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Changes in Chemical Composition and *In vitro* DM Digestibility of Urea and Molasses Treated Whole Crop Canola Silage

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Abstract: In order to determine the effects of different levels of urea and molasses on chemical composition and *in vitro* Dry Matter Digestibility (IVDMD) of canola silage one experiment in a 3×3 factorial arrangement in a complete-randomized design with three replications was conducted. Experimental treatments of this study were 0, 0.5 and 1% of Urea and 0, 4 and 8% of Molasses (On DM basis of canola forage). *In vitro* Dry-Matter Digestibility (IVDMD) of canola silages determined by 2 stages tilly and terry method. In this part of study rumen fluid was provided from 2 growing Holstein steers with average 280±3 kg BW. The results of chemical analyses of silages showed that urea significantly increased DM, CP, pH and ammonia nitrogen concentration of canola silage ($p<0.05$). Increasing of molasses additive levels caused to enhance silage DM content. But ADF and NDF content of canola silage decreased by it. Results of this study indicated that DM digestibility of canola silages was not affected by urea. But molasses decreased DM digestibility of canola silages. In conclusion, the addition of 0.5% urea plus 8% molasses improved DM, CP, NDF and ADF content of canola silages better than other additive levels of urea and molasses. Addition of urea higher than 0.5% decreased canola quality by increasing silage pH and NH_3-N concentration.

Key words: Canola silage, urea, molasses, *in vitro*, dry matter digestibility

INTRODUCTION

In recent years increasing milk production in Iran caused to increase nutrient requirement of dairy cattle. In this situation it is important to know that forage quality is a key factor in dairy cattle nutrition. In other wise in semiarid countries such as Iran providing forage requirement of cattle is limited by deficiency in forage resources.

The last programming of Iran agricultural organization was increasing of oil plants cultivation to enhance oil production. Some factors such as decreasing environmental temperature or molding made canola cultivation not be suitable for seed production. In this situation most farmers eliminate damaged canola forage by means of burning or burring it at beneath of the soil. In this condition there is question about possibility of canola forage utilization in ruminant diets. There are very restricted researches about nutrient composition of canola forage.

Brassica forage contains 80-95% water (Lambert *et al*., 1987; Guillard and Allison, 1988; Guillard *et al*., 1988). High moisture forages are so susceptible to loss their nutrients during ensiling. Canola is one of the oilseed plants that belong to *Brassica* sp. Canola forage has high level of moisture in its tissues and must be wilted to 60-65% moisture before ensiling.

On the other hand, molasses and urea as 2 silage additives can be effective in improvement and preservation of canola forage quality. Molasses is commonly used to provide readily available energy for lactic acid fermentation. Addition of molasses can increase dry matter content of silage that related to relatively high dry matter content of molasses (Baytok and Aksu, 2005). Meanwhile, silage protein content can be increased and proteolysis decreased with the addition of urea. Application of urea to harvested forage before ensiling can restrict the fermentation processes and release ammonia to potentially enhance nutritive value of the ensiled crop and reduce deterioration during storage.

The main objective of this study was to evaluate effects of different levels of urea and molasses on chemical composition and *in vitro* DM digestibility of whole crop canola silage.

MATERIALS AND METHODS

In order to provide whole plant canola to make canola silage, Canola seed (Hyola-308) was planted at the rate of

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6.5 kg ha^{-1} in sandy loam soil on April 4, 2005. It was mown on August 4, 2005 and allowed to wilt to approximately 20% DM before being chopped. Canola forage was ensiled in plastic containers using additives in a 3×3 factorial arrangement in a completely randomized design with three replicates. Additives were molasses and urea. The molasses additive levels were 0, 4 and 8% of canola forage DM. The additive levels of urea were 0, 0.5 and 1% of canola forage DM. In order to complete fermentation process, all silages were kept in cool and dry place for 45 days. After complementation period, all silages opened and analyzed for DM, OM, CP (AOAC, 1990), NDF and ADF content. DM digestibility of all silages was estimated by Tilly and Terry (1963) method. All data were subjected to analysis of variance using General Linear Model procedure of SAS. Mean treatment differences were determined by Duncan's multiple range tests with a level of statistical significance of 5%.

