NC STATE UNIVERSITY
Crop Science Department
Forage And Grassland Program

CORN SILAGE VARIETY TESTING REPORT PREPARED FOR THE MOUNTAIN RESEARCH STATION (WAYNESVILLE, 2014)

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Introduction

Corn silage is one of the most popular conserved forage strategies used to feed cattle in USA, especially dairy cattle. Corn generally has higher net energy for lactation (NE_L; 0.66 Mcal/lb), compared to alfalfa (0.54) and cool-season grass hay (0.50; Dairy NRC, 2001), due to the presence of starch in the grain. Crude protein concentration in corn, however, is lower (8.8 %) compared to alfalfa (19.2 %) and cool-season forages (10.8 %) (Dairy NRC, 2001). Therefore, feeding corn silage to dairy cattle covers more of the energy requirement, but requires more supplementation of crude protein compared to other forages in order to achieve targeted animal responses (i.e. milk yield, weight gains). In addition, adequate chopping length (3/8 - 3/4 inches) and enough physically effective fiber in the ration is needed to avoid digestive upsets when feeding diets that are high in corn silage due to its intrinsically high starch concentration.

The report presents the results of productivity and nutritive value of 25 corn varieties submitted to the Mountain Research Station's variety testing trial in 2014.

Experimental Site

Mountain Research Station - NCDA, Waynesville, NC.

Management Practices

Seedbed preparation:

On 5 May the soil was disked and 10.4-20.2-26.2-3(s) was broadcasted at 350 lb/ac. On 7 May, the field was cultimulched, liquid N (32%) was applied at a rate of 55 gallon/ac, and herbicide bicep 2 magnum was applied at a rate of 2 qt/ac. On 3 June, force 3g insecticide was applied at 5 lb/ac. On 2 July, herbicide steadfast Q, permit was applied at a rate of 1.5 0z/ac.

Establishment and harvesting:

Twenty five entries (Table 1) were planted on 3 June. Planting rate was 29,600 seeds/ac planted in 30-inch row-widths. Each plot consisted of 2 rows of 40 ft length. Plots were harvested on 1 Oct. 2014 when the corn cubs were at ½ milk stage, on average.

Experimental design and data analysis:

Entries were planted in a randomized complete block design replicated four times. Data was analyzed using mixed models; entries were fixed effects and blocks were random effects. Entries were considered different if $P \leq 0.05$.

Plant Responses Evaluated and Results

Nutritive value estimates were determined by near infrared spectroscopy (NIR; Dairy One 2014). Dry matter (DM) concentration at harvest was determined by drying the harvested forage at 140°F until to constant weight. Dry matter concentration estimates were used to calculate dry matter yields.

a) **Dry Matter Yield (tons/ac):** Total biomass produced per acre on a DM basis. Entries with DM yield above the average were: 25, 4, 5, 2, 6, 7 and 1 (Figure 1).

b) **DMD (% of DM):** Digestible fraction of the DM that can be digested by cattle at maintenance levels of intake. Entries with above average values were: 3, 5, 9, 25 and 8 (Table 2).

c) **dDM yield (tons/ac):** Digestible DM yield. Amount of digestible DM from whole-corn plant produced per acre. Entries with above average values were: 25, 5, 4, 2, 6, 3, 7, and 1 (Figure 2).

d) **NDF (% of DM):** Neutral detergent fiber. Fraction of the DM (structural carbohydrate) that can be slowly digestible and/or unavailable to cattle. Entries with above average values were: 17, 10, 24, 15, and 21 (Table 2).

e) **NDFD 30h (% of NDF):** Fraction of the NDF that can be digested by cattle at maintenance levels of intake. Cultivars with the highest value were 9, 3, 25, 5, and 12, (Table 2).

f) **ADF (% of DM):** Acid detergent fiber. Fraction of the NDF that represents cellulose and lignin, expressed on a DM basis. Entries with above average values were: 10, 17, 24, 21, and 15 (Table 2).

