Fluid Sources for Micronutrients Starters for No-Tillage Corn and Soybean in Argentina

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Fluid Fertilizer Foundation

Outline

- What is a starter fertilizer
- Providing micronutrient in starters
- What micronutrients
- Factors to consider for micronutrient supply
- Experiment proposed
- Actual stage

What is Starter Fertilizer?

- Starter fertilizer is a small quantity of fertilizer nutrients applied in close proximity to the seed at planting.
- Starter fertilizers enhance the development of emerging seedlings by supplying essential nutrients, specially P and N, in accessible locations near the roots.

Providing Micronutrient in starters

Granular fertilizers

- Bulk Blends with micro's carriers (i.e. oxysulphates)
- Powder impregnation (coating) into granules
- Complexes with micro's integrated into granules (i.e. Microessentials) by co-granulation or co-compaction
- Bulk blends with complexes which include micros

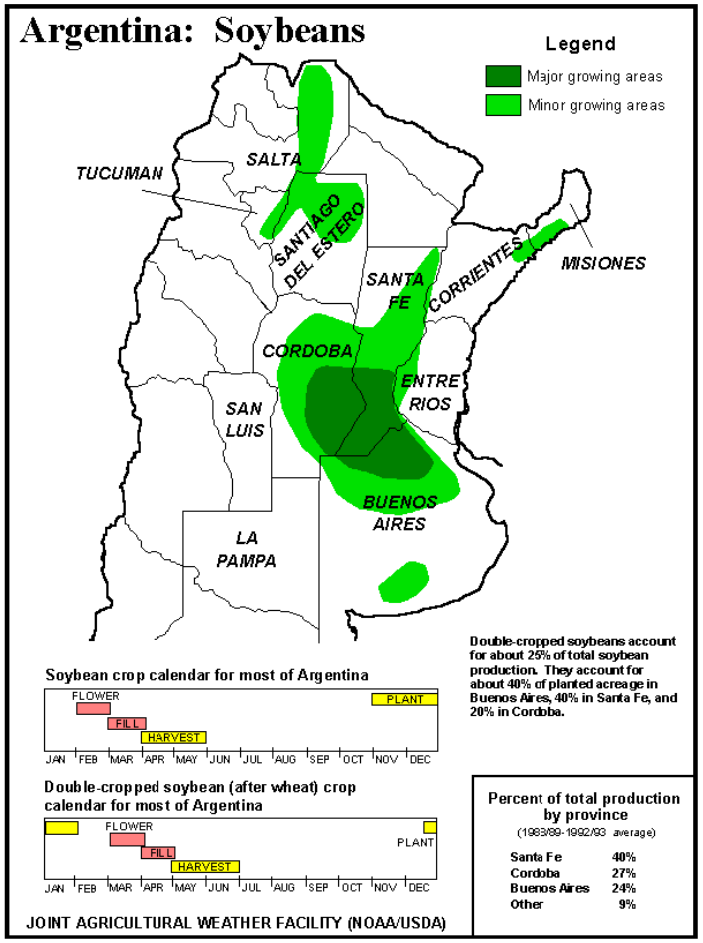
- Large market, traditional method
- Increasing method of supplying micros
- Few suppliers, rigid formulas, usually ZnO very little soluble
- Typical in Brazil where Single superphosphate is co-granulated with micros that later serve as a raw material for NPK blends

