Impacts of Soil and Crop Management Practices on Water Partitioning and Nutrient Losses from Agricultural Fields

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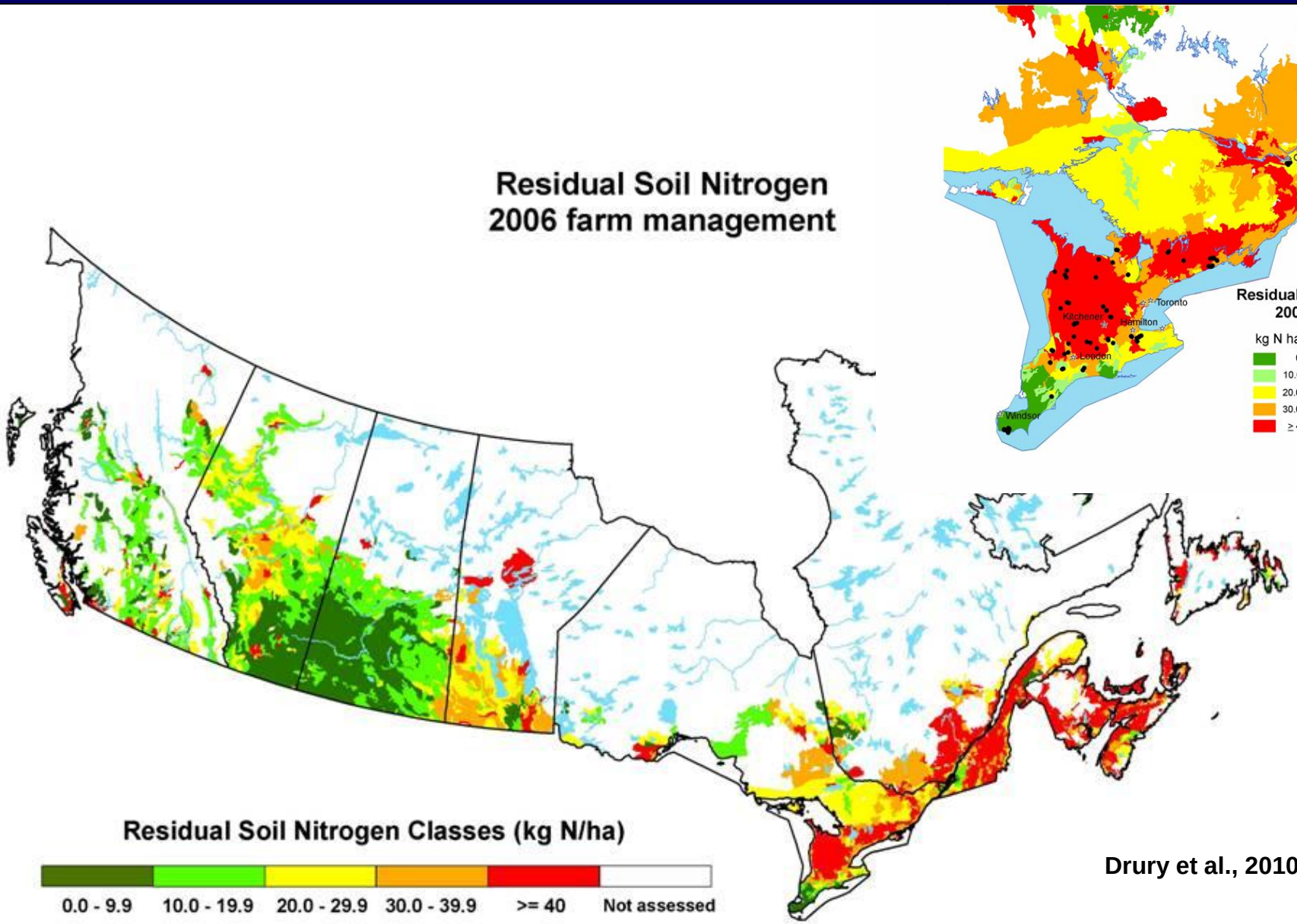
Factors Affecting Nutrient Losses from Agricultural Soils

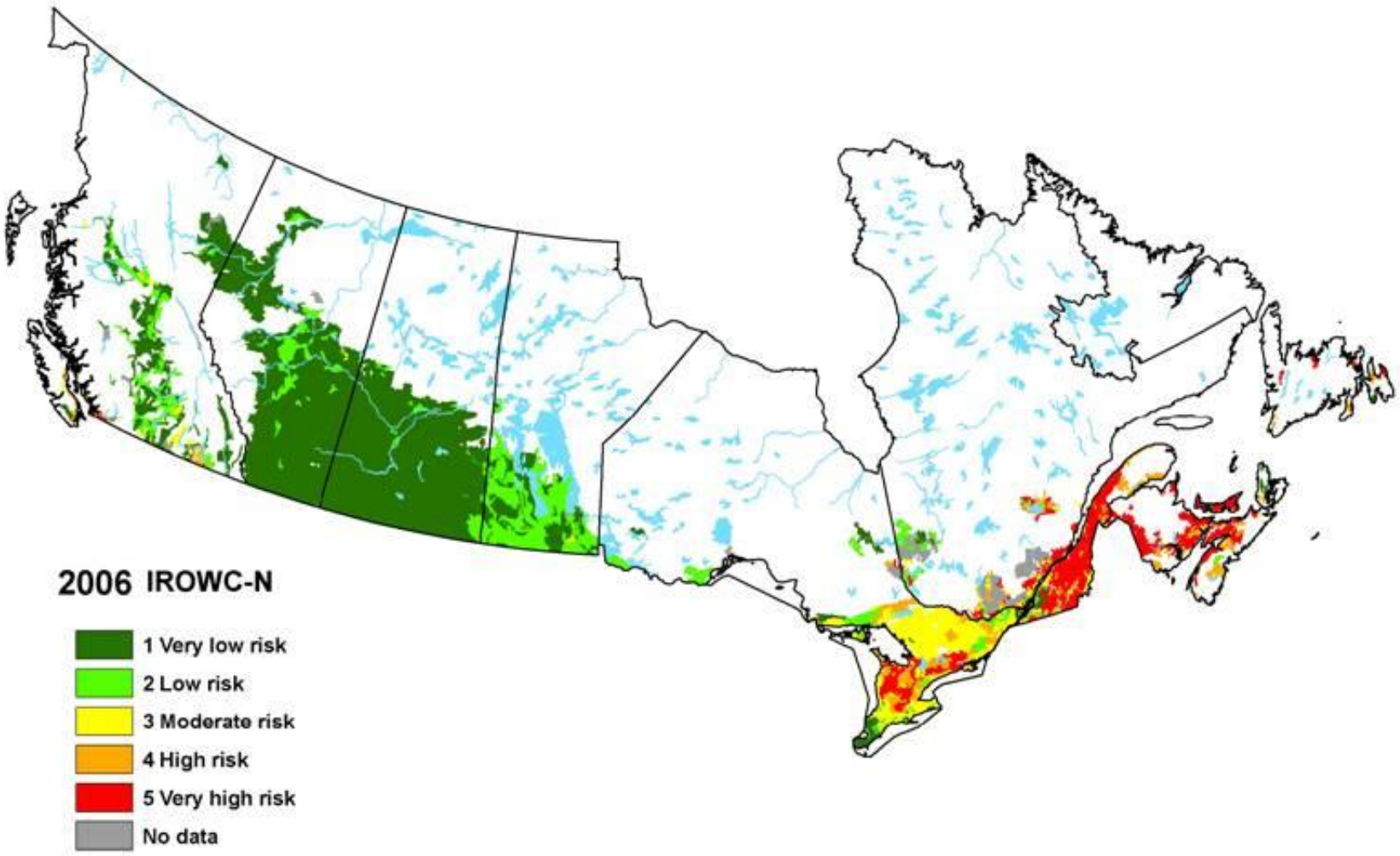
- Soil water content, irrigation & precipitation (intensity, frequency & quantity)
- Available nutrient levels (fertilizers, manures & legumes)
- Growing season nutrient uptake
- Soil type (hydraulic conductivity)
- Landscape (topography, slope)
- Tile drainage

