Integrated Crop – Livestock Systems to Conserve Soil and Water Resources in the Southeastern USA

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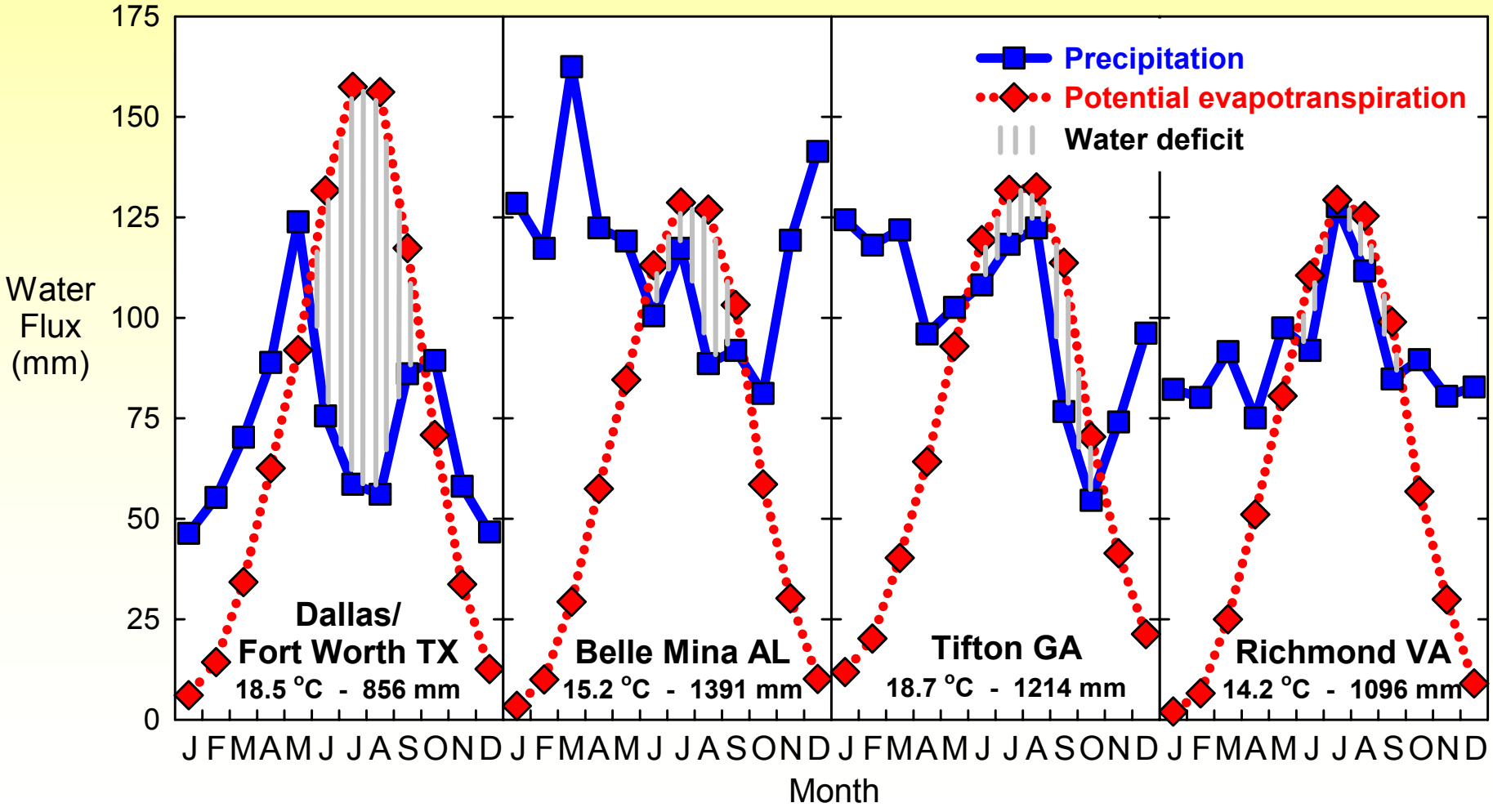
Climatic Characteristics in the Southeastern USA



The Search for Sustainable Agricultural Systems

1. **Specialization,** based on considerations of:
   - Climate
   - Socioeconomics
   - Infrastructure
   - Markets

Specialized agricultural system

Chicago Board of Trade

Leading to a focus typically on the most profitable system possible without regard to other factors

Or most traditional system that fits climate/infrastructure domain of region without regard to other factors

The Search for Sustainable Agricultural Systems

2. **Integration, based on considerations of:**
   - Climate
   - Socioeconomics
   - Infrastructure
   - Markets
   - Natural capital
   - Environmental impacts

Integrated agricultural system






Leading to diverse agricultural enterprises to balance production and economic gains with minimal negative influence on the environment.