g) **Lignin (% of DM):** Fraction of the NDF that is completely indigestible, expressed on a DM basis. Entries with above average values were: 10, 17, 24, 18 and 21 (Table 2).

h) **WSC (% of DM):** Water-soluble carbohydrates. Represent soluble sugars, which are rapidly digested if whole-corn is consumed as greenchop. When whole-corn is ensiled, most of the sugars will ferment into organic acids (e.g. lactic acid) and have a pivotal role in the silage preservation process. Entries with above average values were: 8, 5, 4, 3 (Table 2).

i) **Starch (% of DM):** Fraction of the DM (non-structural carbohydrate) that is moderately available to cattle. It is a good source of energy for high producing cattle. During ensiling some starch will be fermented to organic acids, aiding the preservation process. Entries with above average values were: 14, 3, 7, 6, and 1 (Table 2).

j) **Digestible starch 7h (% of starch**): Fraction of the starch that can be digested in the rumen. Entries with above average values were: 25, 12, 4, 16 and 8 (Table 2).

k) **NE_L (Mcal / lb of DM):** Net energy for lactation. Energy from the feed available for lactation and maintenance of dairy cattle. Entries with above average values were: 3, 5, 14, 8 and 25 (Table 2).

l) **NE_m (Mcal / lb of DM):** Net energy for maintenance. Energy from the feed available for maintaining cattle in equilibrium (i.e. neither gaining or losing weight). Entries with above average values were: 3, 5, 25, 14 and 8 (Table 2).

m) **NE_g (Mcal / lb of DM):** Net energy for gain. Energy from the feed available for body weight gain above maintenance. Entries with above average values were: 3, 5, 14, 8 and 25 (Table 2).

n) **CP (% of DM):** Crude protein. Entries with above average values were: 12, 24, 10, 17 and 18 (Table 2).

o) **Soluble Protein (% of CP):** Fraction of the CP that is rapidly digestible. Entries with above average values were: 22, 25, 12, 19 and 4 (Table 2).

p) **NDICP (% of DM):** Fraction of the CP that is slowly digestible, expressed on a DM basis. Entries with above average values were: 10, 12, 19, 24 and 15 (Table 2).

q) **ADICP (% of DM):** Fraction of the CP that is indigestible, expressed on a DM basis. Entries with above average values were: 10, 17, 24, 21 and 15 (Table 2).

Tables and Figures

Table 1. Entry description.

Brand	Description	Identification #
Dekalb	DKC 66-87	1
Dekalb	DKC 67-88	2
Pioneer	P1449 XR (BMR)	3
Pioneer	P2089 YHR	4
Mycogen	TMF 2H 919	5
Mycogen	TMF 2L 825	6
Mycogen	TMF 2H 747	7
Mycogen	TMF 2R 737	8
Mycogen	F2F 817 (BMR)	9
Phoenix	7914A4	10
Phoenix	6522A4	11
Croplan	8750 RHLF	12
Croplan	6640	13
Croplan	7087	14
Croplan	7927	15
Croplan	8621	16
Croplan	6926	17
Kings / Masters Choice	MC590 C250	18
Kings / Masters Choice	628	19
Kings / Masters Choice	6894	20
Kings / Masters Choice	6753	21
Kings / Masters Choice	6153	22
Kings / Masters Choice	6583	23
Healthy Herd	87A12	24
Healthy Herd	87HFC14	25

Table 2. Concentration of crude protein (CP, % of DM), acid detergent insoluble crude protein (ADICP, % of DM), soluble protein (SP, % of CP), neutral detergent insoluble crude protein (NDICP, % of DM), acid detergent fiber (ADF, % of DM), neutral detergent fiber (NDF, %^ of DM), lignin (% of DM), starch (STH, % of DM), STH digestibility (STHD, % of STH), water soluble carbohydrates (WSC, % of DM), net energy for lactation (NE_L, Mcal/lb), net energy for maintenance (NE_M, Mcal/lb), net energy for gain (NE_G, Mcal/lb), and DM digestibility (DMD, % of DM), and NDF digestibility (NDFD, % of NDF) in corn varieties.