Residual Soil Nitrogen (2006)



Drury et al., 2010

Indicator of Risk of Water Contamination by Nitrate (2006)



DeJong et al. 2010.

OUR GOAL

Manage fertilizer to:

- **Optimize crop yield and quality**
- **Minimize environmental N losses**



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Beneficial Management Practices

1. Cover Crops
2. Crop Rotation
3. Conservation Tillage (ex. no-till, zone tillage)
4. Tile Drainage
5. Watertable Management Systems
6. Buffer Strips

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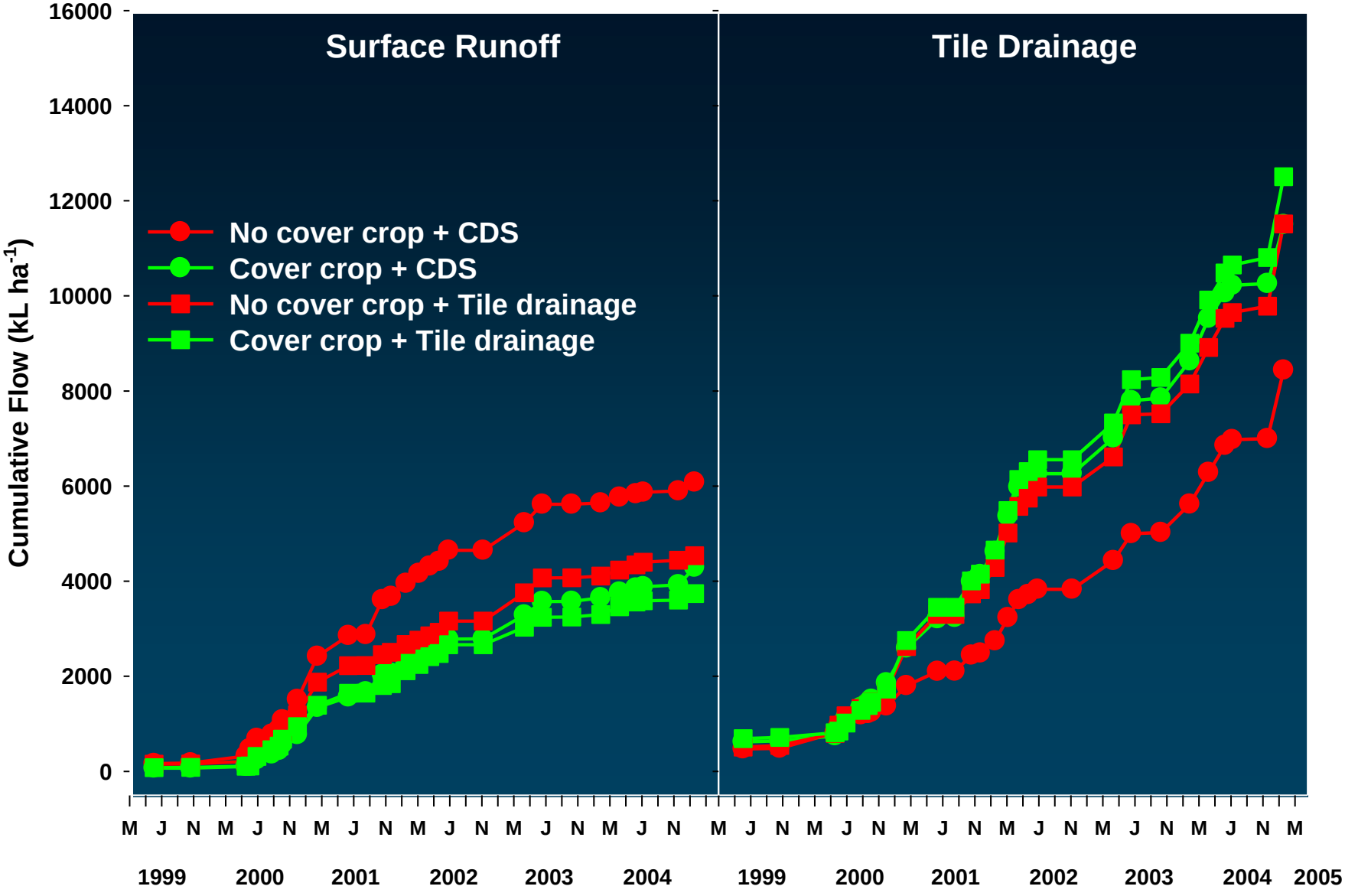
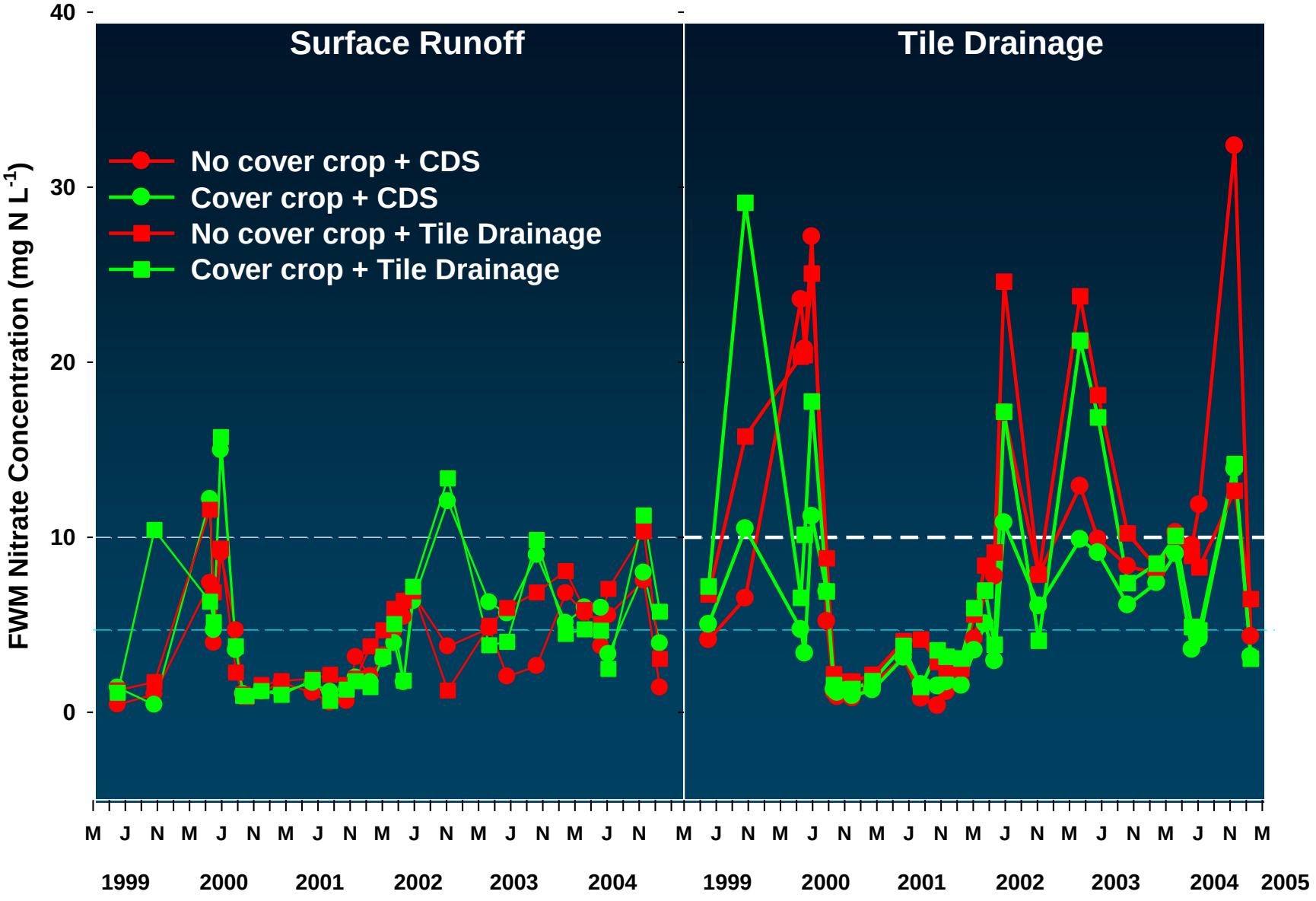
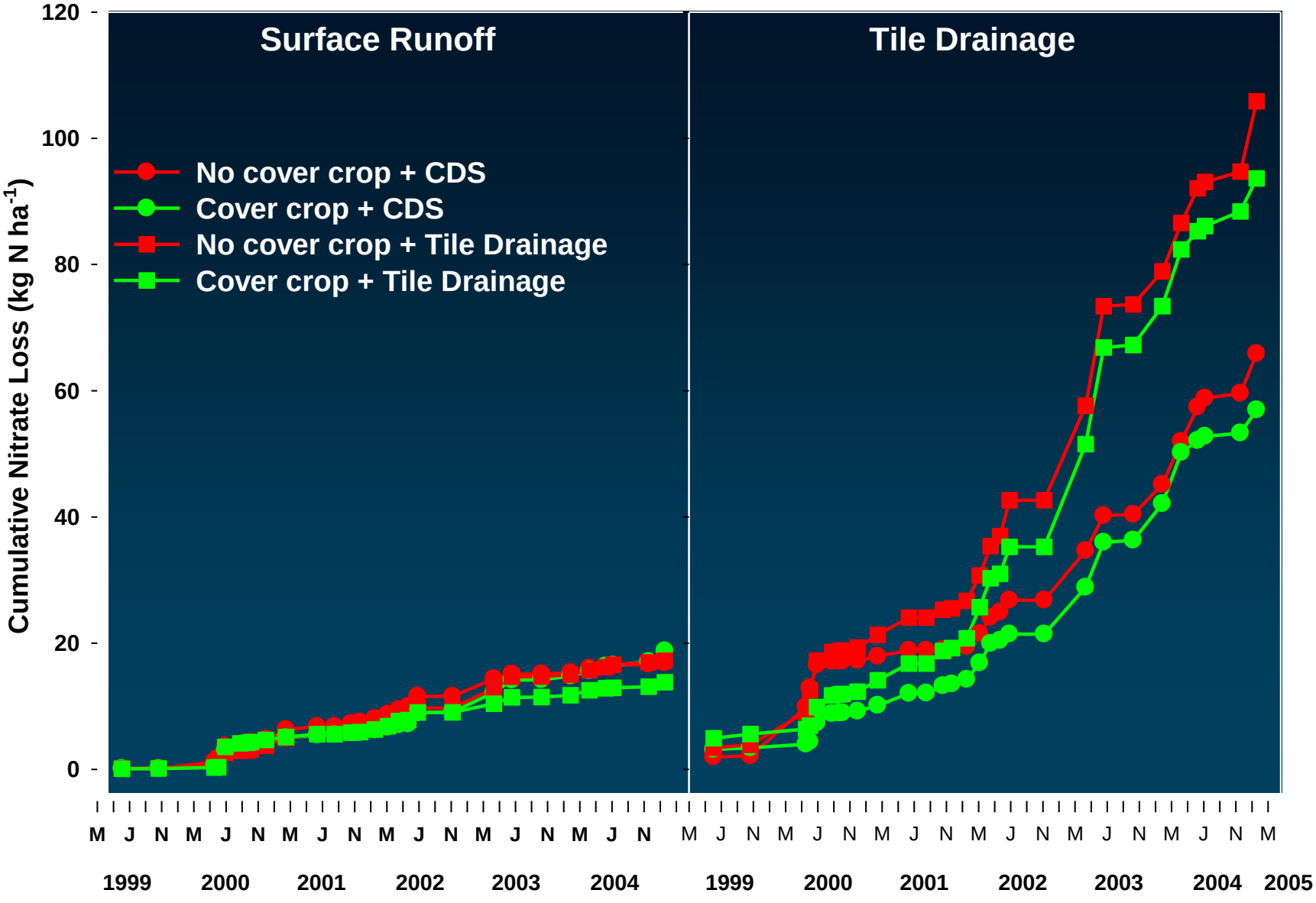
Surface Runoff & Tile Drainage Volume



