ABSTRACT: 95

SOYBEAN MANAGEMENT PRACTICES IN THE SANDY PAMPAS REGION, ARGENTINA

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The recent and abundant availability of technologies for soybean [*Glycine max* (L.) Merrill] production supports part of the expansion of this crop in the sandy pampas region of Argentina. These management practices, among others, include the use of seed treatments for rhizobia inoculation and disease protection, fertilization with macro and micronutrients, foliar fungicides for late season disease control, varied weed and pest products, etc. Although the benefits of these technologies have been individually validated, the regional information about their contribution under uniform production conditions (i.e. soil type, planting date, genotype, previous crop, tillage, etc.) is limited. Our objective was to quantify the single and the cumulative effects of frequently recommended soybean production practices for achieving high yields in the sandy pampas region of Argentina. The study was performed during the 2011/12 growing season in 3 production fields close to America (Buenos Aires province) where 10 crop management treatments were established. The use of better soybean production practices increases grain yield by 8.2 % compared with regular management practices. The application of biological seed treatments with *Bradyrhizobium japonicum* combined with LCO signal molecules for plant growth promotion, the use of residual herbicides and foliar fertilization with Boron explained more than 80 % of the described benefits in grain yield. The use of modern pest and disease control treatments reduced disease incidence, but because of their low initial presence, the effects on grain yield were not significant. In this region, the achievement of high soybean yields requires adequate availability of production resources (nutrients and water), in conjunction with efficient nitrogen nutrition supported by biological seed treatments and fertilization with limiting micronutrients to reduce weed competition. The application of modern pest and disease control treatments can reduce their incidence and minimize the reduction in attainable yields. The use of selected improved technology practices supports the development of high productive soybeans crops to sustain agricultural systems in the sandy pampas region of Argentina.

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Soybean management practices in the sandy pampas region, Argentina

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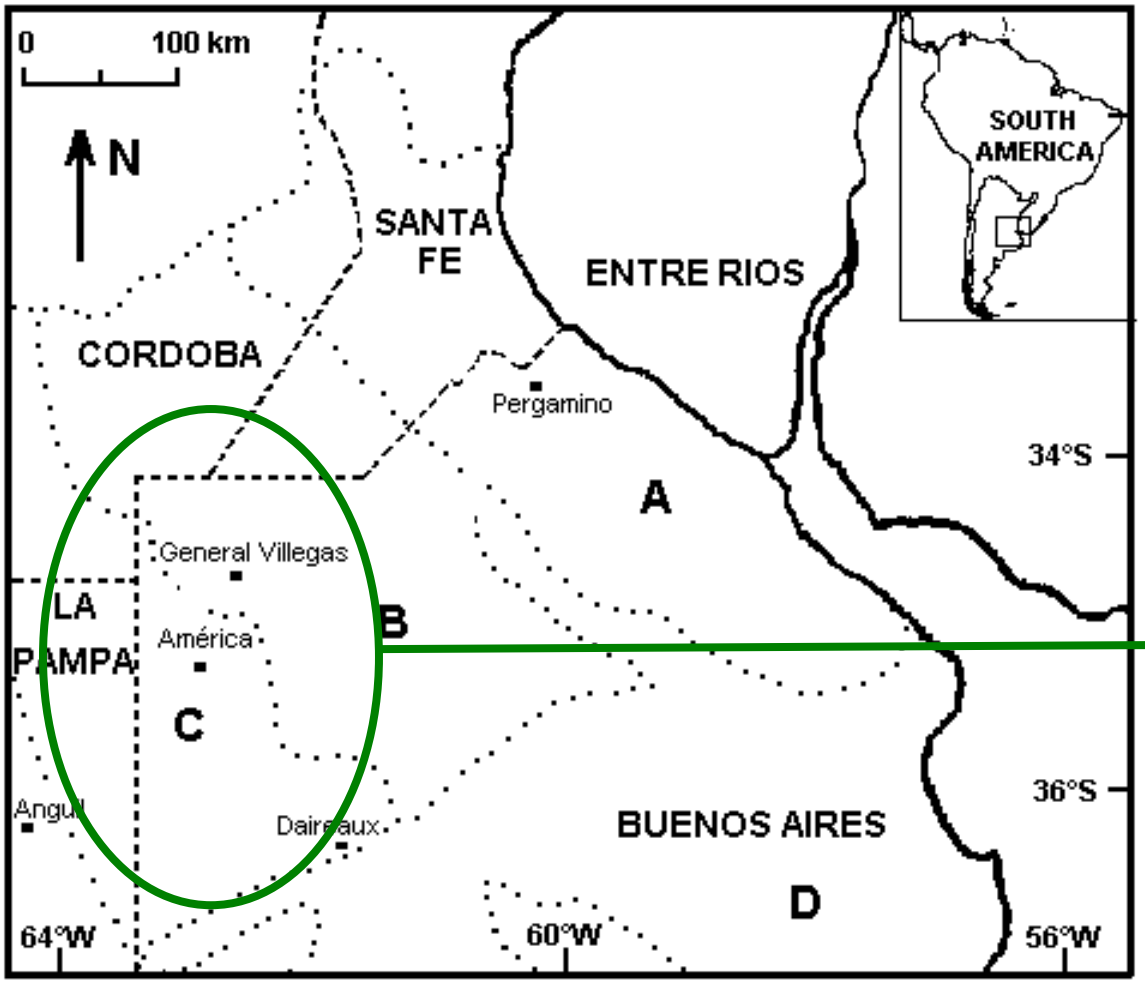
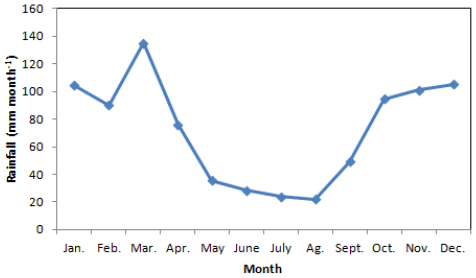
The Pampas region, Argentina



