EFFECTS OF STAGE OF MATURITY AT HARVEST AND KERNEL PROCESSING ON THE NUTRIENT DIGESTIBILITY OF CORN SILAGE

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Summary

Twelve ruminally cannulated crossbred steers were used to evaluate the effects of stage of maturity and kernel processing (rolling) of whole-plant corn silage on nutrient digestibilities. The six silage rations were: 50% milkline, 80% milkline, and 7 days after-black layer (7BL) each ensiled processed (rolled) or unprocessed. Steers consuming the 80% milkline and 7BL processed rations had numerically higher DM and OM digestibilities, and all processed rations had numerically higher starch digestibilities. However, the three processed rations had numerically lower fiber digestibilities (NDF and/or ADF). Steers consuming the 80% milkline rations had numerically higher nutrient digestibilities than those fed the less or more mature silages. Yield data taken at each of the three harvests showed that whole-plant DM and grain yields increased with advancing maturity. The data indicate that harvesting at the 80% milkline stage of maturity and processing the whole-plant maximized DM yield and nutrient utilization.

(Key Words: Mechanically Processed, Corn Silage, Stage of Maturity, Growing Cattle.)

Introduction

Improving the digestibility of whole-plant corn (both the stover and grain) would have a positive impact on the performance of growing cattle. An earlier trial (1998 Cattlemen's Day, pg 25) showed that using a kernel processor on the forage harvester could improve nutrient digestibilities. The objective of this study was to evaluate the effect of stage of maturity at harvest and kernel processing on the utilization of corn silage-based rations by growing cattle.

Experimental Procedures

Pioneer 3394 corn hybrid was grown under irrigation during the summer of 1997. A three-row, self propelled, precision chop, forage harvester (FieldQueen®) was used to harvest the whole plants at three stages of maturity; 50 and 80% milkline and 7 days after-black layer (7BL). Dry matter (DM) contents were 32, 38, and 42%, respectively. The forage was chopped to a 10 mm particle length, and four concrete pilot-scale silos were filled at each harvest date. Two silos were filled with chopped forage that was put through a stationary kernel processor (Roskamp® roller mill), and two silos were filled without further processing. At each stage of maturity, three, 20-foot rows of whole-plant corn were hand-harvested and separated into stover and grain portions, which were dried and weighed for determinations of yield and plant parts.

The nutrient digestibilities of the six corn silage rations (three maturity stages processed and unprocessed) were determined using 12 ruminally cannulated, yearling steers in a Latin square metabolism trial. All rations contained 90% silage and 10% supplement on a dry basis. The steers were housed in a climate-controlled barn, where they were tethered in individual tie stalls. The 21-day periods consisted of four phases: a 10-day ration adaptation, an 8-day total fecal collection (two, 4-day periods), a 2-day ruminal fermentation, and a 1-day ruminal evacuation.

Results and Discussion

The pre-ensiled stover increased in contents of DM, CP, NDF, and ADF as stage of maturity advanced, as did whole-plant DM yield and the proportion of grain in the whole plant (data not shown).

The effects of stage of maturity and processing whole-plant corn silage on nutrient digestibilities are shown in Table 1. Steers consuming the 80% milkline and 7BL processed silage rations had numerically higher DM and OM digestibilities than steers consuming their unprocessed counterparts, and starch digestibilities were numerically higher for all processed silage rations than for unprocessed rations. However, the three processed silage rations did have numerically lower fiber digestibilities (NDF and/or ADF). The 50 and 80% milkline silage rations had numerically higher DM, OM, CP, NDF, and ADF digestibilities than did the respective 7BL silage rations.

The improvements in starch digestibilities observed in the processed corn silage rations likely were due to an increased surface area of the kernel and more starch granules exposed to ruminal fermentation compared to the unprocessed corn silage rations. The slight negative impact of processing on fiber digestibilities could have been due to a carbohydrate effect on ruminal pH and ruminal bacteria activity.

Table 1. Nutrient Digestibilities of the Six Whole-Plant Corn Silage Rations by Growing Steers

	50% Milkline		80% Milkline		7 Days After-Black Layer		
Item	P	U	P	U	P	U	SE
	% of the ration						
DM	72.9^{a}	73.8^{a}	74.3^{a}	73.9^{a}	71.8^{a,b}	70.2^{b}	1.0
OM	74.7^{a}	76.2^{a}	77.0^{a}	76.2^{a}	73.5^{a,b}	72.3^{b}	1.0
Starch	96.4^{a}	94.6^{b}	96.4^{a}	94.0^{b}	94.9^{a,b}	93.3^{c}	.7
CP	71.9^{c}	78.1^{a}	80.5^{a}	76.9^{a,b}	71.4^{c}	74.1^{b}	1.4
NDF	50.4^{c}	53.5^{b}	54.1^{a}	55.8^{a}	50.2^{c}	51.2^{b,c}	1.2
ADF	48.6^{b,c}	53.7^{a}	52.3^{a,b}	53.3^{a}	46.6^{c,d}	45.5^{d}	1.8

^{a,b,c,d}Means within a row with different superscripts differ (P<.05).

P = processed, U = unprocessed.