Stocker Cattle Performance Grazing Wheat Pasture Established Following a Summer Cover Crop

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James K. Rogers, Scott G. Robertson, Gregg G. Sweeten, and Ryan T. Hicks

Abstract

Land used for wheat grazing is typically summer fallowed either with tillage or chemically with little to no crop rotation. Summer fallow may not benefit soil health as it leaves ground vulnerable to wind and water erosion, and lack of shade from a summer crop can allow soil temperatures to elevate which can increase evapotranspiration and decrease soil microbial activity. Growing summer cover crops could provide soil health benefits but, the effect on wheat pasture production and animal grazing performance needs to be understood. To study this effect, we established a multi-species, warm-season cover crop mixture into five-2.0 ha no-till (NTCC) and five-2.0 ha tillage (TillCC) paddocks at the Noble Research Institute's Pasture Demonstration Farm near Ardmore, OK. Five-2.0 ha no-till chemical summer fallow (NT) and five-2.0 ha tillage summer fallow (Till) paddocks serve as controls. Summer cover crop treatments are planted after wheat pasture graze out. Cover crops are grown through the summer, grazed with stockers and terminated in August. Wheat is planted in September then fertilized with Nitrogen (N) after emergence. Forage mass was measured weekly from October to April. Each paddock was stocked with five steers (260 kg ave. wt.) on November 29, 2016. Steer total gain was less ($P < 0.05$) on NTCC paddocks (154 kg hd^{-1}) compared to NT (180 kg hd^{-1}). Steer total gain was less for TillCC paddocks (188 kg hd^{-1}) compared to Till (197 kg hd^{-1}). Within tillage treatments, summer cover crops reduced wheat pasture production and animal performance.

