yugoslavian Symposium on forage crops. 525-533, Osijek.
DINIĆ B., KOLJAJIĆ V., STOŠIĆ M., IGNJATOVIĆ S., LAZAREVIĆ D. (1995): Examinations on the possibility of alfalfa ansiling. Proceedings 7th International Symposium Forage Conservations, Nitra, Sovak Republic, 105-109.
DINIĆ B., KOLJAJIĆ V., STOŠIĆ M., IGNJATOVIĆ S., LAZAREVIĆ, D. (1996): Use of carbohydrate feed and formic acid for alfalfa conservation. Proceedings of Institute for field and vegetable crops, book 26, 491-498, Novi Sad.
IGNJATOVIĆ S., DINIĆ B., KOLARSKI D., UROŠEVIĆ B. (1998): Chemical composition of first and second cut of lucerne (*Medicago sativa L.*) of different stages of maturity. Ecological Aspect of Grassland Management. Proccedings 17th General Meeting of the European Grassland Federation, Debrecen, Hungary, 729-732.
JELAČ S., HANDŽIĆ R., MURATOVIĆ S., DZOMBA E. (1991): The influence of carbohydrate additives and formic acid on the indicators of alfalfa silage fermentation. Proceedings, Faculty of agriculture, 153-162, Belgrade.
KOLARSKI D., PAVEŠIĆ-POPOVIĆ J., KRSTIĆ O., KOLJAJIĆ V. (1989): Fiber composition of Successive Cuts of Lucerne. XVI International Grassland Congres, 724-728, Nica.
KNEŽEVIĆ J. (2009): Quality and nutritive value of silage depending on ratio of alfalfa, orchard grass, ground corn and inoculates. PhD thesis, Faculty of agriculture, University of Priština, Kosovska Mitrovica.
LIN C., BOLSEN K., BRADFORD J.E., BRENT B.E., FEYERHERM A.M., AIMUTIS W.R. (1992): Effects of biomate inoculant and dextrose on the fermentation of alfalfa silages. Cattlemen's day 1992. Agricultural Experiment Station Kansas State University, Manhattan, Report of progress, 651, 118-123.
Mc. DONALD P. (1985): Biochemistry of silo. "Agropromizdat" Moscow.
MIŠKOVIĆ B., ERIĆ R., ĆUPINA B. (1991): Newer discoveries of biochemical processes in silage. Proceedings, 19, 507-517, Novi Sad.
PODKOWKA W., PODKOWKA Z. (1995): Use of high-pressure balers in preparation of alfalfa silage. 7$^{th}$ International symposium Forage conservation. September 18$^{th}$-20$^{th}$, 125-126, Nitra, Slovak Republic.
SMITH D., ROHWEDER D.A., JORGENSEN N.A. (1974): Chemical composition of three legume and four grass herbages harvested at early flower during three years. Agronomy Journal, 66, november-december 1974.

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