Identification #	CP	ADICP	SP	NDICP	ADF	NDF	Lignin	STH	STHD	WSC	NEL	NEM	NEG	DMD	NDFD
1	8.4	0.9	28	1.6	25.3	43.1	3.6	33.4	61	4.6	0.75	0.77	0.49	79	52
2	8	0.9	28	1.6	25	43.1	3.3	31.5	53	7.5	0.73	0.74	0.46	78	49
3	7.2	0.5	28	1.2	20.8	38.1	2.7	37.4	64	10.3	0.84	0.87	0.58	87	65
4	7.5	0.7	33	1.5	25.7	44	3.5	30.4	70	11	0.74	0.75	0.47	78	51
5	8.7	0.7	27	1.6	23.4	39.6	3	31.6	60	11.7	0.82	0.84	0.55	85	62
6	8.9	0.9	26	1.9	24.9	42.3	3.5	33.9	63	5.1	0.77	0.79	0.51	80	54
7	7.9	0.7	29	1.7	24.6	43.3	2.7	35.6	57	4.2	0.76	0.78	0.5	80	54
8	7.6	0.7	32	1.4	24.1	40.6	3.3	31.6	68	12.9	0.79	0.81	0.53	83	58

ID	CP	ADICP	SP	NDICP	ADF	NDF	Lignin	STH	STHD	WSC	NEL	NEM	NEG	DMD	NDFD
9	9.1	0.8	23	2	25	44.9	3.3	31.2	33	3	0.76	0.78	0.5	85	66
10	11.3	2	28	2.2	35.4	55.7	6.5	13	n.a.	5.8	0.6	0.61	0.35	74	54
11	9.4	1.1	30	2.1	28.5	48.5	3.4	27.5	60	4.5	0.7	0.71	0.44	77	52
12	13	1.7	34	2.1	28.1	49.8	3.8	23.6	71	8.2	0.73	0.76	0.49	79	59
13	8.3	0.9	24	1.6	25	43.6	3.3	33.1	54	3.1	0.75	0.76	0.48	78	50
14	8.4	0.6	25	1.5	21	35.5	2.7	39.4	54	7.8	0.8	0.81	0.53	81	48
15	9.5	1	32	2.1	31.8	53.4	4	22.8	67	3	0.66	0.68	0.42	73	50
16	9.3	1.1	29	2.1	28.9	50.6	3.8	26	70	3.6	0.71	0.75	0.47	76	53
17	10.7	1.8	29	2.1	35.4	56.1	5.5	16.7	19	4.2	0.61	0.63	0.37	72	50

ID	CP	ADICP	SP	NDICP	ADF	NDF	Lignin	STH	STHD	WSC	NEL	NEM	NEG	DMD	NDFD
18	10.2	1.7	30	2.1	29.5	48.9	4.7	23.4	23	5.9	0.7	0.72	0.45	78	55
19	9.5	1	34	2.1	28.3	48.9	3.5	26.1	56	5.9	0.7	0.72	0.44	77	53
20	9.4	1.1	31	2	25.1	44.5	3.6	33.1	54	4.1	0.75	0.77	0.49	80	55
21	10.1	1.6	30	2.1	32	52.4	4.1	18.9	43	5.9	0.63	0.64	0.37	73	49
22	9.7	0.2	48	0.9	23.6	43.6	3.3	30.4	56	9.2	0.75	0.77	0.49	80	54
23	8	0.7	31	1.5	26.4	44.7	3.6	31.9	61	6	0.74	0.76	0.48	79	54
24	11.4	1.8	32	2.1	33.6	54.9	4.8	14.2	n.a	6.1	0.64	0.66	0.39	75	54
25	9.4	1.2	38	1.4	26.3	43	3.5	31.1	98	7.9	0.78	0.81	0.52	84	62