Typically, systems that rely on natural capital rather than purchased capital to maximize resource efficiency.

Why Integrate Two Dominantly Conventional Systems?

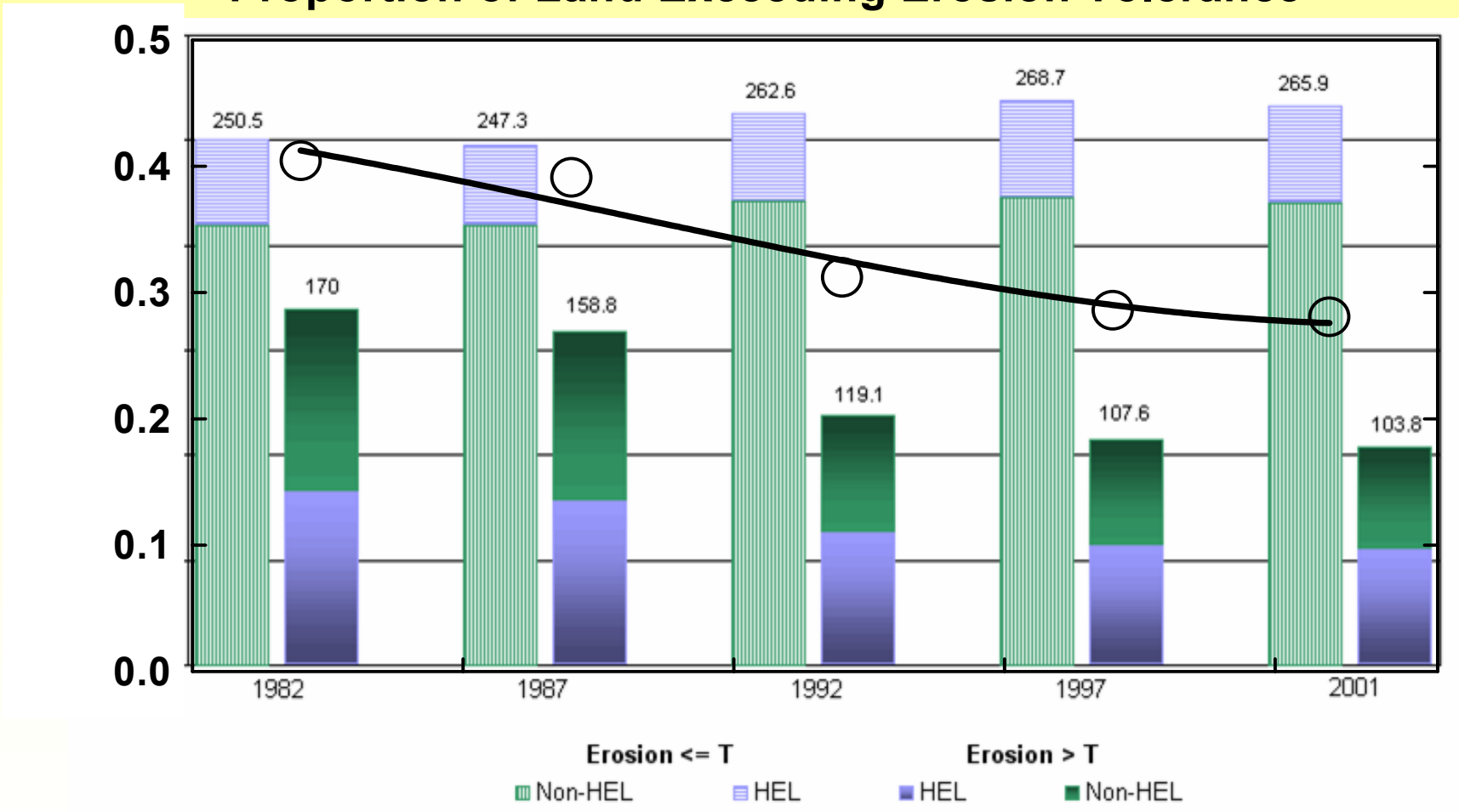
Production

- ✓ Farms operating on marginal profit
- ✓ Economic vulnerability with specialized production
- ✓ High cost of fuel and nutrients
- ✓ Pests become greater with monocultures
- ✓ Yield decline could be overcome with rotation

