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Effect of corn snaplage on lactation performance by dairy cows

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ABSTRACT

The objective of this study was to determine lactation performance by dairy cows fed corn snaplage either alone (SNAP) or in combination with ground dry shelled corn (SPDC) versus rolled high-moisture shelled corn (RHMC). Dry-matter content was greater for RHMC (78.2%) than SNAP (68.5%). The starch content of SNAP was approximately 10%-units lower than RHMC. Sixty Holstein cows (30 primiparous and 30 multiparous; 100 ± 23 DIM and 626 ± 44 kg of BW at trial initiation) were used in a randomized, complete-block, continuous-lactation trial: 2-wk covariate adjustment period with all cows fed a 50:50 mixture (DM basis) of SNAP and RHMC in TMR followed by an 8-wk experimental period with cows fed their assigned treatment corn grain (RHMC, SNAP, or SPDC) in TMR. Intake of DM was reduced by 2.6 kg/d per cow, on average, for SNAP and SPDC compared with RHMC. Milk yield averaged 39.4 kg/d per cow and was unaffected by treatment as were all measures of component-corrected milk yield. Actual milk, FCM, solids-corrected milk, and energy-corrected milk feed efficiencies (kg/kg) were greater, on average, for SNAP and SPDC compared with RHMC by 7 to 9%. Milk fat percentage was reduced by 0.27% units, and milk-urea-nitrogen concentration was greatest, for SNAP compared with RHMC. These changes in milk composition along with reduced DMI were likely related to greater ruminal starch digestibility for SNAP. Milk fat and milk-urea-nitrogen concentrations were improved by the partial replacement of SNAP with ground dry shelled corn in the SPDC treatment.

Key words: corn snaplage, high-moisture corn, dairy cow, starch

INTRODUCTION

Corn harvested as grain for feeding to dairy cattle can be dry or ensiled and most commonly is harvested, stored, and fed as ground dry shelled corn (**GDSC**) or rolled high-moisture shelled corn (**RHMC**), respectively. Shelled corn is harvested with a combine, which dictates the dry down to about 30% kernel moisture before harvest (Mader and Erickson, 2006).

Another option for harvesting high-moisture corn is snaplage (**SNAP**), which can be harvested using a self-propelled forage harvester (**SPFH**) fitted with a corn head (Mahanna, 2008; Lardy and Anderson, 2010). Use of a SPFH for production of SNAP allows the corn harvest to be initiated earlier (greater than 33% kernel moisture) and proceed more rapidly with kernel processing done immediately during the harvest process by way of the SPFH on-board roller mill rather than later at the silo as done with RHMC (Mahanna, 2008; Lardy and Anderson, 2010). Therefore, there is considerable interest in SNAP for dairy-cattle feeding from the corn-production side (Mahanna, 2008).

Nutritionists, however, may be concerned about a reduced energy content of SNAP, because it is composed of kernels, cob, husk, and shank from the ear and possibly some leaf material from above the ear, which serve to dilute its starch content with fiber compared with RHMC or GDSC (Mahanna, 2008). Also, harvest of corn as SNAP with its increased moisture content may increase rate and extent of ruminal starch digestibility (Mahanna, 2008) through breakdown of the starch–protein matrix in the kernel endosperm resulting from more extensive protease activity during the ensiling process (Hoffman et al., 2011; Hoffman et al., 2012). This could contribute to reduced milk-fat content (Oba and Allen, 2003a; Ferraretto et al., 2013a) when SNAP is fed to lactating dairy cows. Because of concerns over starch, energy content, or ruminal starch digestibility, SNAP is often fed in combination with GDSC rather than alone as the sole of grain in dairy-cattle diets.

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Controlled research on feeding SNAP to dairy cattle is lacking. Thus, the objective of this study was to determine lactation performance effects in dairy cows from feeding SNAP either alone or in combination with GDSC compared with RHMC.

MATERIALS AND METHODS

Corn hybrid P35F44 (DuPont Pioneer, Johnston, IA) was planted in a University of Wisconsin Arlington Agricultural Research Station (Arlington, WI) field (16 ha; 84,000 seeds/ha; 76-cm row spacing) on April 22, 2010. Half of the field was harvested as SNAP, and half was harvested as RHMC on September 22 and 29, 2010, respectively. The SNAP and RHMC were stored in separate side-by-side, 2.5-m-diameter × 61-m-long silo bags until the feeding trial was initiated on April 28, 2011. Harvest of SNAP was done using a SPFH (Claas Jaguar Model 860; Claas of America Inc., Omaha, NE) fitted with a 6-row corn head (John Deere Model 643; Deere & Co., Moline, IL) and Kooima (Kooima Co., Rock Valley, IA) header adapter by a custom operator (Bach Farms, Dorchester, WI). The SPFH was set for a 9-mm theoretical length of cut with 1-mm processor gap spacing. Harvest of RHMC was done using a combine (John Deere Model 9400; Deere & Co.) and a roller mill mounted on the silo bagger (Renn Mill Model 36; Renn Mill Center Inc., Lacombe, AB, Canada) set to 1-mm processor gap spacing. A *Lactobacillus buchneri* inoculant (Biotal Buchneri 40788; 600,000 cfu/g; Lallemand Animal Nutrition, Milwaukee, WI) was applied as a liquid to both treatments at the silo bagger. Targeted kernel moisture contents at harvest were 28 to 30% and 32 to 35% for RHMC and SNAP, respectively.

