Crop and Animal Production in Yearly Rotations Under Inversion and No Tillage

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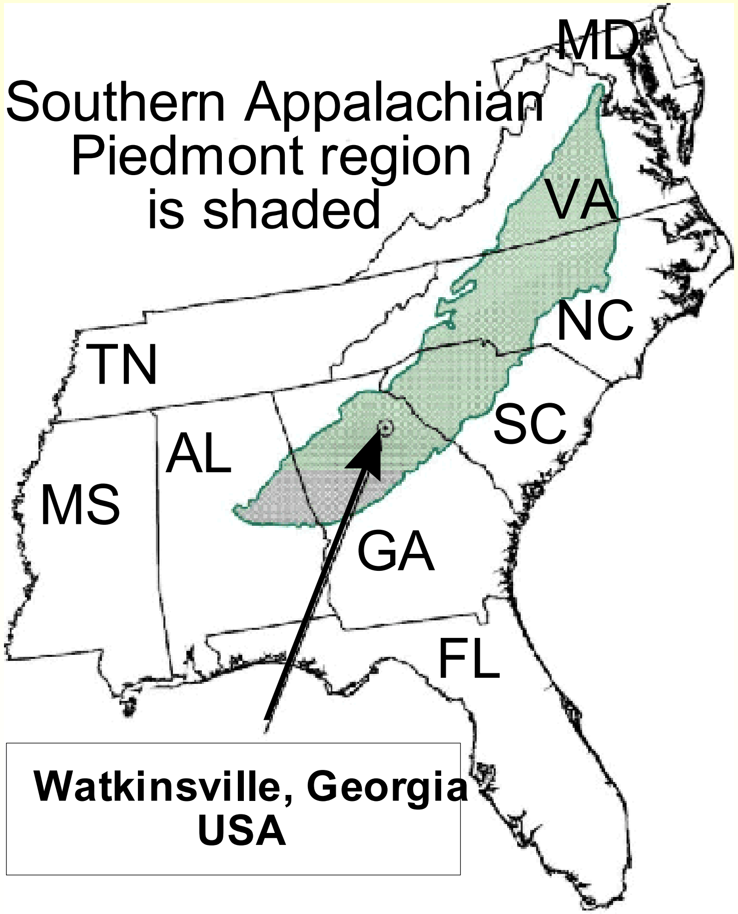


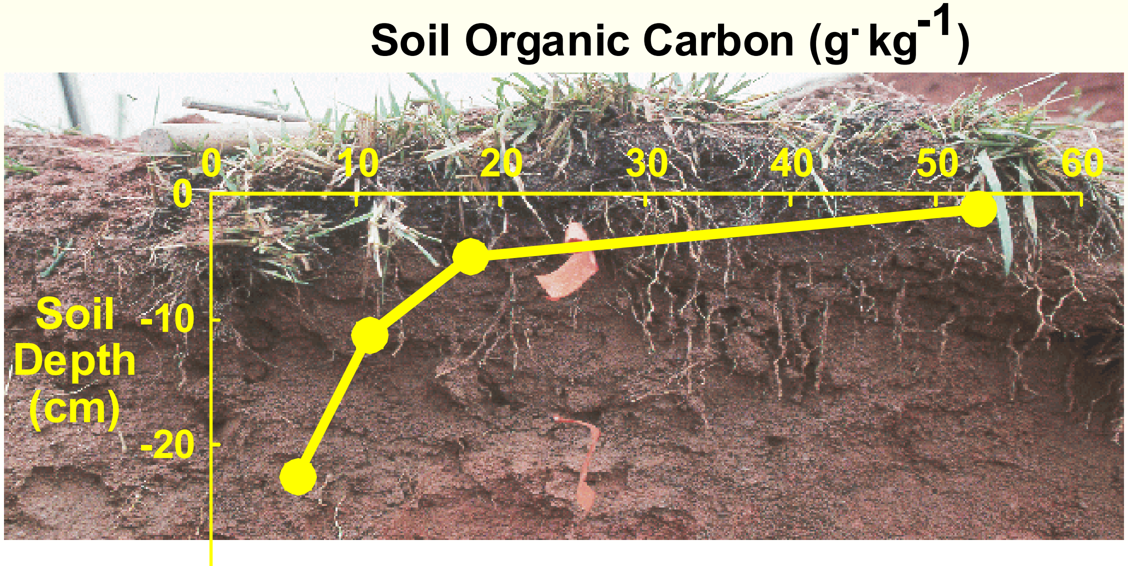
Rationale

- ✓ Degradation of sloping land with historically clean cultivation practices (i.e. inversion tillage) is apparent throughout the piedmont region of the USA.