Environment

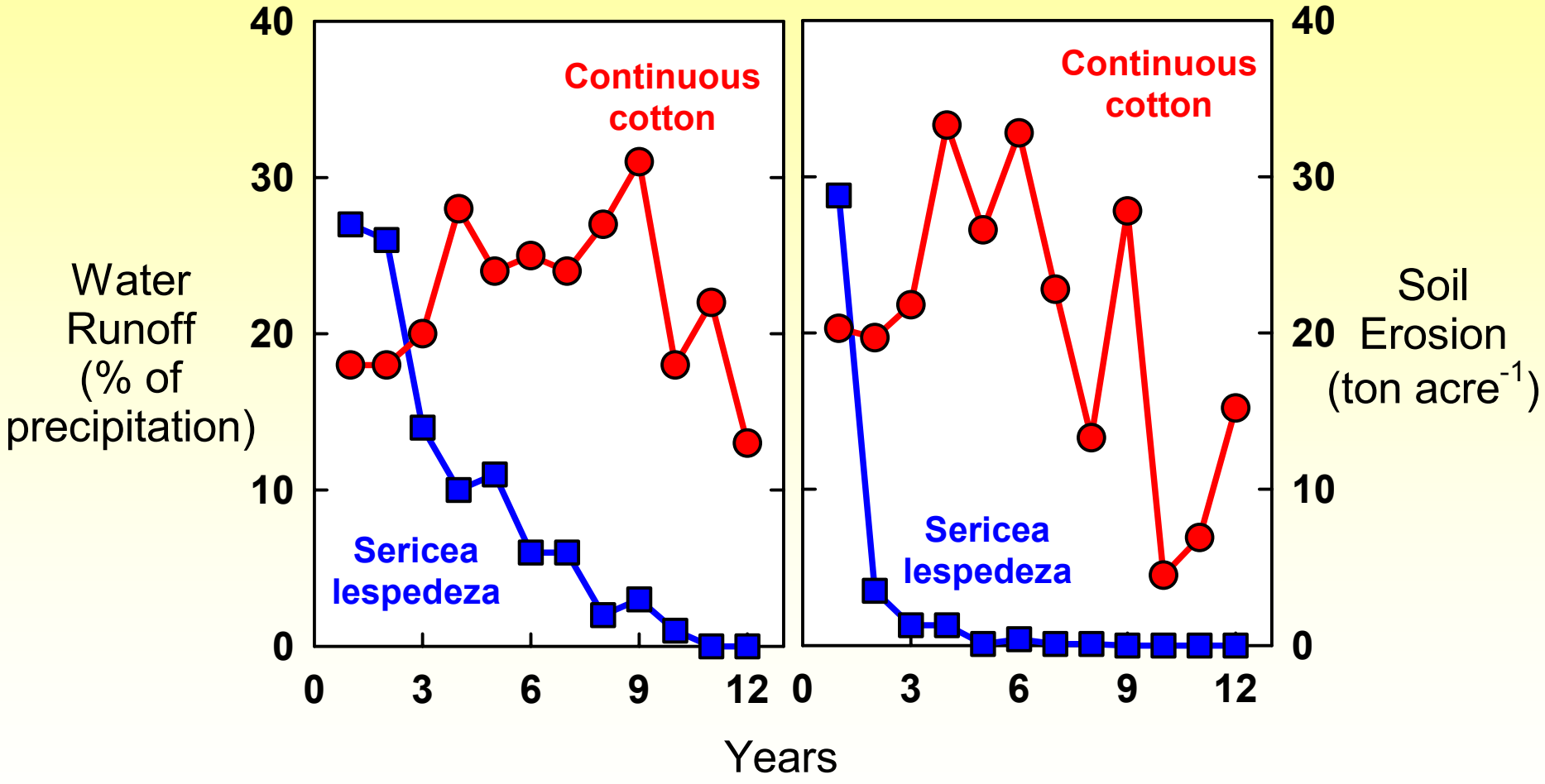
- ✓ Nutrient recycling could be improved in both systems
- ✓ Conservation of soil and water possible with sod-based management systems