RESULTS AND DISCUSSION

Chemical composition and DM digestibility of canola silages are presented in Table 1. Urea had significant effect ($p<0.05$) on DM, CP, pH and NH3-N. Meanwhile, the EE, NDF, ADF and DM digestibility were similar among groups. It seems that the ammonia released as a result of bacterial hydrolysis of urea increased CP and NH3-N in silages treated with urea.

Effect of molasses on DM, NDF, ADF and DM digestibility were significant ($p<0.05$) but CP, EE, pH and NH_3-H were similar among groups. The interaction effects between urea and molasses were significant for canola silage DM, EE, NDF, ADF and DM digestibility percentage. Canola silage dry matter content increased by addition of molasses. High DM content of silage treated with molasses may have resulted from the high DM content of molasses used, which is consistent with the results of Hinds *et al*. (1985) and Lattemae *et al*. (1985).

Similarly, increased CP concentration may have caused by relatively higher CP content of molasses. There are conflicting data in literature about the effects of molasses on CP content of silage. Researchers reported that addition of molasses into silage increased (Lattemae *et al*., 1985; Kennedy, 1990), did not affect (Spoelstra *et al*., 1990; OÕKiely, 1992), or even decreased (Moore and Kennedy, 1994) CP content of silages.

Increasing molasses additive levels to canola forage decreased its silage IVDMD. Keskin and Yilmaz (2005) indicated that the addition of urea and urea plus molasses to forage of different sorghum varieties decreased their silage IVDMD compared to the control. This result can be attributed to increasing organic matter (soluble carbohydrates) losses in the urea and molasses groups. Results indicated that increasing additional level of molasses to canola forage caused to decrease canola silage NDF and ADF content. Researchers have suggested 2 reasons for this decrease.

First, the addition of molasses to silages increases the number of aerobic bacteria, including the lactic acid bacterium; therefore, the NDF and ADF degradation of silages increases (Bolsen *et al*., 1996). Second, a decrease takes place because of the lower ADF content of the additives (Bing and Baytok, 2003).

The results of this study demonstrate that supplementing canola forage with urea can decrease silage quality by increasing silage pH and its N-NH3 concentration. So, the application of urea in canola forage chemical treating is not suggested. Application of molasses for canola forage chemical treating can increase canola silage quality by decreasing silage NDF and ADF content. But application percentage of molasses is important because its high levels can decrease canola silage DM digestibility. Significant interaction effects between urea and molasses on DM, EE, NDF, ADF and DM digestibility of canola silage were related to molasses' significant effects.

Table 1: The mean chemical compositions and DM *in vitro* digestibility of canola forage silage treated with different levels of urea and molasses

Urea	0[a]			0.5			1			Effects			
Molasses	0	4	8	0	4	8	0	4	8	SE	U	M	U×M
DM[b]	17.82	18.79	20.21	19.29	18.82	20.83	19.96	19.93	19.94	0.39	*	*	*
OM	88.00	88.00	87.33	88.00	87.66	88.00	87.33	87.33	88.33	0.65	ns	ns	ns
CP	15.68	15.64	15.84	16.39	16.06	16.67	16.67	16.22	16.34	0.25	*	ns	ns
EE	6.00	4.33	4.00	4.33	3.33	3.66	4.33	3.66	4.33	0.61	ns	ns	*
NDF	52.33	48.66	50.00	49.00	51.66	47.66	50.33	48.66	50.66	0.82	ns	*	*
ADF	32.33	32.33	31.00	32.00	31.66	31.33	32.00	34.66	31.00	0.91	ns	*	*
pH	4.78	4.70	4.71	4.91	4.97	4.84	5.05	5.23	5.07	0.11	*	ns	ns
NH_3-N	2.19	1.88	2.00	3.24	2.91	2.57	4.02	3.85	3.78	0.83	*	ns	ns
DM Dig[c]	733.30	660.00	586.60	720.00	640.00	646.60	760.00	600.00	626.60	2.13	ns	*	*

a. Urea (U) and molasses (M) levels as % of canola forage DM, b. All data quoted as g kg^{-1} DM except pH and ammonia (mg g^{-1} DM of canola silage), c. DM digestibility as g kg^{-1} of canola silages DM, ns = the effect is not significant ($p>0.05$), * = the effects is significant ($p<0.05$)

