Increasing late N availability throughout new products to soybean crops

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Nitrogen for Soybean

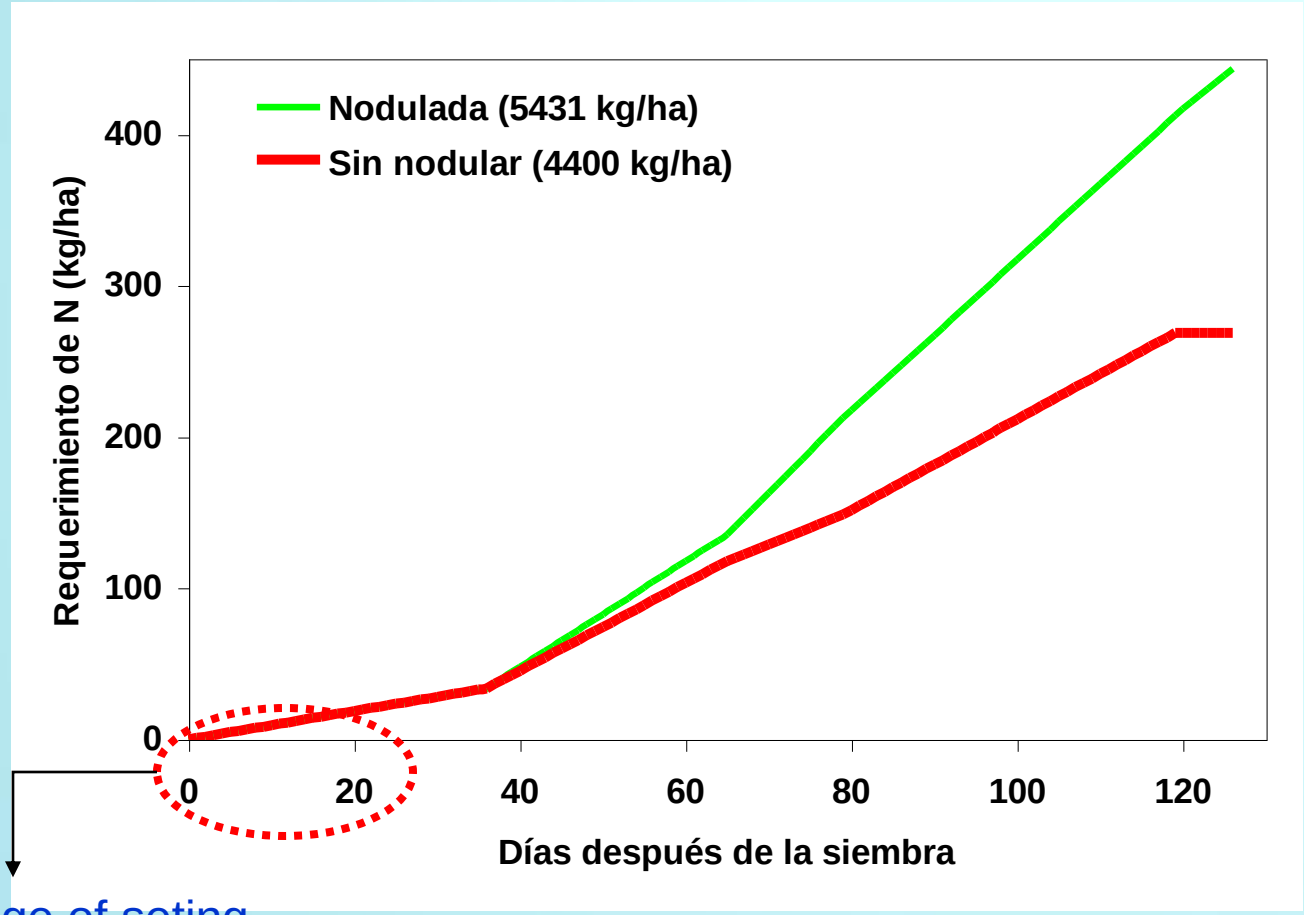
- N soil – NO_3^-
- N atmosphere
- N – NBF