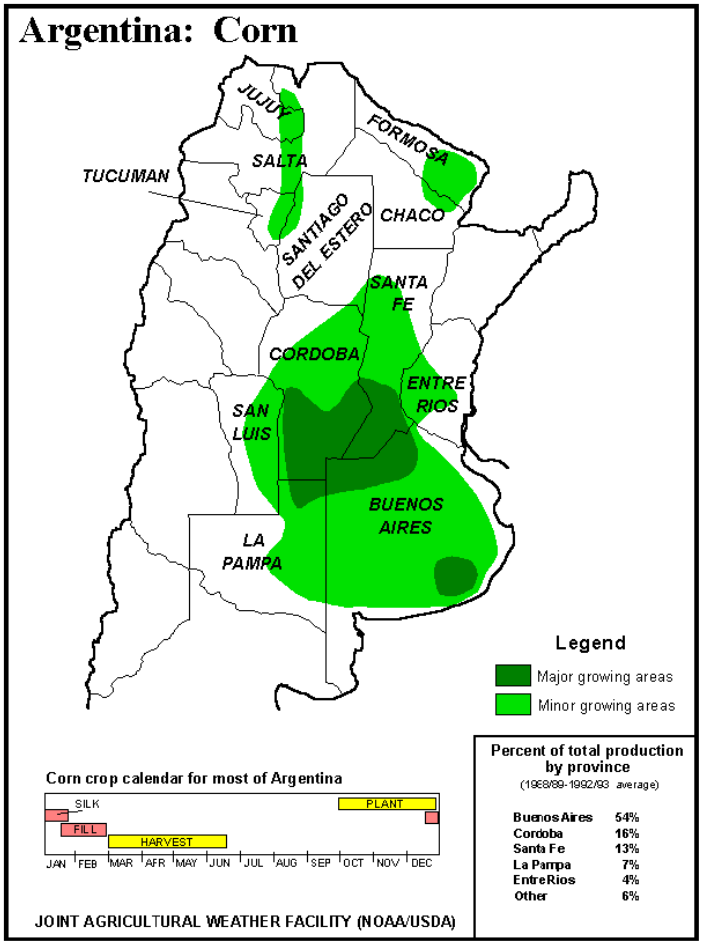
Providing Micronutrient in starters

Fluid fertilizers

- Dissolving chelates in orthophosphate solutions
- Complexion of salts in polyphosphate solutions
- Dissolving salts in orthophosphate suspensions

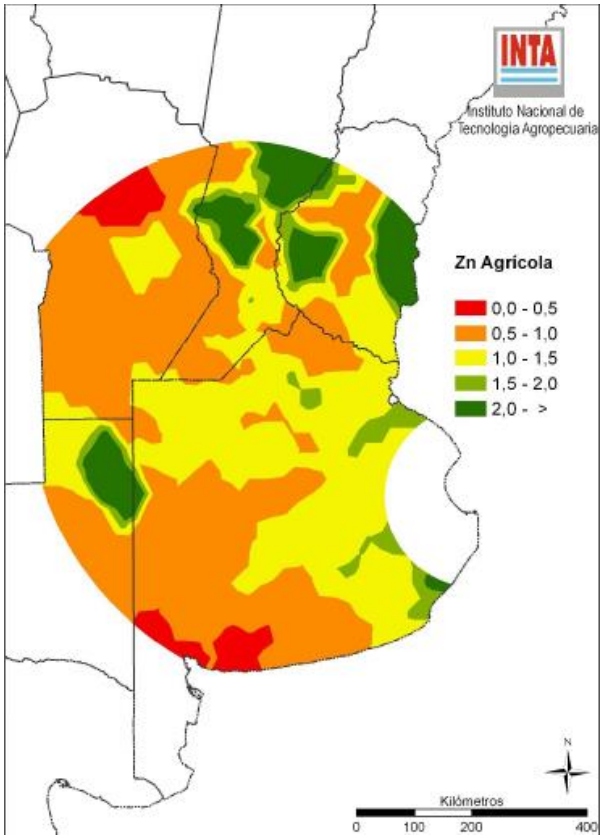
Agriculture in the pampean region



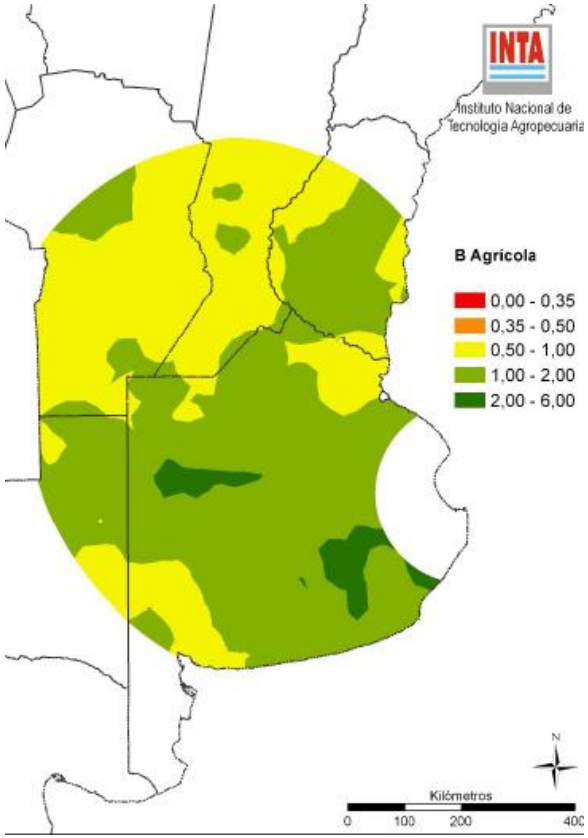


Zinc and Boron are the most widespread deficiencies

Zinc availability (ppm)



