Nitrous Oxide Emissions From Several Nitrogen Sources Applied To A Strip-tilled Corn Field

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Background Information:

- Agriculture contributes ~67% of U.S. total N_2O emissions.
- Global Warming Potential of N_2O is ~296 times greater than CO_2.
- Applying N fertilizer generally increases N_2O emissions.
- Developing management practices to reduce N_2O emissions in agricultural systems is important.

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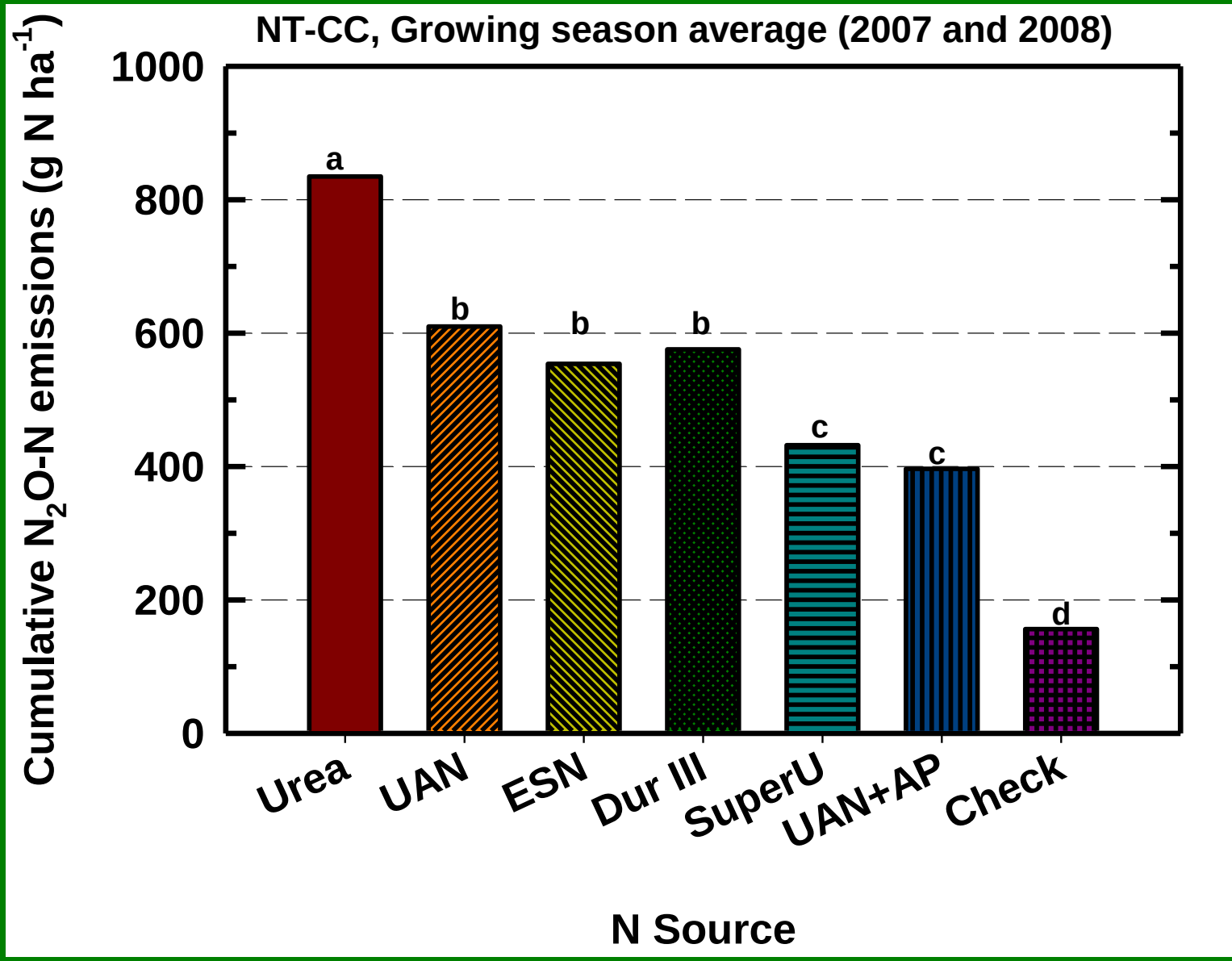
Previous N Source Comparisons in NT Continuous Corn



