



Agricultural Research Service



**J. Phil Campbell Sr.
Natural Resource
Conservation Center**

**1420 Experiment
Station Road
Watkinsville Georgia
30677**

**Research from the
Soil Resource
Management
&
Agricultural System
Competitiveness and
Sustainability
National Programs**

Prepared by

**Alan Franzluebbbers
Ecologist**

706-769-5631

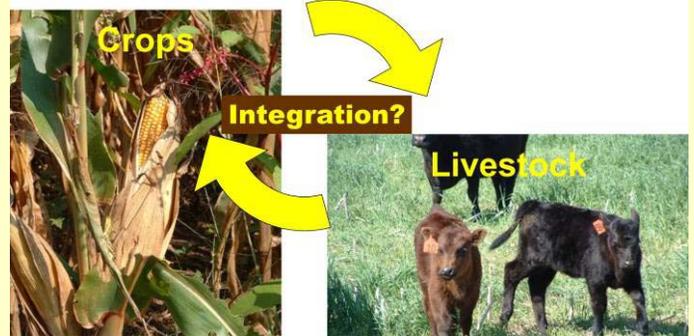
alan.franzluebbbers@ars.usda.gov

**JPC Research Note
19**

Won't Soil be Damaged if Cattle Graze Cover Crops?

Why does it matter?

- Integration of crops and livestock could provide economic benefits to producers by intensifying land use and improving resource efficiency, but how this management might affect soil compaction, water infiltration, and soil strength has not been well documented.



- Key factors in balancing cattle production with environmental quality are (1) matching stocking density with forage availability and (2) limiting access of cattle to vulnerable parts of the landscape, such as natural water sources or shaded areas that can result in heavily trafficked and damaged vegetation.
- Cover crops, such as annual grasses, small grains, and forage legumes following grain or fiber crops, would be excellent sources of high-quality forage that could be utilized in integrated crop-livestock systems.

What was done?

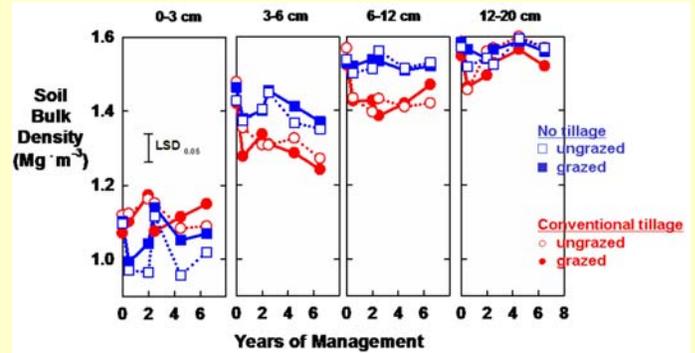
- A field study previously in tall fescue pasture (1982-2002) was converted to grain cropping with cover crops (ungrazed and grazed) managed with conventional tillage (plow + disk) and no tillage (no disturbance with glyphosate to control weeds).
- Soil was evaluated for compaction, ability to infiltrate water, and stability of aggregation.
- Cropping systems during the first 3.5 years were (a) grain sorghum followed by rye cover crop and (b) wheat followed by pearl millet cover crop. Later, cropping systems were corn-wheat/soybean with (a) rye/ryegrass and (b) rye/crimson clover as cover.



- Cow/calf pairs grazed cover crops for 48 ± 16 days each season.
- Soil bulk density and aggregation were measured yearly.
- The rate of water entering soil and the resistance of soil to a thin rod hammered into soil determined compaction.

What was found?

- Conventional tillage loosened soil initially with moldboard plowing compared with no disturbance of the long-term pasture, but the effect diminished with time.
- Grazing of cover crops had no detrimental effect on soil bulk density, perhaps because of the high soil organic matter content following perennial pasture that mitigated compaction.
- Surface-soil aggregation was degraded by conventional tillage compared with the organic-matter enriched and stabilized soil under no tillage.
- Stability of soil aggregates was unaffected by grazing of cover crops, irrespective of tillage system.
- Across 17 sampling events during 4 years, soil water content was 12% greater with no tillage than with conventional tillage suggesting significant water conservation. Removing cover crop forage by grazing also exposed soil to more evaporation and resulted in 4% lower water content than when ungrazed.
- Water infiltration was reduced by 44% with grazing of cover crops when measurements were taken with high soil water content (3 events). When soil was drier (4 events), grazing of cover crops reduced water infiltration only by 3%.
- Soil strength (measured in Joules, i.e. work required) was greater under no tillage than under conventional tillage. It was also greater under grazed than under ungrazed cover crops with conventional tillage, but not different between cover crop system with no tillage.
- Biannual tillage operations may have alleviated any surface degradation with animal trampling, but the initially high level of soil organic matter following long-term pasture and conversion to cropland with no tillage may have buffered the soil from any detrimental effects of animal trampling.



Soil penetration resistance

Tillage	Cover crop	Water content m ³ m ⁻³	Soil depth (cm)		
			0-10	10-20	20-30
----- Joules -----					

Dry soil conditions (4 events in 2004 and 2005)

CT	Grazed	0.12	119	246	290
CT	Ungrazed	0.11	84	261	337
NT	Grazed	0.12	151	248	296
NT	Ungrazed	0.12	139	313	394

NT > CT

Wet soil conditions (6 events in 2003, 2004 and 2005)

CT	Grazed	0.20	104	115	124
CT	Ungrazed	0.20	62	111	118
NT	Grazed	0.22	102	133	133
NT	Ungrazed	0.22	90	131	137

NT > CT

G > U

NT > CT



What is the impact?

- Cover crops (winter or summer) can provide high-quality forage and increase economic return and farm diversity, but farmers have been reluctant to take this advantage due to perceived “compaction” caused by animal trampling.
- Grazing of cover crops does indeed compact soil, but not to the detrimental levels often perceived.
- Crop and cattle producers who adopt integrated crop-livestock systems are encouraged to utilize conservation tillage management techniques to help preserve surface soil organic matter and prevent deterioration of soil quality.
- Recommendations are applicable to small- and medium-sized farms throughout the southeastern USA.

For more information

Full-length article can be accessed at: www.sciencedirect.com/science/journal/01671987

Franzluebbers AJ, Stuedemann JA. 2008. Soil physical responses to cattle grazing cover crops under conventional and no tillage in the Southern Piedmont USA. *Soil and Tillage Research* 100, 141-153.