FWM Nitrate Concentration



Nitrate Loss



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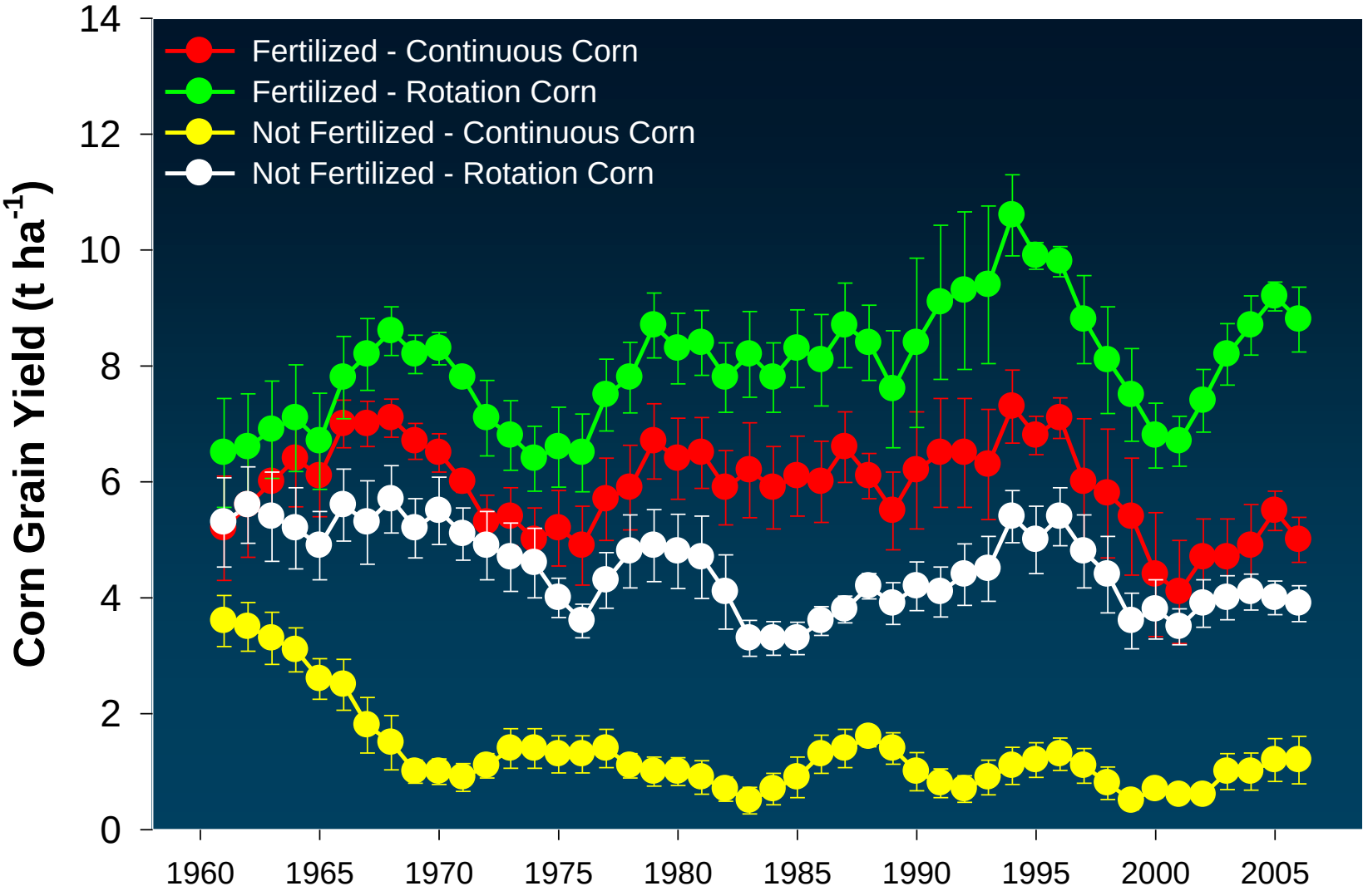
Continuous Corn - Fertilized
12/07/01


