RESEARCHES REGARDING THE ACTION OF SOME INFLUENTIAL FACTORS ON THE NUTRITIVE COMPOSITION OF THE CORN SILAGE

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Abstract

The pourpose of the research was to show the influence of the ensilage on the chemical composition of corn silo. The material studied was corn silage from different silos respectively: SA - silage covered with waterproof foil, has been introduced corn in phase of wax maturity and SN - uncovered silage (covered with 20 cm of chopped straw) has been introduced corn in similar phase of maturity. Samples were collected from the surface of the silo (50 cm deep) CS1 and SN_1, the laterally sides of the silo (70 cm from side walls) US2 and CS2, and from the centre of the silo US2 and US3. Following the calculations performed on samples collected from the silo were observed appreciable differentiations in terms of the DM (CS1 - 328.3 g/kg gross SN_1 - 262 g/kg gross) and Ash (CS1 - 48 g /kg DM, SN_1 -90.1 g/kg DM). CS2 and US2 content of samples varied for DM (CS2 - 244 g/kg gross, US2 - 319.8 g/kg gross), CP (CS2 - 72.3 g/kg DM, US2 - 96.3 g/kg DM) and CF (CS2 - 254.2 g/kg DM, US2 - 228.9 g/kg DM). Tests on samples US2 and US3 showed a relative consistency in chemical composition compared with other samples. Chemical composition of studied silos were influenced by several factors as stage of growth at harvesting, silage technology, climatic conditions, factors that led to a decrease of quality of the pickled fodder studied.

Key words: corn silage, chemical composition, influential factors;

INTRODUCTION

Corn harvested for silage is an important feed crop. The crop provides livestock producers with a high-yielding, relatively consistent source of forage and the animals with a highly digestible and palatable feed [13]. Crop managers are more closely monitoring crop maturities to ensure optimum dry matter levels at harvest. Harvesters adjust chop length, height and processing to deliver a potentially high quality feed to the storage structure. A great challenge to successful silage production occurs in the silo, an bunker. In a silo, microbial processes can be modified to enhance fermentation, through management practices such as harvest moisture, length of harvest period, oxygen exposure, and silage inoculation [10]. Optimum silage fermentation occurs in an oxygen free environment. More dense silage provides ideal conditions for rapid oxygen depletion at the start of fermentation and minimizes the introduction of oxygen back into the silage pack during storage and feedout.

Any good forage crop should have high dry matter yield, high protein content, high energy content (high digestibility), high intake potential (low fiber), and optimum dry matter content at harvest for acceptable fermentation and storage. With the exception of high protein level, corn silage exhibits these characteristics better than other forages. The production difficulty farmers often encounter is timing harvest so that the proper moisture for ensiling is obtained for the storage. If corn silage is too wet then yield is often reduced, silo seepage occurs and the silage is sour tasting resulting in lower intake by livestock. If corn silage is too dry then yield is often reduced, heat damage and mold more easily develops in the silo because fermentation is inadequate, and the silage has lower protein and digestibility. Maturity at harvest [10; 7; 8; 14] and cutting height at harvest [3; 4] also affect grain and stover content and subsequent corn forage quality. Corn silage is variable in nutrient value due to hybrid, climatic conditions, maturity upon harvest and conservation methods [15;17].

MATERIALS AND METHOD

The material used in the experiments was procured from a farm from Bacău county, respectively corn silage, consisting of corn hybrids for silage Monalisa and Florence and a hybrid for grain PR38V9, hybrids sold by Pioneer. Maize was sown in early May on three parcels, of which only two (plots planted with hybrid PR38V9 and Florence) were works of fertilization with manure (45t/ha) and without irrigation. Maize was harvested between 11.08 - 25. 08.2007. The harvesting took place at a height of 10-12 cm from the soil in order to avoid the contact of the chopped mass with the soil and harvested mass was chopped at the dimension of 10 - 20 mm, condition in which the cobs were well fragmented and the beans broken. Samples of silage were taken from a silo covered with polyethylene film (CS)(closed on 16.08.2007 in the composition of which were introduced hybrids PR38V9 and Monalisa) and a silo uncovered (US), (covered with 20 cm chopped straw, which was introduced corn hybrids in Florence, Monalisa and PR38V9 and closed on 26. 08.2007). Samples were prepared for analysis in accordance with the rules in the standard: - SR ISO 6498/2001 (Fodders. Preparation of samples for analysis). Analysis of chemical composition took place in INCDBNA - Baloteşti. For chemical determinations were performed using the standards: ISO 6496/2001 feed. Determining the moisture content and other volatile substances, ISO 5984/2001 feed. Determining the crude ash, SR 13325/1995 feed. Determining the nitrogen content and calculation of protein content, ISO 6492/2001 feed. Determining the fat content, SR EN ISO 6865/2000 feed. Determining the gross fiber content filtering with intermediary method . Determining the neutral detergent fiber and acid detergent fiber was performed by gravimetric method and the starch was carried out by the polarimetric method according to ISO 6493/2000.