Rationale

✓ Grass-based agricultural systems may improve soil quality by

- protecting the soil surface against erosion
- improving soil hydraulic characteristics (i.e. infiltration and percolation)
- accumulating soil organic matter



Rationale

✓ Integration of cropping and livestock operations could potentially improve the livelihood of farmers in the southeastern USA by

- Increasing crop vigor and yield
- Improving soil quality
- Reducing pest pressures
- Diversifying and increasing income

Sod-Based Cropping Systems Conference held in Quincy FL in February 2003 (http://nfrec.ifas.ufl.edu/sodrotation/postconference.htm)

Gates R, Integration of perennial forages and grazing in sod based crop rotations

Garcia-Prechac F, Rotating crops and grazed pastures in Uruguay

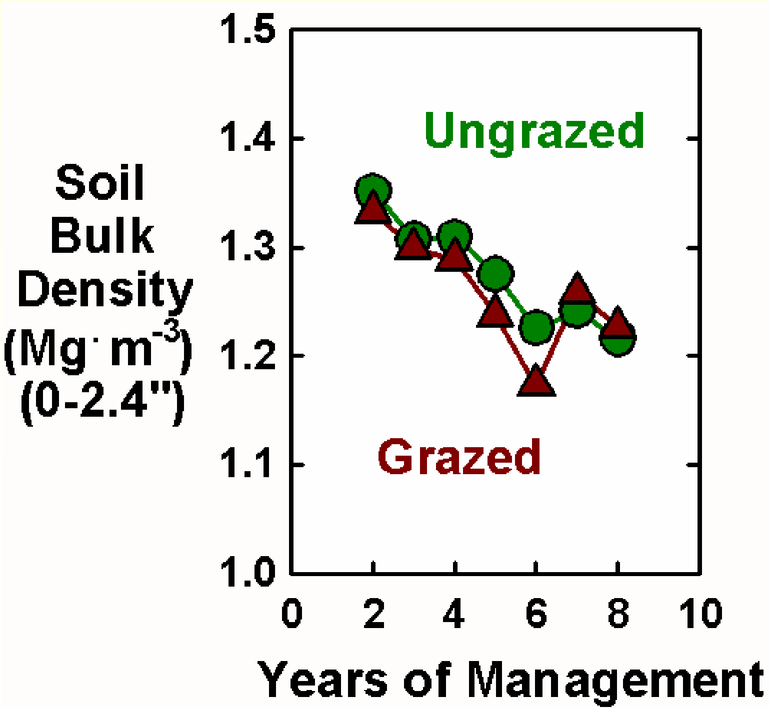
Wright D, Marois J, Perennial grasses, soil organic matter and crop yield

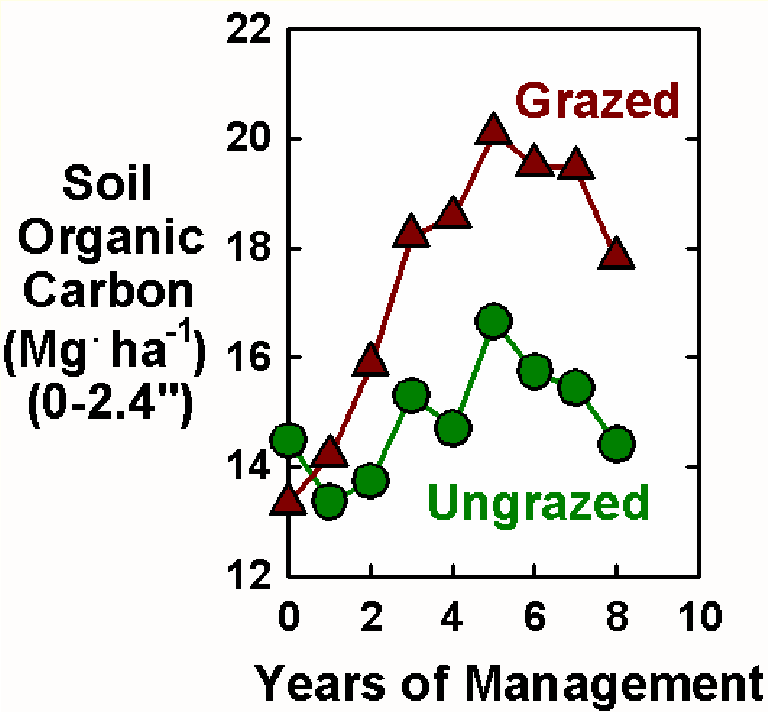
Siri-Prieto G, Reeves W, et al., Integrating winter annual grazing in a cotton-peanut rotation

Gallaher R, Baldwin J, et al., No-till management of agronomic row crops in perennial sod

Rationale

- Our previous research has demonstrated that grazing of warm-season perennial grass can have positive impacts on soil organic matter without significant compaction (Franzluebbers, Stuedemann, Wilkinson, 2001; Soil Science Society of America Journal 65, 834-841.).





