

Effects of Ensiling Duration on Chemical Composition of Maize Silages

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Abstract

The present study was conducted to investigate the effects of ensiling durations on nutritional composition of maize silage. For this purpose, chopped maize samples were ensiled in 3-liter glass jars for 7, 14, 21, 28, 35, 42, 49 and 56 days. Ensiling duration significantly increased crude protein (CP) and crude oil (CO) CP contents of maize silage ($P < 0.05$). The initial pH value of 4.43 decreased to 3.87 at the end of 56 day ensiling period. On the other hand, there were not any significant changes in dry matter (DM), crude ash (CA), ADF and NDF content of maize silage throughout 56-day ensiling period ($P > 0.05$). Current findings revealed that increasing ensiling durations created significant decreases in pH contents and increases in CP and CO contents. It was concluded that minimum ensiling duration for maize silage should not be less than 40 days.

Key words

Maize, Silage quality, Ensiling duration, Conservation, Nutritional composition

1. INTRODUCTION

Meat, milk and egg-like animal products have a great place in human nutrition. In Turkey, feed costs constitute the primary input of livestock facilities (50-70%). Quality roughage plays a significant role especially in feeding of high-yield animals. About half of total daily feed needs of dairy cows is met with roughage. In this way, well operation of animal digestive system is provided and with created nutrient balance it is possible to get desired quality and quantity yield. Quality silage is quite rich in energy and more delicious and nutritious than the other feeds. Silage is also an economic feed source and may significantly reduce the production cost of meat and milk [1].

With several benefits, silage is an essential nutrient source for ruminant feeding. Therefore, the quality and nutritional composition of silages are quite significant issues for livestock facilities. There may be some nutrient losses during the ensilage period. Such losses may vary based on silage structure and silage material, harvest period of the material, the way of ensilage and the other conditions to be obeyed during the ensilage. These losses generally observed at different stages throughout the ensiling period. They may be experienced at field while harvest and chopping of the green herbage, on the way to the silo while transporting them, or in silo during the fermentation of the material. All these losses may sometimes reach to 25-30% of the total material in weight and may also result in serious quality losses [2]. It is evident that the silage with great losses in nutrients may not provide any benefits in reaching desired milk or meat needs.

The present study was conducted to investigate the variations in nutrient composition of the maize silage throughout the ensiling period and to determine potential losses. Experimental outcomes will provide significant contributions for better management of silage processes.

2. MATERIALS AND METHODS

The maize to be ensiled was supplied from the fields of Agricultural Research and Implementation Center of Erciyes University. Samples were taken from maize plants before making the silage. Then the plants were chopped in 3 cm pieces. They were homogenized and placed in 3-liter glass jars. Lids were tightly closed as not have any air. A total of 24 silage were prepared.

The silage samples were opened at 7, 14, 21, 28, 35, 42, 49 and 56th day in 3 replications. About 25 g samples were taken from each jar in accordance with the method specified as in [3]. They were mixed in 100 ml distilled water for 5 minutes, homogenized and pH values were measured. Dry matter (DM), crude protein (CP) crude oil (CO) and crude ash (CA) analyses were performed in accordance with the methods specified in [4]. Acid detergent fiber (ADF) and neutral detergent fiber (NDF) analyses were performed in accordance with the principles specified as in [5].

Experimental data were subjected to statistical analyses with SPSS (Statistical Package for the Social Sciences, version 14.0) software. Single-way ANOVA analysis was performed to compare the groups and multiple range tests were used to identify the differences between the groups.

3. RESULTS AND DISCUSSION

The effects of fermentation (ensiling) duration on nutritional composition of maize silage are provided in Table 1.

Table 1. The effects of fermentation (ensiling) duration on nutritional composition of maize silage

	Ensiling duration (days)									SEM
	0	7	14	21	28	35	42	49	56	
DM (%)	35.76	35.54	35.46	35.21	34.95	34.78	34.42	34.19	33.94	0.369
pH	4.43 ^a	4.34 ^a	4.21 ^{ab}	4.16 ^{ab}	4.10 ^{ab}	4.03 ^b	3.98 ^b	3.93 ^{bc}	3.87 ^c	0.098
CP (% DM)	5.65 ^d	5.73 ^{cd}	5.79 ^c	5.82 ^c	5.97 ^{bc}	6.07 ^{ab}	6.18 ^{ab}	6.24 ^{ab}	6.30 ^a	0.140
CA (% DM)	4.55	4.52	4.60	4.57	4.50	4.45	4.46	4.39	4.40	0.111
CO (% DM)	2.57 ^c	2.62 ^{bc}	2.67 ^{bc}	2.74 ^b	2.80 ^b	2.88 ^b	2.94 ^a	3.03 ^a	3.09 ^a	0.164
ADF (% DM)	21.59	21.46	21.37	21.28	21.22	21.17	21.08	20.91	20.87	0.233
NDF (% DM)	42.55	42.41	42.47	42.34	42.25	42.18	42.05	41.87	41.69	0.301

^{a, b, c, d, e, f, g}: The difference between the means indicated with different letters in the same line is significant; SEM: Standard Error of Means; DM: Dry Matter; CP: Crude Protein; CA: Crude Ash; CO: Crude Oil; ADF: Acid Detergent Fiber; NDF: Neutral Detergent Fiber.

As seen in Table 1, fermentation duration did not have significant effects on DM content of maize silage ($P>0.05$). On the other hand, fermentation durations had significant effects on crude protein (CP) and pH values of maize silage ($P<0.05$), but did not have significant effects on crude ash (CA) contents ($P>0.05$). Again as seen in Table 1, fermentation durations had significant effects on crude oil (CO) contents of maize silage ($P<0.05$), but did not have significant effects on ADF and NDF contents of silage samples ($P>0.05$).

There was a decrease in DM contents of silage samples with increasing ensiling durations, but such a decrease was not significant ($P>0.05$). The initial DM content of 35.76% decreased to 33.04% at the end of 56 day fermentation period. The pH values also decreased throughout the ensiling period and the initial pH value of 4.43 decreased to 3.87 at the end of 56 day ensiling period. The decrease in pH was found to be significant ($P<0.05$). Similar decreases in pH values with increasing ensiling durations were also reported by previous researchers (e.g. [6], [7]).

Similar to findings of some previous studies (e.g. [8], [9], [10]), the initial CP content of 5.45% increased to 6.70% at the end of 56th day and such an increase with increasing ensiling durations was found to be significant ($P<0.05$). The effects of fermentation durations on CA contents were not found to be significant ($P>0.05$). There was an irregular increase in crude ash contents of samples with increasing ensiling durations.

Effects of fermentation durations on crude oil (CO) contents of maize silage were found to be significant ($P<0.05$). The initial CO value of 2.47% increased to 3.36% at the end of 56 day ensiling duration. Similar increases in CO contents with increasing ensiling durations were also reported by [11] and [12]. Finally, the effects of fermentation duration on ADF and NDF contents of maize silage were not found to be significant ($P>0.05$).

4. CONCLUSIONS

Considering the current findings, it was concluded that while increasing ensiling durations created significant decreases in pH values of maize silage, but increased CP and CO contents of the silage samples. It was finally concluded that the minimum ensiling duration for maize silage should not be less than 40 days.

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