Continuous Corn – Not Fertilized
12/07/01

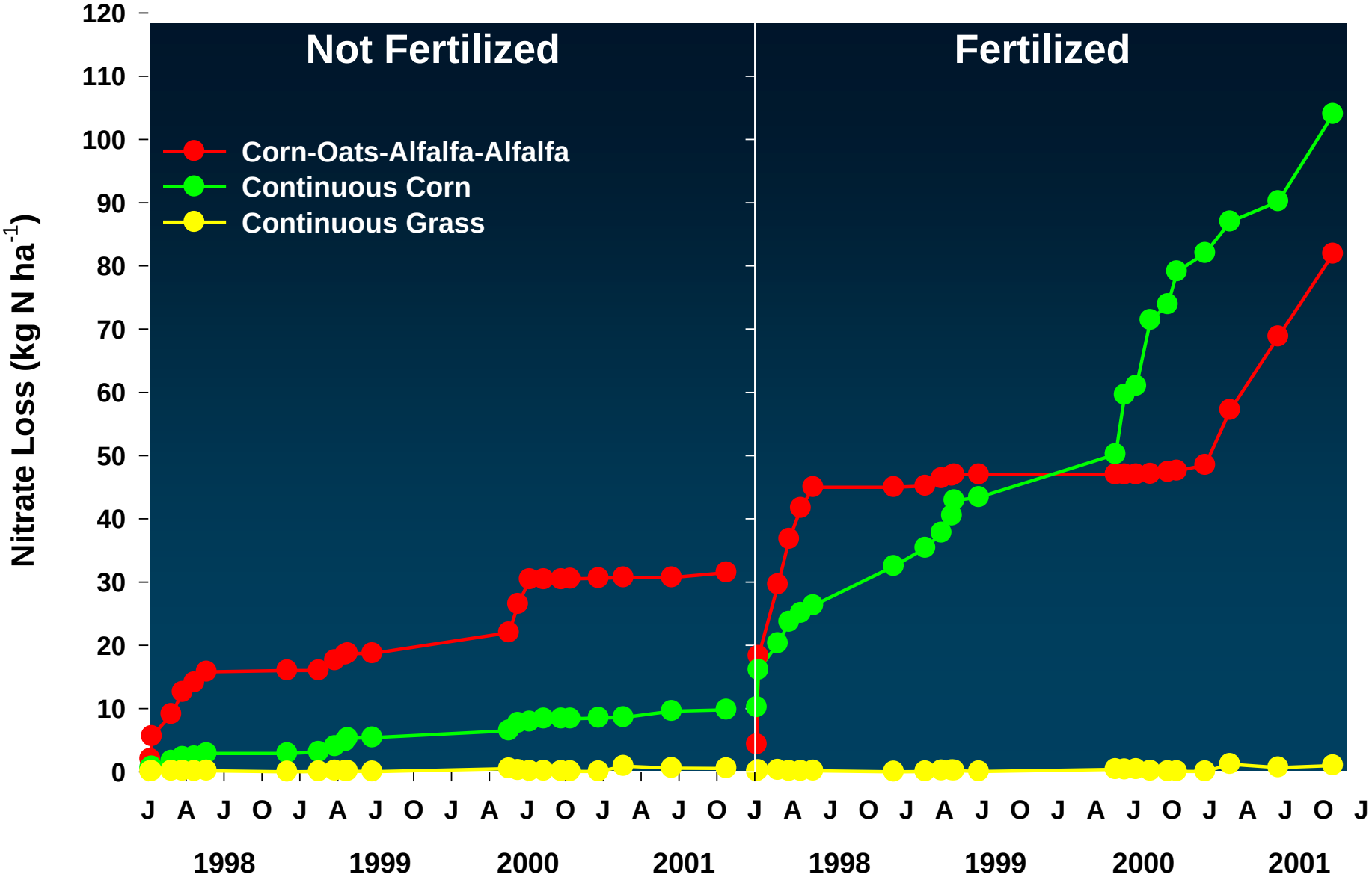

Rotation Corn - Fertilized
12/07/01


Rotation Corn – Not Fertilized
12/07/01

Corn Grain Yields (5 yr Averages)



Nitrate Loss in Tile Drainage Water



Tan et. al., 2002

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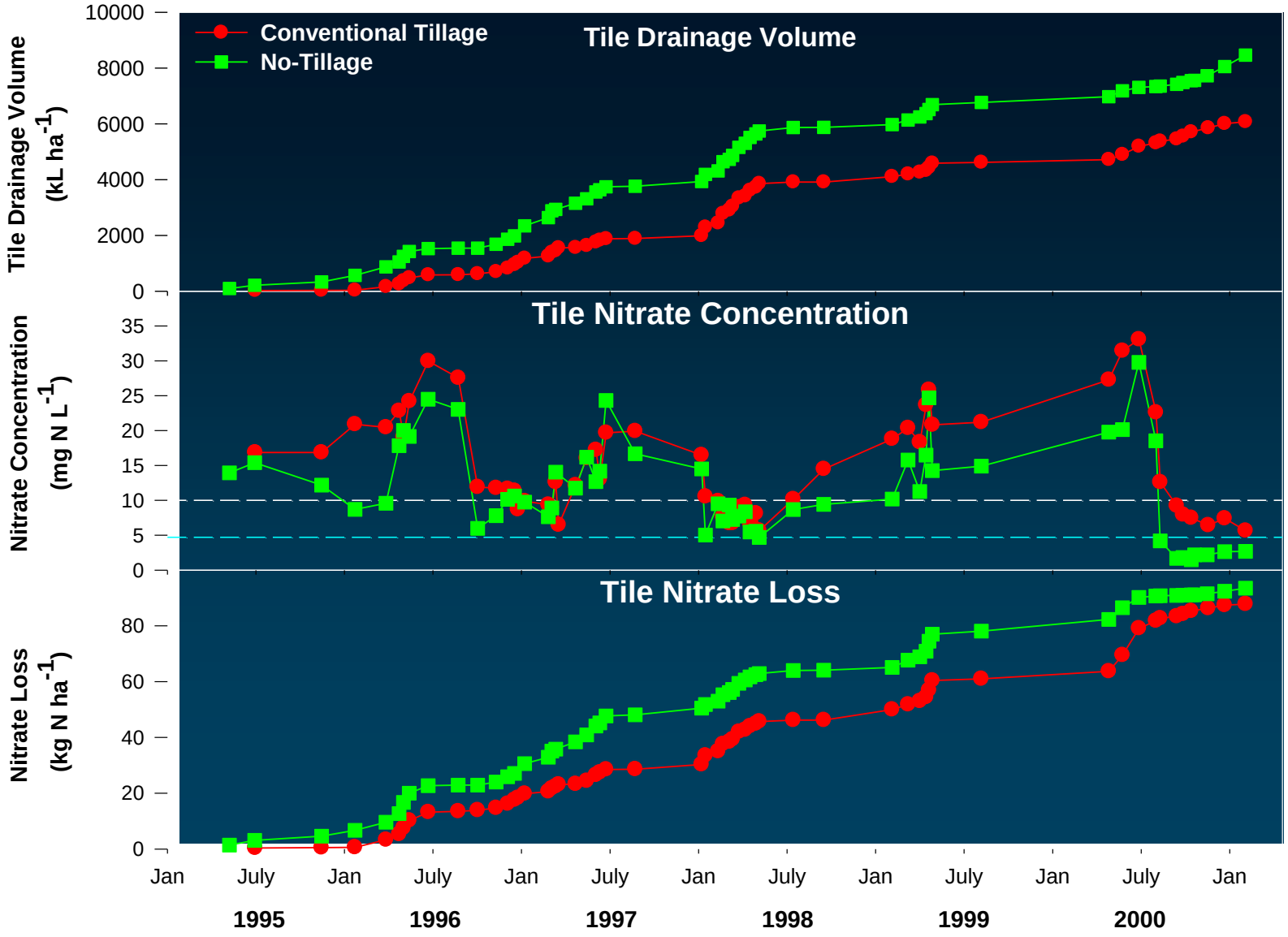
Conservation vs Conventional Tillage

