Soil Physical and Biological Responses to Cattle Grazing of Cover Crops

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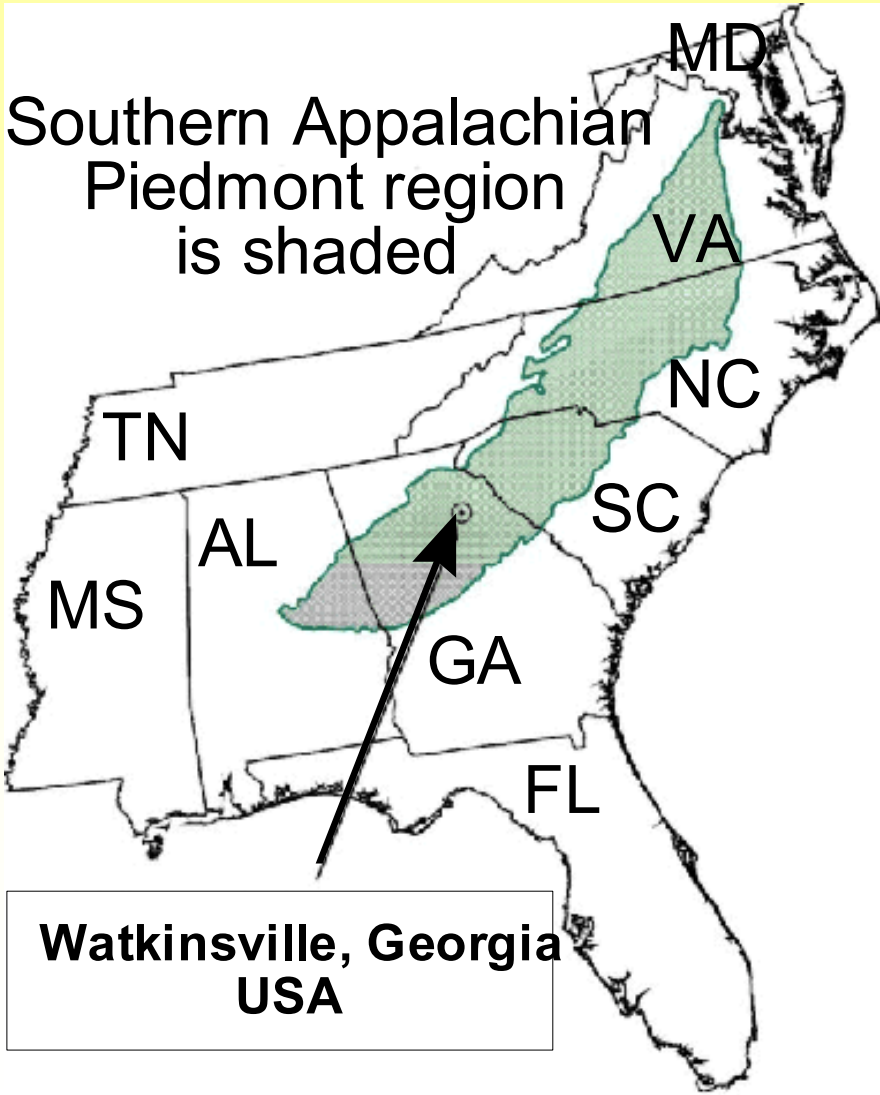
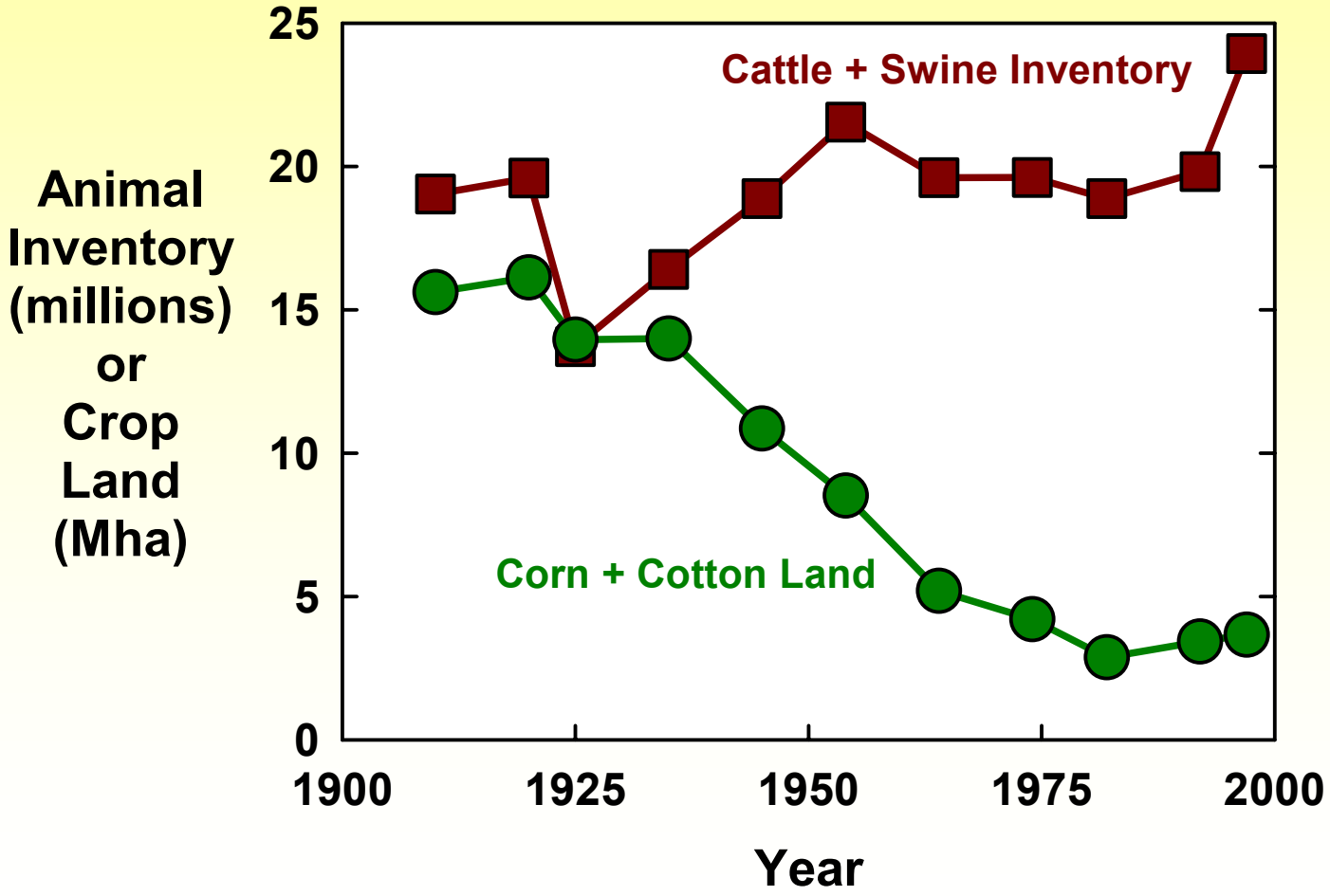


Recent History of Agriculture in Georgia



From USDA – National Agricultural Statistics Service

The Future?