The animal research was conducted under an approved protocol by the Institutional Animal Care and Use Committee of the College of Agricultural and Life Sciences. Sixty Holstein cows (30 primiparous and 30 multiparous; 100 ± 23 DIM and 626 ± 44 kg of BW at trial initiation) were used in the study. Thirty electronic gate feeders (RIC system, Insentec, Marknesse, the Netherlands) in the University of Wisconsin–Madison sand-bedded, freestall barn (Blaine Dairy Research Center, Arlington, WI) were randomly allocated to 6 groups each with 5 gates. Cows were blocked by parity (primiparous or multiparous) and randomly assigned to a group of gates with the 10 cows able to access all 5 gate feeders within the group. The gate feeders (1.40 m deep, 0.80 m wide, and 0.75 m high) were situated on weigh cells, and each cow was fitted with an identification transponder to record consumption of each individual cow meal. This electronic feeding system was described by Chapinal et al. (2007). The groups of 5 gates were then randomly assigned to 1 of 3 treatments in a randomized complete-block design in a continuous-lactation trial: 1 wk for adaptation of cows to gates, a 2-wk covariate adjustment period with all cows fed a 50:50 mixture (DM basis) of SNAP and RHMC in TMR, and an 8-wk treatment period with cows fed their assigned treatment corn grain in TMR: 1) RHMC, 2) SNAP, and 3) SNAP plus GDSC (**SPDC**). Ingredient composition of the experimental diets is provided in Table 1. Ground, pelleted soy hulls partially replaced RHMC in that treatment (70:30 ratio of RHMC to soy hulls on DM basis) to induce more similar total NDF and starch concentrations for the RHMC and SNAP treatments. The ratio of SNAP to GDSC was 69:31 (DM basis) to induce more similar total NDF and starch concentrations for the GDSC and SNAP treatments. Respective concentrate mixtures, which did not include the ensiled corns, were prepared at the University of Wisconsin Feed Mill (Arlington, WI). The covariate and treatment-period TMR were mixed once daily at 1000 h and fed twice daily at 1200 and 1600 h.

All cows were injected with bovine somatotropin (Posilac, Elanco Animal Health, Greenfield, IN) every 14 d commencing on d 1 of the covariate period. The gate feeders were supplied with TMR to allow for 5% refusals, with daily DMI determined

Table 1. Ingredient composition of the experimental diets[1]

Ingredient	RHMC	SNAP	SPDC
Corn silage	21.8	21.8	21.8
Alfalfa silage	32.7	32.7	32.7
High-moisture rolled shelled corn	21.5	—	—
High-moisture rolled corn snaplage	—	29.2	20.0
Dry ground shelled corn	—	—	9.2
Ground, pelleted soy hulls	9.0	—	—
Soybean meal, 48% solvent	8.6	9.7	9.7
Distillers dried grains	3.6	3.6	3.6
Energy Booster 100[2]	0.91	0.91	0.91
Calcium carbonate	0.84	1.04	1.04
Monocalcium phosphate	0.15	0.15	0.15
Magnesium oxide	0.18	0.18	0.18
Mg-K-S[3]	0.09	0.09	0.09
Trace mineral salt[4]	0.45	0.45	0.45
Vitamin premix[5]	0.18	0.18	0.18

[1]RHMC = diet containing high-moisture corn; SNAP = diet containing corn snaplage; SPDC = diet containing corn snaplage and dry ground shelled corn.

[2]Minimum 98% total fatty acids (MSC Company, Dundee, IL).

[3]Dynamate (11% Mg, 18% K, 22% S; The Mosaic Co., Plymouth, MN).

[4]Contained 88% NaCl; 0.002% Co; 0.2% Cu; 0.012% I; 0.18% Fe; 0.8% Mn; 0.006% Se; 1.4% Zn.

[5]Vitamin A, 3,300,000 IU/kg; vitamin D, 1,100,000 IU/kg; vitamin E, 11,000 IU/kg.