

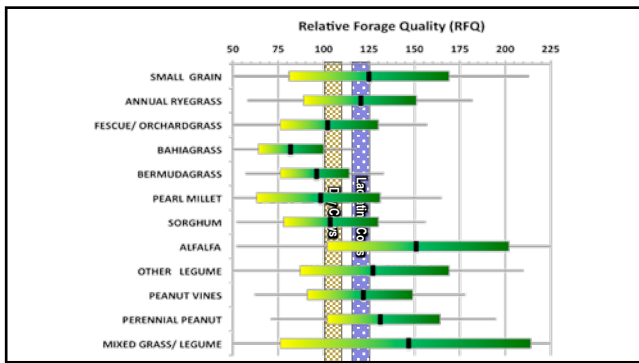
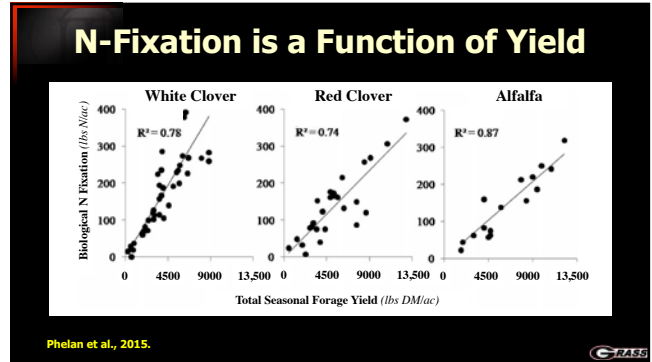
Georgia Forages Conference

Benefits and limitations to replacing commercial N with legumes in cool season grass-based pastures

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Dr. Dennis Hancock
 Professor and Extension Forage Specialist
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Integrating Legumes

“Dilution is the Solution”


- Plant legumes with E+ tall fescue
- > “Dilutes” (offsets) consumption of hot fescue



The Effect of Clover Addition to Grass on Animal Performance and Productivity

Blaser, et al. 1956. (Virginia).


Treatment	ADG lbs/hd/d	Steer days Steer-days/ac	Gain/acre lbs
Orchardgrass + 216 lb N/ac			
Orchardgrass + Clover			
Fescue (?E+) + 216 lb N/ac			
Fescue (?E+) + Clover			



The Effect of Clover Addition to Grass on Animal Performance and Productivity

Blaser, et al. 1956. (Virginia).

Treatment	ADG lbs/hd/d	Steer days Steer-days/ac	Gain/acre lbs
Orchardgrass + 216 lb N/ac	1.07b		
Orchardgrass + Clover	1.19a		
Fescue (?E+) + 216 lb N/ac	0.89c		
Fescue (?E+) + Clover	1.01b		



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Summary of Animal Production Data

- Burns and Standaert (1985) found 42 experiments measuring ADG in grass+N vs. grass+clover comparisons. 90% reported advantage for grass+clover (mean = 18% inc.)
- Only 38 studies with production/acre reported.
 - Mean inc. in production/acre was 18% inc.
 - But, only 50% of studies showed a real (significant) increase. 27% showed no difference, and 23% showed a DECREASE!
- Persistence an issue in some of the others exhibiting a dec.?

Persistence is a KEY Consideration

Table 6. Beef steer performance on tall fescue pastures planted fall 1998 with Durana white vs Regal ladino clover in central Georgia, fourth year after establishment, March 28-June 14, 2002. Paddocks were not grazed the first year due to extreme drought. (Bouton et al., 2003).

Pasture	Average daily gain (lb/d)	Gain per acre (lbs)
Toxic tall fescue + N	0.60	187
Toxic tall fescue + Durana	1.79	296
Toxic tall fescue + Regal	0.89	136

Forage Persistence is a Major Limit

- Reviewing 18 trials measuring legume proportion in the diet self-selected by a ruminant, Phelan et al (2015) found that the average preference was a diet consisting of 72 +/- 4% legumes.
- Management factors (e.g., broadleaf weed management, N fert., manure application, short rest periods, hoof damage, etc.)
- Seed yield and persistence are inversely related.

Annual Cost Advantage for Grass + Clover Depends on N Price and Stand Life¹

Differences in animal performance still must be factored in before assuming profit or loss!

	Clover stand life, years				
	1	2	3	4	5
Annualized cost of clover establishment	\$24.19	\$12.53	\$8.65	\$6.72	\$5.56

¹ Low cost conditions scenario. The estimated variable cost of clover establishment (\$22.50/acre) was annualized assuming a 7.5% interest rate. Annual variable cost of maintaining grass + clover was estimated to be \$106/acre. A spreadsheet containing the input costs and rates of fertilization is available at (<http://bit.ly/grasscloverN>).

Annual Cost Advantage for Grass + Clover Depends on N Price and Stand Life¹

Differences in animal performance still must be factored in before assuming profit or loss!