Soybean – Bradyrhizobium

$$2N_2 + 3H_2 \xrightarrow{\text{Nitrogenase}} 2NH_3$$

$$NH_3 + R\text{–}COOH \longrightarrow \text{Proteins}$$

Soybean – N uptake

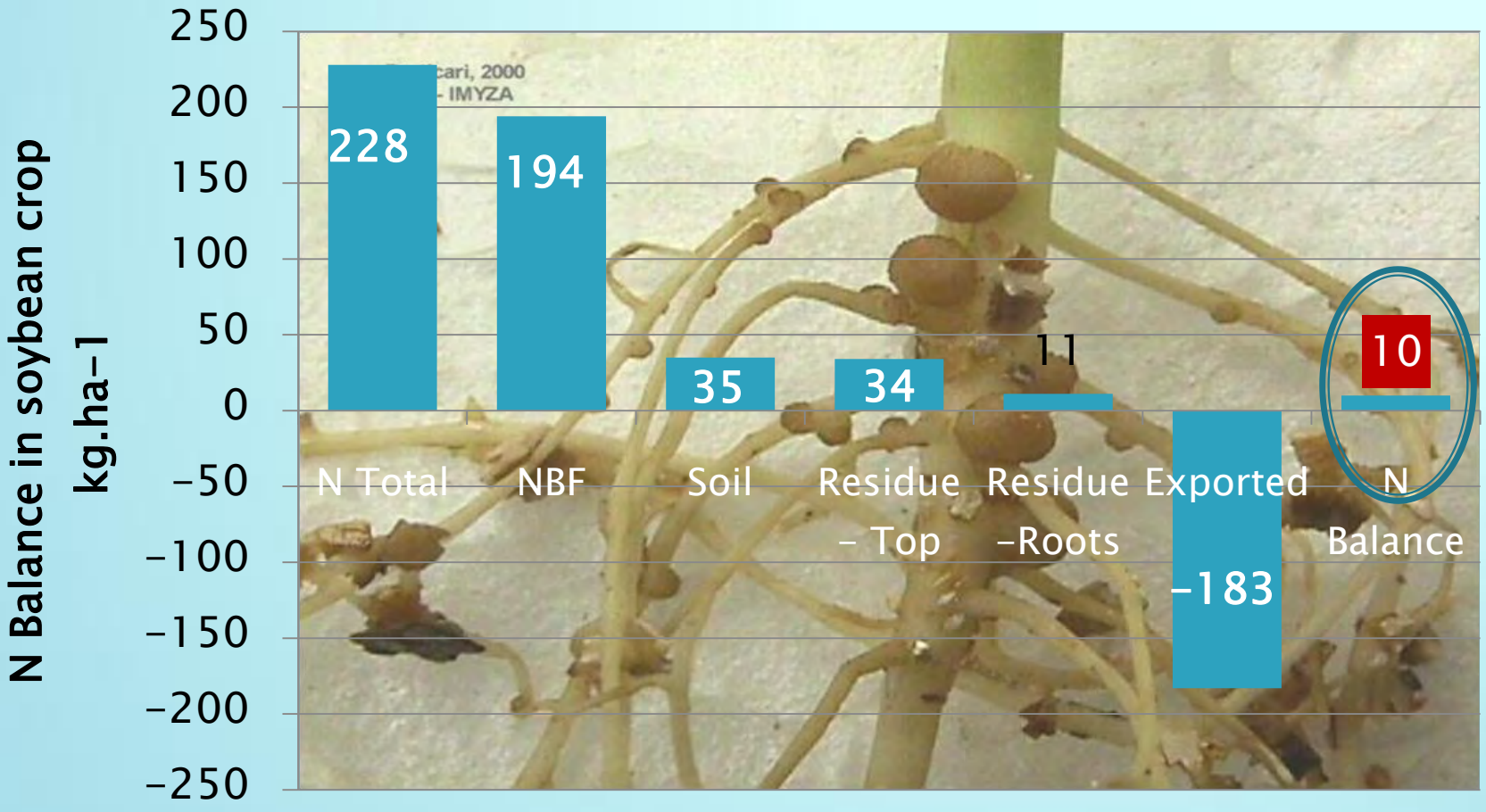


Critical stage of seting nodules from the inoculant

➔ Up to R1 minimum N requirements, soil supply

➔ R3 - R6 maximum N assimilation. High supply by BNF

N Balance in soybean crop



N Fertilization on soybean

- Compete with BNF
- Inhibits nodule formation & infestation
- Inefficient – very low NUE

- Grain yield is directly related to N total in plant
- NBF Provides near 52 % of total N uptake
- The proportion of fixed N decreased with increasing fertilizer-N additions