Materials and Methods

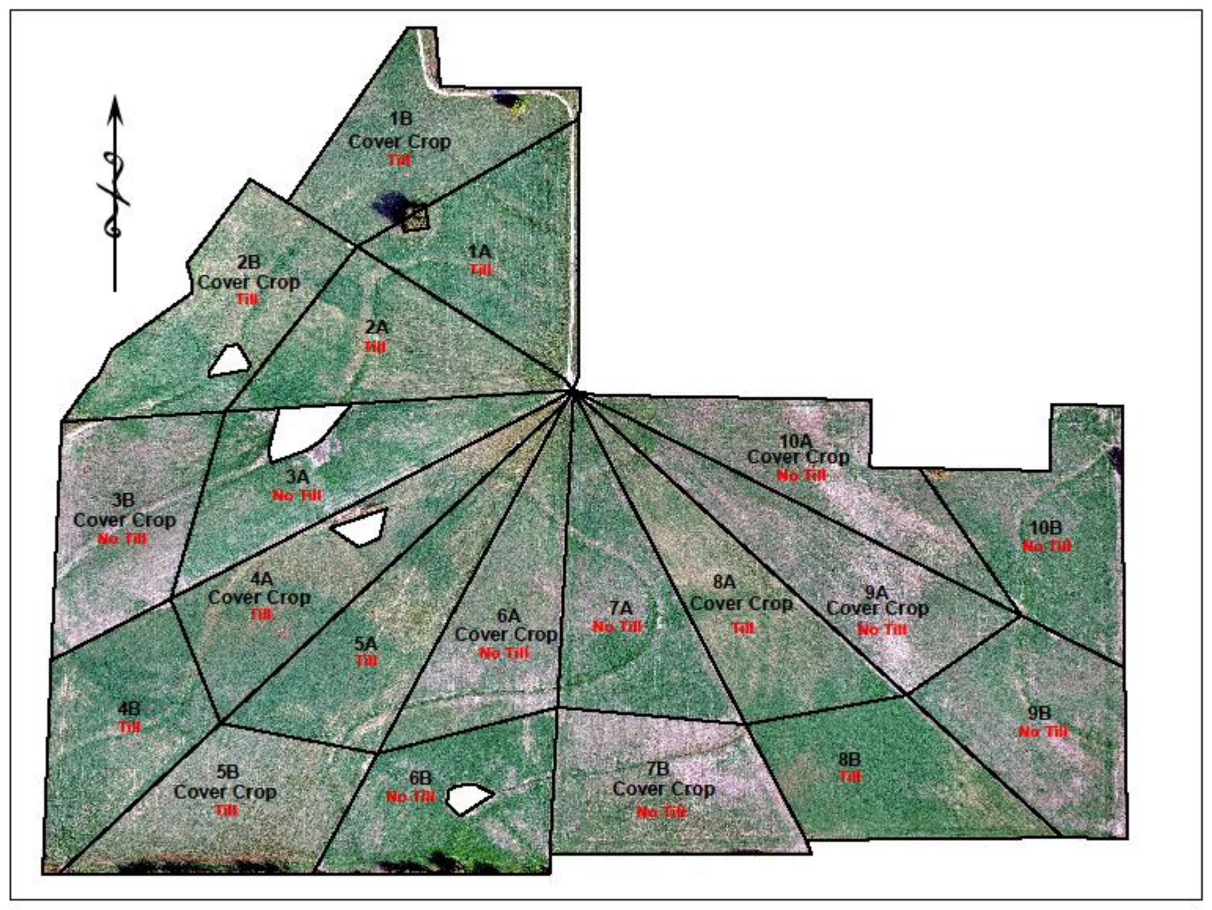


Figure 1. Tillage whole plot and cover crop sub-plot treatment arrangement.

The study area (Figure 1) is 40.5 ha of silt loam to loam soils arranged in a whole plot (tillage treatment) sub-plot (summer cover crop) design with five replications. In May, 2016 NT and NTCC paddocks were burned down with .946 L glyphosate + 473 ml 2, 4-D per ha^{-1}. After chemical burndown, NTCC paddocks were planted with a mixture of 4.5 kg corn, 7.8 kg millet, 3.4 kg buckwheat, 3.4 kg sunn hemp, 6.7 kg cowpeas, and 6.7 kg soybeans at a seeding rate of 33.6 kg ha^{-1}. To maintain chemical fallow, NT paddocks were burned down again in July. In May, Till paddocks were plowed then in July sprayed with .946 L glyphosate + 473 ml 2, 4-D per ha^{-1} to maintain tillage fallow. TillCC were disk twice then planted in mid-June with the same cover crop mixture and seeding rate as the NTCC paddocks. No N was added to the cover crops. Phosphorus and potassium levels were not limiting to production according to soil test. In August, cover crops were grazed for 25 days with 318 kg steers (n=5) per paddock. Total steer mean gain on NTCC paddocks was 36 kg hd^{-1} compared to 28 kg hd^{-1} for TillCC paddocks. In September, NT and NTCC paddocks were chemically terminated with .946 L glyphosate + 473 ml 2, 4-D per ha^{-1} and Till and TillCC paddocks were disk twice. All paddocks were then either no-till or conventionally planted with wheat (var. Gallagher) at a 134 kg ha^{-1} seeding rate. Wheat received 67.2 kg N ha^{-1} after emergence in October. On November 29 each paddock received five steers (260 kg ave. wt.) when DM forage mass averaged 1300 kg ha^{-1} across paddocks. Steer weights were collected every 28 days from November to April. Forage mass was collected weekly with a calibrated rising plate meter. Year 1 results are presented here.

