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AN EVALUATION OF THREE FEED MIXING WAGONS

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Summary

Three mixer wagons, a poor condition triple auger (PCA), a good condition triple auger (GCA), and a new reel type (RT) mixer, were evaluated after 2, 4, 6, and 8 minutes of mixing time. Two diets were used: a grower diet with 37.14% ground hay and 62.86% concentrate and a finisher diet with 10.22% ground hay and 89.78% concentrate on a dry matter basis. Concentrate included whole shelled corn, high moisture ear corn and pelleted and liquid supplements. The coefficient of variation among acid detergent fiber levels appeared to be the best indicator of adequacy of mix. The PCA mixer required 8 minutes to mix both the finisher and grower diets. The grower diet appeared adequately mixed after 2 minutes for the GCA mixer and after 6 minutes for the RT mixer. The finisher diet appeared adequately mixed after 4 minutes for both the GCA mixer and the RT mixer.

Key Words: Mixer Wagon, Ration Quality Control

Introduction

Ration quality control is an important component of feedlot management. Providing cattle with properly formulated and mixed diets is critical in maintaining uniform levels of feed intake and optimal performance. Previous research conducted at the Southeast South Dakota Experiment Farm has demonstrated that growing heifers consuming a completely mixed diet gained weight 10% more rapidly and converted feed 10% more efficiently than heifers consuming

a diet where the ingredients were layered in the feed bunk.

There are several different types of mixing equipment available for producers to choose from. In addition, equipment that is currently used by many producers may be in need of major repair. The objective of this research was to evaluate how effective three different mixer wagons were in mixing two different ration types.

Materials and Methods

The mixers evaluated in this study included an Oswalt[®] triple auger mixer that was in good operating condition (GCA), a Little Augie[®] triple auger mixer that was in need of many repairs (PCA), and a Reel Augie[®] reel type (RT) mixer. The auger flighting was missing from one of the top augers near the rear of the PCA mixer.

Table 1 shows the ingredient and theoretical nutrient composition of the growing and finishing rations used in this study. For both the growing and finishing diets, whole shelled corn was added first to the mixers. Liquid supplement was distributed evenly across the top of the corn. The liquid supplement was then mixed into the corn for about 30 seconds prior to the addition of the remaining ingredients. The mixers were then stopped and the remaining ingredients were added in the following order for the growing diet: ground high moisture ear corn, soybean meal, pelleted supplement, switchgrass hay, and brome hay. The remaining ingredients were added to the finishing diet in the following order: soybean meal, pelleted supplement, and switchgrass hay.

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Table 1. Ingredient and nutrient composition of diets used to evaluate mixing equipment

Item ^a	Diet type	
	Grower	Finisher
Ingredient		
Whole shelled corn	28.44	79.93
Ground high moisture ear corn	21.99	--
Switchgrass hay	19.35	10.22
Bromegrass hay	17.79	--
Soybean meal	7.43	5.24
Liquid supplement	2.72	2.51
Pelleted supplement	2.28	2.10
Nutrient		
Dry matter	80.07	86.78
Crude protein	12.03	11.40
Acid detergent fiber	20.85	8.98

^aDry matter basis.

Once the last ingredient was added, the mixer was started and allowed to run for 2 minutes. The mixer was then stopped and a 2-quart sample was obtained off the top of the mixture from the front, middle, and back of the wagon. The mixer was then started again and stopped at 2-minute intervals and additional samples were obtained at each interval. Thus, three samples were obtained after 2, 4, 6, and 8 minutes of mixing. Samples were analyzed for dry matter, crude protein, acid detergent fiber (ADF), and ash according to standard wet chemistry procedures. ADF values were reported on an ash free basis.

Samples collected from the front, middle, and rear of the mixer were considered replicates 1, 2, and 3 at each time period. Mean values were calculated at each time period and the coefficient of variation was used as a criterion to determine adequacy of mix.

Results and Discussion

Table 2 shows the observed dry matter, crude protein, and ADF values for the various mixer ration types. Coefficients of variation are

shown in Table 3. The coefficients of variation observed for dry matter content were extremely small for all mixers, rations, and time periods evaluated. Dry matter appears to have been adequately distributed throughout the mixtures. Most of the ingredients used in the formulation had similar dry matter contents. Therefore, it is not surprising that dry matter content can not be effectively used to evaluate the adequacy of ration mixing in these diets. Perhaps dry matter would be more useful if corn or sorghum silage or another wet feed was used in the formulation.