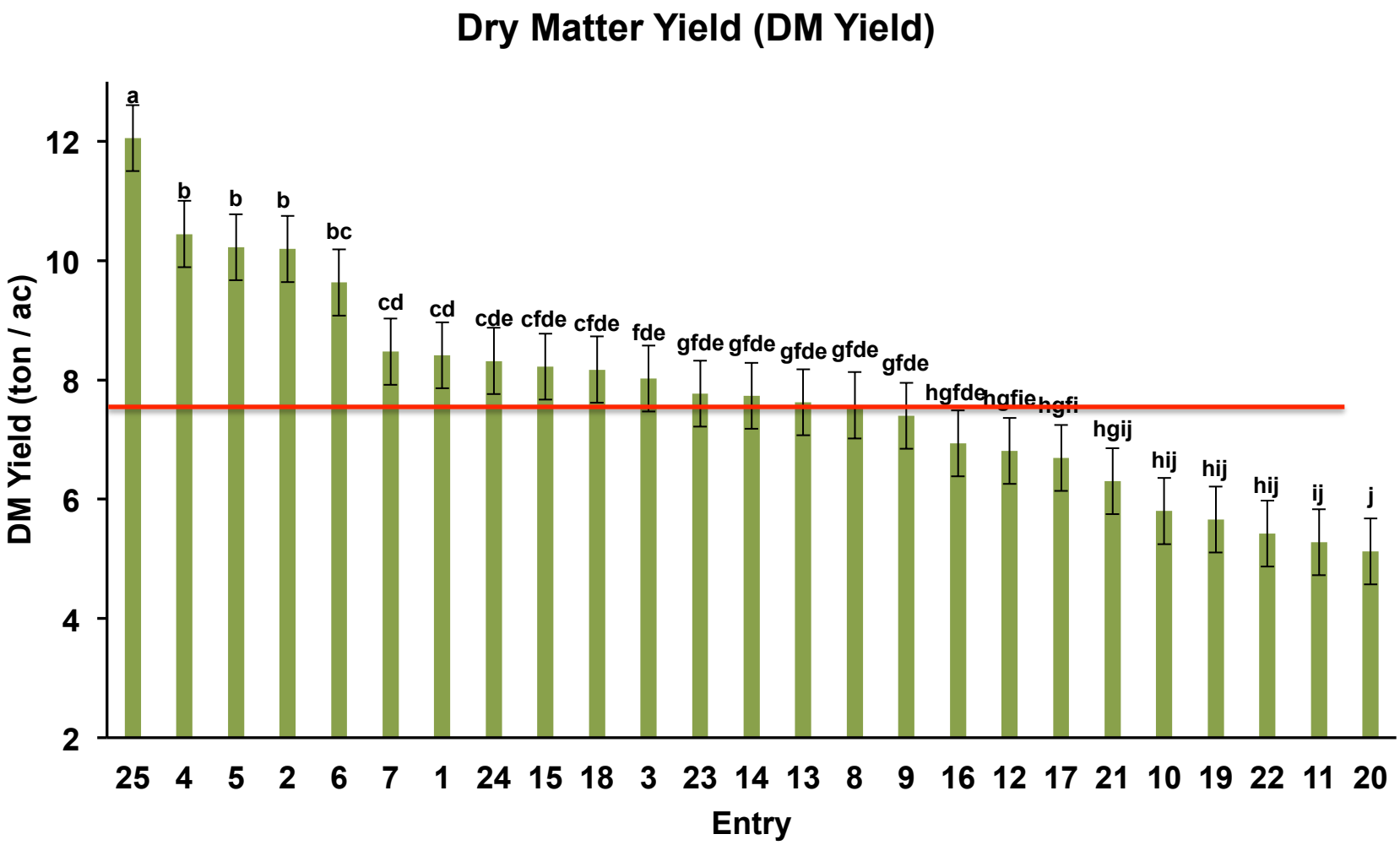

Figure 1. Dry matter (DM) yield of 25 corn varieties planted in Waynesville in 2014. Red line indicates average DM yield for the trial = 7.7 ton/ac. Means with different letters are significantly different ($P < 0.05$)