Controversial

Facts

New products in market

Controlled release fertilizers

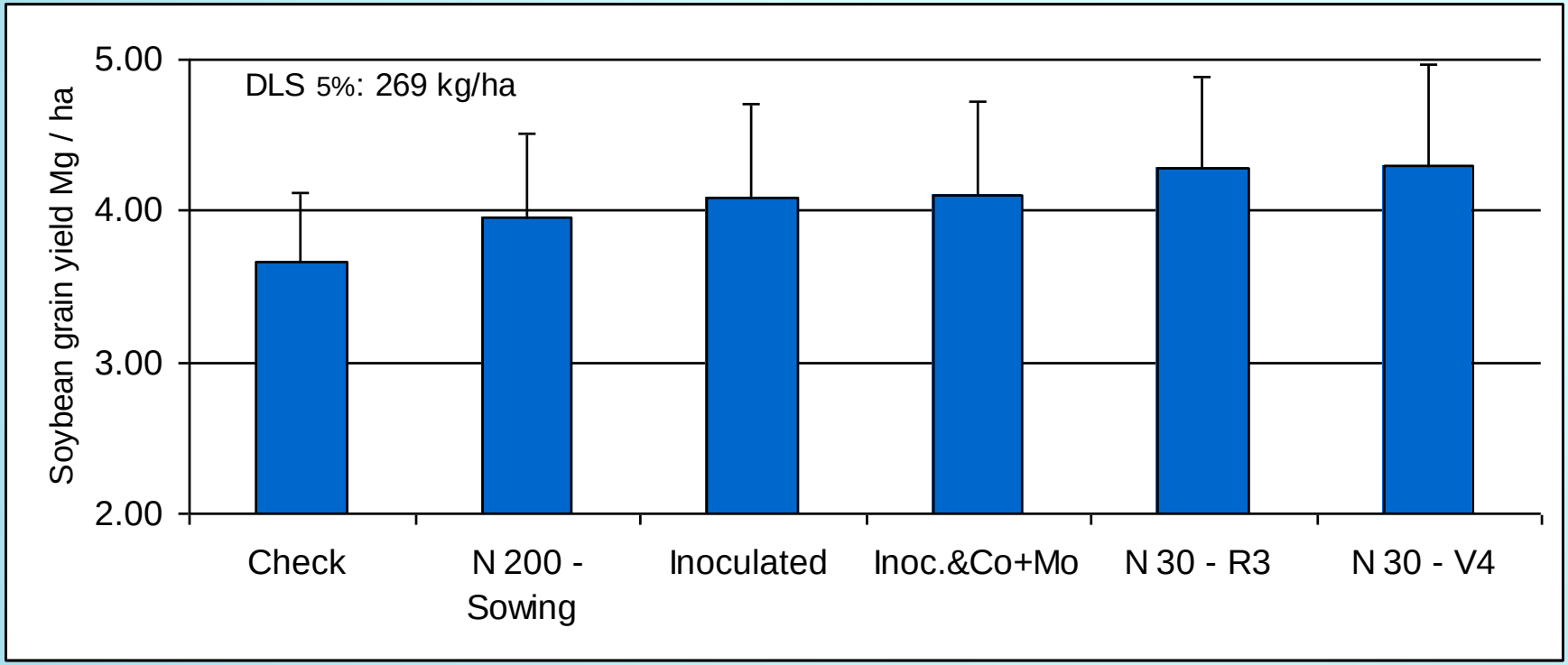
- Delays transformation of N of urea-compounds into soluble forms (NH_4^+)
- Nitamin & Nitamin NFusion (Georgia-Pacific)

Inhibitors of urease

- Delays transformation of urea into NH_4^+
- Agrotain

Synchronization of N in soil with plant needs maximum uptake

N fertilization in soybean in Pergamino



Δ Yield with 30 kg N ha^{-1}: 197 $kgha^{-1}$

Six site-year experiments 2000-03
South Santa Fe-North Buenos Aires

Objective

- To evaluate the effect of increasing late N availability by improving placement/product combinations of fluid N sources on soybean grain yields and N uptake

Field trials

- Four sites in 2008-09
  1. Mercedes (Corrientes)
  2. Crespo(Entre Rios)
  3. Ocampo (N Buenos Aires)
  4. Acevedo (N Buenos Aires)
- Repeated in 2009-10

Nine 40 kg N ha^{-1} treatments & Check (No N)

Product	Placement
No N Fertilizer	--
Ammonium Nitrate	Broadcast
Nitamin®	Knifed or Dribbled
Nitamin NFusion	
Urea solution	
Idem + 0.5% Agrotain	