Integration could be beneficial:

- **Agronomically**
- **Environmentally**
- **Economically**

Objectives

- ✓ ***Quantify agronomic responses*** of crops to tillage and cover crop management
- ✓ ***Determine soil changes*** following cropping of previous land in pasture
- ✓ ***Determine soil responses*** to tillage and cover crop management during crop–livestock production

Experimental Design

Tillage

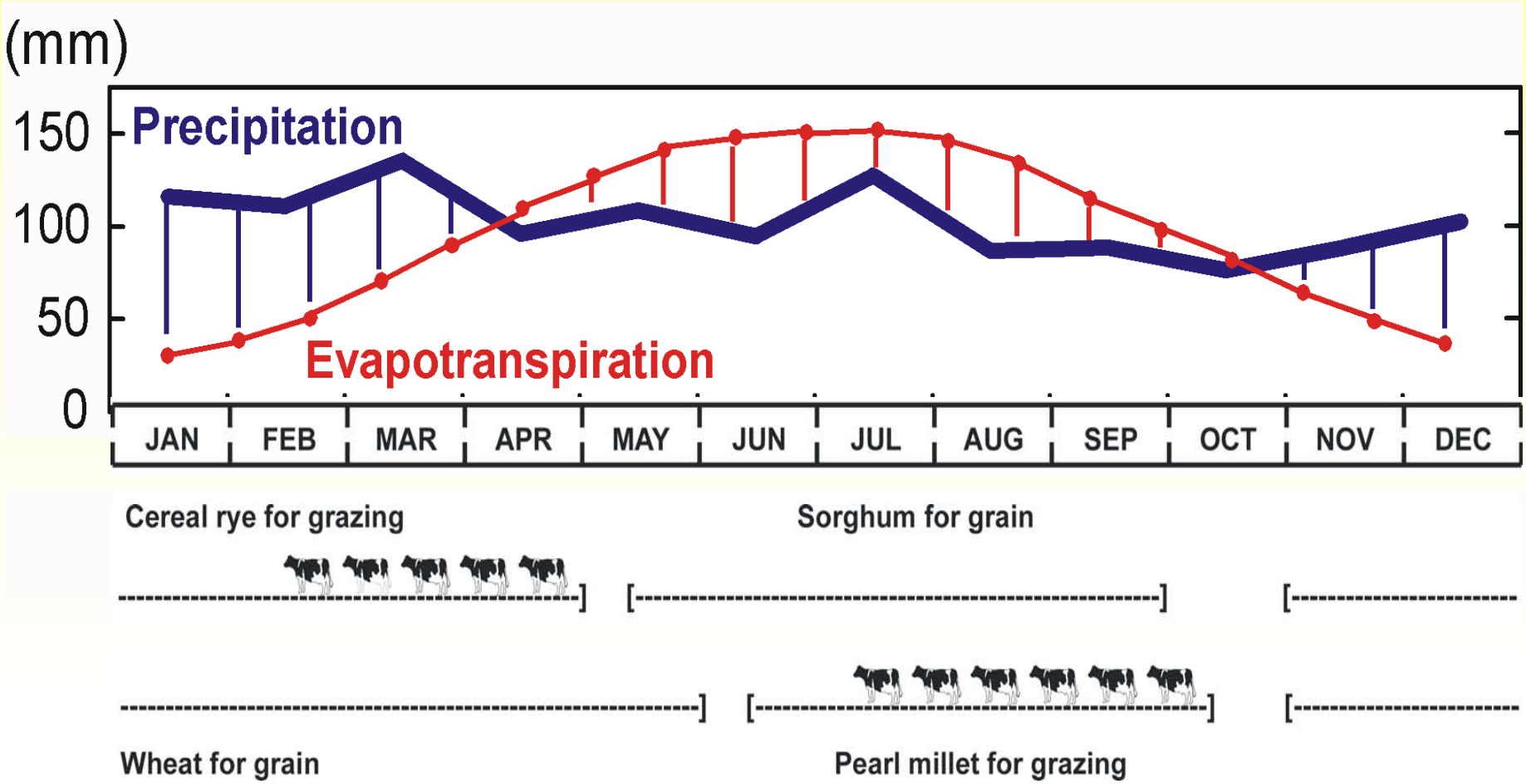
X

Cropping System

X

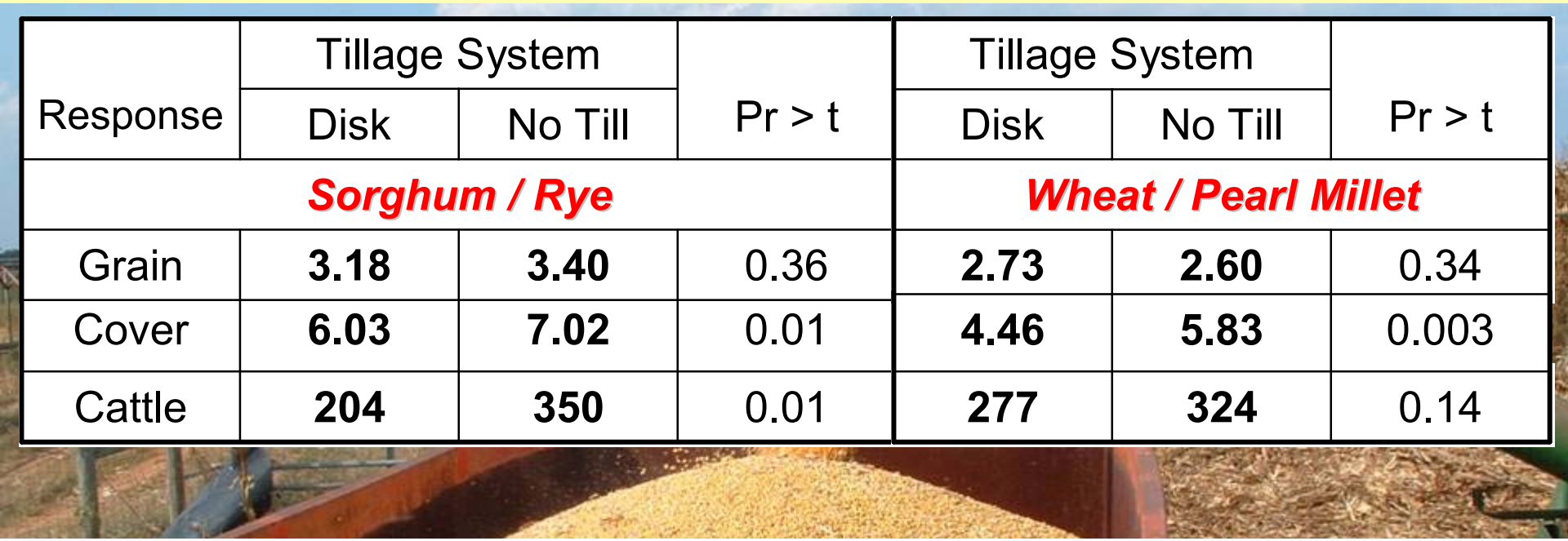
Cover crop utilization

Seasonal Conditions



Summary of production responses to tillage system

Response	Tillage System		Pr > t	Tillage System		Pr > t
	Disk	No Till		Disk	No Till	
	Sorghum / Rye			***Wheat / Pearl Millet***		
Grain	**3.18**	**3.40**	0.36	**2.73**	**2.60**	0.34
Cover	**6.03**	**7.02**	0.01	**4.46**	**5.83**	0.003