RESULTS AND DISCUSSION

High temperatures in May, June and July correlated with reduced amounts of precipitation fell in these months characterized agricultural season in 2007, dry one (tab.1). Slower development of plants in the first three months of growing season was caused by environmental conditions (drought and high temperatures). Rainfall fell in August and reported normal temperature, resulted filling grains and green part of plants (wilting prematurely). The consequence of environmental conditions has been increasing medium content in dry plant mass, but also a decrease in production of green mass per hectare (23-30 t / ha).

Table 1
Temperature and monthly precipitation amounts from 2007

Month	Temperature			Precipitation		
	2007	Needed ºC	1971-2000	2007	Needed mm	1971-2000
May	18,6	15-20	16,1	35,5	60-80	62,7
June	23,2	18-21	19,5	34,2	100-120	97,6
July	25,4	20-23	20,8	37,6	90-100	81,8
August	22,4	19-22	20	79,6	40-60	58

The stage of maturity at harvest is a major factor in determining the nutritive value and fermentation characteristics of corn silage [6; 9] therefore, in an attempt to optimize nutrient value and achieving high milk production , ensiling at proper stage of kernel maturity, wax is often recommended [1;12].

Results of chemical composition performed on silage samples are presented in tab. 2. The average in DM was variable in silos mass, the covered silo (CS) from 24 - 33% DM, and uncovered silo (US) 26 - 32% DM depending on the harvest. Filling silos (over two weeks), type and location of parcels hybrids, along with weather conditions have influenced samples content in DM. Hybrid and DM content at harvest had highly significant effects on forage quality characteristics [2].

Table 2
Gross chemical composition of silage samples

Specification		Samples of corn silage					
		CS 1	US 1	CS 2	US 2	CS 3	US 3
DM (g/kg raw)	$\bar{x} \pm s\bar{x}$	328.3±0.83	262±0.61	244.2 ±0.59	319.8±0.55	285.2±0.59	319.4±0.87
	V %	0.98	0.90	0.93	0.66	0.8	0.86
CP (g/kg DM)	$\bar{x} \pm s\bar{x}$	73.7± 0.34	95.5±0.49	72.3±0.36	96.3±0.45	83.8±0.34	97±0.26
	V %	1.8	1.98	1.92	1.81	1.57	1.04
Fat (g/kg DM)	$\bar{x} \pm s\bar{x}$	18±0.17	26.7±0.33	28.1±0.21	22.5±0.24	19.6±0.14	22.5±0.2
	V %	3.62	4.77	2.84	4.11	2.72	2.52
CF (g/kg DM)	$\bar{x} \pm s\bar{x}$	210.2±0.42	264.5±0.28	254.2±0.34	228.9±0.33	235.7±0.35	229±0.21
	V %	0.78	0.41	0.52	0.56	0.57	0.36
NFE (g/kg DM)	$\bar{x} \pm s\bar{x}$	650±0.37	523.2±0.32	583.9±0.4	593.5±0.44	605.9±0.24	595.9±0.46
	V %	0.22	0.24	0.26	0.28	0.15	0.3
Ash (g/kg DM)	$\bar{x} \pm s\bar{x}$	48.1±0.28	90.1±0.31	61.3±0.4	58.8±0.32	55±0.22	55.4±0.22
	V %	2.28	1.35	2.51	2.1	1.56	1.52

CS1 and US1 - samples collected at 50 cm from the silo, CS2 and US2 - samples collected at 70 cm from the side walls; CS3 and US3 - samples collected from middle of the silo;

Recent studies shows that the crude protein content of corn silage made from corn harvested after a period of drought, but with relatively green plant at harvest, little ear and with 24% DM, the crude protein was 113 g/kg DM and when ear was little, plant almost dry, with the 46.6% DM crude protein was 82 g/kg DM. Under heat stress, a silo made with corn silage hybrids register loss compared with a normal silage by 33% DM and 83 g/kg DM crude protein [11].