Application at V3

Measurements

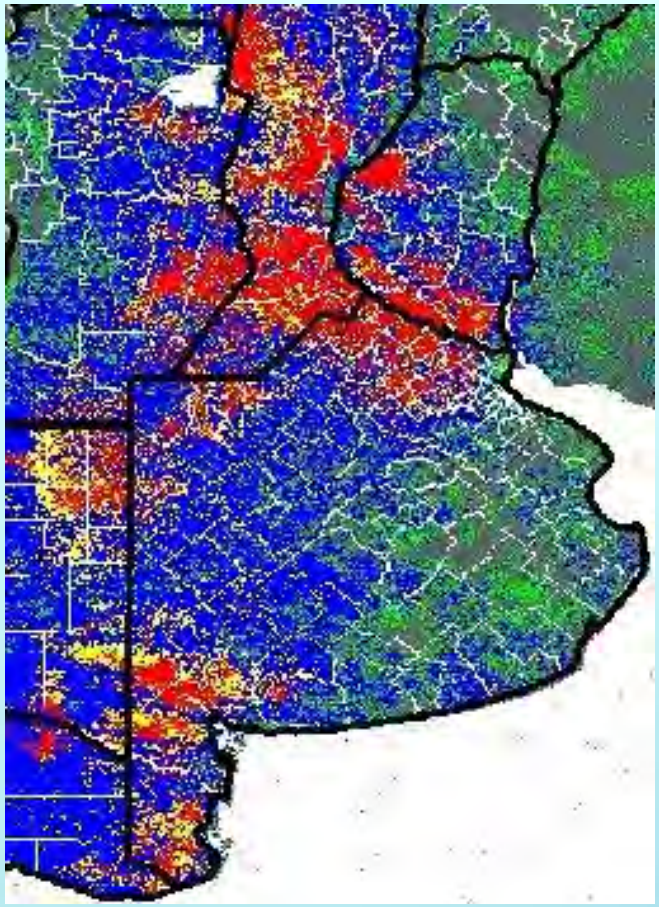
- Total aboveground biomass at R5. Splitting leaves, stems and pods
- N concentrations in leaves stems & pods ➔
- N uptake in aboveground biomass at R5
- Grain yields
- Total aboveground biomass at harvest
- Grain protein

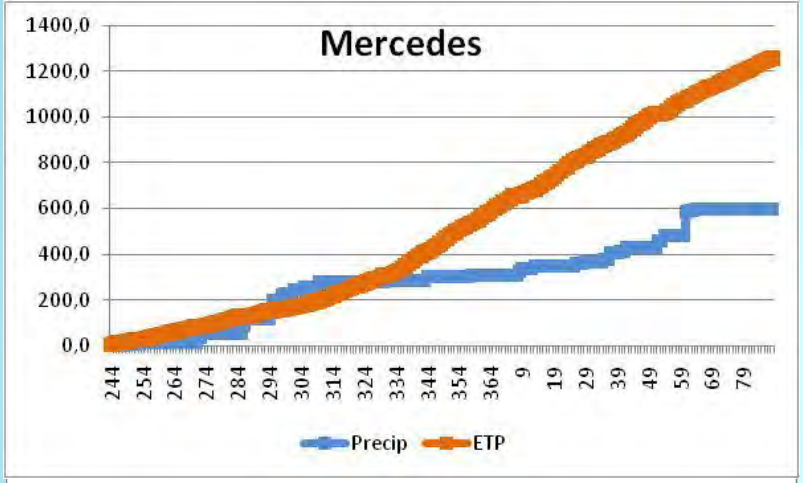
Results

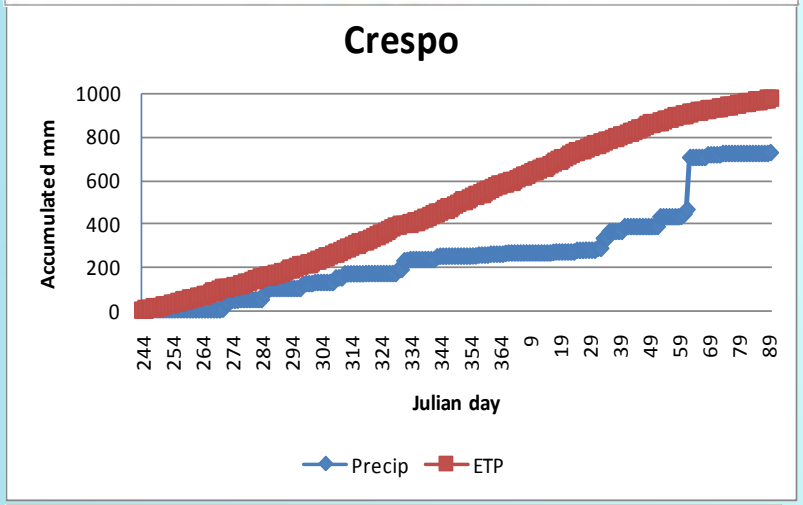
2008-09 Drought!