	Clover stand life, years				
	1	2	3	4	5
Annualized cost of clover establishment	\$168.78	\$87.44	\$60.37	\$46.88	\$38.80

¹ **Challenging** conditions scenario. The estimated variable cost of clover establishment (\$157/acre) was annualized assuming a 7.5% interest rate. Annual variable cost of maintaining grass + clover was estimated to be \$106/acre. A spreadsheet containing the input costs and rates of fertilization is available at (<http://bit.ly/grasscloverN>).

Effect of Tall Fescue, Endophyte, and White Clover on Stocker Production in the Spring

	ADG (lbs/hd/d)	Gain (lb/acre)
E+	1.10	126
NE		
E+ & WC		
NE & WC		

Jesup Tall Fescue and Durana White Clover, 3-yr trial. Eatonton, GA. Hill, Andrae, and Bouton (unpublished data)

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Not really

"Dilution is the Solution"


- Plant legumes with E+ tall fescue
 - > "Dilutes" (offsets) consumption of hot fescue
- May only add quality rather than diluting the toxins. May still consume toxic dose!



Economics of E+ and NE Fescue With and Without Clover

	E+ Fescue + N	E+ Fescue + Clover
ADG (lb) ²	1.1	1.6
Gain/acre ¹	126	150
Stocking rate (cows/acre) ¹	0.5	0.41

¹ Based on Hill et al., 2007.
² Current maintenance costs and rates for inputs listed in UGA enterprise budgets (Russell and Hancock, 2016), and Extension rec. P, K, & lime rates assuming medium soil test P and K.
³ Assumes feeder calf prices of \$148/cwt.
⁴ Assumes non-pasture related cow costs are \$325/hd from UGA enterprise budgets.




The most challenging issues I face on my farm:

Rating Challenge

Most Challenging

Least Challenging


Hancock, unpublished data. Legume usage survey of GA Cattlemen, spring 2007.



How would you finish the following sentence? The use of legumes in my pastures and hayfields will:

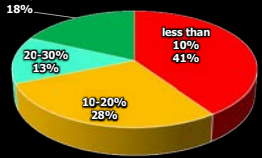
Percent of Responses	
33%	increase forage quality.
25%	lower nitrogen fertilizer costs.
21%	put more weight on my weanlings.
8%	too severely limit weed control.
4%	not be cost-effective.
4%	reduce my carrying capacity.
4%	cause bloat problems.

Hancock, unpublished data. Legume usage survey of GA Cattlemen, spring 2007.

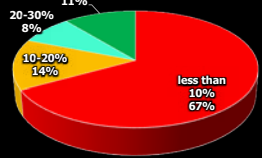


What Percentage of Your Fields Contain Forage Legumes?


PASTURES



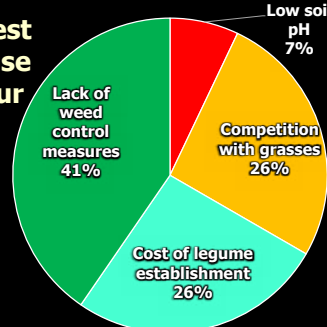
HAYFIELDS




Hancock, unpublished data. Legume usage survey of GA Cattlemen, spring 2007.



What is the greatest limitation to the use of legumes on your farm?



Hancock, unpublished data. Legume usage survey of GA Cattlemen, spring 2007.



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Bloat: A Potential Problem with Legumes in Pastures

Buildup of trapped gas in the rumen

- Foam buildup at the base of esophagus that prevents eructation
- Rumen distends on left side
- Animal can suffocate
- Sometimes occurs on small grains, too.

Prevention

- Don't turn them out hungry
- Provide mixed forages
- Monensin or ionophore
- Poloxalene (Bloat Guard™)

Photo credit: Dr. Garry Lacefield, UK

Isoflavones in Clover

Estrogen

Equol

Adapted from a slide by M. Flythe, USDA-ARS, Lexington, KY

Vasoconstriction

Vaso-relaxation

The alkaloids made by the fungal endophyte in toxic tall fescue are **vasoconstrictors**

The isoflavone metabolites are **vaso-relaxants**

Aiken and Flythe, *Frontiers in Chemistry* 2014 Slide credit: M. Flythe, USDA-ARS, Lexington, KY

Phyto-estrogens in legumes

Legumes are high in isoflavones that mimic estrogen.

- **Formononetin, genistein, daidzein, biochanin A, and coumestrol**
 - Red clover has highest concentration
 - Alfalfa if overly mature or stressed by disease
- In extreme cases, can lead to infertility, lack of ovulation, and anestrus.
- Can also show up in milk/dairy products at levels 2-10 times typical conc.