Wheat forage mass

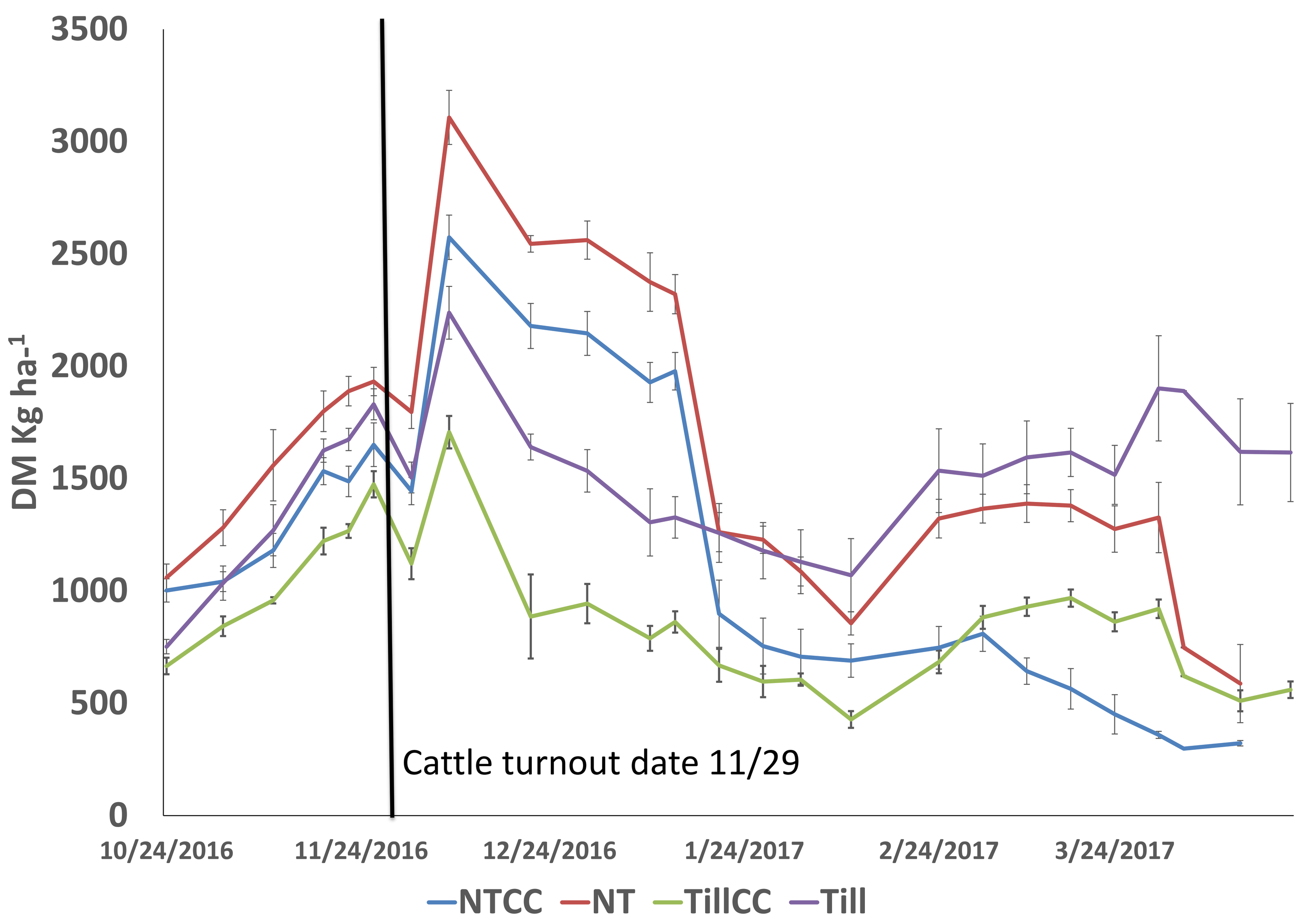


Figure 2. Weekly wheat treatment mean forage mass measurements established with tillage or no-tillage methods following a summer cover crop or summer fallow taken at the Pasture Demonstration Farm near Ardmore, OK. from October, 2016 to April, 2017.

Pasture forage mass (Figure 2) was measured weekly on all paddocks using a rising plate meter (Jenquip; Feilding, NZ) that was calibrated monthly. Within tillage treatments, summer cover crop paddocks produced less forage compared to paddocks that did not have a summer cover crop. Forage mass production across all treatments declined in January with low temperatures but, tillage paddocks recovered as temperatures warmed in late February. The NTCC paddocks continued to decline through the spring period and this is attributed to the NTCC paddocks becoming nitrogen depleted as a result of summer cover crop growth consuming and binding available nitrogen. This effect may also be occurring but, to a lesser extent in the TillCC paddocks. Reduction in forage mass resulted in differences in grazing days (Till-140, TillCC-132, NT-132, NTCC-126) total animal gain (Figure 3) and value of animal gain (Table 1).