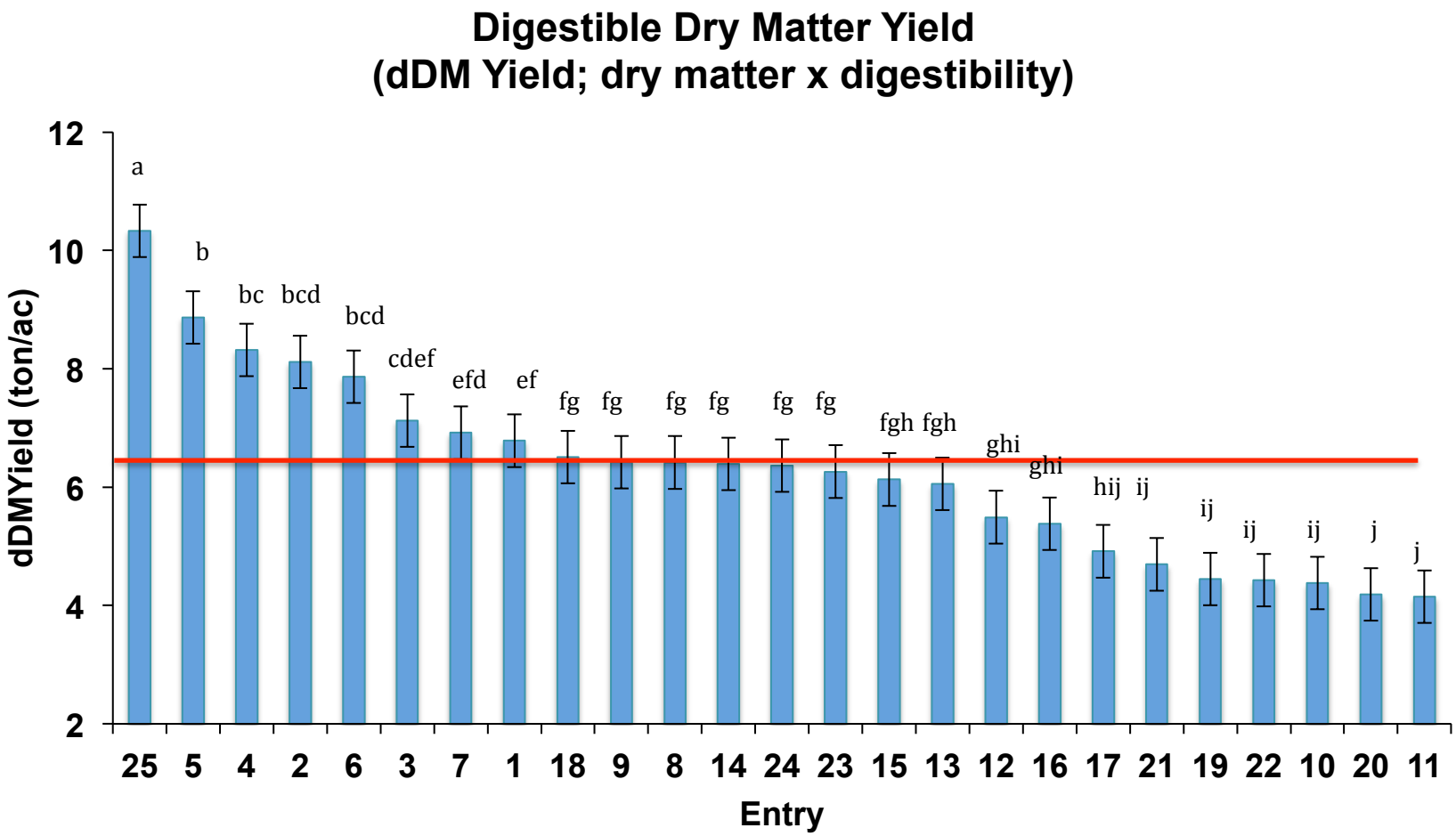

Figure 2. Digestible dry matter (dDM) yield of 25 corn varieties planted in Waynesville in 2014. Red line indicates average dDM yield = 6.28 ton/ac. Means with different letter are significantly different ($P < 0.05$).