Source: Halvorson et al. 2010. JEQ 39:1554-1562

Current Study Objective:

- Compare N_2O emissions from soil resulting from application of various N sources to an irrigated, strip-till corn system.
- N Fertilizers compared:
  - dry granular urea (46-0-0)
  - polymer-coated urea (ESN, 44-0-0)
  - stabilized urea (SuperU, 46-0-0)
  - liquid UAN (32% N)
  - Stabilized liquid UAN (UAN+AgrotainPlus, 32% N)
  - Slow release UAN (UAN+20%Nfusion, 30% N).

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N Management Details

- **N Rates:**
  - **202 kg N/ha all N sources**
  - **Check** (no N added) located in a separate plot from N sources and a **Blank** (no added N) in same plot area.
- **N Sources: (all surface band applied near corn row at emergence plus subsurface band ESN, followed by 19 mm irrigation water the day after N application)**
- **Designation of N Treatments in Tables and Figures:**
  - **ESN = surface band**
  - **ESNssb = subsurface band**
  - **UAN+AP = UAN + AgrotainPlus**
  - **UAN+Nf = UAN + 20%Nfusion**

SuperU and AgrotainPlus (Agrotain International products) contain:
Urease Inhibitor: N-(n-butyl)-thiophosphoric triamide (NBPT)
Nitrification Inhibitor: dicyandiamide (DCD)

N fusion (Georgia Pacific Chemicals, LLC) is a slow release liquid N source (22% N) made up of slowly available urea polymers in the form of methylene urea plus triazone. When added to UAN at 20%, the result is a 30% N product.

Greenhouse Gas Measurements

- **Randomized complete block design with 3 replications and 2 GHG measurements per rep (total 6 GHG measurements/treatment)**
- **N_2O measurements: 1 to 3 times per week, immediately following crop planting until crop harvest (growing season).**
- **Static, vented chamber technique used to collect the gas samples in the field.**
- **Gas chromatograph used to determine N_2O concentration in gas sample.**

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Chamber anchors placed in N Source Treatment, June 11, 2010

