Invited presentation at the 2018 Southern Agricultural Economics Association Annual Meeting, February 2-6, 2018, Jacksonville, Florida

Economic Assessment of Perennial Summer Dormant Tall Fescue and Annual Wheat Forage Grazing Systems in the Southern Great Plains

Narayan Nyaupane, Jon T. Biermacher, Jimmy Stein, Mike Trammell, Evan Whitley, Twain Butler, and Sindy Interrante

Noble Research Institute, LLC

Ardmore, OK

Introduction

- Stocker cattle grazing is an important economic activity in the Southern Great Plains.

- Annual small grain cereal crops such as wheat and rye are commonly grazed during the cooler months.

- Forage-only systems are common in areas of the SGP that have marginal growing conditions (poor soil and low rainfall).

Introduction-cont.

- Increases in production expenses associated with the annually established grazing system (fuel, labor, fertilizer, machinery) are reducing producer net returns.

- Environmental issues (soil moisture retention, nitrogen leaching into watersheds, loss of soil carbon, soil erosion, lower water infiltration) have become more important to consumers.

- What is the potential for using a perennial cool-season forage as an alternative?

Summer Dormant Tall Fescue

- Early varieties of summer dormant tall fescue found in the Mediterranean region (Greece).
- Tends to do well in hot, dry growing conditions.
- Two endophyte free varieties have been tested and developed by plant breeders in New Zealand and the Noble Research Institute.
- TF/NZ (Flecha) is a variety that was originally developed for grazing in New Zealand and further developed for grazing in the SGP.
- TF/NRI (Chisholm) is a variety selected from Flecha while being developed for beef cattle grazing at research stations in North-Central Texas and South-Central Oklahoma.

Objectives

- Compare the economics of a three summer dormant tall fescue forage grazing systems with a cereal wheat grazing system commonly used in the region.

- To determine the effects of grazing systems on on-weight, off-weight, ADG, steer grazing days, total gain per acre, gross revenue, total cost and net return to land, labor, management and overhead.

- To determine how sensitive the results are to *ceteris paribus* changes in price of cattle (VOG), life expectancy of tall fescue and alfalfa, and grazing days for wheat and tall fescue.

Alternative Grazing Systems

- WHT: Conventional grazing tolerant winter wheat (NF101) grazeout system.
- TF/NZ: Tall fescue (Flecha) plus nitrogen fertilizer.
- TF/NRI: Tall fescue (Chisholm) plus nitrogen fertilizer.
- TF/Alf: Tall fescue (Flecha) with alfalfa (Bulldog) established together. No nitrogen fertilizer.

Data and Experimental Design

- Animal performance data were collected for four grazing years (2013/14 through 2016/2017) in a CRD experiment.
- Noble Research Institute's Research Farm: South-Central Oklahoma
- Four systems: TF/Alf, TF/NZ, TF/NRI, and WHT.
- Two-acre paddocks replicated three times each year.
- *In year 2, TF/Alf failed due to extensive flooding. It was re-established in year 3.

Cattle Management

- Sale barn steer/bull calves purchased in late August/mid-September
- Calves processed the day after they were received.
- Calves were vaccinated for internal and external parasites: IBR, PI3, BVD, BRSV, and a 5-Way Clostridial.
- Bulls calves were castrated and calves bearing horns were dehorned.
- Given access to free-choice rye hay and supplement for approximately 40 days.
- Used a put-and-take system (based on forage availability) throughout the grazing season for each year.

Economic Methods

- Enterprise budgeting techniques were used to estimate expected revenues and costs for each system, paddock and year.
- Prices for operating inputs (seed, pesticides, fertilizers, etc.) were obtained from local input suppliers.
- Published custom rates where used for tillage, planting, fertilizer, and pesticide applications.
- Cattle prices were obtained from the Beef Basis Forecasting calculator (www.beefbasis.com).
- Sensitivity analysis conducted to determine how robust relative results are to value of gain, life expectancy of TF (and alfalfa), and growing conditions (yields).

Statistical Methods

- Effects of treatment on production and economic variables were estimated using a random effects mixed ANOVA model using the Mixed Procedure in SAS.

- A likelihood ratio test was used to test the null hypothesis of no year random effect:
  - The null hypothesis was rejected at a 95% level of confidence,
  - As a result we treated year as random and report our results accordingly.

- For each model, the Type 3 Test for Fixed Effects was used to test the null hypothesis of no difference between systems.

- In cases where the null hypothesis was rejected, differences in least square means was used to rank the variable of interest between systems.

