FERMENTATION OF COWPEA ALONE OR IN MIXTURE WITH CORN OR FORAGE SORHGUM FOR SILAGE

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INTRODUCTION

It is well documented that corn and forage sorghum silage have high energy value, but crude protein (CP) concentration is low. There is evidence that intercropping corn or forage sorghum with annual legumes could increase CP concentration of the mixture. Cowpea bean (*Vigna unguiculata* L. Walp.) is a warm-season annual legume that has high CP concentration and good nutritive value. Cowpea has shown good adaptation to southeastern, NM. There is limited information about fermentation characteristics of cowpea when alone or in mixture with corn or forage sorghum for silage.

The objective of this study was to assess the nutritive value and fermentation characteristics of cowpea alone or in mixture with different proportions of corn or forage sorghum silage.

MATERIAL AND METHODS

- **Corn (CS), cv Pioneer 32B34; forage sorghum (FS), cv DG 712; and Cowpea (CB), cv Iron and Clay; were planted in separate fields in 2009 at NMSU-Agricultural Science Center at Clovis, NM.**
- **All three crops were irrigated and fertilized based on soil analysis recommendations.**
- **Corn and FS plant density were 79,000 and 222,000 plants/ha respectively, and CB plant density was 148,000 plants/ha.**
- **Corn, FS, and CB maturity at harvest were 1/2 milk line, late-dough stage and vegetative, respectively.**
- **All three crops were chopped separately to a theoretical length of 20 mm.**
- **Six, hand-made CS-CB and FS-CB mixtures were ensiled in a 30 x 40 cm plastic bag and vacuum sealed, four bags per treatment. Each treatment-combination consisted of 0.5 kg per bag.**
- **Mixtures were fermented for 137 d at room temperature (25° C).**
- **Mixtures were analyzed for nutritive value and fermentation profiles.**
- **Data were analyzed using the Proc Mixed procedure of SAS as a complete randomized design. Differences among means were tested using LSMEANS with the PDIFF option ($P < 0.05$).**

Table 1. Nutritive Value (g/kg DM) of Cowpea (CB), Corn (CS) and Forage Sorghum (FS) Silage Mixtures.

	DM[1]	CP	ADF	NDF	NDFD	TDN
CS	386	82	212	348	620	773
FS	309	86	253	389	428	660
75CS-25CB	328	103	232	388	605	740
75FS-25CB	276	118	258	369	413	668
50CS-50CB	257	145	286	418	600	668
50FS-50CB	237	147	274	392	498	668
25CS-75CB	220	189	295	401	628	643
25FS-75CB	204	184	321	433	554	643
CB	169	267	357	416	527	577
SEM	6.33	3.48	10.40	13.95	13.69	11.1
P-value	0.001	0.001	0.001	0.013	0.001	0.001

[1]DM = Dry Matter; CP = Crude Protein, ADF = Acid Detergent Fiber, NDF = Neutral Detergent Fiber, NDFD = Neutral Detergent Fiber Digestibility, and TDN = Total Digestible Nutrients.

RESULTS

- **Crude protein concentration increased either in CS or FS as the proportion of CB increased in the mixture (Table 1).**
- **NDF and ADF concentrations increased in the mixtures with the addition of CB, but NDF digestibility increased in the FS-CB mixtures but not in the CS-CB mixtures (Table 1).**
- **All CS-CB and FS-CB mixtures had greater pH than CS and FS alone ($P < 0.0001$) (Table 2).**
- **Both lactic and acetic acids increased in either CS-CB or FS-CB mixtures as the proportion of CB increased in the mixture (Table 2).**
- **Because of the low DM concentration in CB, mixtures with high proportion of CB conducted to a clostridial fermentation.**

CONCLUSIONS

- **Mixing CB with CS or FS for silage increased CP concentration, but also increased other constituents such as ADF, NDF, pH, and lactic and acetic acid concentrations.**
- **Cowpea can be mixed with CS or FS for silage, but it is necessary to wilt the CB to avoid a clostridial fermentation.**

Table 2. Fermentation Profile (g/kg DM) of Cowpea (CB), Corn (CS) and Forage Sorghum (FS) Silage Mixtures.

	pH	Lactic Acid	Acetic Acid	L:A ratio	Other Acids[1]	Total Acids
CS	3.93	36.2	12.7	3.0	0.0	49.0
FS	4.13	32.9	17.4	2.8	0.2	50.4
75CS-25CB	4.10	53.3	16.3	3.3	0.0	69.9
75FS-25CB	4.50	52.6	26.1	2.1	0.4	79.1
50CS-50CB	4.35	84.1	36.4	2.3	0.0	121.2
50FS-50CB	4.70	63.3	40.4	1.6	0.7	104.4
25CS-75CB	4.58	103.0	51.7	2.0	0.0	155.8
25FS-75CB	5.30	36.7	46.5	0.7	26.3	109.4
CB	5.93	0.9	82.3	0.0	66.3	149.5
SEM	0.06	5.12	2.87	0.34	3.17	3.33
P-value	0.001	0.001	0.001	0.001	0.001	0.001

[1] Propionic, Butyric, Iso-butyric acids