aJava

Asian Journal of Animal and Veterinary Advances

Academic
Journals Inc.

www.academicjournals.com

Asian Journal of Animal and Veterinary Advances 5 (2): 175-179, 2010
ISSN 1683-9919

Study of Chemical Composition and Quality Characteristics of Corn, Sunflower and Corn-Sunflower Mixture Silages

[1]E. Mafakher, [1]M. Meskarbashee, [1]P. Hassibi and [2]M.R. Mashayekhi
[1]Faculty of Agriculture, Shahid Chamran University, Ahvaz, Iran
[2]Member of Scientific Board of Agriculture and
Natural Resources Research Center of Khuzestan Province, Iran

Abstract: This study was carried out to determine chemical composition and quality characteristics of corn and sunflower ensiled alone and the mixtures (fresh matter basis) of corn and sunflower at differing rates included 75% corn plus 25% sunflower ($C_{75}S_{25}$), 50% corn plus 50% sunflower ($C_{50}S_{50}$), 25% corn plus 75% sunflower ($C_{25}S_{75}$). Whole corn and sunflower plants were chopped at milk-dough seed stage and ensiled in plastic jars for 45 days. At this experiment, forage characteristics of corn and sunflower plants pre ensiling and dry matter, crude protein, crude fiber, ash, pH, flieg point and physical characteristics (smell, structure and color) of silages were measured. Corn and sunflower plants had significantly differences in terms of dry and fresh forage yield, dry matter, crude protein, total water soluble sugars and starch amount. Among the silages, highest crude protein (12.87%), ash (16.5%) and pH value (4.3) were determined from sunflower silage alone ($p<0.01$) and declined in the mixtures with increasing levels of corn in silage. While, flieg point (103.01) was greater in corn silage alone. In addition mixing corn and sunflower forage in silo improved silage feeding value and best mixing was 50% corn plus 50% sunflower.

Key words: Chemical composition, corn, quality characteristics, silage, sunflower

INTRODUCTION

In Iran maximal part of ruminants feed resources make from low quality nutrients with inadequate feed value, therefore most of them have deficient nutrient, good silage is one of the best feed for provide energy, protein, minerals and vitamin for ruminants. Silages crops must provide forage of high nutritive value and high yields per unit of land (Valdez *et al*., 1988). Corn is an important forage component of ruminants feeding Programs in Iran (Forouzmand *et al*., 2005). But nutrients such as protein content and minerals of corn silage is inadequate to meet the nutritional requirements of most class of ruminants (Mir *et al*., 1992). Researches indicated that crude protein content can be increased by mixing with other forages such as sunflower (Bueno *et al*., 2004). Demirel *et al*. (2008) concluded that high quality silages could be obtained from green herbag of corn or sunflower alone, however their nutritive values be improved in mix silage with 50% ratio. Valdez *et al*. (1988) reported that corn-sunflower intercropped silage had intermediate concentrations of fat, fiber and protein compared to those of corn or sunflower silages. Mir *et al*. (1992) found that corn silage contained less protein, fat, acid detergent fiber and lignin than corn-sunflower silages

Corresponding Author: Elahe Mafakher, Faculty of Agriculture, Shahid Chamran University, Ahvaz, Iran Tel: +9806113364056 Fax: 2210781

($p<0.05$). Experiment of Demirel *et al.* (2006a) reported that better quality silages could be obtained by mixing sorghum and sunflower at 50% ration.

The objectives of this study were to compare physical and chemical characteristics of different mixed silages of corn and sunflower using experimental silos.

MATERIALS AND METHODS

Whole corn (cv. DC370) and oilseed type of sunflower (cv. Euroflor) plants were harvested with hand at milk-dough seed stage, chopped at a length of 1-3 cm, wilting (until about 25% dry matter) and ensiled in 2 L plastic jars as one of follow five treatments: 100% corn (C_{100}), 75% corn plus 25% sunflower ($C_{75}S_{25}$), 50% corn plus 50% sunflower ($C_{50}S_{50}$), 25% corn plus 75% sunflower ($C_{25}S_{75}$) and 100% sunflower (S_{100}) on fresh material basis. Sealed experimental silos were incubated to the laboratory for 45 days. At the end of this period, The silos were opened and silages were analyzed for physical and chemical properties. Their pH value was measured with a digital pH meter, Flieg point was calculated using the following formula (Kara *et al*., 2009). Physical characteristics of silage measured by the method of Demirel *et al.* (2006b). Dry matter, crude protein, crude fiber and ash following the method of Association of Official Analytical Chemists (1990). Water soluble sugars and starch amount was determined according to Schlegl (1986). The experiment was arranged as completely randomized design and data were analyzed by Statistical Analysis System (SAS Institute, 2003).