Sustainability Cannot Occur with Soil Erosion



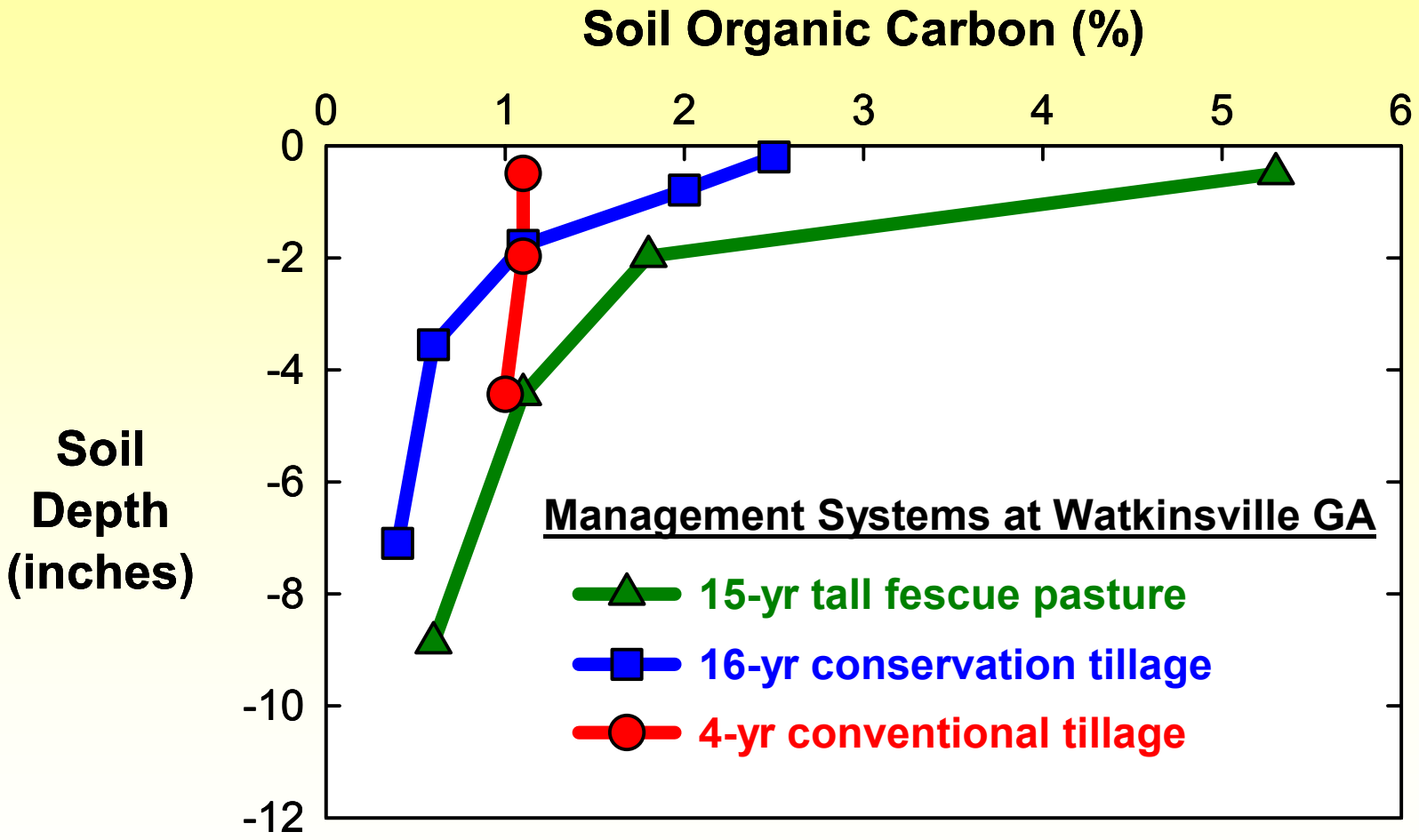
From www.nrcs.usda.gov/technical/land/nri01/erosion.pdf