Cattle	**204**	**350**	0.01	**277**	**324**	0.14

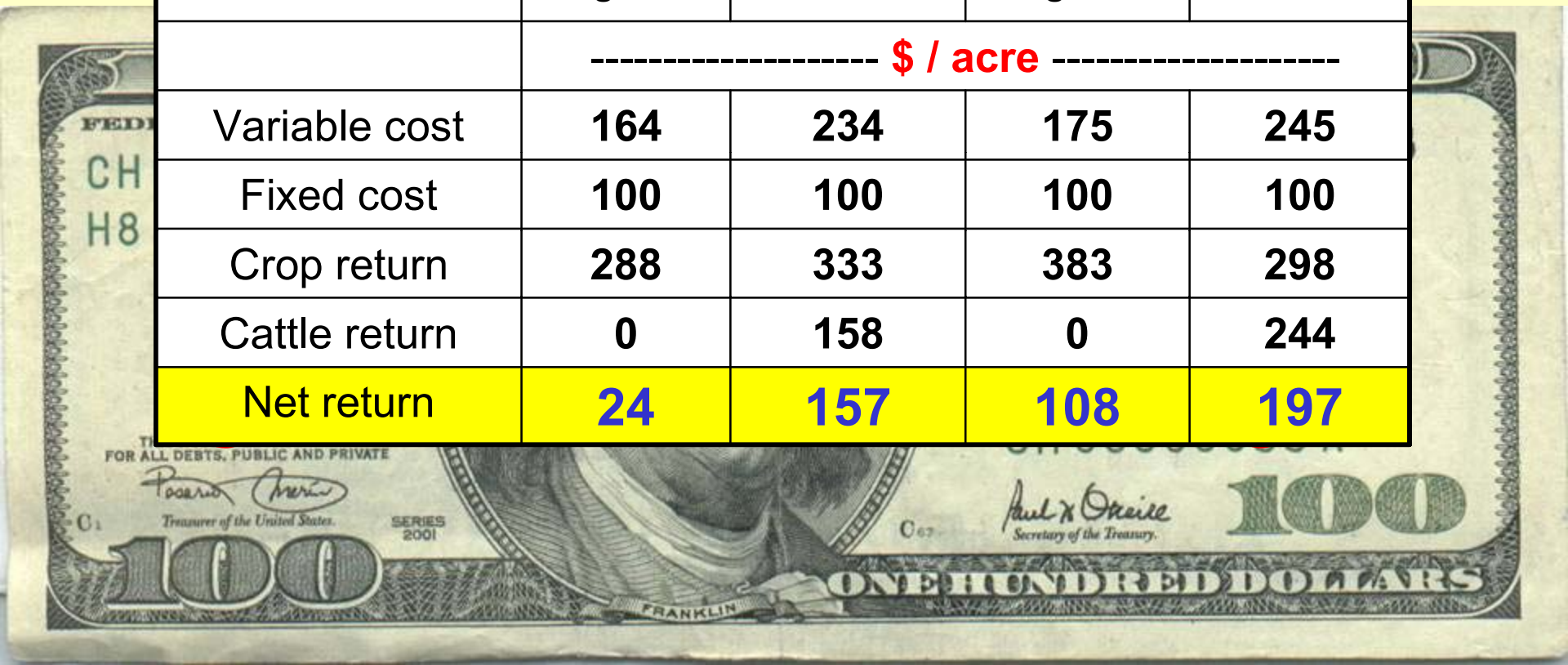


Grain production was unaffected by tillage system

Cover crop growth was enhanced with NT compared with DT in both systems, which led to greater cattle gain on rye

Will it pay to integrate cattle with cropping systems?

Response (Corn 2005)	Disk Tillage		No Tillage	
	Ungrazed	**Grazed**	**Ungrazed**	**Grazed**
	---------- $ / acre ----------			
Variable cost	**164**	**234**	**175**	**245**
Fixed cost	**100**	**100**	**100**	**100**
Crop return	**288**	**333**	**383**	**298**
Cattle return	**0**	**158**	**0**	**244**
Net return	**24**	**157**	**108**	**197**



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Soil Responses


Penetration resistance


Soil moisture


Water infiltration


Soil sampling

How has soil changed with tillage?