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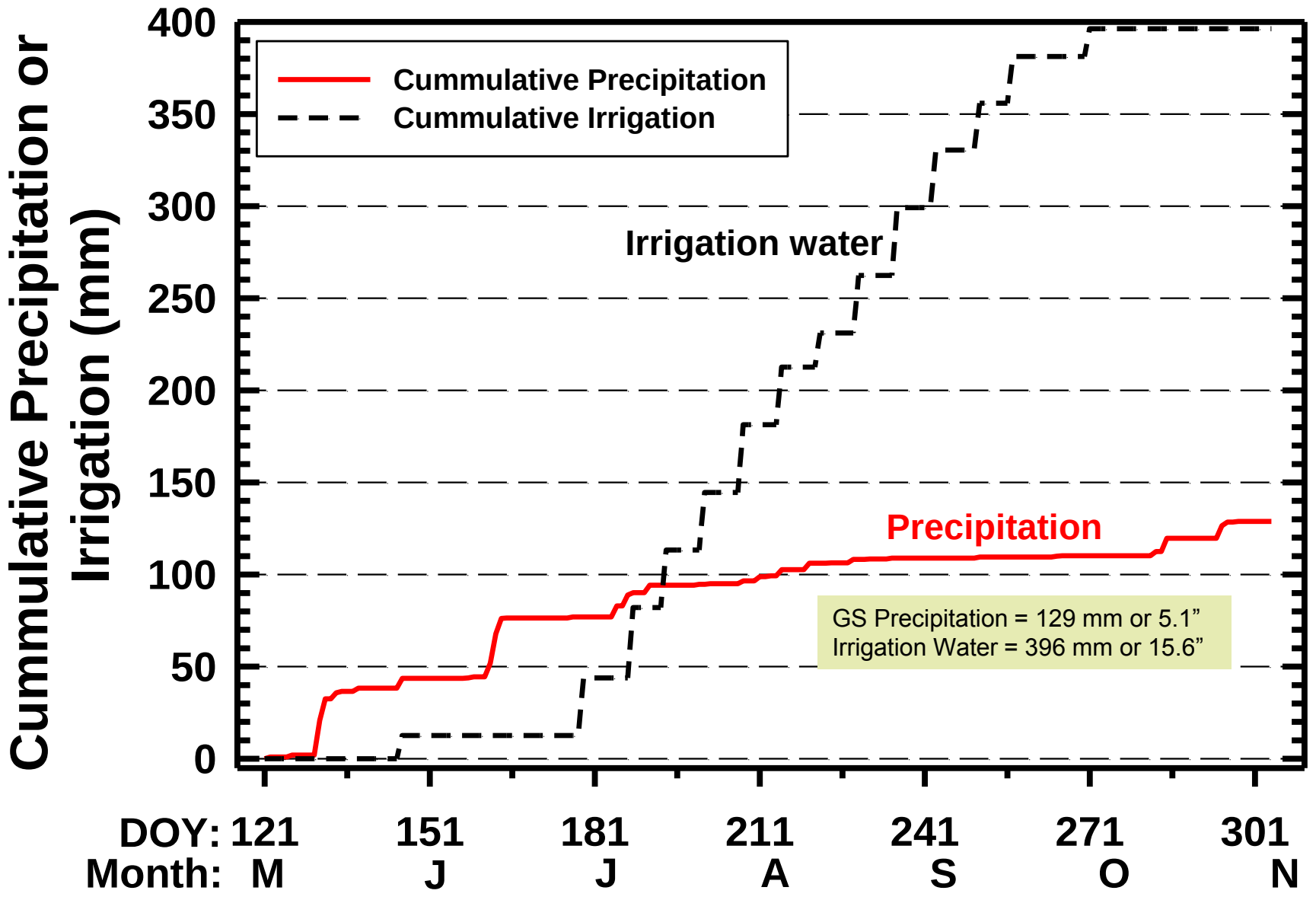
ARS Technicians collecting GHG samples, soil temp, and water data in ST-CC rotation

Injecting field gas samples into vials for analysis on Varian 3800 GC.

Strip-till and No-till GHG Studies (1 May to 31 Oct. 2010)