CONCLUSION

The results of this study indicated that canola forage has suitable nutrient composition that it can be used in dairy cattle nutrition without any adverse effect. High moisture of canola forage is one of the dangerous factor in decreasing canola silage quality. But application of silage additives especially urea and molasses can improve its quality.

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REFERENCES

Association of Official Analytical Chemists International, 1990. Official Methods of Analysis. 15th Edn. AOAC, Arlington, VA., Vol. 1.

Baytok, E. and T. Aksu, 2005. The effects of formic acid, molasses and inoculant as silage additives on corn silage composition and ruminal fermentation characteristics in sheep. Turk. J. Vet. Anim. Sci., 29: 469-474.

Bingl, H.T. and E. Baytok, 2003. The effects of some silage additives in sorghum silage on the silage quality and ruminal degradability of nutrients. I. The effects on silage quality. Turk. J. Vet. Anim. Sci., 27: 15-20.

Bolsen, K.K., G. Ashbell and Z.G. Weinberg, 1996. Silage fermentation and silage additivis. Asian-Aust. J. Anim. Sci., 9: 483-493.

Guillard, K. and D.W. Allinson, 1988. Yield and nutrient content of summer- and fall-grown forage Brassica crops. Can. J. Plant Sci., 68: 721.

Guillard, K., D.W. Allinson and R.L. Hough, 1988. Performance of sheep grazing fall-grown tyfon. Applied Agric. Res., 3: 86.

Hinds, M.A., K.K. Bolsen, J. Brethour, G. Milliken and J. Hoover, 1985. Effects of molasses/urea and bacterial inoculant additives on silage quality, dry matter recovery and feeding value for cattle. Anim. Feed Sci. Technol., 12: 205-214.

Kennedy, S.J., 1990. Comparison of the fermentation quality and nutritive value of sulphuric and formic acid-treated silages feed to beef cattle. Grass Forage Sci., 45: 17-28.

Keskun, B. and Ü.H. Yilmaz, 2005. Effects of urea or urea plus molasses supplementation to silages with different sorghum varieties harvested at the milk stage on the quality and *in vitro* dry matter digestibility of silages. Turk. J. Vet. Anim. Sci., 29: 1143-1147.

Lambert, M.G., S.M. Abrams, H.W. Harpster and G.A. Jung, 1987. Effect of hay substitution on intake and digestibility of forage rape (*Brassica napus*) fed to lambs. J. Anim. Sci., 65: 1639.

Lattemae, P., C. Ohlsson and P. Lingvall, 1985. The combined effect of molasses and formic acid and quality of red-clover silage. Swedish J. Agric. Res., 1: 31-41.

Moore, A.C. and S.J. Kennedy, 1994. The effect of sugar beet pulp based silage additives on effluent production, fermentation, in-silo losses, silage intake and animal performance. Grass Forage Sci., 49: 54-64.

OÕKiely, P., 1992. The effect of ensiling sugar beet pulp with grass composition, effluent production and animal performance. Irish J. Agric. Food Res., 31: 115-128.

Spoelstra, S.F., A. Steg and J.M.W. Beuvink, 1990. Application of Cell Wall Degrading Enzymes to Grass Silage. In: Dekkers, J.J., H.C. van der Plas and D.K. Vuijk (Eds.). Agricultural Biotechnology in Focus in The Netherlands, Pudoc, Wageningen.

Tilly, J.M.A. and R.A. Terry, 1963. A two-stage technique for the *in vitro* digestion of forage crops. J. Br. Grassl. Soc., 18: 104-111.