Boron availability (ppm)

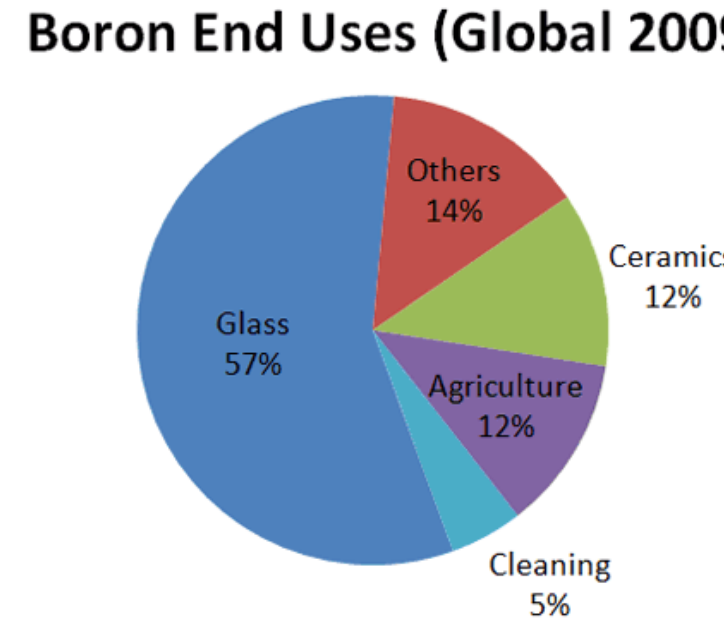


Critical values: Zinc < 1 ppm ; Boron < 0,5 ppm

Sainz Rosas et al, 2012

- Therefore supplying Zn and B at sowing and right placement is important since seedling plants must have access to these generalized micronutrient deficiencies.

- Very few, if any, figures on micronutrient markets by sources.
- Estimations says that about 400 thousand t (as Zn equivalent) are tied to agricultural demand, most of it in the form of zinc sulfate, around the world.
- Boron use in agriculture data are also elusive. Near 300 K tons are used in agriculture as fertilizers.



5 MMT t/yr

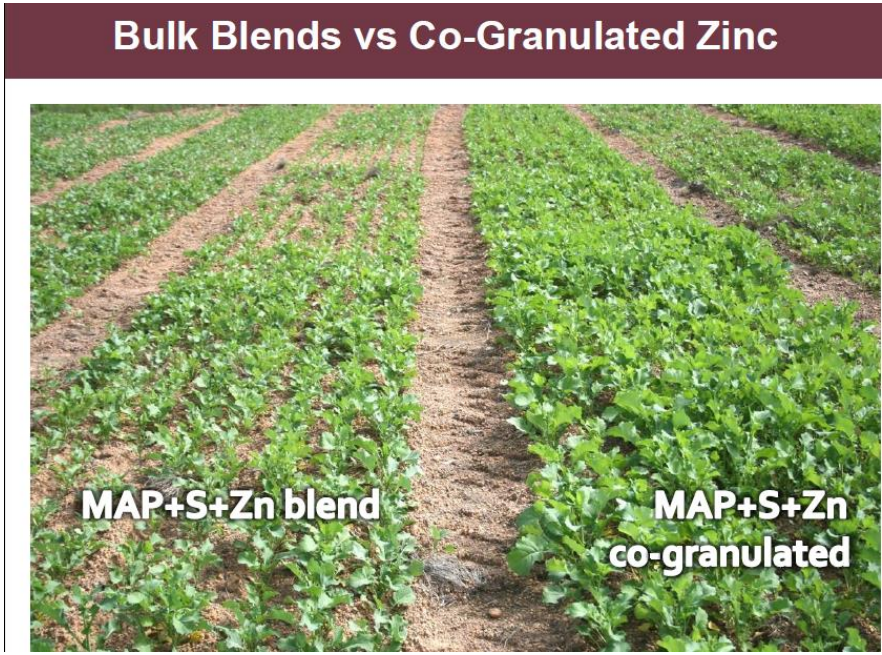
Factors affecting Zn uptake for maximum efficiency