Soil is Altered with Permanent Cover



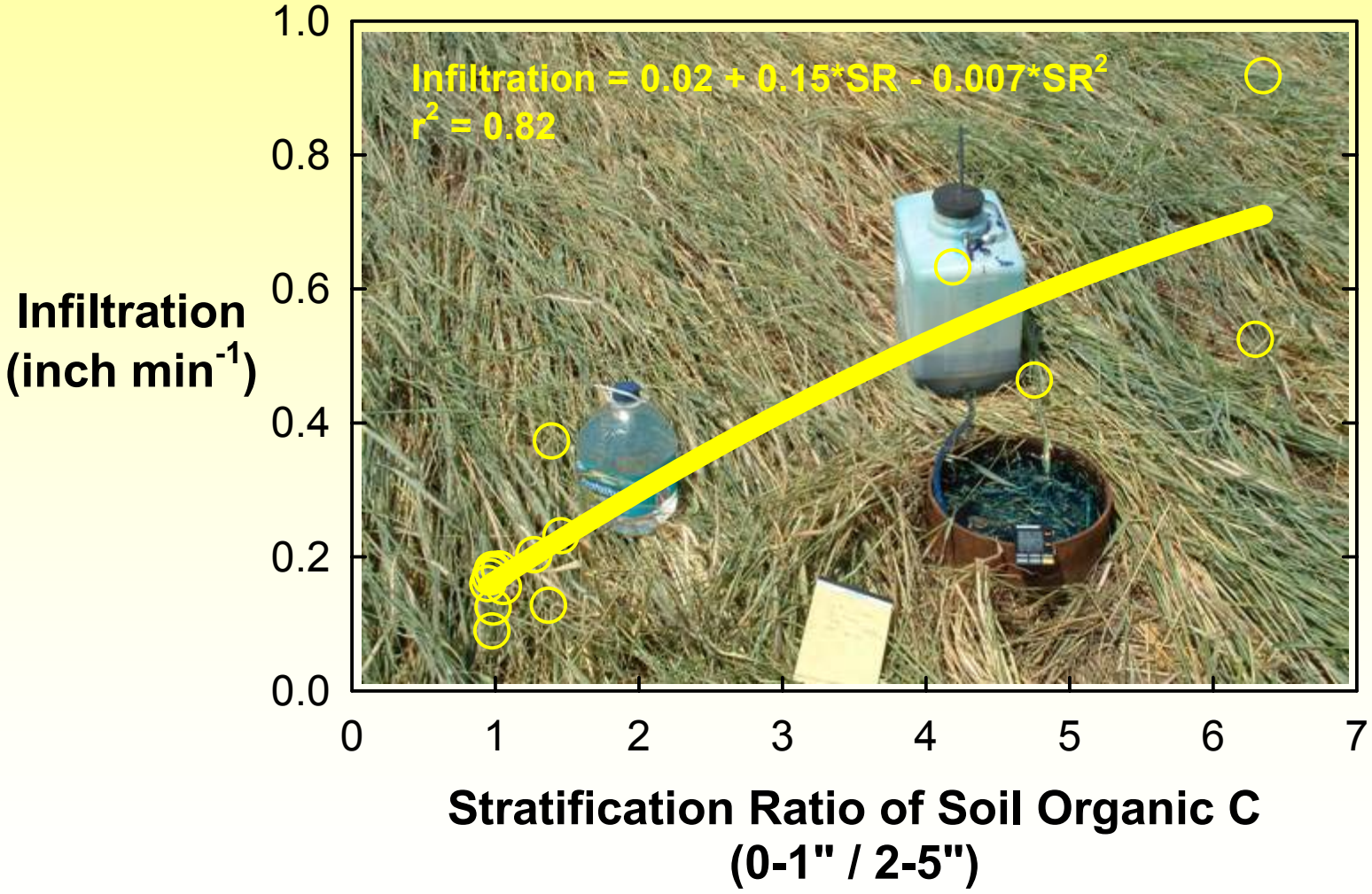
Data from Barnett (1965) J. Soil Water Conserv. 20: 212-215.

How does Soil Change with Conservation Management?



From Schnabel et al. (2001) Potential of US Grazing Lands to Sequester C & Mitigate the GH Effect, p. 291-322.