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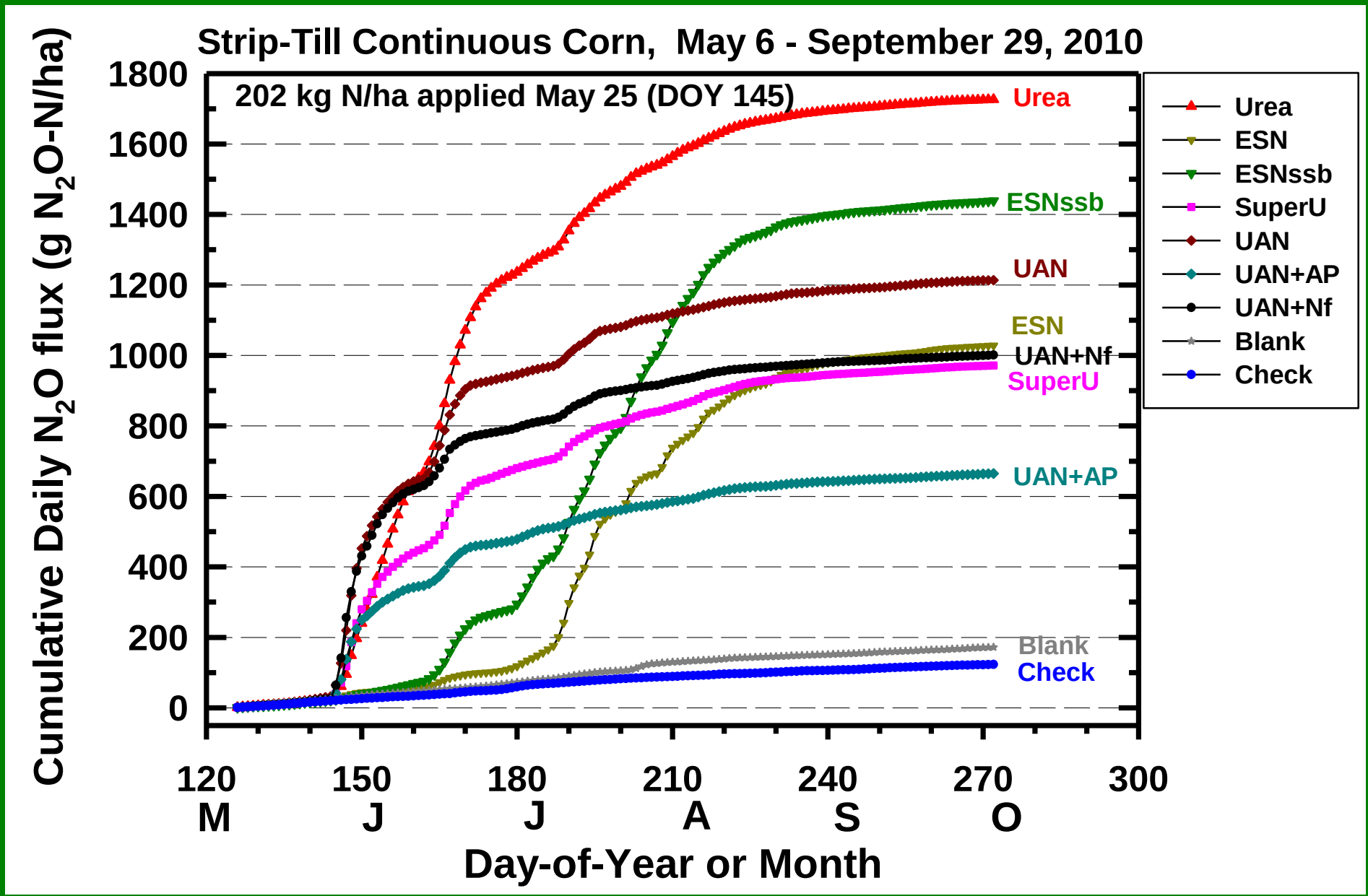