The crude protein coefficients of variation reported for the finishing diet mixed with the PCA mixer suggest that the optimum mix time for the finishing diet is 8 minutes. The other coefficients of variation reported for crude protein were not very useful in evaluating the mixers.

ADF values are much more variable and the most useful measure in evaluating the adequacy of diet mix. ADF values ranged from essentially 0 for the liquid supplement to 46.32% for the switchgrass hay. As a result of this wide range in ADF composition, reduced coefficients of variation may indicate an adequate mix.

Table 2. Mean nutrient composition for grower and finisher diet for each mixer wagon

Variable	Time, min.	Diet type					
		Grower			Finisher		
		PCA ^a	GCA ^b	RT ^c	PCA	GCA	RT
Dry matter	2	80.43	81.41	79.83	85.95	86.60	86.92
	4	81.51	81.10	79.92	85.32	86.44	86.87
	6	80.75	81.05	79.94	85.28	86.52	86.96
	8	80.55	80.97	80.02	85.72	86.79	86.97
Crude protein	2	12.53	12.15	11.81	11.06	11.07	11.65
	4	12.39	12.29	10.96	11.09	11.07	12.11
	6	12.13	12.58	10.90	11.73	11.28	11.95
	8	12.65	12.56	12.05	11.97	11.33	11.70
Acid detergent fiber	2	21.91	23.11	28.78	21.57	11.28	10.68
	4	23.65	22.98	27.87	16.78	11.80	9.94
	6	24.04	22.52	29.11	12.14	10.70	10.48
	8	24.04	22.72	25.82	11.09	10.03	10.11

^aPoor conditioned auger.

^bGood conditioned auger.

^cReel type.

The PCA mixer required 8 minutes to adequately mix the grower and finisher diets. The coefficients of variation declined over time from 35.25% to 13.36% for the grower diet and from 92.05% to 8.47% for the finisher diet.

The GCA mixer appeared to adequately mix the grower diet after 2 minutes and the finisher diet after 4 minutes. The RT mixer appeared to require 6 minutes for the grower diet and 4 minutes for the finisher diet.

The observed ADF content for both diets for all three mixers over all mixing times was greater than the theoretical levels calculated for each diet. All feed commodities were sampled and actual ADF values were used to calculate theoretical values. However, ration samples were obtained from the top of the mixer. The corn (4.56% ADF) was always the first ingredient added, while the hay (46.32 or 41.07% ADF) was the last ingredient added to the mixer. It appears

as if it is difficult to obtain a uniform mix from top to bottom in all of these mixers. A more accurate sample may be obtained directly from the feed bunk. This allows the ration to also mix as it is delivered to the bunk.

The data reported in this paper support the contention that each feed mixer and ration type should be evaluated to determine optimum time of mixing. Obtaining several samples from the entire length of the feed bunk may be a more desirable sampling procedure than obtaining samples directly from the top of the mixer wagon.

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Table 3. Coefficients of variation for the grower and finisher diet for each mixer wagon

Variable	Time, min.	Diet type					
		Grower			Finisher		
		PCA ^a	GCA ^b	RT ^c	PCA	GCA	RT
Dry matter	2	1.90	.32	.08	.52	.10	.47
	4	1.35	.17	.36	.26	.51	.29
	6	1.50	.32	.27	.27	.20	.39
	8	.91	.21	.36	.18	.22	.43
Crude protein	2	8.15	4.62	.54	21.87	1.59	1.83
	4	10.80	4.64	5.74	11.89	2.42	3.95
	6	5.80	4.46	3.97	4.79	2.08	2.80
	8	4.88	3.12	3.65	3.13	1.96	4.11
Acid detergent fiber	2	35.25	2.88	16.10	92.05	15.64	17.74
	4	26.65	11.08	17.36	64.50	5.03	5.73
	6	19.18	10.56	6.16	14.04	7.49	7.19
	8	13.36	8.57	10.14	8.47	5.25	6.46

^aPoor conditioned auger.

^bGood conditioned auger.

^cReel type.