

## Research Note

### **SILAGE YIELD, FERMENTATION CHARACTERISTICS AND AEROBIC STABILITY OF TWO CORN HYBRIDS<sup>1,2</sup>**

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Grazing of tropical grasses represents the most common forage source used for ruminant nutrition in Puerto Rico. However, because of limited land availability for agricultural purposes and periodic extended drought during recent years, many dairy producers have adopted the use of total mixed rations (TMR) as a feeding system for dairy cattle. Low yield and poor nutritive value of tropical grasses represent one limitation of this feeding method. Therefore, the evaluation of high yielding forages with potential for use in silage production represents an urgent need. Corn (*Zea mays* L.) is the most frequently used forage source in TMR in temperate environments. Knowledge about the agronomic and ensiling characteristics of corn hybrids planted, harvested and ensiled in tropical environments will enable selection of the most appropriate varieties. This research was designed to determine yield (dry matter basis), fermentation characteristics and aerobic stability of silages made from two corn hybrids.

An experimental planting of the two corn hybrids, Dekalb DKC 67-60 and Dekalb DKC 69-71, was carried out for the stated purpose. Research plots (50 × 50 m) were established at the Agricultural Experimental Sub-station located in Lajas, Puerto Rico. The two commercial corn hybrids evaluated were replicated four times in the plots. Research plots were irrigated as needed to ensure germination and no weed control was needed. Lannate Pw<sup>5</sup> (Metomil-S-metil N-metilcarbamil oxitioacetamidate) was sprayed (0.3 kg ai/ha) with a pressure sprayer at 35 days after corn emergence to control fall army worm [*Spodoptera frugiperda* (Smith)].

Measurements of plant density (number of plants per hectare) were taken at 28, 37 and 90 days after planting. Forage dry matter yield and cob length (cm) was measured only after 90 days. Statistical analysis for the agronomic characteristics was appropriate for a randomized block (corn hybrids) design (Steel and Torrie, 1980). To study the ensiling characteristics, we harvested a subsample of planted corn after 77 days of growth and ensiled it in lab-scale microsilos (1.2-kg capacity). Triplicate samples of each hybrid were analyzed to determine initial (prior to ensiling) chemical composition using standard procedures (AOAC, 1990; Van Soest et al., 1991). Three silos of each corn hybrid were opened after 45 days of fermentation and silage samples were analyzed to determine pH, and fermentation end-products (organic acids). Statistical analysis of the ensiling characteristics was according to a randomized design with a 2 (Dekalb corn hybrids) by 2

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<sup>5</sup>Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

TABLE 1.—*Forage dry matter yield (DM) and plant density of Dekalb corn hybrids harvested at 90 days in Puerto Rico.*

Characteristic	Corn hybrid	
	DKC 67-60	DKC 69-71
DM Yield (kg/ha)	14,391	13,679
Plant Density (no. plants/ha)	59,485	55,921

(fermentation length, 0 and 45 d) factorial arrangement of treatments. Aerobic stability of the resulting silage was determined during seven days of aerobic exposure by using pH and temperature as criteria. After 0, 3 and 6 d of aerobic exposure samples from each variety were analyzed to determine pH. Temperature of silages exposed to aerobic conditions was monitored daily with thermometers embedded in the surface of the silage. Statistical analysis of the aerobic stability data was performed as a randomized design. All statistical analyses were performed by using the General Linear Model subroutine of SAS (1990) and also the Bonferroni t-test for mean separation where applicable.

Results showed that the two corn hybrids evaluated had similar ( $P = 0.05$ ) forage yields (Table 1), plant height, and plant density at 28, 37 and 90 days after planting (Table 2). However, cob length (cm) was shorter ( $P < 0.05$ ) in DKC 67-60 than in DKC 69-71 (Table 2). Initial chemical composition was similar for both corn hybrids (Table 3). Nutrient composition of the corn hybrids evaluated in this experiment is in agreement with values previously reported in planted corn harvested in tropical environments (Arias, 1998). After 45 d of fermentation, pH was lower ( $P < 0.05$ ; 3.63 vs. 3.85) in DKC 69-71 than in DKC 67-60 silage; however, production of organic acids (lactic, acetic, and butyric) was similar (Table 4).