- Right placement, close to seed but maximizing contact surface
- Maximum solubility from fertilizers

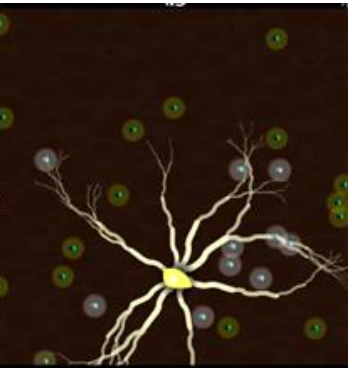
Cationic micronutrients (like Zn^{++}), but also Cu, Mn, Fe, applied to soil in soluble form (i.e. $SO_4^{=}$) can be quickly immobilized, (precipitation, complexion, crystallization) perhaps before can be uptake by crop roots

Soil applications of Zinc

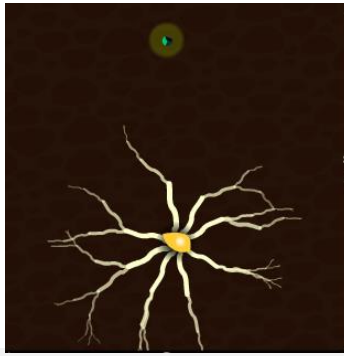
- Enhancing distribution with seedlings favors contact
- But maximizing contact surface increase fixation



Mc Laughlin, 2015



153 fertilizer granules in a soil layer 37 cm x 12 x 7.5 cm after a 150 kg/ha rate of 18-46-0