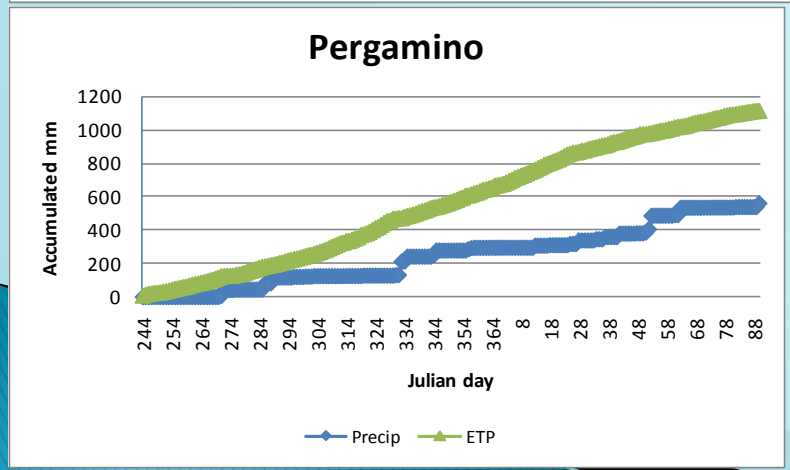
- The country's worst drought in 50 years has cut agriculture output almost 20%.
- Disastrous consequences for the farmers, for the rural towns, the agribusiness chain and the whole country's economy

Satellite imagery of vegetation of December 2008 relative to same month of 1996-2007 series