Measures of Animal Performance across Forage System

Animal Performance Measure	Forage Systems			
	WHT	**TF/Alf**	**TF/NZ**	**TF/NRI**
Initial grazing date	27-Nov	27-Sep	1-Nov	30-Oct
Standard deviation, initial grazing date (days)	15	73	48	50
Initial grazing weight (lbs/hd)	619	601	581	557
Termination date	22-Apr	28-May	21-May	21-May
Termination weight (lbs/hd)	803	736	779	746
Total steer grazing days, d/acre	135	129	180	181
Average daily gain, lb/hd	2.20	2.05	1.64	1.59
Stocking rate	1.03	1.54	1.03	0.96
Total gain, lb/acre	**295**	**227**	**272**	**255**

Expense Categories for Establishing and Maintaining Alternative Forage Systems

Expense Category	Forage Systems WHT	TF/Alf	TF/NZ	TF/NRI
Establishment Costs				
Initial herbicide application for weed control ($/acre)	19.68	28.42	28.42	28.42
Fertilizers (DAP, K20) and fertilizer application ($/acre)	68.18	13.60	0.00	0.00
Tillage and seedbed preparation ($/acre)	9.21	42.93	46.59	46.59
Custom seed establishment ($/acre)	11.27	11.27	15.03	11.27
Wheat and Alfalfa seed cost ($/acre)	21.25	111.24	--	--
Tall fescue seed cost ($/acre)	--	60.00	70.67	92.00
Total cost for tall fescue establishment ($/acre)	--	108.11	--	--
Total cost for alfalfa establishment ($/acre)	--	159.35	--	--
Total cash cost for establishment ($/acre)	--	267.46	160.71	178.28
Total amortized cost at 5% APR ($/acre)	--	**145.63**	**20.81**	**23.09**
Annual Pasture Maintenance Costs:				
Fertilizers (N, P2O5, K20) and fertilizer application ($/acre)	0.00	10.12	64.66	57.18
Herbicide for broadleaf weeds and annual grasses ($/acre)	17.94	22.58	27.15	27.36
Insecticide for alfalfa weevil and fall army worm ($/acre)	16.51	12.48	--	--
Total annual maintenance costs ($/acre)	34.45	45.18	91.81	84.54
Annual operating capital for pasture maintenance ($/acre)	0.78	1.02	2.30	2.11
Pasture establishment and annual maintenance ($/acre)	164.82	191.83	114.92	109.74
Operating capital on steers during grazing duration ($/acre)	17.03	14.20	18.90	17.60
Total Establishment and Maintenance Costs ($/acre)	**181.85**	**206.03**	**133.82**	**127.34**

Expected Values for Price of Gain, Total Costs, Revenue, and Net Return by System

	Forage Systems			
Economic Measure	**WHT**	**TF/Alf**	**TF/NZ**	**TF/NRI**
Value of gain, base ($/lb)	0.80	1.00	1.18	1.18
Total cost of production ($/acre)	182	206	134	127
Gross revenue ($/acre)	236	227	321	301
Expected net return ($/acre)	**54**	**21**	**188**	**174**

Sensitivity Analysis

- Relative results were sensitive to the price of gain (VOG).
  - A VOG of $1.26 would be needed for WHT to breakeven with the TF/NZ system.
- NR between WHT and TF/NRI is not sensitive to life expectancy of the TF stand.
  - This could change if growing conditions change.
- NR between WHT and TF/Alf is sensitive to the life expectancy of alfalfa.
  - If alfalfa can last 5 years instead of 2 years, the NR for the TF/Alf system would increase by $82/acre, making it somewhat more attractive.
- A reduction in TF/NRI grazing days by 25% (from 180 to 135 days), would result in a 43% decline in NR (from x to y $/acre).
- It will take a 55% increase in grazing days for WHT in order to breakeven with the TF/NZ system.

Summary

- ADG and Total Gain favored WHT; but, TF realized more grazing days, lower costs, and better cattle prices.
  - A typical summer in the region is expected to affect TF grazing days negatively,
  - A typical fall would be expected to affect WHT positively.

- Cost of establishing and maintaining tall fescue was ~$50 lower than it was for wheat pasture.

- Record flooding in the spring of year 2 resulted in a stand failure for the TF/Alf system. It was replanted, and only time will tell if it will go 5 or 6 years under grazing.

- Significant differences in the variation (days) surrounding the average initiation on-date could signify difficulty and extra costs associated with buying and managing cattle to graze tall fescue.

Limitations

- Limited years of study
- TF/Alf stand lost in the second year
- Using a put and take system of animal management may not be typical to what producers do.
- We have observed non-typical growing conditions during the first four years of the study. It would be good to have data that represent average growing conditions.

Questions/Comments/Suggestions?