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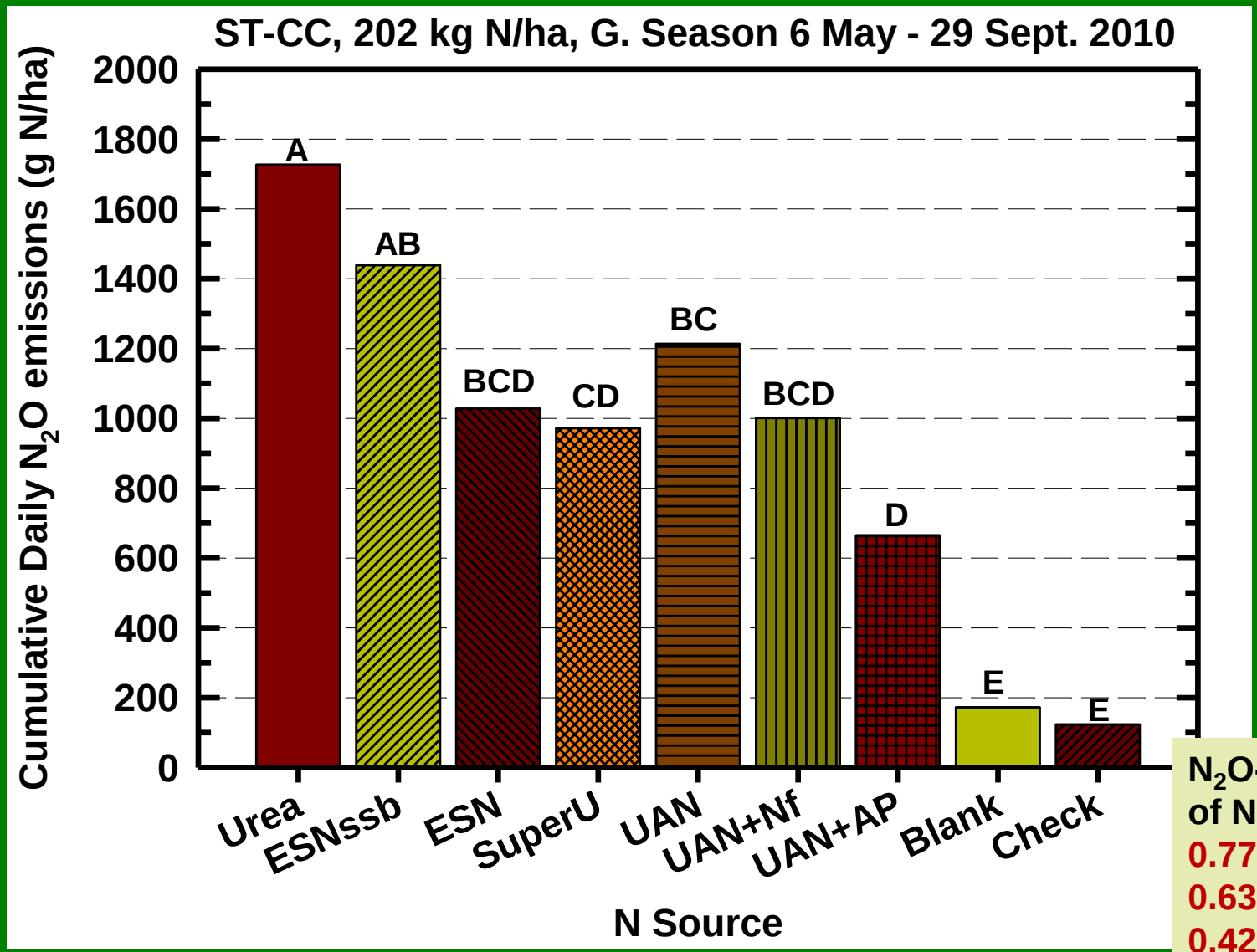

N_2O-N loss per unit of N applied was:

0.77% Urea
0.63% ESNssb
0.42% ESN
0.40% SuperU
0.52% UAN
0.41% UAN+Nf
0.24% UAN+AP

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N Source Effects on Reducing N_2O-N Emissions in Strip-Till corn (2010)

- **Compared to Urea**
  - ESNssb (17%)
  - UAN (30%)
  - ESN (40%)
  - SuperU (44%)
  - UAN+20%Nfusion (42%)
  - UAN+AgrotainPlus (61%)

- **Compared to UAN**
  - ESNssb (-19%)
  - ESN (15%)
  - SuperU (20%)
  - UAN+20%Nfusion (18%)
  - UAN + AgrotainPlus (45%)