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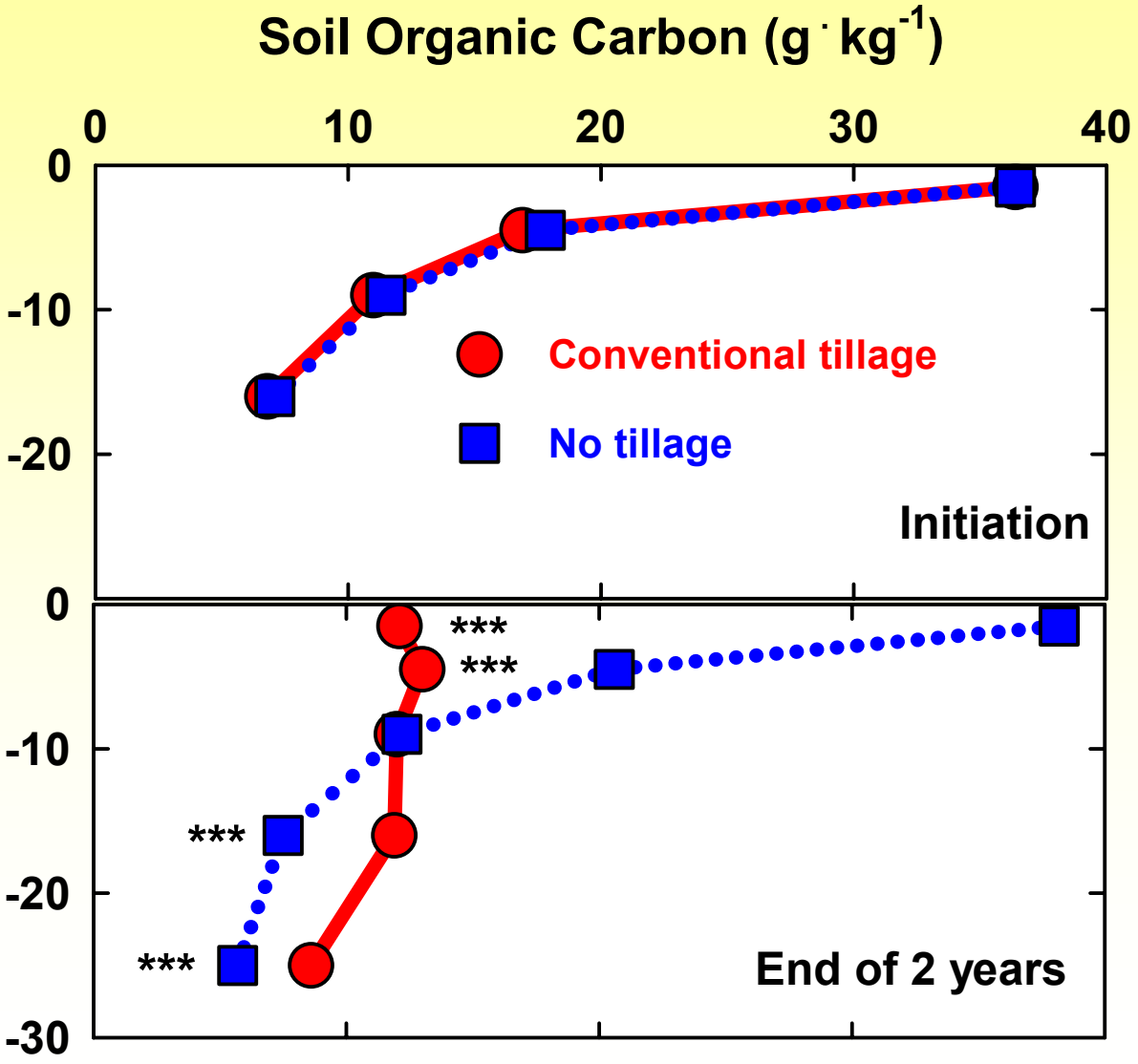
At initiation of this study, land was in long-term tall fescue pasture.

Land converted to cropping systems of wheat/pearl millet or sorghum/rye.



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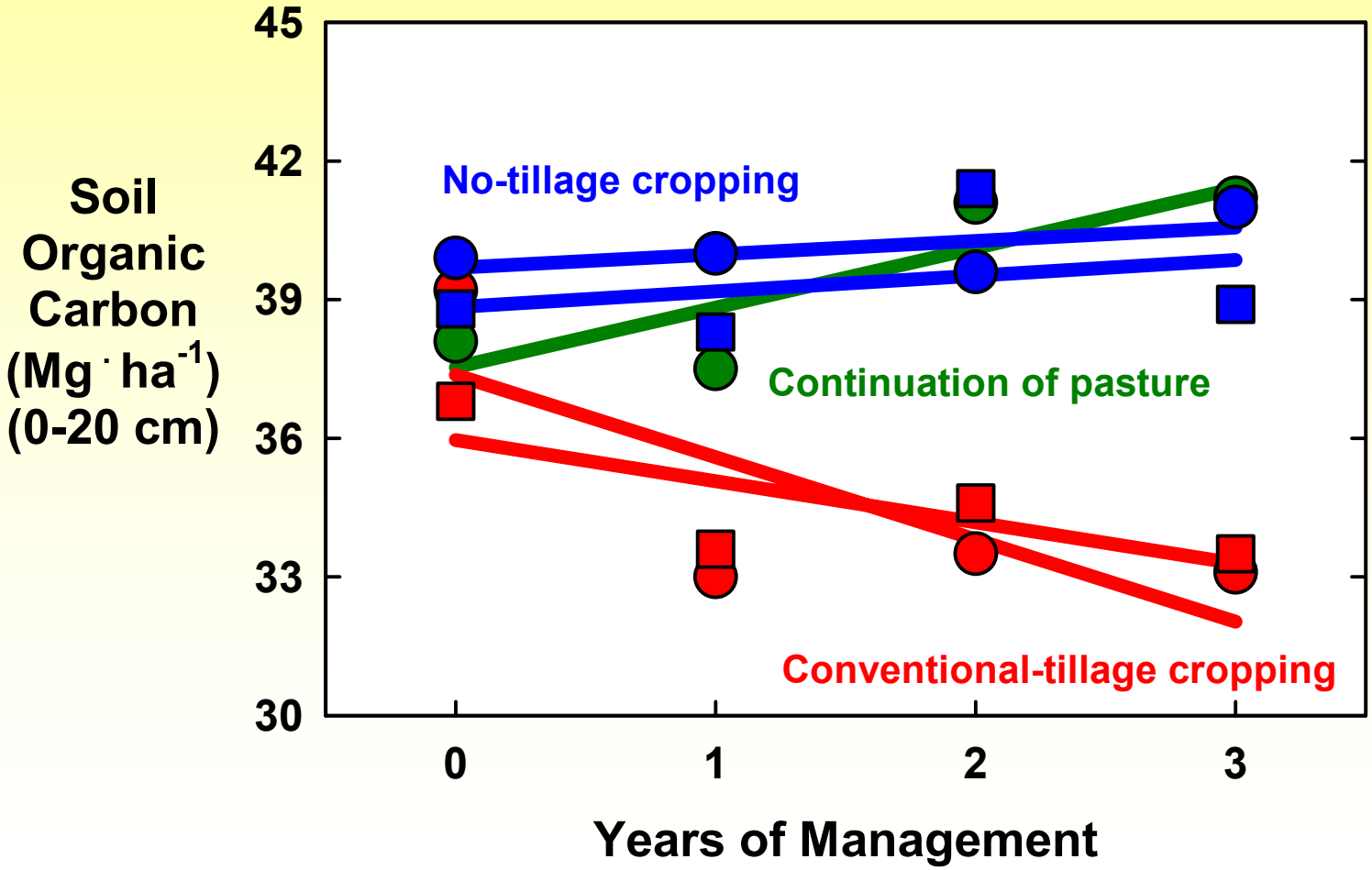