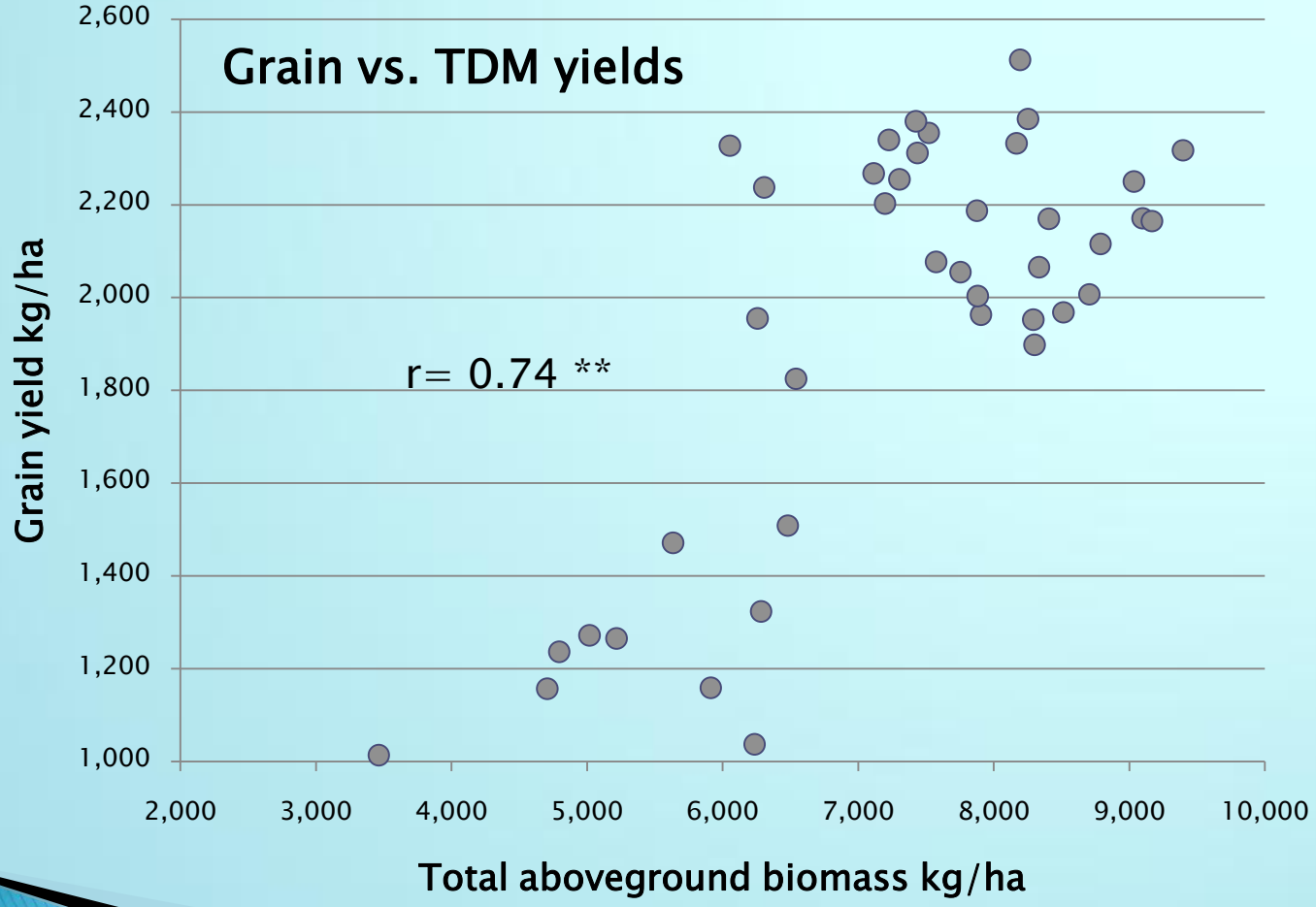


Results

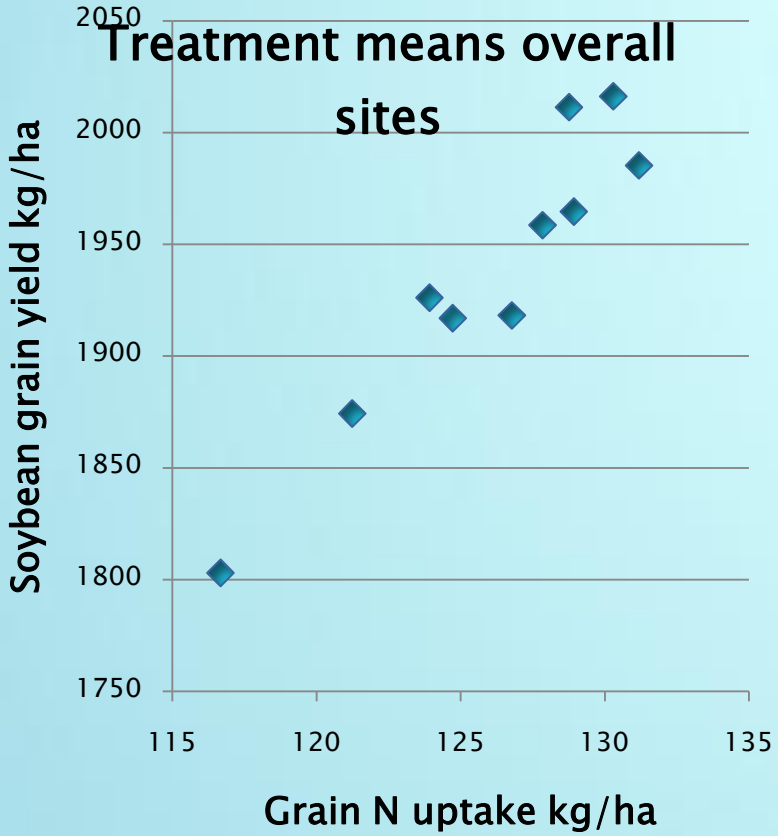
Site	Check	Mean All N	ΔYield
	Kg ha $^{-1}$		
Mercedes	1825	2252	427
Crespo	1953	2270	317
Ocampo	1963	2069	106
Acevedo	1471	1219	-252

We were unable to find site factors that explain N response differences

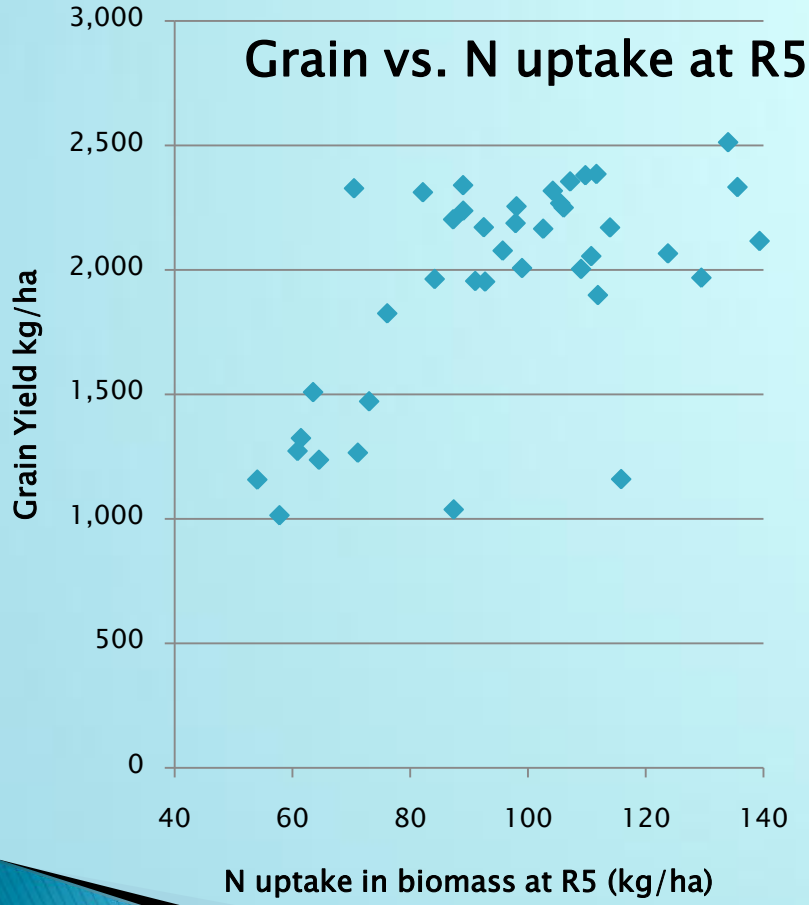
Grain yields were related to Total Aboveground Biomass Yields