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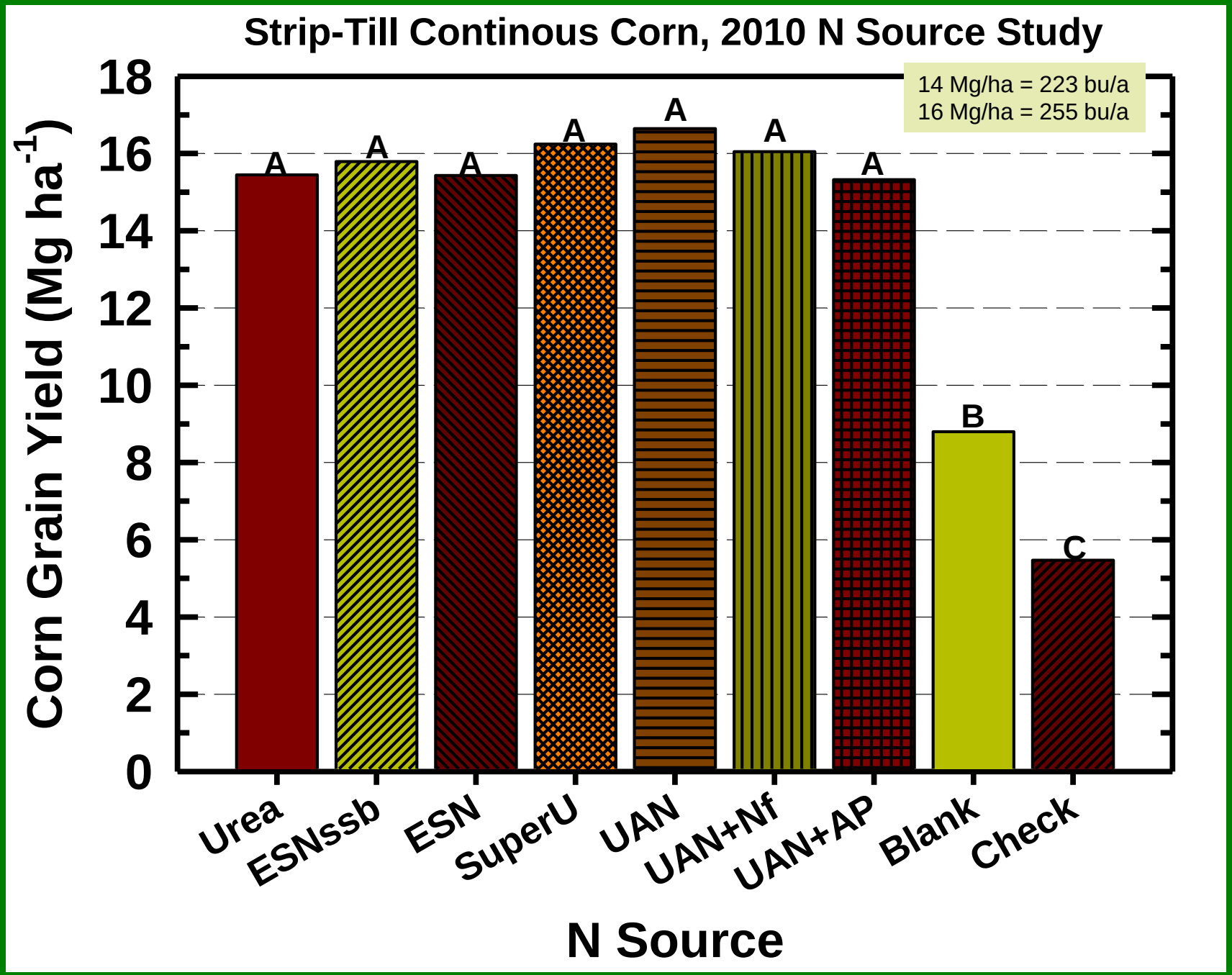