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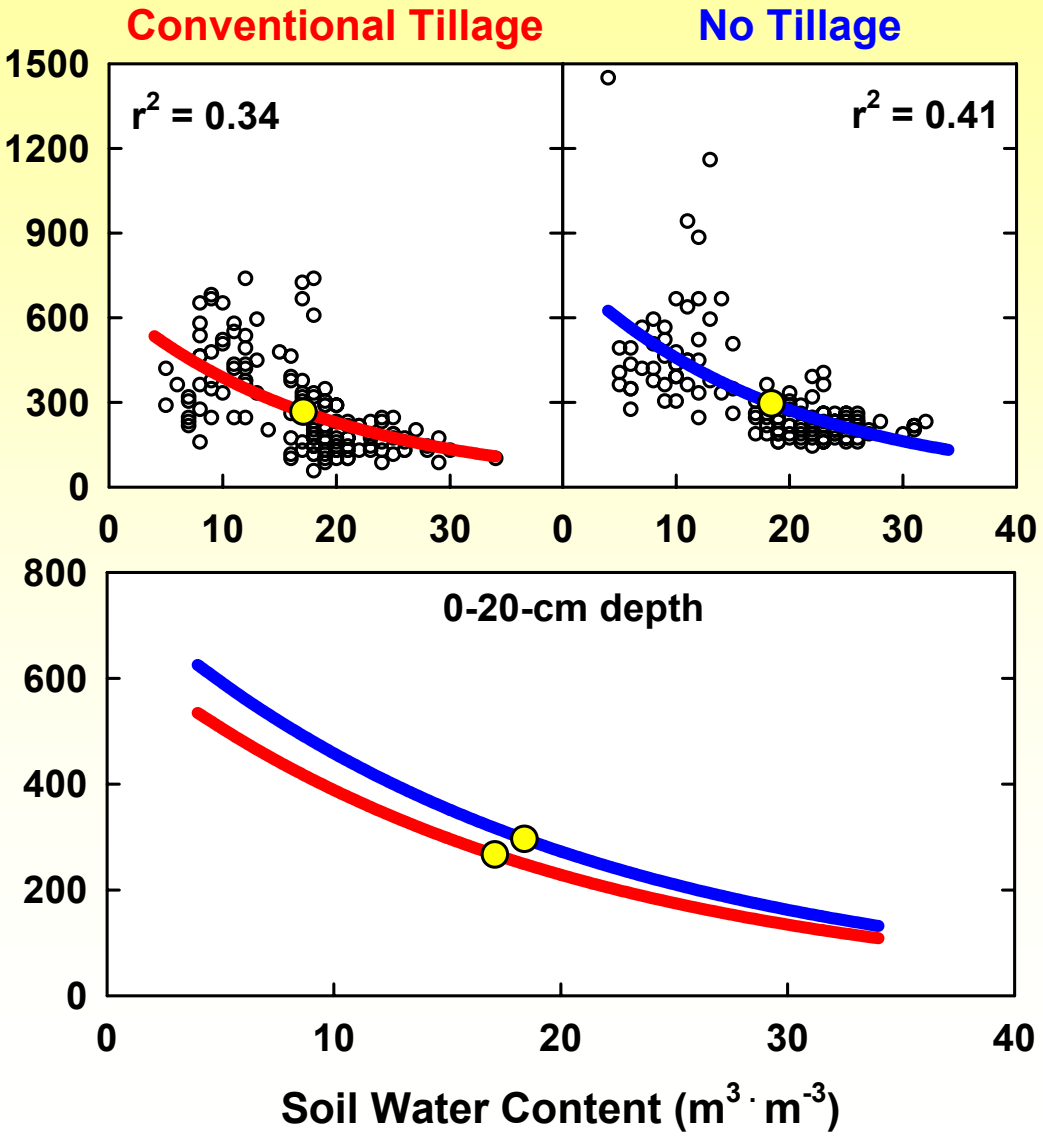
Penetration resistance (PR) was related to antecedent soil water content.

PR was little affected by tillage system

Soil water content averaged:

CT = 17.1%

NT = 18.4%



Water infiltration was also related to antecedent soil water content.

At low water content, infiltration was:

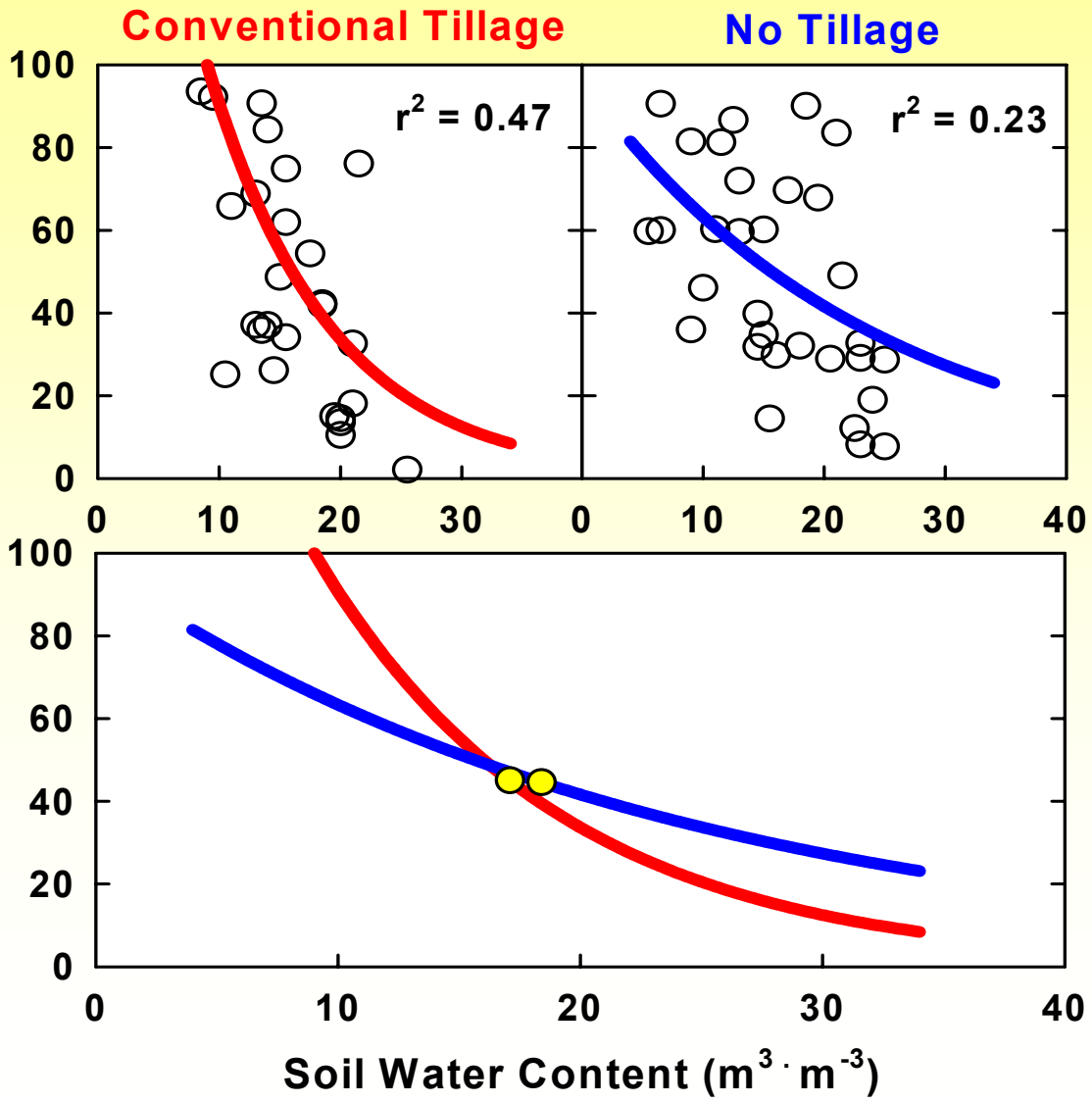
CT > NT

Likely due to large pores from tillage.

With wet soil, infiltration was: NT > CT

likely due to more connected pores.

At average water content, infiltration was: NT = CT



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How has soil changed with cover crop mgmt?

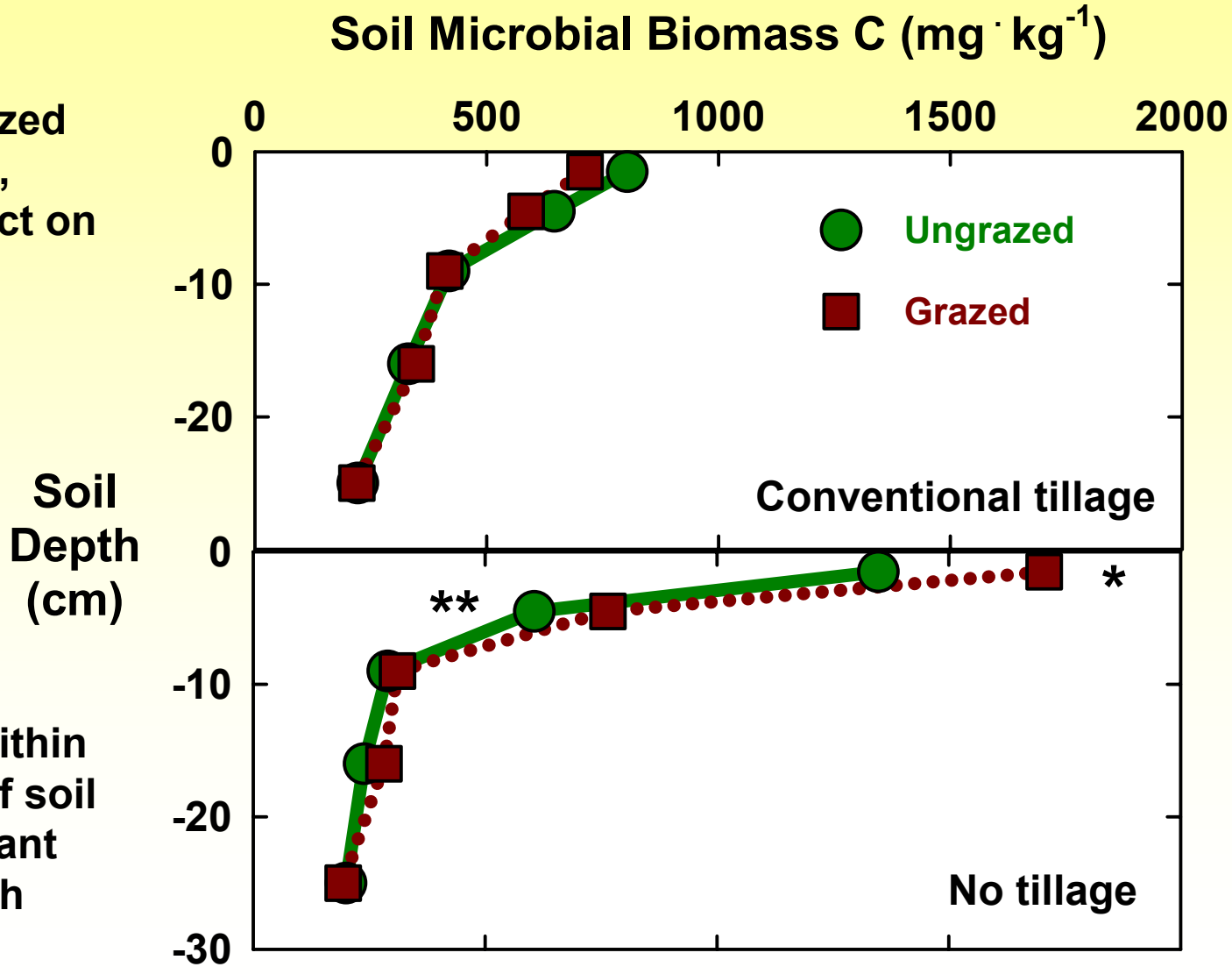
Mowing in DT system

Ungrazed

Grazed

Whether cattle grazed cover crops or not, there was no impact on SMBC under CT.