Average content of crude protein in the two silos were close (in silo CS: 73.7 ± 0.34g/ kg DM, 72.3 ± 0.36 g/kg DM, 83.8 ± 0.34 g/kg DM; and silo US: 95.5 ± 0.49 g/kg DM, 96.3 ± 0.45 g/kg DM, 97 ± 0.26 g/kg DM), ranging is within the limits mentioned above.

In tab.3 is presents the content of fiber and starch analyzed silos. The crude cellulose, neutral detergent fiber and acid detergent fiber evolved inversely proportional to the dry mater of silage. With the increasing amount of dry matter, in silage decreased the amount of crude fiber. This development was reported by Johnson et al., (1999), the NDF and ADF were lower as the plant is more advanced phase of growth at harvest. This is due to increase in the share ear in whole plant [1; 9; 18].

The nutritional composition of drought stressed corn silage is strongly dependent on grain set and development of ears, which can be reduced significantly when there was a water deficit at the time of pollination. Sugars build up in the green parts of plants with no ears or partly filled ears resulting in nutrients only partly being translocated to the ear and converted to starch.

Table 3
The fiber and starch content in corn silo

Specification		Samples of corn silage					
		CS 1	US 1	CS 2	US 2	CS 3	US 3
DM (g/kg raw)	$\bar{x} \pm s\bar{x}$	328.3±0.83	262±0.61	244.2 ±0.59	319.8±0.55	285.2±0.59	319.4±0.87
	V %	0.98	0.90	0.93	0.66	0.8	0.86
NDF (g/kg DM)	$\bar{x} \pm s\bar{x}$	478.5±0,35	566.03±0,45	543.3±0,42	482.8±0,46	528.8±0,38	503.8±0,4
	V %	0,28	0,31	0,3	0,37	0,28	0,31
ADF (g/kg DM)	$\bar{x} \pm s\bar{x}$	294.2±0,23	319.5±0,42	342.6±0,29	315±0,54	315.6±0,38	305.6±0,4
	V %	0,3	0,5	0,32	0,66	0,47	0,51
Starch	$\bar{x} \pm s\bar{x}$	227,8±0,37	170,2±0,44	136±0,23	180,06±0,22	152,2±0,27	176,4±0,32
	V %	0,63	1	0,65	0,48	0,67	0,7

CS1 and SN1 - samples collected at 50 cm from the silo, CS2 and US2 - samples collected at 70 cm from the side walls; CS3 and US3 - samples collected from middle of the silo;

Evolution of the average quantity of starch in the silo has been directly proportional to the changing content in dry matter. Thus, if for 244.2 g/kg gross DM amount of starch was 136 g/kg DM, increase the average amount of DM at 328.3 g/kg resulted a increase of average starch content with 90 g/kg DM (tab.3), values approaching with presented by Bal et al., (1997) [1].

In the uncovered silo amount of starch was recorded between 170 g/kg DM and 180 g/kg DM and DM average value registered was between 262 g/kg raw and 319.8 g/kg raw. Increasing the amount of starch with 10 g/kg DM can be caused by type of hybrids used in silo (in the largest proportion were introduced corn hybrids for silage), drought stressed wich has not allowed a normal development of plant and ear.

Ash found in the two silos had values between 48.1 and 61.3 g/kg DM, similar to those presented by Burlacu et al., (2002), except the sample taken from the silo US 90 g/kg DM which can be due to accumulation of dirt from the silage [16].

CONCLUSION

Reaseches performed have shown a variability in the quantity of dry matter (CS1 328.3 g/kg raw US1 262 g/kg raw CS2 244 g/kg raw US2 319.8 g/kg raw CS3 285.2 ± 0.59 g/kg raw US3 319.4 ± 0.87 g/kg gross) in silos mass, due to the location of maize crops, by type of hybrid used and long periods of harvesting.

Although the quantity of NDF and ADF decreased with increasing amount of dry matter in silage, their level was relatively high due to heat stress and drought.

Variability of chemical composition of corn silo was determined largely by the poor homogenization of green mass used in silage.

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