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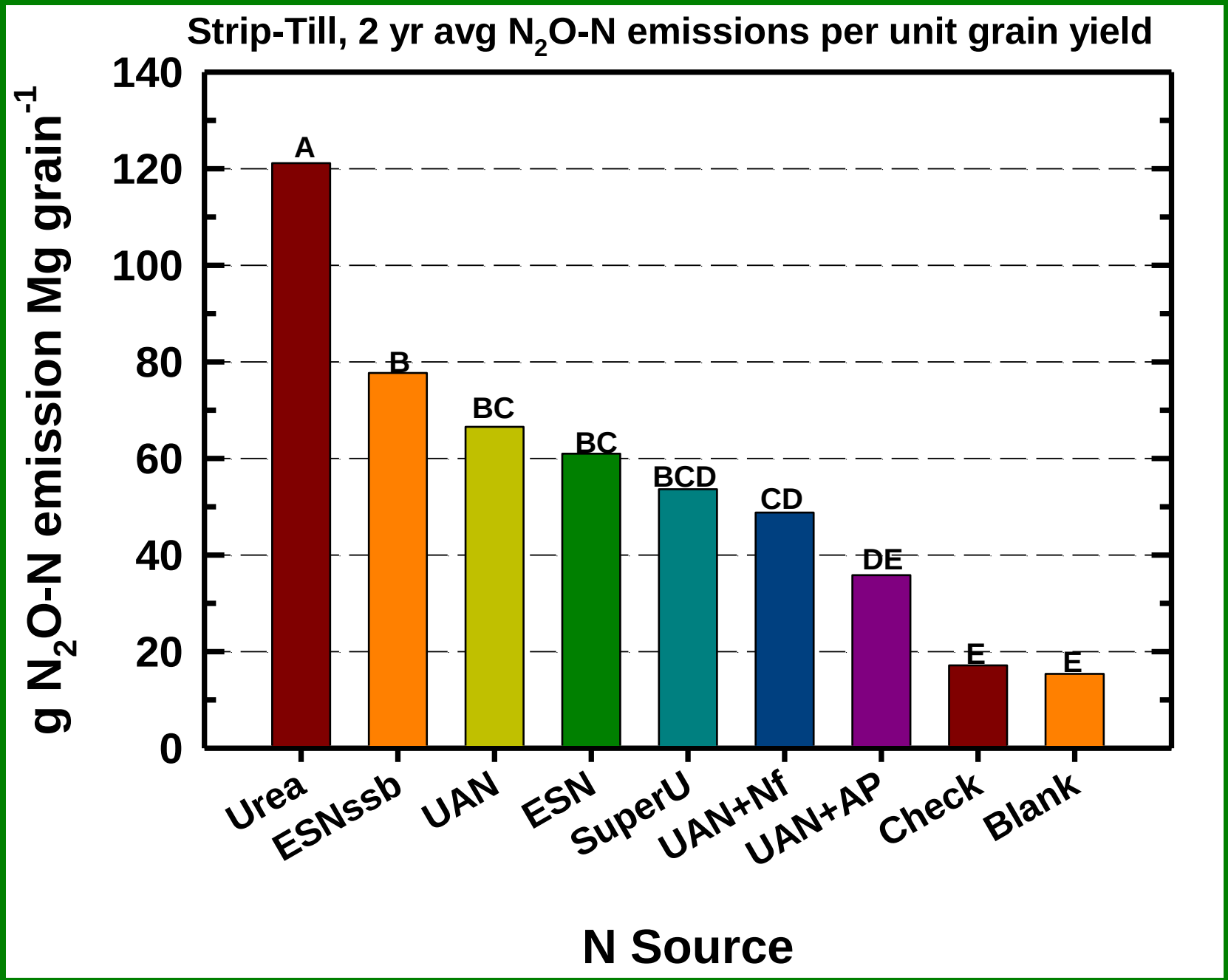