Under NT, grazing improved SMBC within the surface 6 cm of soil probably due to plant processing through animal digestion.



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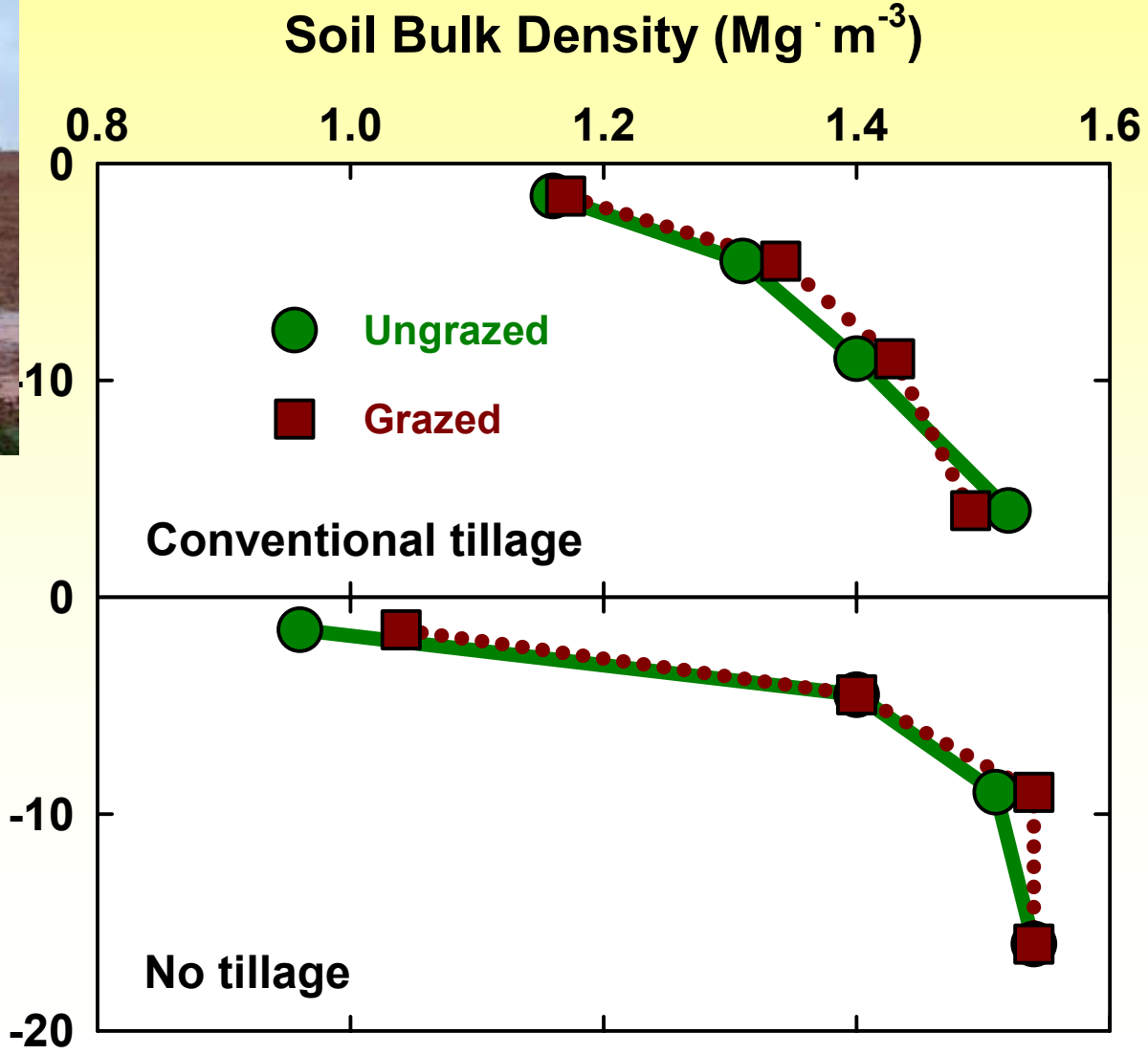
Whether cattle grazed cover crops or not, bulk density was little affected under either CT or NT, at least at the end of 2 years of management.