Phyto-oestrogen	White clover	Red clover	Lucerne	Chicory	P value
Chrysin	3.5 ^a	4.5 ^a	2.5 ^a	64.5 ^b	0.29
Naringenin	31.5 ^a	175.5 ^b	87.0 ^b	72.5 ^b	0.0097
Biochanin A	17.0 ^a	888.7 ^b	11.5 ^a	3.5 ^a	0.0009
Formononetin	40.5 ^a	1142.0 ^b	156 ^b	60 ^a	0.0001
Glycitein	8.5 ^a	91.3 ^b	6.0 ^a	37.5 ^b	0.0047
Total concentration	466 ^a	21399 ^b	263 ^a	237.5 ^b	0.0002

DM = dry matter; Samples were obtained from May and June. P-values for the effect of diet are shown. The superscript symbols a, b designate significant difference (P < 0.05) between dietary treatments.

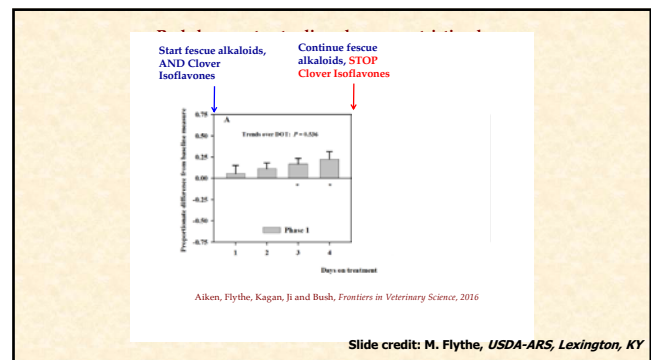
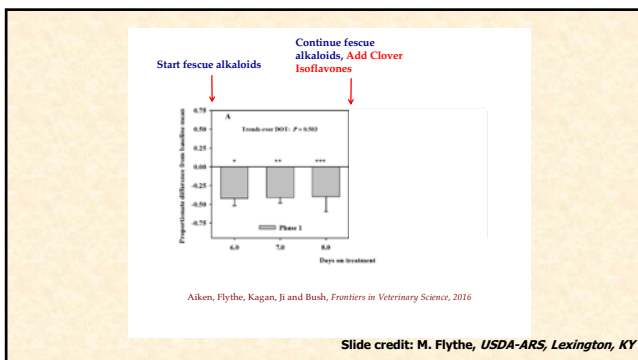
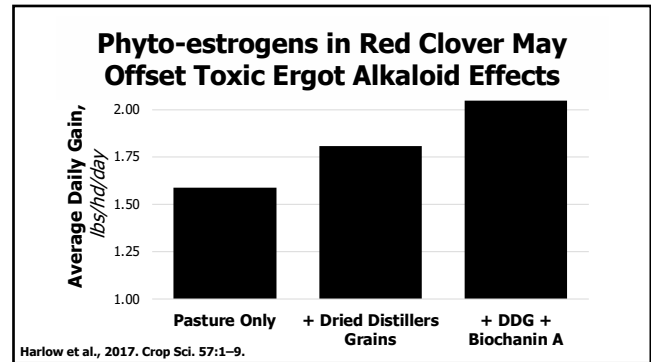
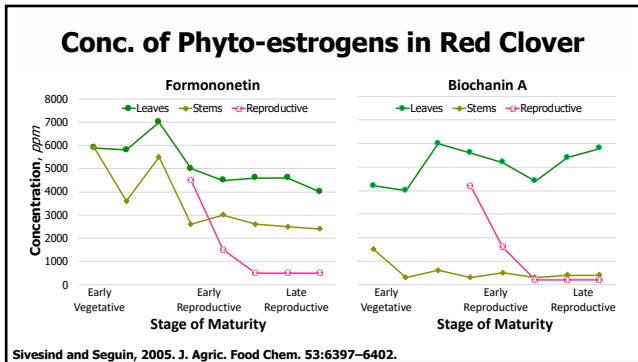
Andersen et al., 2009.

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Summary

- Integrating clover in cool season grass-based pastures:
 - Very likely to increase individual animal production
 - Usually will increase animal production per acre
 - Your results may vary
 - Persistence (variety selection and weed management) and establishment costs have large influence on profitability
 - Poorer soils, frequent droughts, and stressful conditions dec. production

Prove Your Hay is the Best.

Participate in the Southeastern Hay Contest and showcase your high quality hay for a chance to win great prizes and recognition.

Grand Prize:
 1 year of a New Massey Ford 4000 HP Case IH Rotary Mower for CM Spikes Professionals 2016-2017 season and \$1000 cash prize.

Individual category prizes:
 All individual categories will be awarded for top quality hay and baleage samples.

Entry Deadline: September 22, 2016

Contest winners will be announced at the Sunbelt Ag Expo Oct. 18-20, 2016!

For contest rules, entry form and more information scan the QR code below with your smart device or go to: bit.ly/SEHayContest

Logos for Massey Ferguson, Sunbelt Ag Expo, UF Extension, Clemson, UF IFAS Extension, and UGA are present.

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