RESULTS

Variance analysis of data regarding forage characteristics of corn and sunflower plants pre ensiling and dry matter, crude protein, crude fiber, ash, pH, flieg point and physical characteristics (smell, structure and color) of silages were conducted. Means were compared using the Least Significant Range (LSR) test.

Results showed that forage yields, leaf to stem proportion, number of leaves in plant and crude protein percent of sunflower were higher than corn ($p<0.01$), the amounts of dry matter, water soluble sugar and starch were significantly higher in corn than sunflower ($p<0.01$) (Table 1).

Results indicated that there were significant differences in terms of crude protein, ash ($p<0.01$) and crude fiber ($p<0.05$). Among silages, the highest crude protein (12.87%) and ash (16.50%) were obtained from S_{100} and highest crude fiber (38%) was determined from C_{100}. The lowest crude protein (9.21%) and ash (8.50%) were determined from C_{100} and crude fiber (32.75%) was obtained from C_{100} (Table 2).

Table 1: Forage characteristics of corn and sunflower plants at dough stage (pre ensiled)

Items	Corn	Sunflower	CV
Density (plants ha^{-1})	80000	130000	
Day after planting	86	86	
Dry yield (t ha^{-1})	11.22b	24.47a	9.60
Fresh yield (t ha^{-1})	45.47b	187.42a	13.08
Dry matter (%)	24.68a	13.70b	6.47
Crnde fiber (%)	39.50	39.16	8.14
Crnde protein (%)	9b	12.46a	5.38
Sugar (mg g^{-1})	183.25a	74.59b	12.32
Starch (mg g^{-1})	283.13a	139b	13.94
Leaf/steam	0.27b	0.42a	4.65
Leaves in plant (number)	10.33b	25.91a	7.68

Mean values in the same column followed by the same letter(s) are not significantly different; $p<0.01$

Table 2: Chemical composition of different silages

Silages	Dry matter	Crude protein	Crude fiber	Ash
	(%)			
C_{100}	23.92a	9.21c	38.00a	8.50c
$C_{75}S_{25}$	24.39a	9.82c	34.00ab	9.37c
$C_{50}S_{50}$	23.89a	11.01b	37.50a	12.25b
$C_{25}S_{75}$	24.28a	11.26b	28.75b	14.62ab
S_{100}	24.19a	12.87a	32.75ab	16.50a
Significant level	ns	**	*	**
CV	1.68	3.74	10.95	9.57

Mean values in the same column followed by the same letter(s) are not significantly different; *p<0.05; **p<0.01; ns: Not signification

Table 3: Quality characteristics of different silages

			Physical characteristics				
Silages	Flieg point	pH value	Smell	Structure	Color	Score	Quality classification
C_{100}	103.01a	3.66d	13.58	4	2	19.58	Very good
$C_{75}S_{25}$	100.23ab	3.83c	12.41	4	2	18.41	Very good
$C_{50}S_{50}$	95.73b	3.92c	12.24	4	2	18.24	Very good
$C_{25}S_{75}$	87.331c	4.15b	12.33	4	2	18.33	Very good
S_{100}	81.14d	4.30a	12.83	4	2	18.83	Very good
Significant level	**	**					
CV	2.40	1.27					

Mean values in the same column followed by the same letter(s) are not significantly different; **p<0.01

Results given in Table 3 indicated that the highest flieg point (103.01) and the best pH value (3.66) were determined from C_{100} compared to other silages ($p<0.01$). The lowest flieg point (81.14) and the highest ph value (4.30) were determined from S_{100}. Highest of physical characteristics such as smell, structure and color was obtained from C_{100}.

DISCUSSION

In the study, variations occurred among silages regarding crude protein, crude fiber, ash, fleig point and pH value. The concentrations of crude protein and ash were significantly lower in C_{100} silage compared to other silages ($p<0.01$). Crude protein and ash percents increased as the proportion of sunflower in mixtures increased ($p<0.01$). Highest of ash and protein percents are in leaf and there lowest are in stem (Mello *et al.,* 2004). Therefore, corn protein and ash values decreased than sunflower due to decreasing of leaf to stem Proportion (Table 1). Similar results were also obtained by McGuffey and Schingoethe (1980), Gaines and Nevens (1925) and Mello *et al.* (2004). Lowest and highest crude fiber were determined from $C_{25}S_{75}$ and C_{100}, respectively.