Conventional vs No-tillage – Tile drainage



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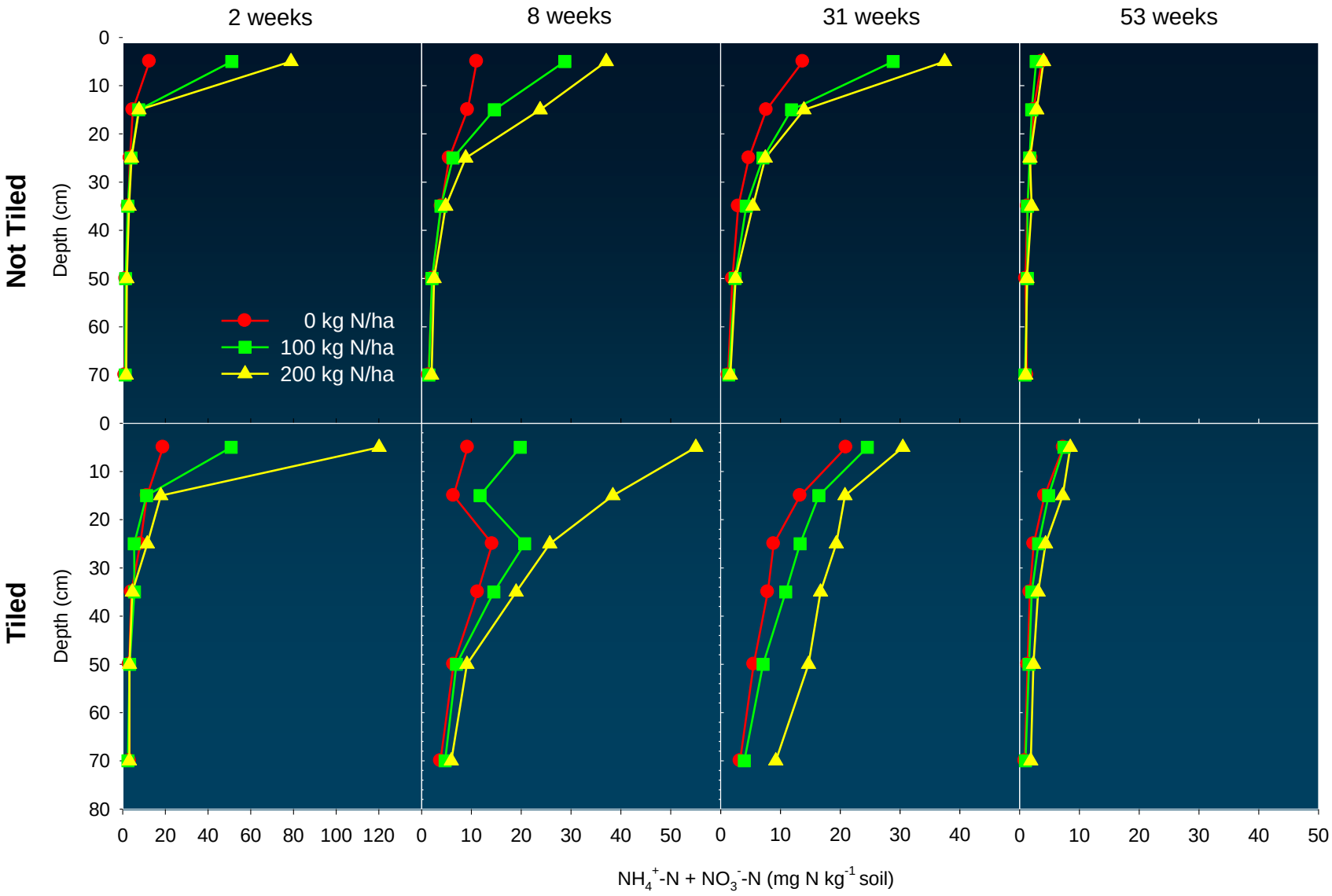
Tile vs not tiled Brookston clay loam soil