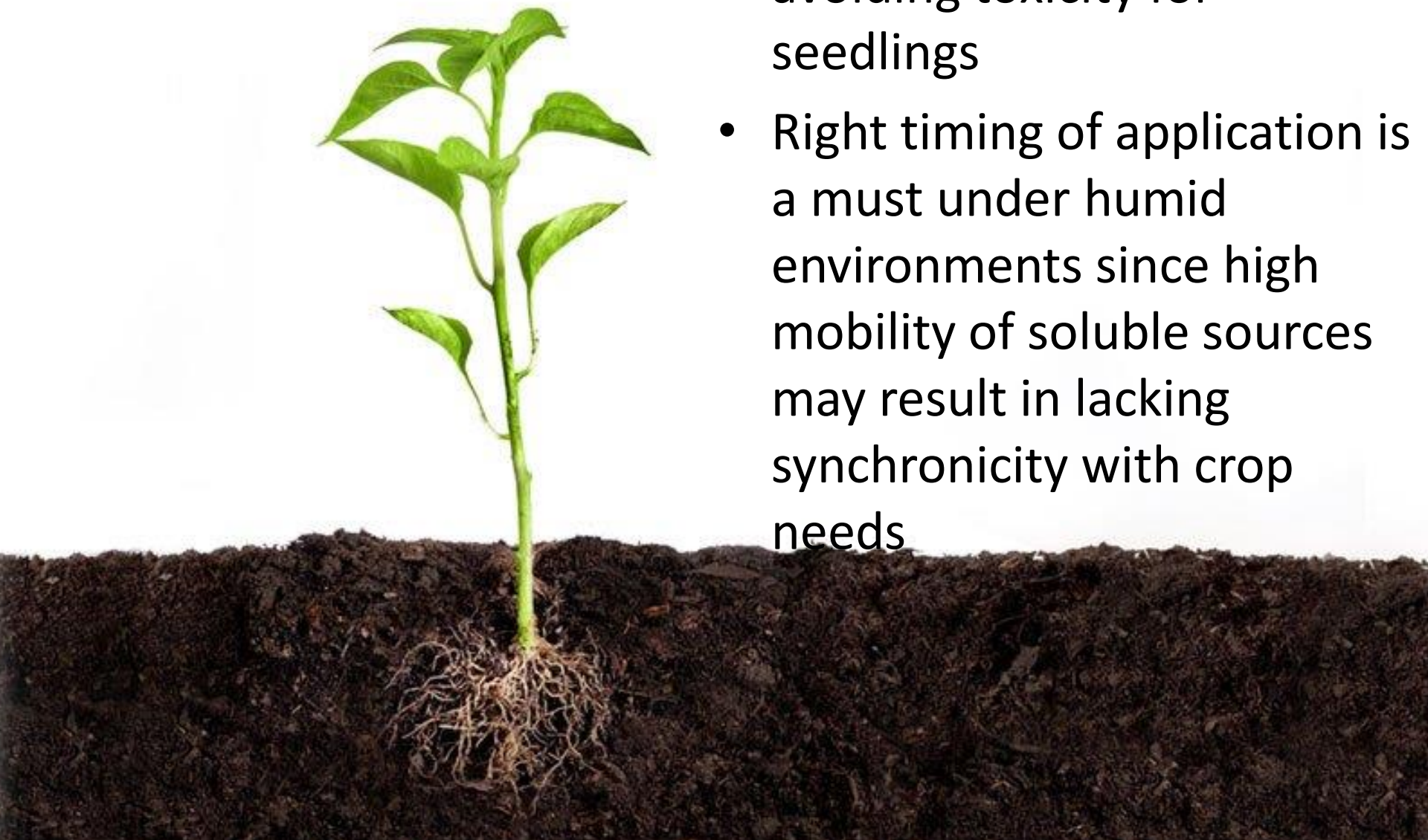


2 granules of micronutrient source in the same layer after a 5 kg/ha rate of a product with 35 % Zn

Zinc in starter fertilizers

- Very low solubility. Only 0,5 % uptake efficiency
- Zn + PO_4 ➔ $Zn_3(PO_4)_2$ + other phosphate precipitates
- ZnO or $ZnSO_4$ incorporated or coated at granulation remain insoluble
- Ways to improve efficiency (Mc Laughlin, 2015)
  - Physically protect Zn from phosphate
  - Chemically protect Zn from phosphate
  - Change granule chemistry (e.g. chelates)
  - Fluid fertilizers –soil and foliar

Soil applications of Boron



- Right rates must be applied with soluble sources avoiding toxicity for seedlings
- Right timing of application is a must under humid environments since high mobility of soluble sources may result in lacking synchronicity with crop needs

Boron in starter fertilizers

- Soluble boron (B) sources pose a risk of B toxicity to seedlings just after planting
  - Row applications with risk of uneven or excessive application, either in the total rate, or from localized hot spots.
- Very mobile in soils. Early application may be lost by leaching before plant uptake, unmatching higher needs at later stages of the crop.
- Ways to improve efficiency (Abat et al. 2014-15)
  - Use of slow released sources (Ulexite and Colemanite)
  - Co-granulate B with phosphates

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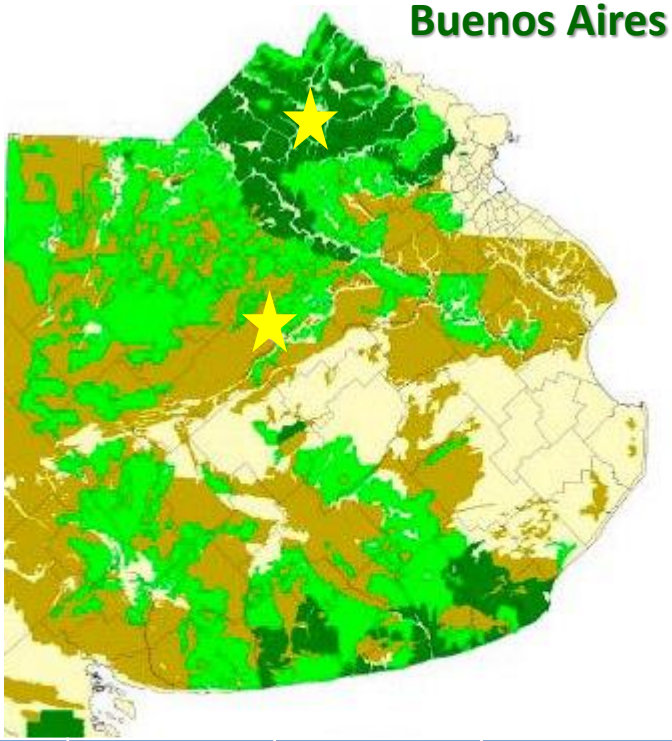
ON GOING EXPERIMENTS

