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ASSOCIATIVE EFFECT OF INGREDIENT SOURCES ON THE PARTIAL MIXED RATION AND TMR SILAGES FOR FEEDLOT BEEF CATTLE DIETS IN BRAZIL

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Introduction & Objective

Corn-based ethanol industry evolved in Brazil reaching 22 plants in 2024, producing together 5 million ton of DDG (dried) and WDG (wet) coproducts. Besides the huge increase of DDG for ruminant and monogastric diets, it is still there the offering of wet distillers' grains with solubles (WDGS) as a diet ingredient, mostly for finishing beef cattle. Its typical high moisture content (60-65%) and high solubles pose a challenge to logistics on hauling, storage and conservation at the farm level. Cottonseed hulls and soybean hulls are also available in large quantities in Brazil. Therefore, **wet distillers' bran with solubles** (WDBS) might be conserved combined with these drier ingredients to form a stable total mixed ration (TMR) silages or either partial mixed ration (PMR) silages to reduce conservation losses during storage and become more attractive to compose beef cattle finishing diets. The aim of this study was to identify strategies to control the spoilage and effluent losses in WDBS combined with dry ingredients for silage production.

Material and Methods

Treatments composition

Ingredient (% DM)	Treatment				
	TMR	WDBS	WDBS +CH	WDBS +SH	WDBS +CORN
Tropical grass silage	7	-	-	-	-
Cottonseed hulls (CH)	9	-	15	-	-
Soybean hulls (SH)	12	-	-	19	-
Ground corn (CORN)	19	-	-	-	28
WDBS	50	100	85	81	72
Mineral-vitamin mix	3	-	-	-	-

CH, SH and CORN were mixed and ensiled according to the inclusion rate defined on the TMR silage treatment, which was based on a typical beef cattle finishing diet in Mato Grosso, Brazil. All treatments were mixed thoroughly, packed into 20-L polyethylene bucket silos and stored for either 60 or 120 days with four replicates. The treatments were analyzed in a 5×2 factorial scheme (five treatments and two storage lengths). The statistical analysis was carried out using the MIXED procedure of SAS 9.Means were considered different when P < 0.05 by Tukey test.

Results

Table 1. Fermentative profile of TMR silage and PMR silage.

Items	Length of storage (d)	Treatments						SEM	P-value		
		TMR	WDBS	WDBS+ CH	WDBS+ SH	WDBS+ CORN	Mean		T	L	T×L
pH	60	4.34Aa	3.73Bc	3.78Bbc	3.79Bb	3.74Bc	-	0.01	<0.01	<0.01	<0.01
	120	4.34Aa	3.87Ab	3.92Ab	3.92Ab	3.88Ab	-				
Lactic acid, % DMcorr[1]	60	4.74	4.95	3.69	5.07	4.48	*4.59B*	0.61	0.03	<0.01	0.13
	120	5.49	6.08	6.14	8.64	7.51	*6.77A*				
	Mean	*5.12ab*	*5.52ab*	*4.91b*	*6.85a*	*5.99ab*	-				
Acetic acid, % DMcorr	60	0.37	0.30	0.24	0.30	0.31	*0.30B*	0.03	<0.01	0.01	0.47
	120	0.40	0.31	0.31	0.40	0.36	*0.36A*				
	Mean	*0.39a*	*0.31b*	*0.27b*	*0.35ab*	*0.33ab*	-				
Propionic acid, mg/kg DMcorr	60	383	140	130	134	120	*181B*	17.9	<0.01	0.01	0.17
	120	351	145	176	172	152	*199A*				
	Mean	*367a*	*143b*	*153b*	*153b*	*136b*	-				
Butyric acid, mg/kg DMcorr	60	117Aa	8.50Abc	3.25Ad	3.75Acd	12.5Ab	-	3.22	<0.01	0.70	0.02
	120	105Aa	11.0Ab	3.25Ac	6.00Abc	5.00Bc	-				
Ethanol, % DMcorr	60	0.11Aa	0.10Aa	0.10Aa	0.13Ba	0.11Ba	-	0.01	<0.01	<0.01	<0.01
	120	0.10Ab	0.12Ab	0.13Ab	0.20Aa	0.19Aa	-				

[1] Volatile-corrected dry matter.
T - treatment; L - length of storage; T×L - interaction between treatment and length of storage.
a-c Means of treatments within a row with different lowercase letters differ (α=0.05).
A-B Means of storage length within a column with different capital letters differ (α=0.05).

Table 2. Fermentative profile of 45 days fermented TMR silages treated with heterolactic bacteria or chemical additives.

Items	Length of storage (d)	Treatments					SEM	P-value		
		TMR	WDBS	WDBS+ CH	WDBS+ SH	WDBS+ CORN		T	L	T×L
DM losses,%	60	1.80Ac	5.05Bb	7.85Aa	3.83Bbc	6.33Bab	0.61	<0.01	0.01	0.01
	120	0.58Ab	7.48Aa	7.65Aa	6.28Aa	8.75Aa				
Production of effluent (g/kg FM)	60	26Ac	120Ba	101Aab	40Bc	86Bb	5.30	<0.01	0.01	<0.01
	120	35Ad	180Aa	115Ab	57Ac	120Ab				

FM – fresh matter.
T - treatment; L - length of storage; T×L - interaction between treatment and length of storage.
a-c Means of treatments within a row with different lowercase letters differ (α=0.05).
A-B Means of storage length within a column with different capital letters differ (α=0.05).

Prolonged length of storage increased pH, DM losses and effluents production. Fermentation and losses in silages, measured during the ensiling period and mixed either as TMR or PMR silages were dependent of the associative effects of the individual Water Retention Capacity (WRC) from single ingredients.

Conclusions

The results suggested that the strategy of mixed ensiled high moisture WDBS with other feedstuff was an effective method of preserving it. All WDBS-based PMR silage were well-preserved with a low pH and high aerobic stability. WDBS+SH treatment reached the lowest dry matter loss and effluent net flow. Despite the relatively higher pH, WDBS-based TMR did not affect the fermentation quality and aerobic stability, and showed lower dry matter loss and effluent production than WDBS- based PMR.

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