The Impact of Surface Soil Organic Matter

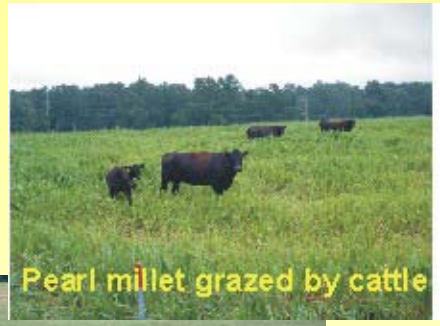


Separation of Components

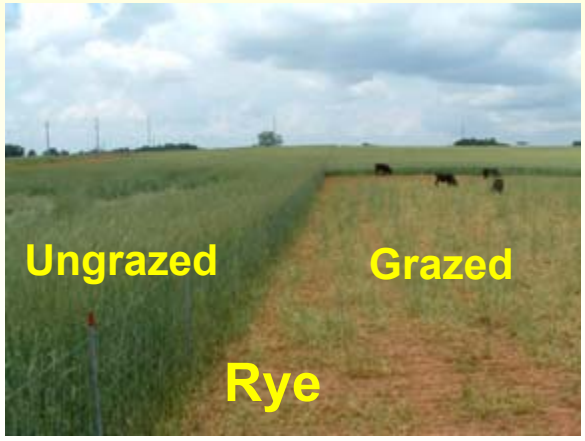
Crops

Livestock

Integrated Crop – Livestock Systems



Space



Time

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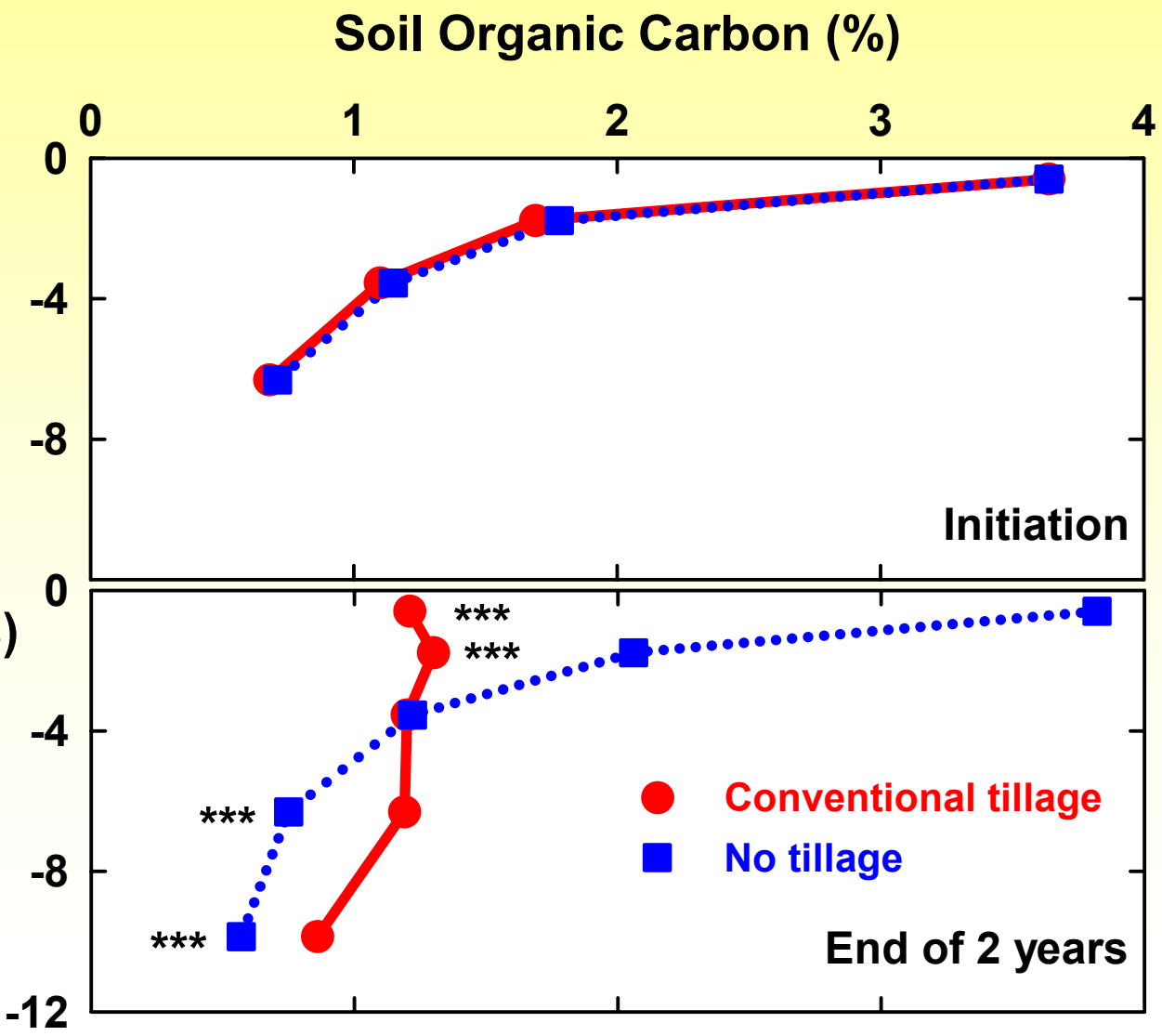
Rotation of Long-Term Pastures with Crops

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.