In both planted corn hybrid silages exposed to aerobic conditions, pH increased as length of aerobic exposure increased (Table 5). In both cases, maximum silage temperature was observed within two days of aerobic exposure (Figure 1). Thereafter, temperature decreased slightly until the end of the exposure period. In summary, agronomic performance, ensiling characteristics, and aerobic stability were similar in the two corn hybrids, DKC 67-60 and DKC 69-71, evaluated in this experiment.

TABLE 2.—*Plant height and density of Dekalb corn hybrids evaluated at three stages of growth in Puerto Rico.*

Characteristic	Day of growth	Corn hybrid	
		DKC 67-60	DKC 69-71
Plant height (m)	28	0.139	0.139
	37	0.213	0.214
	90	1.480	1.400
Plant density (no. of plants/ha)	28	63,939	74,013
	37	63,583	68,462
	90	56,332	57,777
Cob length (cm)	90	20.12 b	20.73 a

Means followed by different letters differ ( $P < 0.05$ ).

TABLE 3.—*Initial chemical composition of Dekalb corn hybrids harvested at 90 days of growth in Puerto Rico.*

Component, %	Corn hybrid	
	DKC 67-60	DKC 69-71
Dry matter	21.30	20.45
Organic matter <sup>1</sup>	93.10	92.79
Inorganic matter <sup>1</sup>	6.90	7.21
Crude Protein <sup>1</sup>	4.34	5.28
NDF <sup>1</sup>	56.88	57.36
ADF <sup>1</sup>	31.88	32.01

<sup>1</sup>Dry Matter basis.

TABLE 4.—*Fermentation characteristics of Dekalb corn hybrids harvested at 90 days of growth and ensiled in Puerto Rico.*

Characteristic	Days after ensiling	Corn hybrid	
		DKC 67-60	DKC 69-71
pH	0	5.89	5.87
	45	3.63 a	3.58 b
Fermentation products (g/100 g)			
Lactic acid	0	0.07	0.06
	45	0.83	0.87
Acetic acid	0	0.06	0.04
	45	0.21	0.19
Butyric acid	0	0.00	0.00
	45	0.01	0.02

Means followed by different letters differ (P < 0.05).

TABLE 5.—*pH of silages of Dekalb corn hybrids exposed to aerobic conditions in Puerto Rico.*

Characteristic	Day of exposure	Corn hybrid	
		DKC 67-60	DKC 69-71
pH	0	3.63 a	3.58 a
	3	6.12 b	5.97 b
	6	6.42 c	6.45 c

Means in columns followed by different letters differ (P < 0.05).

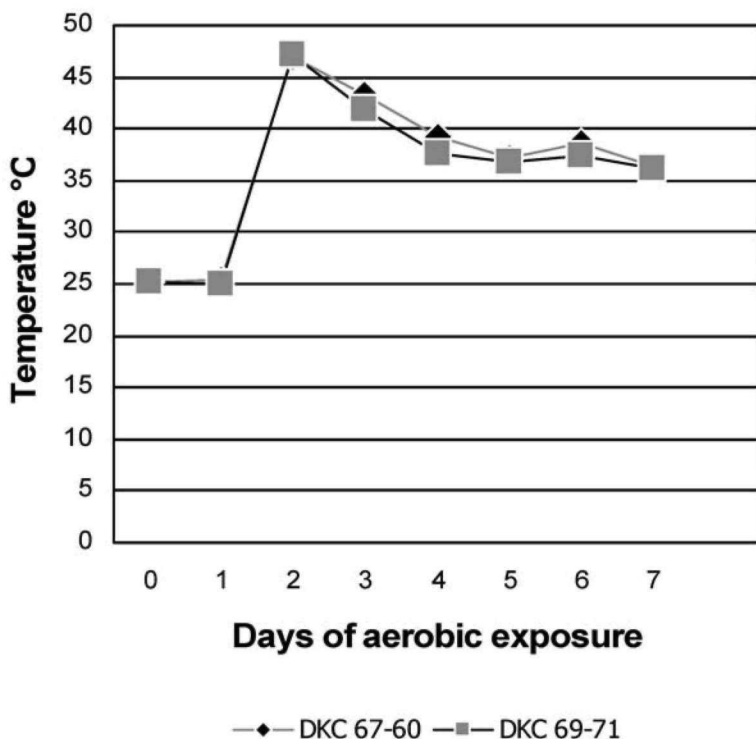


FIGURE 1. Temperature of Dekalb corn hybrid silages exposed to aerobic conditions for seven days.

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