Agriculture & Natural Resources
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Nitrogen-Delivery Methods for Stocker Cattle Grazing Annual Ryegrass

This information sheet provides a summary from a three-year stocker cattle trial in Central Alabama evaluating nitrogen delivery methods for grazed annual ryegrass systems and animal performance.

Introduction: Nitrogen fertilizer costs represent a major variable input cost for forage and cattle production. Alternatives to nitrogen fertilizer that maintain production while reducing costs may be advantageous for cattle producers. Nitrogen fertilizer alternatives can include interseeded legumes or supplementation with high-protein by-product feeds (generally ≥ 20% CP). The following project evaluated legume or supplemental feeding systems as a method for providing part of the nitrogen fertilizer requirement in grazed annual ryegrass systems.

What were the goals of this study?

- To compare cattle performance (average daily gain and total gain/acre), grazing factors (stocking densities, forage allowance, and grazing days), and economics of nitrogen fertilizer and alternative N-delivery methods including: interseeded crimson clover or arrowleaf clover, supplementation with dried distillers grains plus solubles, or supplementation with whole cottonseed, with or without monensin.
- To compare forage characteristics (forage mass, CP, and digestibility) in each system and clover presence in those containing legumes.

What was evaluated?

In each of three years, 90 crossbred stocker steers [average initial body weight 528 pounds, (lb)] were randomly assigned to one of 30 two-acre pastures (3 steers/pasture):

- Treatments included 1) pressed complete mineral block with or without monensin and 2) N-delivery methods of: annual ryegrass fertilized with 100 lb N/ac in split application (NFERT), annual ryegrass fertilized with 50 lb N/ac with interseeded crimson clover (CC), annual ryegrass fertilized with 50 lb N/ac with interseeded arrowleaf clover (AC), annual ryegrass fertilized with 50 lb N/ac and dried distillers grains plus solubles supplemented at 0.65% of animal body weight daily (DDGS), annual ryegrass fertilized with 50 lb N/ac and whole cottonseed supplemented at 0.65% of animal body weight daily (WCS).
- Seeding rates were: 30 lb ryegrass/ac for NFERT, DDGS and WCS, 15 lb ryegrass and 30 lb crimson clover for CC, and 15 lb ryegrass and 8 lb arrowleaf clover/ac for AC.
- In each of the three years grazing lasted: 140 d in year 1, 84 d in year 2, and 56 d in year 3, due to different yearly climatic conditions.
- Steers were weighed every 28 days during the trial. Stocking densities and supplement amounts were adjusted at the same time. Stocking densities were adjusted to maintain a forage allowance of 1 lb forage DM mass/lb steer BW.

- Forage mass (lb dry matter per acre) and clover presence (% of stand) were measured every 28 days. Forage nutritive value analyses included crude protein (CP) and *in vitro* true digestibility (IVTD)

Forage Responses (Table 1 and 2)

- Nitrogen-delivery method did not impact forage CP or IVTD (17 and 89% DM, respectively).
- Forage mass was greatest for NFERT, DDGS and WCS, intermediate for CC, and least for AC.
- Clover presence was greater for CC than AC. There was increased presence of CC when monensin was supplemented.

Table 1. Forage mass (lb DM/acre) for N-delivery systems in grazed annual ryegrass.

Treatment	Forage mass, lb DM/acre
NFERT	867[a]
CC	758[b]
AC	651[c]
DDGS	833[a]
WCS	815[a]

[abc] Within a column means without a common superscript differ ($P < 0.10$).

Table 2. Clover presence in grazed annual ryegrass overseeded with crimson or arrowleaf clover and supplemented with or without monensin.

Clover Presence (%)	CC	AC
Overall	12.9[ae]	0.6[b]
With monensin	16.7[d]	0.4

[abc] Within row means without a common superscript differ ($P < 0.10$).
[de] Within a column means without a common superscript differ ($P < 0.10$).

Cattle Performance (Table 3)

- ADG, total gain/ac, stocking density, and grazing days/ac were all greater for NFERT, DDGS and WCS when compared with CC and AC.

Table 3. Effect of N-delivery method on cattle performance

	N-delivery methods				
Item	NFERT	CC	AC	DDGS	WCS
ADG (lb/d)	3.3[a]	2.8[b]	2.8[a]	3.3[a]	3.2[a]
Total gain (lb/ac)	389[a]	289[b]	277[b]	398[a]	388[a]
Stocking density (steers/ac)	1.5[a]	1.2[b]	1.2[b]	1.4[a]	1.4[a]
Grazing days (d/ac)	125[a]	102[b]	98[b]	121[a]	123[a]

[ab] within row means without a common superscript differ ($P < 0.10$).

Economic Evaluation (Table 4)

- Input costs ($/ac) were greatest for DDGS and WCS, intermediate for NFERT and AC, and least for CC. This reflects increased costs associated using feed inputs in the supplementation systems.
- Overall revenue per acre was greatest in NFERT and supplemented pastures because of greater gain per acre supported in these systems.

Table 4. Estimated input costs ($/acre) associated with N-delivery methods for grazed annual ryegrass

Item	N-delivery method				
	NFERT	CC	AC	DDGS	WCS
Fertilizer, $/ac	$85.00	$57.50	$57.50	$57.50	$57.50
Seed, $/ac	$19.00	$39.00	$45.40	$19.00	$19.00
Supplement, $/ac	$0.00	$0.00	$0.00	$49.92	$57.05
Fertilizer, seed, and supplement input costs, $/acre	$104.00	$96.50	$102.90	$126.42	$133.55
Revenue/ac, $/ac	$291.75	$216.75	$207.75	$298.50	$291.00
Returns to management and other costs/acre, $/ac	$187.75	$120.25	$104.85	$172.08	$157.45

Take Home Points

- Supplementation with DDGS and WCS maintained or exceeded cattle performance (ADG, total gain, stocking density, and grazing days) when compared with NFERT and interseeded clover pastures.
- Among the clovers, CC provided more forage mass, but this did not translate to increased ADG, total gain/ac, stocking density, or grazing days/ac compared with AC.
- Supplementation with high-protein by-product feeds may be a viable option for reducing N fertilizer usage while maintaining cattle performance.

Acknowledgements: Special thanks to the Alabama Agricultural Experiment Station, Alabama Cattlemen's Association, and National Institute of Food and Agriculture, US Department of Agriculture. Appreciative acknowledgement is extended to Ridley Block Operations, Mankato, MN and The Wax Company LLC, Amory, MS for providing compressed mineral block and ryegrass seed, respectively, used in this study.

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