No-Tillage Seed Drilling into Sod

Benefits of no-tillage planting of crops into pasture

- Elimination of wild forms of E+ tall fescue
- Control of problem weeds in pastures
- Greater income from upland sites
- Greater labor efficiency

Short-Term Grazing of Cover Crops

Rye grazed by cattle

Pearl millet grazed by cattle

Short-Term Grazing of Cover Crops

Benefits of cover crops

- Controlling soil erosion
- Providing high quality forage
- Reducing water and nutrient runoff
- Improving soil tilth, structure, and nutrient cycling
- Modifying soil moisture through ↑ uptake and ↓ evaporation
- Contributing to soil C sequestration and soil biodiversity
- Controlling weeds through competition, allelopathy, etc.
- Controlling insect and disease pressures more ecologically
- Serving as a nutrient trap in high-fertility systems
- If leguminous, providing biologically fixed N

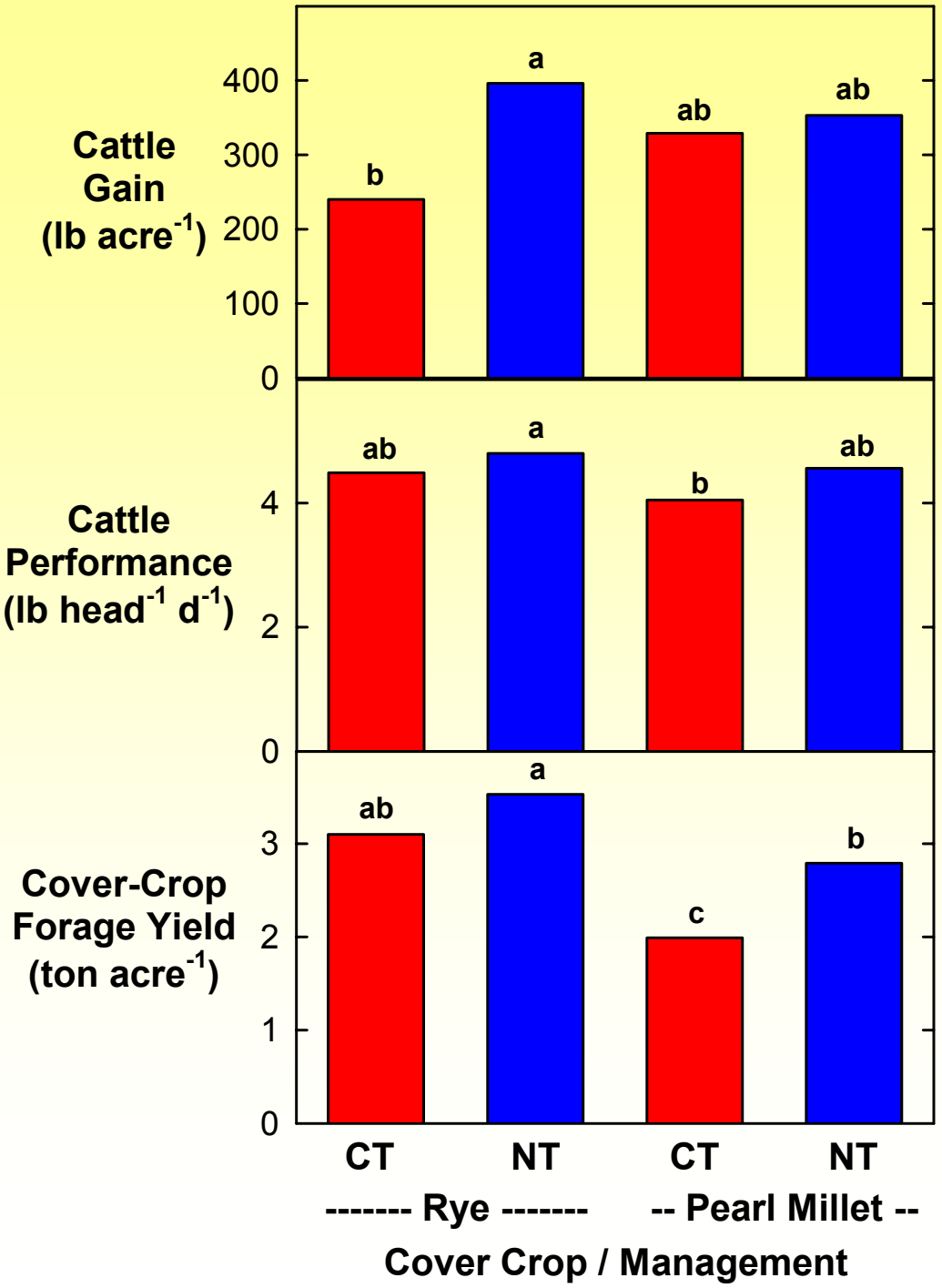
Outcomes of Cover Crop Grazing

During the first 2 years of production, sorghum and wheat grain yields were unaffected whether cattle grazed cover crops or not.

