Impact of Poultry Litter Application on Yield and Quality of Alfalfa Grown in Mississippi

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RATIONALE & OBJECTIVES

- Trials were conducted in eastern Mississippi (2018-2019) to evaluate alfalfa yield and nutritive value in response to poultry litter (PL) applications.
- Due to poor drainage and excessive weed populations, the Starkville site was abandoned. However, the Newton site experienced great growing conditions throughout both years of the trial which resulted in 11 total harvests.

STUDY DESCRIPTION

Plot layout:
Randomized complete block design with four replications.

Locations:
Newton and Starkville, MS.

Factors:
Varieties: 'Bulldog 805', 'Bulldog 505', 'Alfagraze 600RR'.

Treatments: 1 and 2 tons PL/acre; positive control (N, P, and K applied at the same nutrient content of the 2 ton/acre PL rate); negative control (P and K applied at the same nutrient content of the 2 ton/acre PL rate).

Analysis:
Forage dry matter (DM) yield, nutritive value (NIRS analysis), and stand persistence (crown counts) were determined for each plot at each harvest. Plots were harvested at 30% bloom using a self-propelled plot harvester. All data were analyzed using SAS 9.4 to determine significant differences between varieties and fertilizer treatments using repeating measures at $\alpha = 0.005$.

RESULTS

- Starkville, MS site was abandoned due to poor drainage and weed pressure.
- Eleven harvests were conducted at Newton location (6 in 2018; 5 in 2019).
- Cumulative DM yield was affected by year ($P < 0.0001$). No differences were observed by variety ($P = 0.3729$; Table 1) or fertilizer treatment ($P = 0.1141$; Table 1) when run as repeated measures.

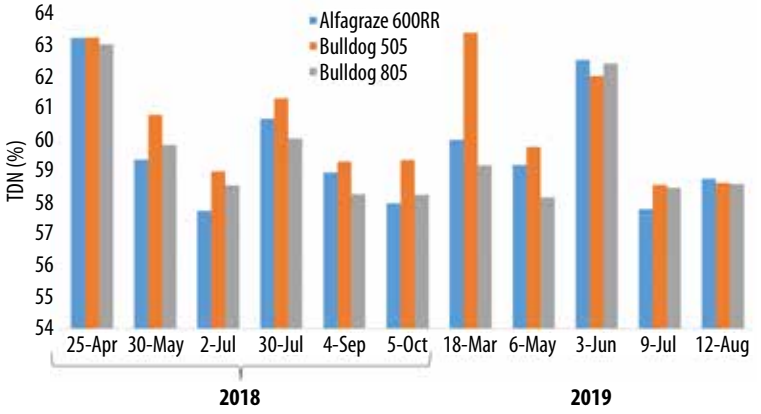
Table 1. Mean cumulative DM yield (lb/acre) by variety and fertility treatment, 2018-2019, Coastal Plain Branch Experiment Station, Newton, MS.

Variable	Yield (lb/acre)	
	2018	2019
Variety		
Bulldog 505	11,188	7,418
Bulldog 805	9,820	8,084
Alfagraze 600RR	10,519	6,602
Treatment		
(1) 1 ton PL/acre*	10,856	8,641
(2) 2 ton PL/acre*	10,754	7,448
(3) Synthetic N, P, K*†	10,569	6,229
(4) Synthetic P, K*†	9,857	7,155

*Applied in split applications; ½ in winter 2017 and ½ approximately 30 d prior to first harvest.
†Synthetic fertilizers were applied as 33-0-0 for N, 0-46-0 for P, and 0-0-60 for K; amounts used were based on PL analysis and were applied at the same rate as treatment 2.

- Crude protein (CP) was affected by harvest ($P < 0.0001$). No differences were observed by variety ($P = 0.7118$) or fertilizer treatment ($P = 0.4470$).
- Total digestible nutrients (TDN) was affected by harvest ($P < 0.0001$). Differences were observed by variety ($P < 0.0001$; Figure 1) and treatment ($P = 0.0452$; Figure 2).

Figure 1. Mean TDN by variety across all fertilizer treatments, 2018-2019, Coastal Plain Branch Experiment Station, Newton, MS.



- 'Bulldog 505' consistently produced the lowest cost per ton for both years of the trial ($96.29 and $147.57 for 2018 and 2019, respectively; Table 2).
- The 1 ton PL/acre fertility treatment resulted in the lowest cost per ton for both years of the trial ($93.89 and $115.37 for 2018 and 2019, respectively; Table 2).

Figure 2. Mean TDN by fertilizer treatment across all varieties, 2018-2019, Coastal Plain Branch Experiment Station, Newton, MS.

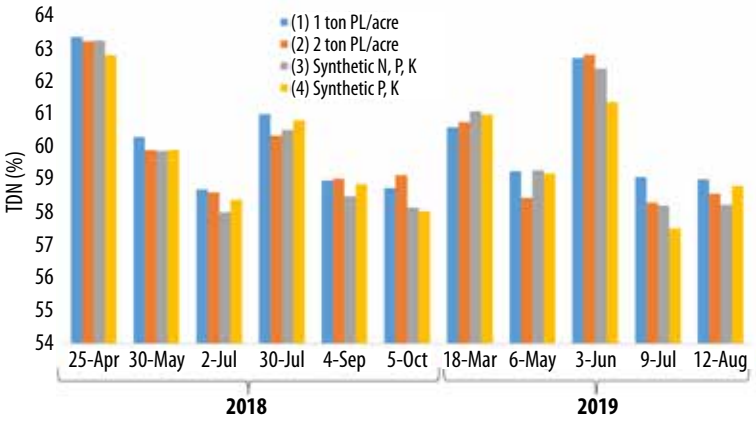


Table 2. Mean cost per ton ($/ton) by variety and fertilizer treatments, 2018-2019, Coastal Plain Branch Experiment Station, Newton, MS.

Variable	Cost per ton ($/ton)[§]	
	2018	2019
Variety		
Bulldog 505	96.29 c*	147.57 b
Bulldog 805	112.49 b	147.96 b
Alfagraze 600RR	126.18 a	198.87 a
Treatment		
(1) 1 ton PL/acre[†]	93.89 b	115.37 b
(2) 2 ton PL/acre[†]	99.18 b	143.45 b
(3) Synthetic N, P, K[†‡]	128.71 a	209.34 a
(4) Synthetic P, K[†‡]	124.84 a	191.03 a

*Lowercase letters denote significant differences within a year by variable (α = 0.05).
[†]Applied in split applications; ½ in winter 2017 and ½ approximately 30 d prior to first harvest.
[‡]Synthetic fertilizers were applied as 33-0-0 for N, 0-46-0 for P, and 0-0-60 for K; amounts used were based on PL analysis and were applied at the same rate as treatment 2.
[§]Costs include operational/input expenses on a per acre basis for baleage. These include: equipment, seed, pesticide, fertilizer, net wrap, plastic wrap, labor, and depreciation costs (Mississippi State University Forage Planning Budget, 2017).

CONCLUSIONS/SUGGESTIONS

- While no differences were observed between variety or fertility treatments for cumulative DM yield, management decisions should be based on costs and input availability, along with soil and tissue analysis to meet crop demands.
- With successive years of PL applications, special attention should be placed on soil testing to ensure nutrients (specifically P) are being removed with hay and are not accumulating in soil profile.
- 'Bulldog 505' combined with the 1 ton PL/acre application generated the most economical cost per ton DM produced.
- Forage nutritive value decreases with increasing maturity; harvest timing had the greatest impact on DM yield and nutritive value.

Alfalfa
U.S. Alfalfa Farmer Research Initiative

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