Objective

To determine the best formulation and placement for providing micronutrients to no-till corn and soybean under local conditions

We want to compare granular with fluid formulation sources of micronutrients applied to soil at planting

Experiments in two different environments with corn and soybean



- **Pergamino** (-33.9 S; -60.6 W). Silty Loam
- **9 de Julio** (-35.5 S; -60.9 W). Sandy Loam

Location	*Texture top soil*	*pH*	*OM*	*P-Bray 1*	*S-SO_4*	*K*	*Zn*	*B*
			g kg^{-1}	..... mg kg^{-1}				
Pergamino	Silty loam	5.8	35	17.6	7.8	702	1,0	0,55
9 de Julio	Sandy loam	5.9	29	9.8	7.1	479	1,0	0,80

Pergamino

Corn	Nov 1	Ax 7822 HClMG	8.6 pl m^2 0,7m
Soybean	Nov 11	Cz 4505 STS	34 pl m^2 0,35m

Nueve de Julio

Corn	Dec 6	LT 622 VT3P	10 pl m^2 0,7m
Soybean	Dec 1	Sy 3X7	60 pl m^2 0,35 m

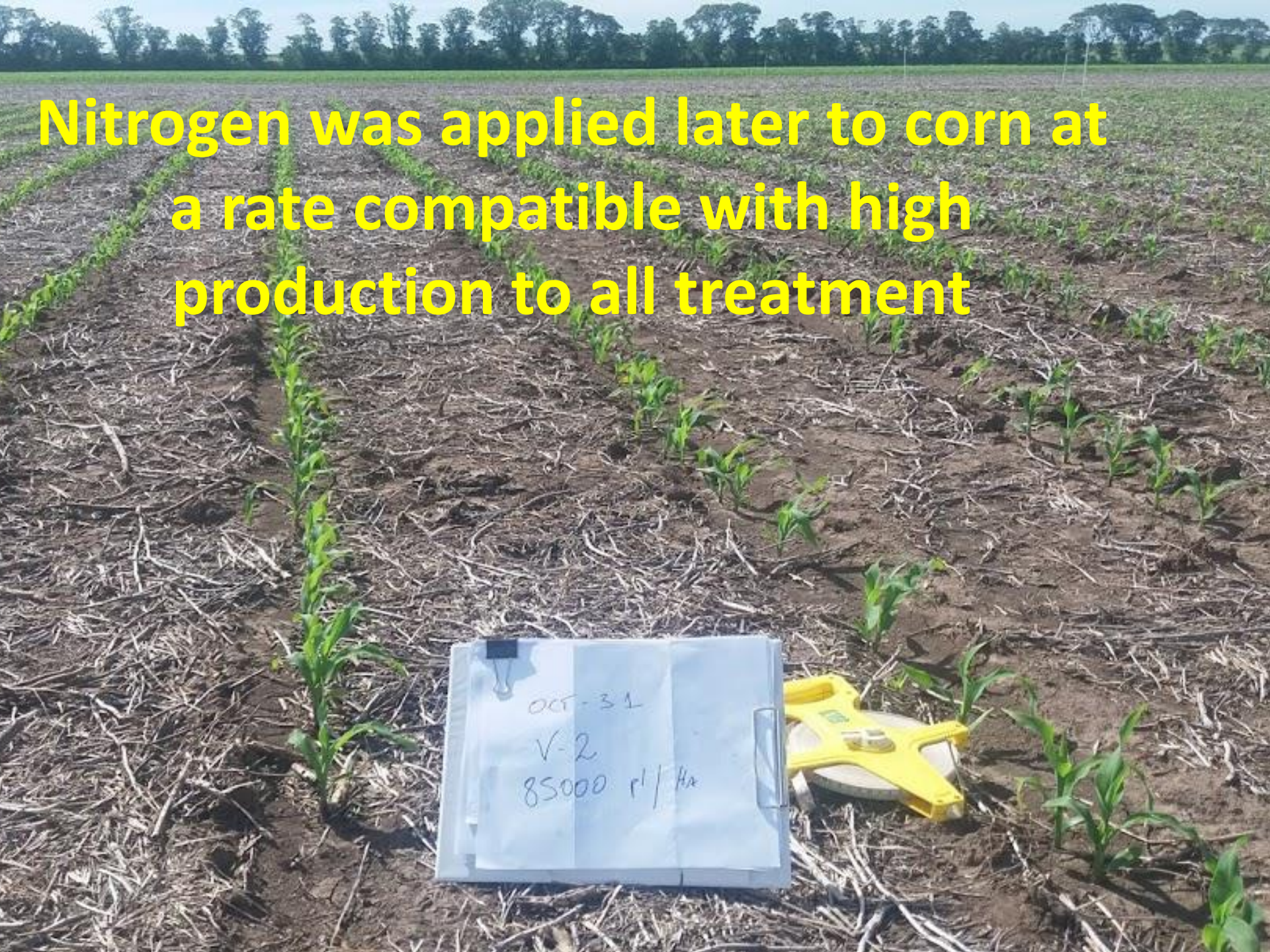
Corn Treatment Fertilizers

Treatments	Sources	Grade	$N-P_2O_5-K-S-Zn$	Rate	Notes
Six - 6		$N-P_2O_5-K-S$	Kg ha $^{-1}$		
Control - Granular	MAP+SSP (65-35)	7-40-0-4	7-40-0-4S	100	
Control – Fluid	APP+TSA (80-20)	11-30-0-5	16-41-0-7	140	
Complex + Zn	MAP+S+Zn	12-40-0-10	$12-40-0-10-1_{Zn}$	100	SZn Microessentials ®
Bulk Blend + Zn	MAP+SSP+OxSZn	6,7-39-0-4	$7-40-0-4-1_{Zn}$	104	5% OxSZn (20% Zn)
Coated + Zn	MAP+SSP+$ZnO/ZnSO_4$	6,7-39-0-4	$7-40-0-4-1_{Zn}$	104	1,5% $ZnO+SO_4Zn$ (66-33)
Fluid + Zn	APP+TSA+$ZnSO_4$	11-29-0-5	$15-40-0-7-1_{Zn}$	140	3% SO_4Zn (34 % Zn)

Soybean Treatment Fertilizers

Treatments	Sources	Grade	N-P_2O_5-K-S-Zn	Rate	Notes