Rationale

- Cover crops in rotation with grain or fiber crops can be be an excellent source of high quality forage to supplement grazing on permanent pastures
- Under relatively low soil organic matter conditions, compaction of soil with animal trampling can be significant (Tollner, Calvert, Langdale, 1990; Agriculture, Ecosystems & Environment 92, 981-986).
- Sufficient surface residue may provide a buffer against animal trampling effects, such that no-tillage crop production following long-term pasture could overcome potential detriments from integrated crop-livestock production

Objective

✓ Evaluate the impacts on crop and animal productivity from three management factors

Tillage

X

Time of grain cropping

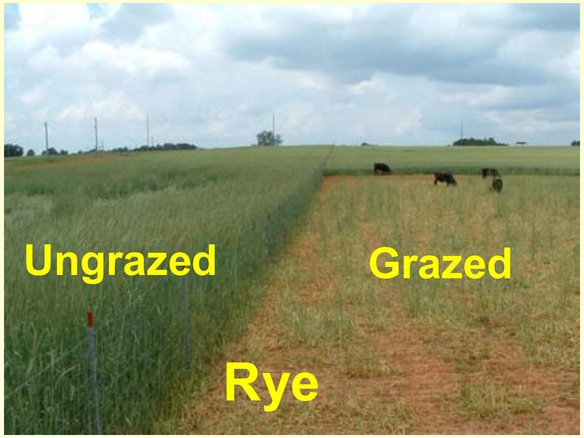
X

Cover crop utilization

Experimental Setup

- Controlled conditions at the J. Phil Campbell Sr. Natural Resource Conservation Center on Cecil sandy loam
- 18 paddocks (1.7-acre each) previously in tall fescue treatments for 20 years
- Randomized block design of 2 tillage x 2 cropping systems x 4 replications with 2 split-plots for cover crop utilization
- Grazed plots are 1.1 acre each and ungrazed plots are 0.6 acre each
- Wheat (Nov-May) rotated with pearl millet (Jun-Sep)
- Sorghum (May-Sep) rotated with rye (Nov-Apr)

Experimental Setup



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Results

Crop production (sorghum/rye system)

Yield parameter	Ungrazed CT		Ungrazed NT	Grazed CT		Grazed NT	LSD
Sorghum grain yield (bu/a)							
2002	18	*	9	23	*	11	9
2003	61		72	59		61	NS
Sorghum stover yield (lb/a)							
2002	1687		1933	1582		2030	NS
2003	3167	*	6524	2538	*	4508	1152
Standing rye dry matter (lb/a)							
2003	6437	*	7902	558		815	1355

Results

Crop production (wheat/millet system)

Yield parameter	Ungrazed CT	Ungrazed NT	Grazed CT	Grazed NT	LSD
Wheat grain yield (bu/a)					
2003	38	38	39	40	NS
Wheat stover yield (lb/a)					
2003	1152	1312	1256	1427	NS
Standing pearl millet dry matter (lb/a)					
2002	4712	5256	359	873	941
2003	3254 *	5907	171	403	2109

Results

Animal production (sorghum/rye system)

Animal parameter	CT	NT	LSD
Yearling steer live-weight gain (lb/a)			
2003	234	278	NS
Yearling steer animal unit days			
2003	70	70	NS
Yearling steer average daily gain (lb/d)			
2003	3.3	4.0	

Results

Animal production (wheat/millet system)

Animal parameter	CT		NT	LSD
Live-weight gain (lb/a)				
2002 (yearling steers)	443		446	NS
2003 (bred cows)	100		123	NS
2003 (suckling calves)	181		204	NS
Animal unit days				
2002 (yearling steers)	142	*	125	14
2003 (cow-calf pairs)	118		123	NS
Average daily gain (lb/d)				
2002 (yearling steers)	3.1		3.6	
2003 (cow-calf pairs)	2.4		2.7	

Summary

- ✓ This evaluation represents only 1.5 years of a ≥3-year study and represents only the yield components of an integrated production and environmental quality study

Production system	Ungrazed		Grazed	
	CT	NT	CT	NT
Sorghum/rye				
Crop grain yield (bu/a)	40	40	41	36
Cattle live-weight gain (lb/a)	-	-	234	278
Wheat/millet				
Crop grain yield (bu/a)	38	38	39	40
Cattle live-weight gain (lb/a)	-	-	362	386

Conclusions

- ✓ Through the first 1.5 years, crop production characteristics have been generally improved with NT compared with CT, especially with regards to plant biomass production for cattle consumption
- ✓ Although not significant in any of the individual growing seasons, cover crop utilization as forage has led to a trend for greater cattle performance and production under NT compared with CT
- ✓ An integrative assessment of crop and livestock production, environmental quality, and economic outcomes will be derived following the completion of this study

Acknowledgements

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