Grain yields were related to N Uptake in grain

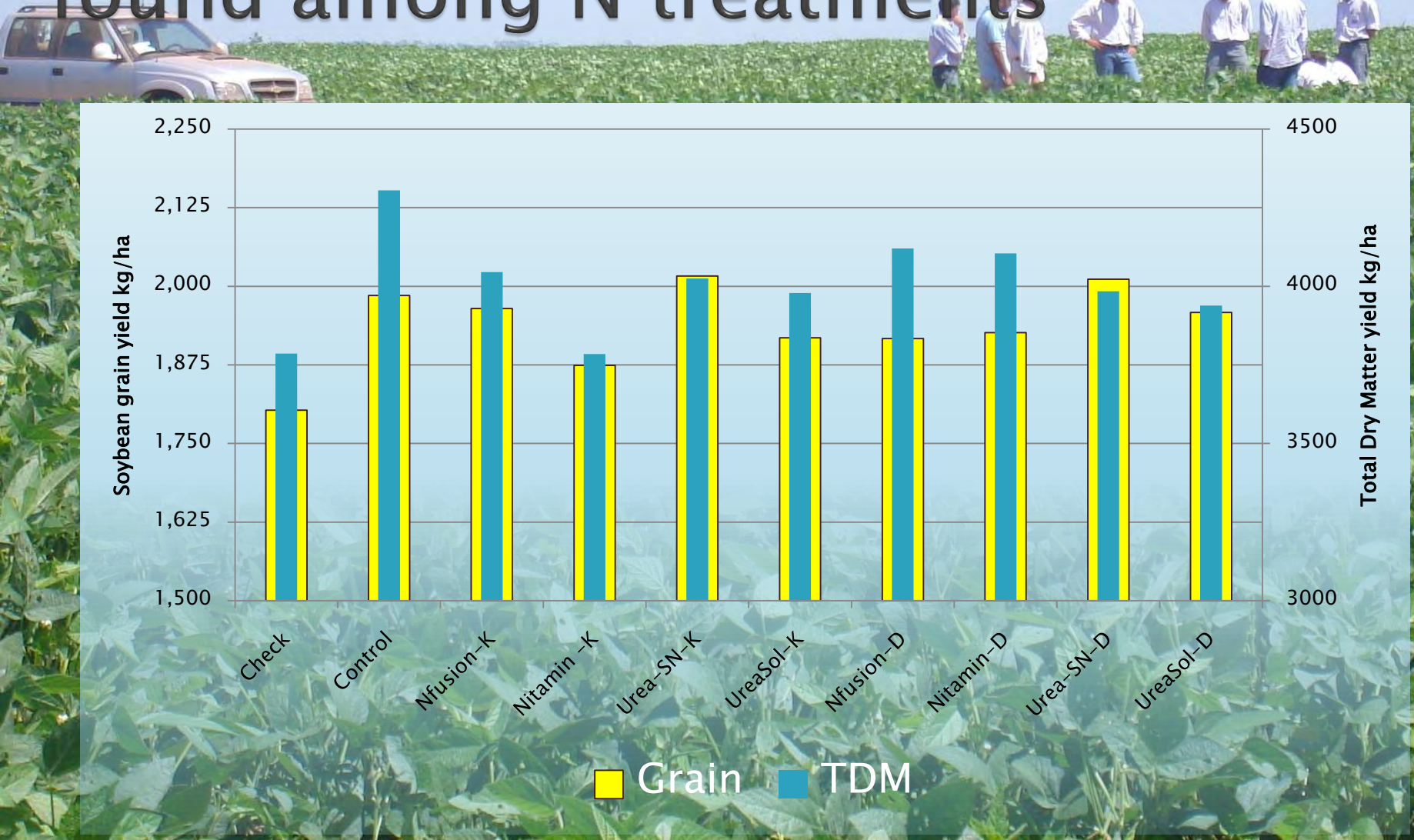


Grain yields did correlate to N uptake at R5 but did not to grain protein



Treatments	Protein
Check	37.0 %
Control	37.8 %
All N Knifed	37.3 %
All N Dribbled	37.0 %