Cover crops were more productive under no tillage.

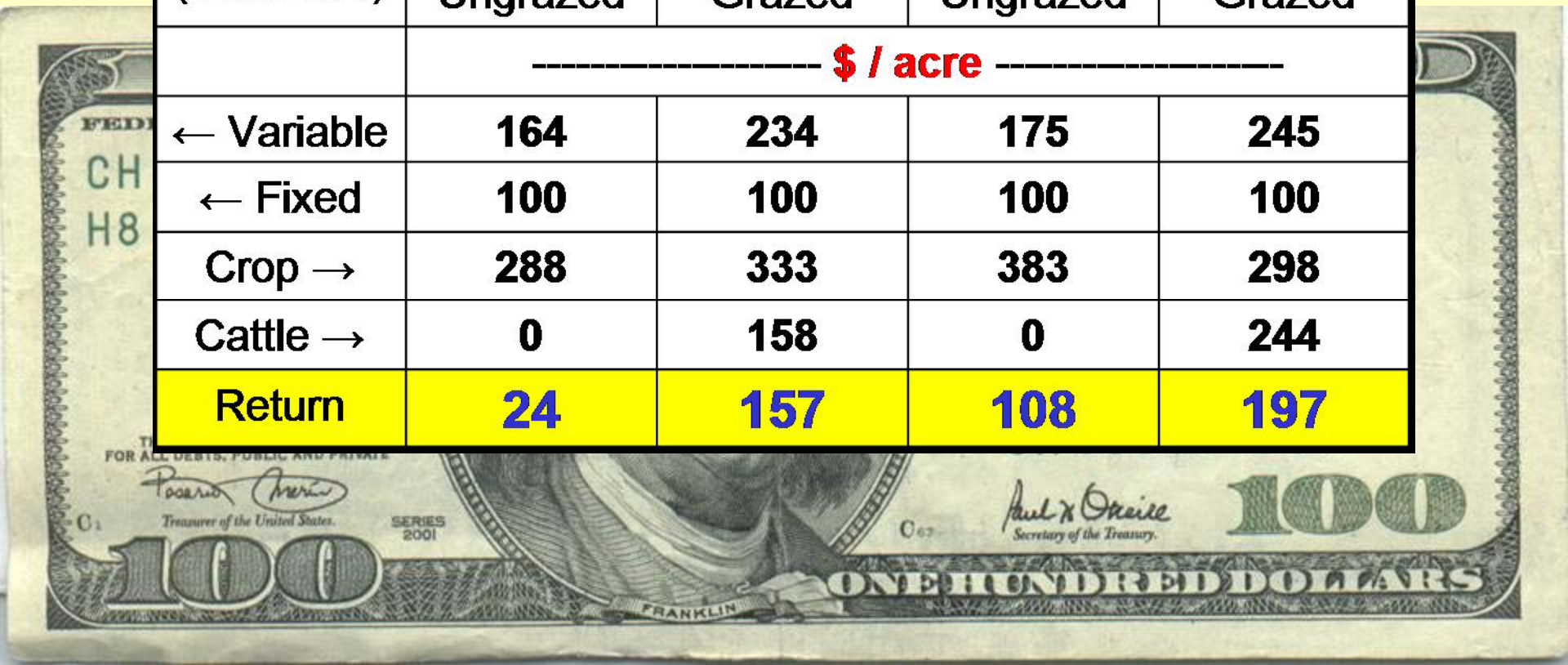
Cattle performance was excellent on all cover crops.

Cattle gain added value and diversity of income.



Will it Pay to Integrate Cattle with Crops?

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



Other Opportunities for Integration

- ✓ Relay or intercropping
  - Drilling small grains into dormant bermudagrass
  - Corn planted into partially killed tall fescue sod
  - Modern technologies of plant genetics and herbicides will allow more effective weed control and precision planting
- ✓ Agroforestry
  - Wide tree spacing with open areas cropped initially and later made available to grazing animals
  - Opportunity to apply animal manures, benefiting crops or pastures and trees

Agroforestry Example from MS

Outlook

Conservation of soil and water resources is a necessity in our world of ever-changing and competing human activities.

Meeting the food and fiber demands of a growing world population will only become more difficult with competing energy and natural resource commitments.

Integration of crops and livestock has great potential to improve resource efficiency of agricultural production in the southeastern USA and around the world.

Some cases of integration have been developed, but much more research is needed to optimize systems within unique local and regional conditions.