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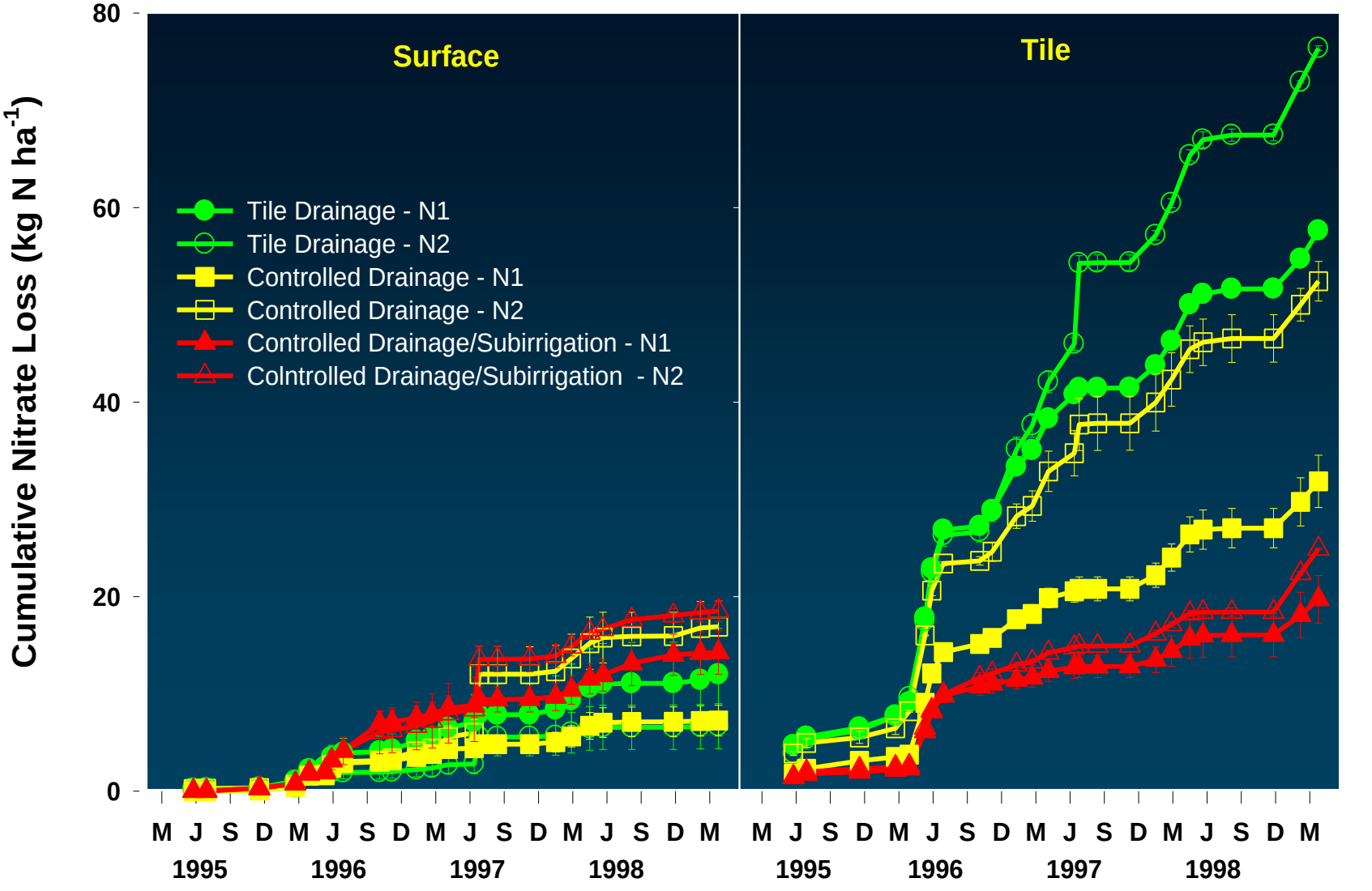
N EFFICIENT CROPPING SYSTEMS

Capture and recycling of nutrients in drainage water

Surface Runoff and Tile Drainage Nitrate Loss



Drury et al. 2009

Observations

- **Management practices which reduce water and nutrient loss through surface runoff (ex. conservation tillage, cover crops) may increase water and nutrient loss through tile drainage.**
- **Conversely, management systems that control tile drainage may increase surface runoff. However water management systems can supply water in drought periods and increase nutrient uptake.**
- **Tile drains enable producers to plant earlier in the spring and harvest later in the season and thereby increase nutrient uptake and crop yields. Tiles can however increase nutrient leaching.**

Summary

- **Nutrient losses occur as a natural part of all ecosystems**
- **Environmental problems occur when excess nutrients are present or when crop growth is restricted**
- **Management practices which:**
  - **1) predict nutrient availability**
  - **2) overcome crop limitations (water, soil quality)**
  - **3) reduce transport**
  - **4) recycle water and nutrients**

will help to minimize losses, optimize nutrient uptake and maintain soil, water and air quality

Acknowledgements

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Thank You!