Lowest pH value was obtained from C_{100} compared to other silages and increased parallel to the increase of sunflower levels in the mixtures (Table 3). The lowest flieg point and the highest pH value were determined from S_{100} (Table 3). The pH silages declined in the mixtures with increasing levels of corn. This results can be due to decreasing of protein (Wilson and Wilkins, 1973) and ash (Mello *et al.*, 2004; Kadoshnikov *et al.*, 2001) contents and increasing of fermentable carbohydrate content (Mehmet, 2006) of plant material ensiled (Table 1, 2). There were not significantly differences among physical characteristics of silages (Table 3) and all of the silages were very good in terms of physical characteristics score (Table 3).

CONCLUSION

At this experiment, all silages were well preserved based on silage pH and flieg point. As percentage of sunflower increased in silo, crude protein, ash and pH value were

increased. It has been concluded that better protein, organic matter and quality of silages could be obtained by mixing corn and sunflower at the rate 50/50%.

ACKNOWLEDGMENTS

We are grateful for the financial support provided by the Scientific Research Presidency of Shahid Chamran University. M.Sc. Thesis: 8833177 No. We are also thankful to the Jahad Agriculture organization of Khuzestan Province for supplying the seed and Agriculture and Natural Resources Research Center of Khuzestan Province for assistance with the experiment.

REFERENCES

Association of Official Analytical Chemists, 1990. Official Methods of Analysis. 13th Edn., AOAC, Washington, DC., USA., ISBN: 0841209391.

Bueno, M.S., E.Jr. Ferrari, R.A. Possenti, C.F.C. Rodrigues, F.F. Leinz and D. Bianchini, 2004. Sunflower or maize silage with different proportions of concentrate in lamb feeds. Albeitar, 77: 8-10.

Demirel, M., D. Bolat, S. Celik, Y. Bakici and A. Tekeli, 2006a. Evaluation of fermentation qualities and digestibilities of silages made from sorghum and sunflower alone and the mixtures of sorghum-sunflower. J. Boil. Sci., 6: 926-930.

Demirel, M., D. Bolat, S. Celik, Y. Bakici and S. Celik, 2006b. Quality of silages from sunflower harvested at different vegetational stages. J. Applied Anim. Res., 30: 161-165.

Demirel, M., D. Bolat, S. Celik, Y. Bakici and S. Eratak, 2008. Determination of fermentation and digestibility characteristics of corn, sunflower and combination of corn and sunflower silages. J. Anim. Vet. Adv., 7: 707-711.

Forouzmand, M.A., G.R. Ghorbani and M. Alikhani, 2005. Influence of hybrid and maturity on the nutritional value of corn silage for lactating dairy cows 1: Intake, milk production and component yield. Pak. J. Nutr., 4: 435-441.

Gaines, W.L. and W.B. Nevens, 1925. The Sunflower as a Silage Crop: Composition and Yield at Different Stages of Maturity. University of Illinois Agricultural Experiment Station, Urbana, Ill., p: 454-455.

Kadoshnikov, S.I., D.M. Martirosian, I.G. Kadoshnikova and I.A. Chernov, 2001. A study on the silage use of plain and combined amaranth in ontogenesis. Legacy Official Newslett. Amaranth Inst., 14: 4-7.

Kara, B., V. Ayhan, Z. Akman and E. Adiyaman, 2009. Determination of silage quality, herbage and hay yield of different triticale cultivars. Asian J. Anim. Vet. Adv., 4: 167-171.

McGuffey, R.K and D.J. Schingoethe, 1980. Feeding value of high oil variety of sunflower as silage to lactating dairy cows. J. Dairy Sci., 63: 1109-1113.

Mehmet, A.B., 2006. Effects of hybrid type stage of maturity and fermentation length on whole plant corn silage quality. Turk. J. Vet. Anim. Sci., 30: 331-336.

Mello, R., J.L. Nornberg and M.G. da Rocha, 2004. Productive and qualitative performance of corn sorghum and sunflower hybrids for ensiling. R. Barsa. Agrociencia., 10: 87-95.

Mir, Z., P.S. Mir, S. Bittman and L.J. Fisher, 1992. Ruminal degradation characteristics of corn and corn-sunflower intercropped silages prepared at two stages of maturity. Can. J. Anim. Sci., 72: 881-889.

SAS Institute, 2003. User's Guide Statistics. SAS Institute Inc., Cary, NC.

Schlegl, H.G., 1986. Die verwertung organgischer souren durch chlorella lincht. Planta, 47: 510-526.

Valdez, F.R., J.H. Harrison, D.A. Deetz and S.C. Fransen, 1988. *In vivo* digestibility of corn and corn and sunflower intercropped as a silage crop. J. Dairy Sci., 71: 1860-1867.

Wilson, R.F. and R.J. Wilkins, 1973. Formic acid as a silage additive. 1. Effect of formic acid on fermentation in laboratory silos. J. Agric. Sci., 81: 117-124.