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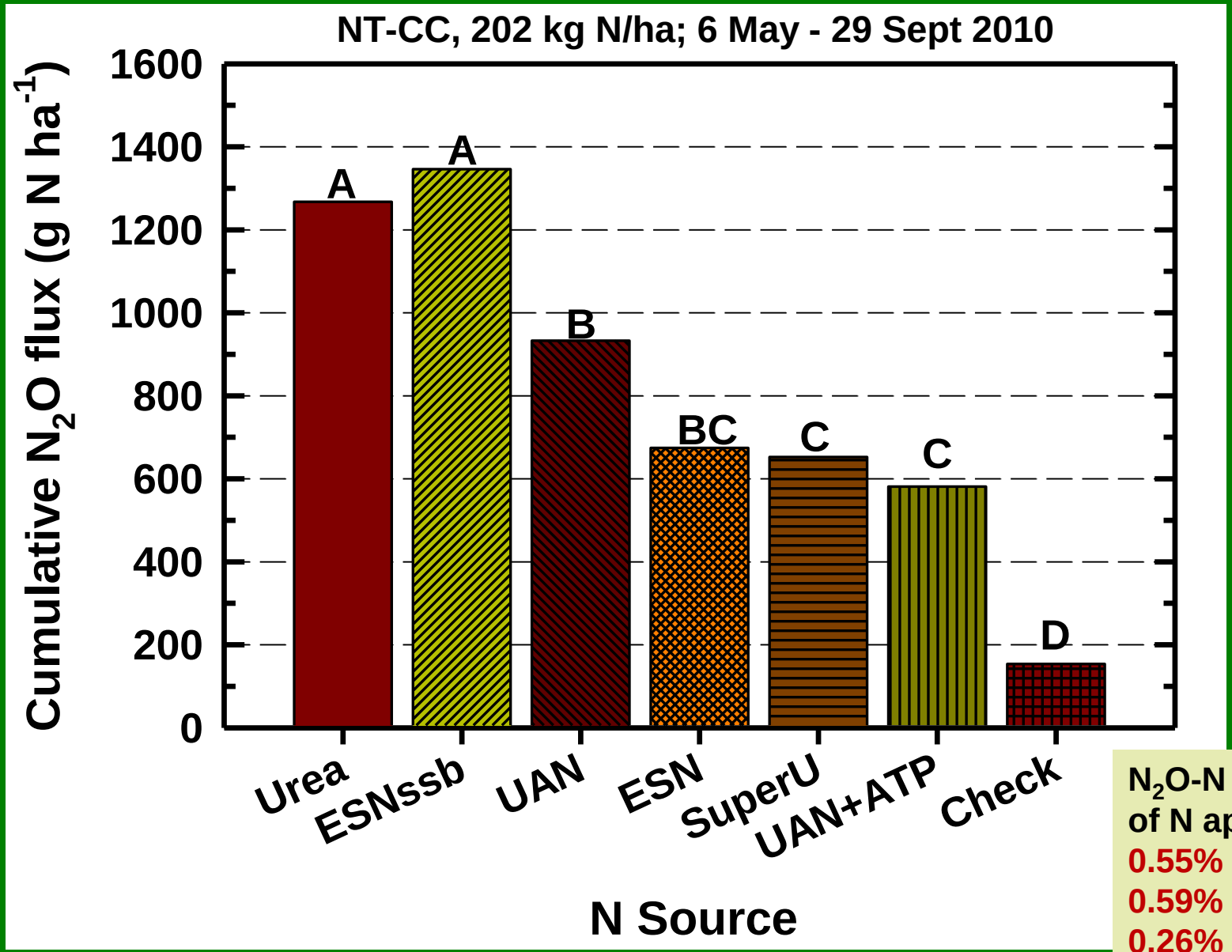

N_2O-N loss per unit of N applied was:

0.55% Urea

0.59% ESNssb

0.26% ESN

0.25% SuperU

0.39% UAN

0.21% UAN+AP

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Summary

- Cumulative N_2O-N fluxes increased more rapidly for urea and UAN than the other N sources following application.
- The enhanced-efficiency fertilizers (polymer-coated, stabilized, and slow release) sources and UAN reduced N_2O-N emissions in irrigated strip-till corn when compared to granular urea, and UAN+AP when compared to UAN.
- Growing season N_2O-N losses per unit of N applied were generally below the 1% loss value used by IPCC.
- Corn grain yields were not different between N sources.
- Further evaluation is needed to confirm the effectiveness of the enhanced-efficiency N sources in reducing N_2O-N emissions under other climatic, soil, and management conditions.

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Thanks for Listening!!

Questions???