Eight - 8		N-P_2O_5-K-S	Kg ha $^{-1}$		
Control - Granular	MAP+SSP (65-35)	7-40-0-4	8-44-0-4S	110	
Control – Fluid	APP+TSA (80-20)	11-30-0-5	16-41-0-7	140	
Bulk Blend + Zn	MAP+SSP+OxSZn	6,7-38-4	7-40-0-4-1$_{Zn}$	104	5% OxSZn (20% Zn)
Bulk Blend + B	MAP+SSP+Granubor	6,7-39-4	7-43-0-4-0.4$_{B}$	110	2,5% Granubor (15 % B)
Coated + Zn	MAP+SSP+ZnO/$ZnSO_4$	6,7-39-0-4	7-40-0-4-1$_{Zn}$	104	1,5% ZnO+ SO_4Zn (66-33)
Coated + B	MAP+SSP+Boric Ac.	6,7-39-0-4	7-43-0-4-0.4$_{B}$	110	2% Boric Ac. (20% B)
Fluid + Zn	APP+TSA+$ZnSO_4$	6,7-39-0-4	15-40-0-7-1$_{Zn}$	140	3% SO_4Zn (34 % Zn)
Fluid + B	APP+TSA+ Boric Ac.	6,7-37-0-4	8-44-0-4-0.4$_{B}$	120	8% Boric Ac. (8 % B)

All fertilizer treatments applied banded at planting


Nitrogen was applied later to corn at a rate compatible with high production to all treatment
OCT - 31
V-2
85000 pl/Ha

No fitotoxicity signs were observed with any treatment

Growth stages at this time

Soybean – R5

Corn – R5.5

Next….

- Leaf analysis for Zn and B
- Harvest soon 1st Year
- 2nd year in 2017-18 season

See you next year

Thank you very much for your attention !

¿Questions?

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Providing micronutrient in fluid fertilizers

- Enhance micronutrient availability through better, more even distribution in the band
- Higher soil surface contact and root interception
- Large variety of carriers: salts, chelates
- Polyphosphates are excellent for micronutrient sequestration