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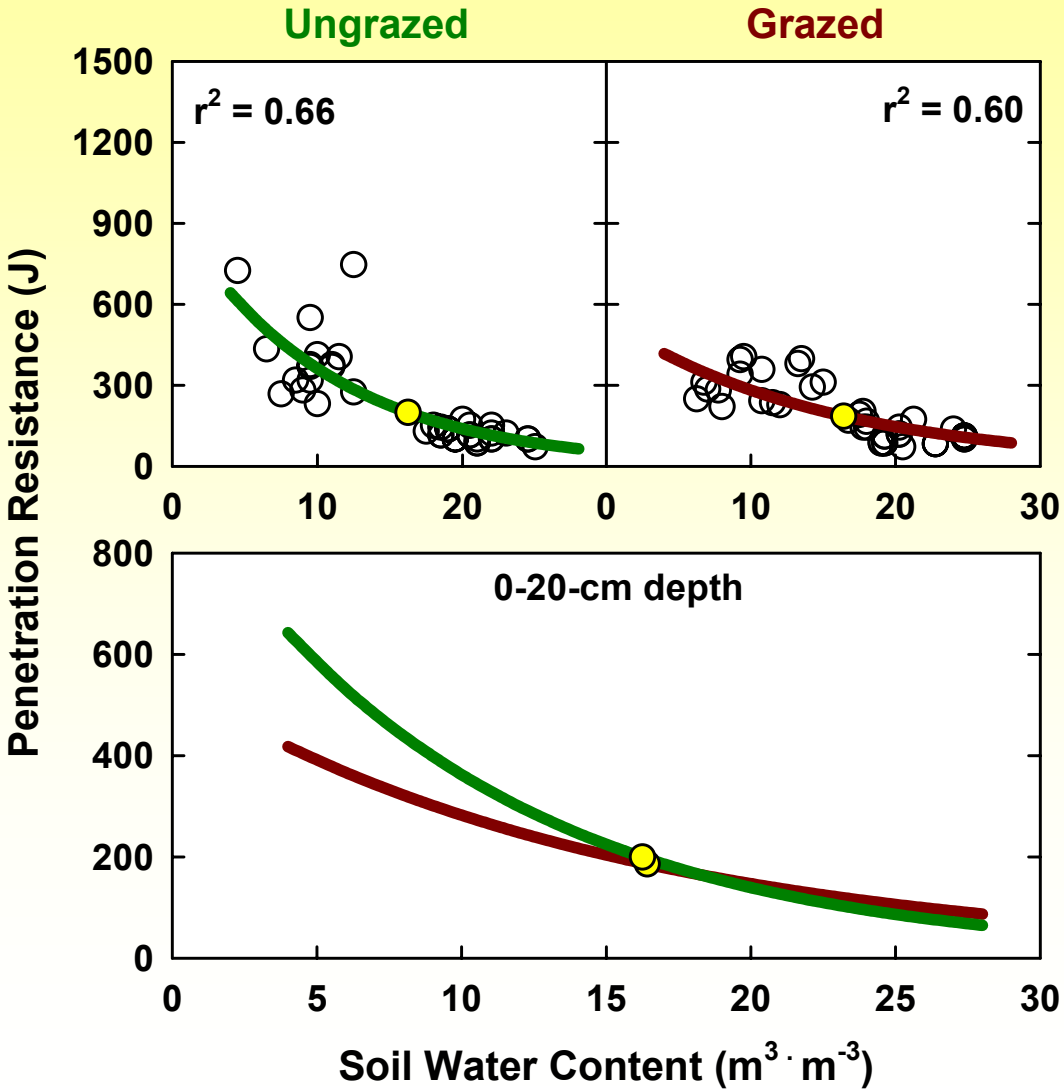

Whether cattle grazed cover crops or not, there was little impact on soil resistance, except at low soil water content.

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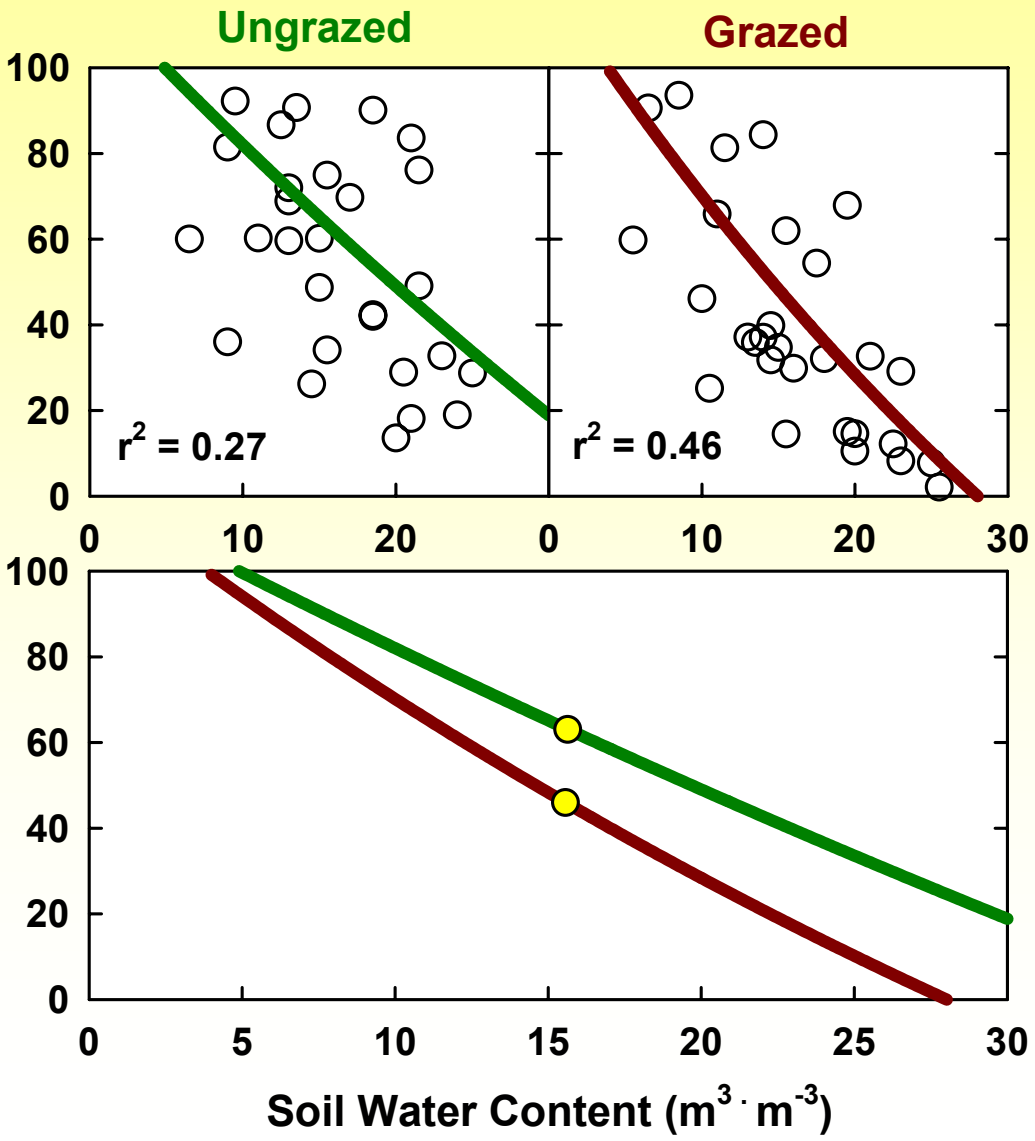
Water infiltration tended to be lower under grazed than ungrazed condition, especially with high soil water content.

Grazing of cover crop tended to have a relatively minor impact on water infiltration, although more years of grazing might change the magnitude of this effect.



- Implications from study -

- No tillage preserved the stratified nature of soil organic and microbial C following long-term pasture, which helped preserve soil microbial biomass and larger water-stable aggregates and maintain high water infiltration.

- Grazing of cover crops was greatly beneficial to overall production and had only minor or no detrimental effects on soil properties during the first few years.

- Integration of crops and livestock is possible to improve production and environmental quality.

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- Support -

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