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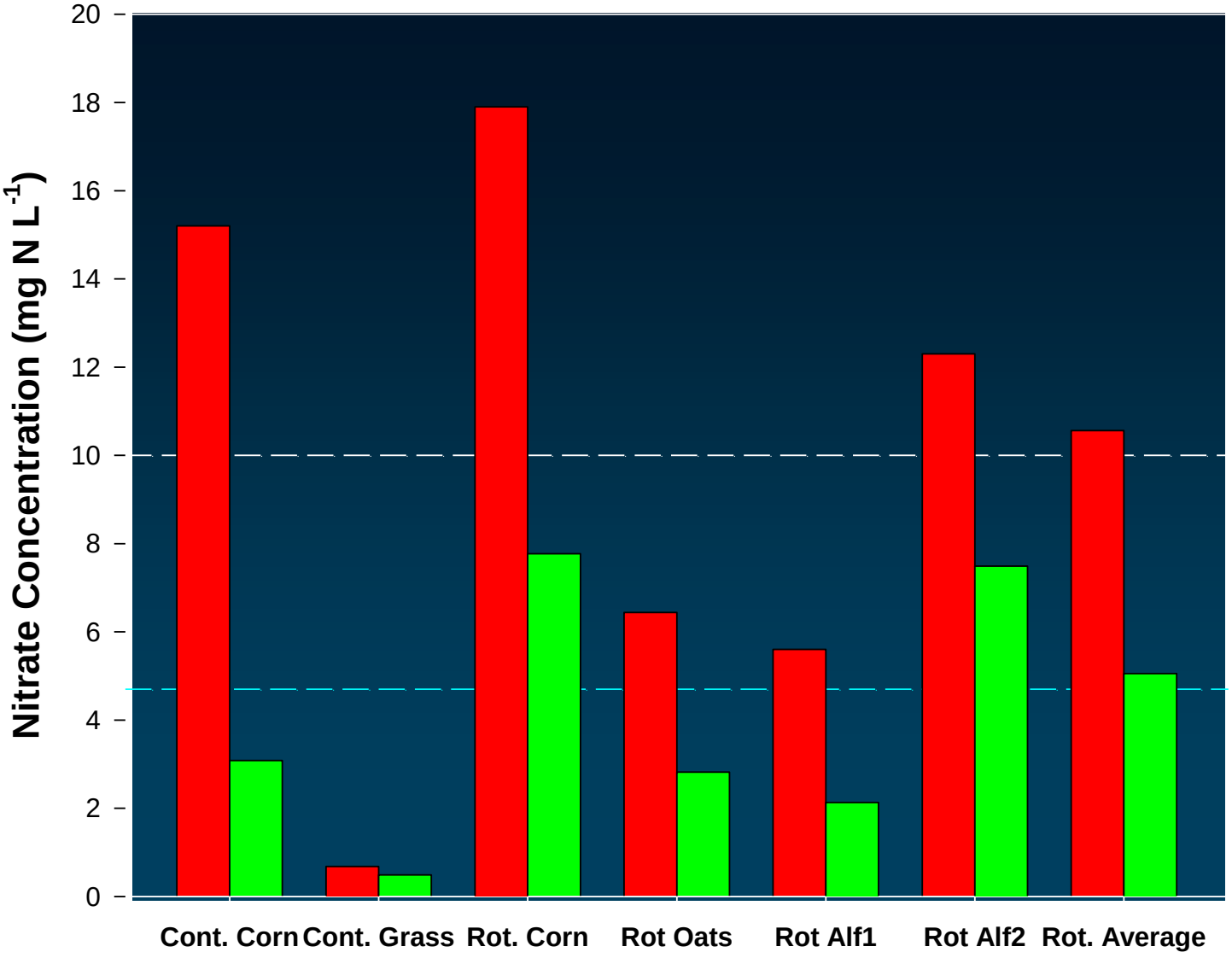
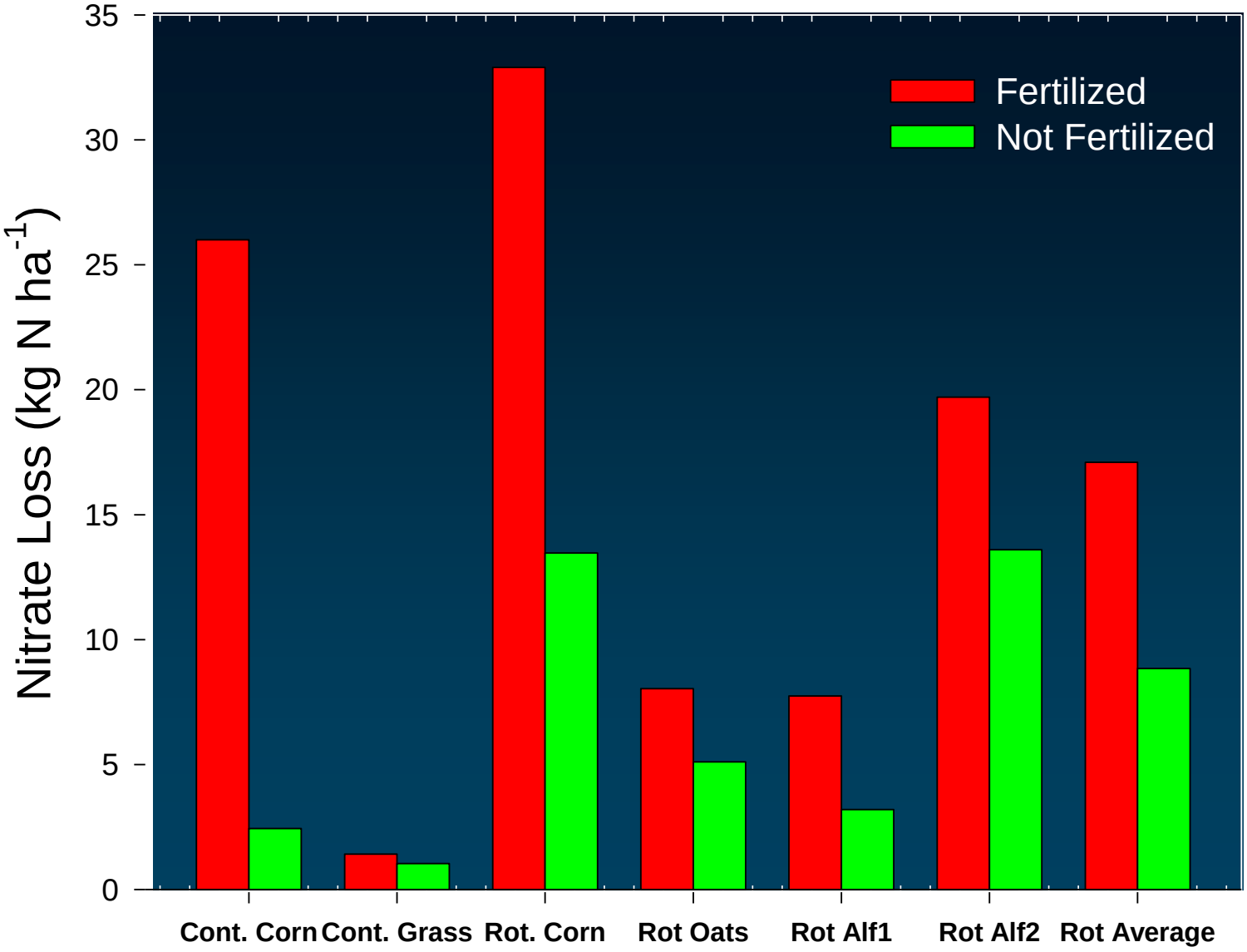
Nitrate Concentration in Tile Drainage Water



Tan et al., 2002

Annual Nitrate Loss in Tile Drainage



Tan et al., 2002