No significant differences were found among N treatments

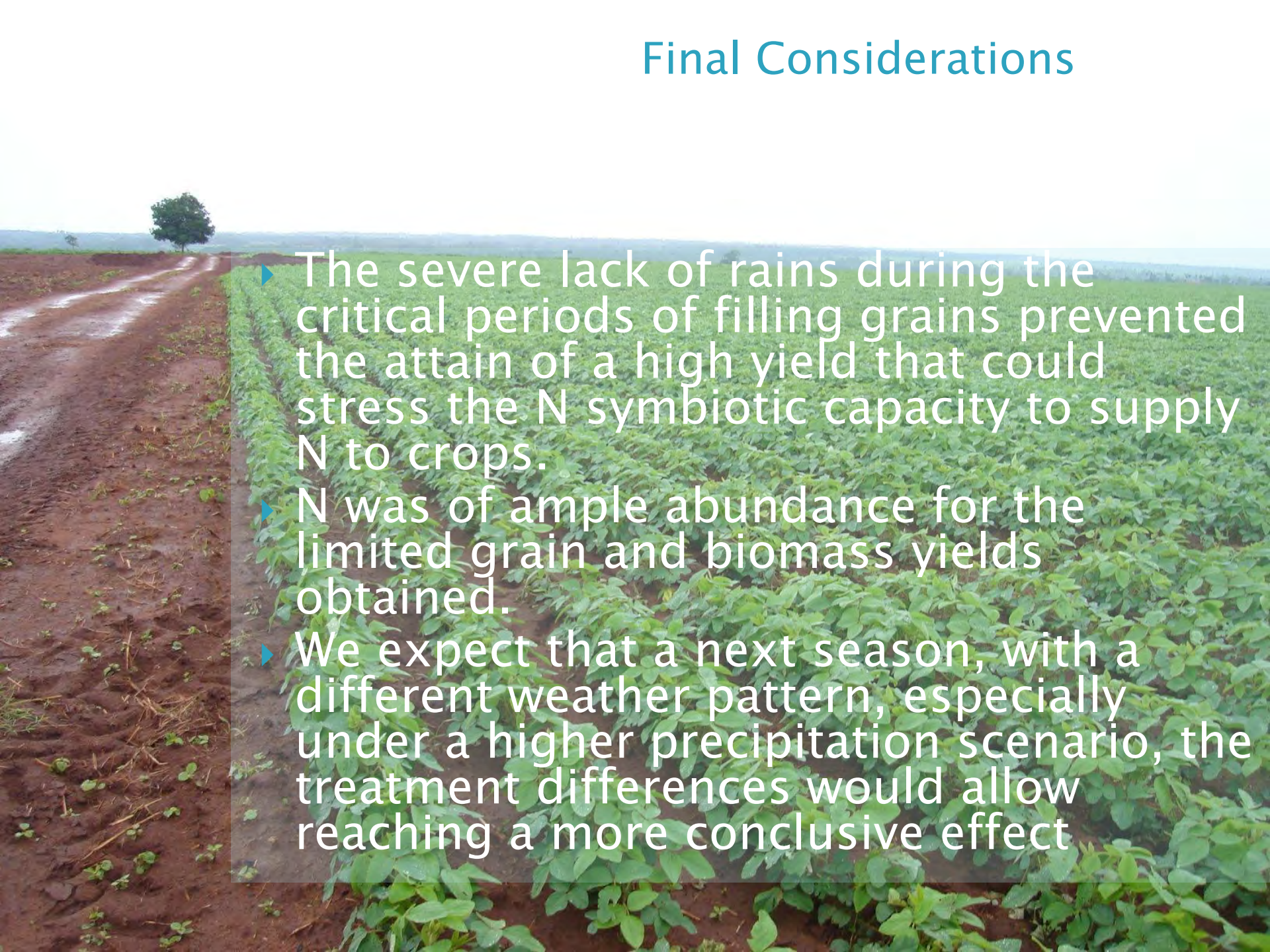


LSD 5% Grain: 497 kg/ha – TDM: 919 kg/ha

Summary findings

- Grains yield correlated to N uptake
- We could not find site factors associated to N response differences
- There were not differences among treatments

Final Considerations



- The severe lack of rains during the critical periods of filling grains prevented the attain of a high yield that could stress the N symbiotic capacity to supply N to crops.
- N was of ample abundance for the limited grain and biomass yields obtained.
- We expect that a next season, with a different weather pattern, especially under a higher precipitation scenario, the treatment differences would allow reaching a more conclusive effect

Thank you very much for your attention…

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