Animal performance

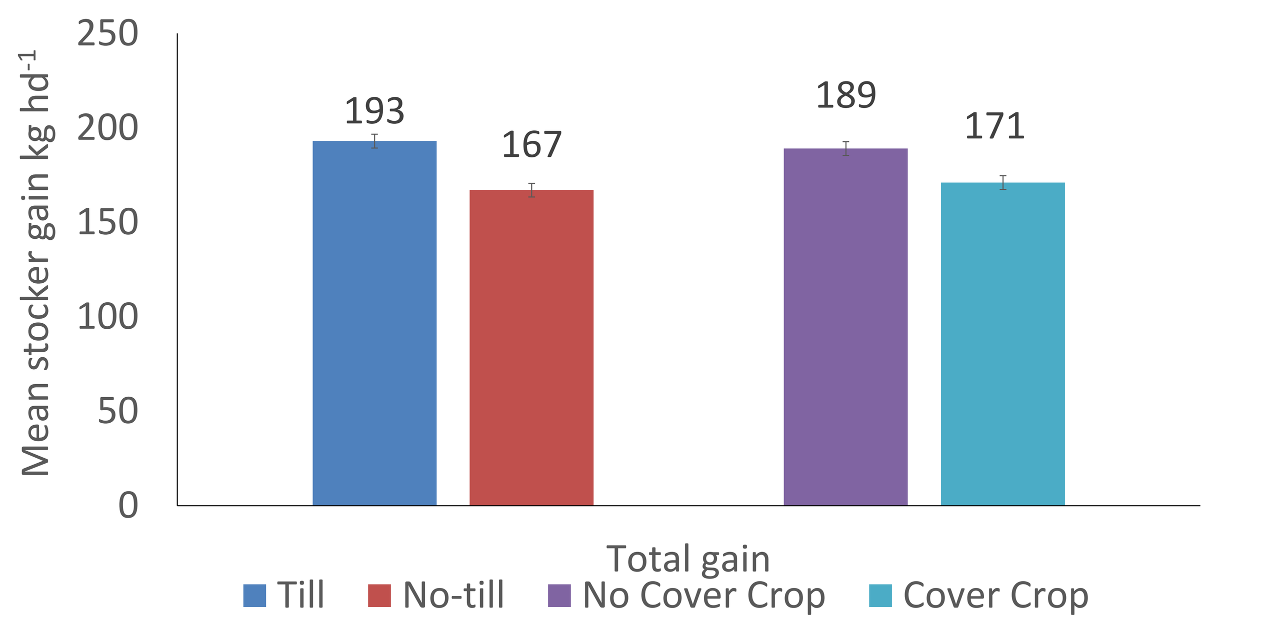


Figure 3. Tillage and cover crop effect on mean total gain of steers grazing wheat pasture from November-April at the Pasture Demonstration Farm near Ardmore, OK.

Steer gain data was analyzed using the Proc Mixed procedure in SAS 9.3. Tillage method and cover crop and their interaction was set as fixed effects and replication was considered random. Means were separated at ($P < 0.05$) using the LSMEANS procedure with Tukey-Kramer adjustment. Main effects of tillage and cover crop were significant ($P < 0.05$) while the interaction was non significant ($P > 0.05$). Total individual animal gain was greatest for steers on wheat paddocks established with tillage methods with no previous summer cover crop. Gains were lowest on no-till established wheat paddocks that followed a summer cover crop. These differences are attributed to variations in forage mass (Figure 2).

System production costs and returns

Table 1. Production costs and returns for wheat pasture and cover crops.

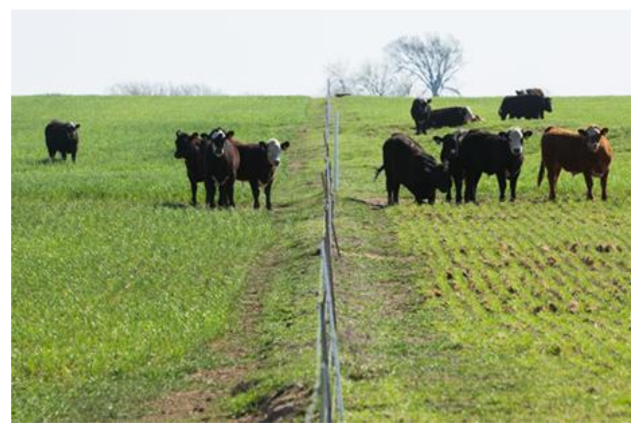
	Production and Costs						
	Wheat forage			Cover Crop			
Trt.	Stocker gain kg/ha	*VOG/ha	Cost/ha	Stocker gain kg/ha	VOG/ha	Cost/ha	Net return/ha
NTCC	380	$511	$185	90	$45	$138	$233
NT	446	$746	$240	n/a	n/a	n/a	$506
TillCC	465	$790	$215	69	$11	$168	$418
Till	488	$872	$215	n/a	n/a	n/a	$657

*Value of gain per hectare (VOG) = [(ending animal value – beginning animal value)/total weight gain]*total gain/hectare

Production costs for wheat pasture and cover crops include seed, chemical, tillage, and planting. Custom rates from Oklahoma State University (CR-205) were used for tillage and planting costs. Seed costs were $74 ha^{-1} for the cover crop mixture and $44 ha^{-1} for wheat. Steer VOG was based on current market price. Animal performance on the cover crops was good considering the limited number of grazing days but, improvement in stocker value while grazing the cover crops did not offset cover crop establishment costs. The impact of the cover crops on wheat pasture forage mass, grazing days, and animal performance reduced the net return from cover crop paddocks. It should be noted that these are first year results of wheat pasture production following a summer cover crop. Additional years of data will be required to fully access the impact of cover crops on soil health, forage production and economics.

Summary

- Animal performance was greater on tillage established wheat pasture with no previous summer cover crop.
- Grazing the summer cover crop did not offset the cost of cover crop establishment.
- Additional nitrogen may need to be added to the wheat pasture-cover crop system to avoid nitrogen depletion in the wheat during the spring.
- These are year 1 results, additional years of data will be needed to access the true total system impact.



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