A = Rolling Pampa
B = Inland Flat Pampa
C = Inland Western Pampa
D = Flooding Pampa

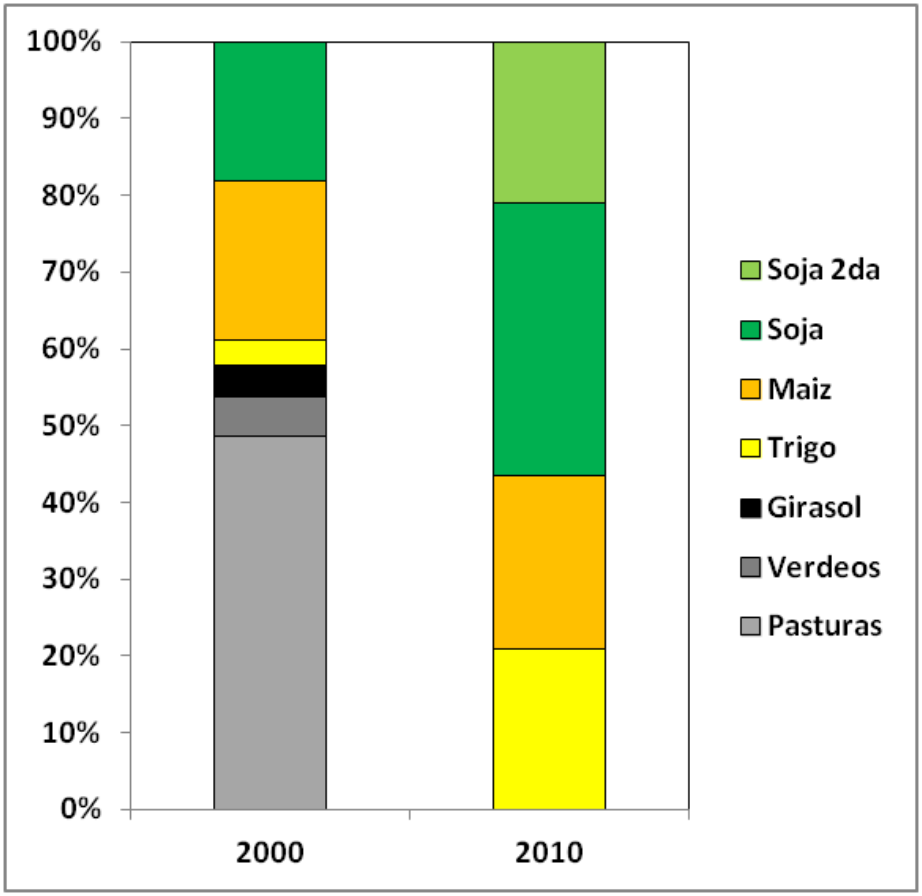
The sandy pampas region

- Deep, coarse textured Hapludolls
- Temperate climate (dry winter, negative water balance in summer)



- Crops: soybean, sunflower, maize, wheat, alfalfa and fescue pastures.

Sandy pampas region. Changes in the production systems

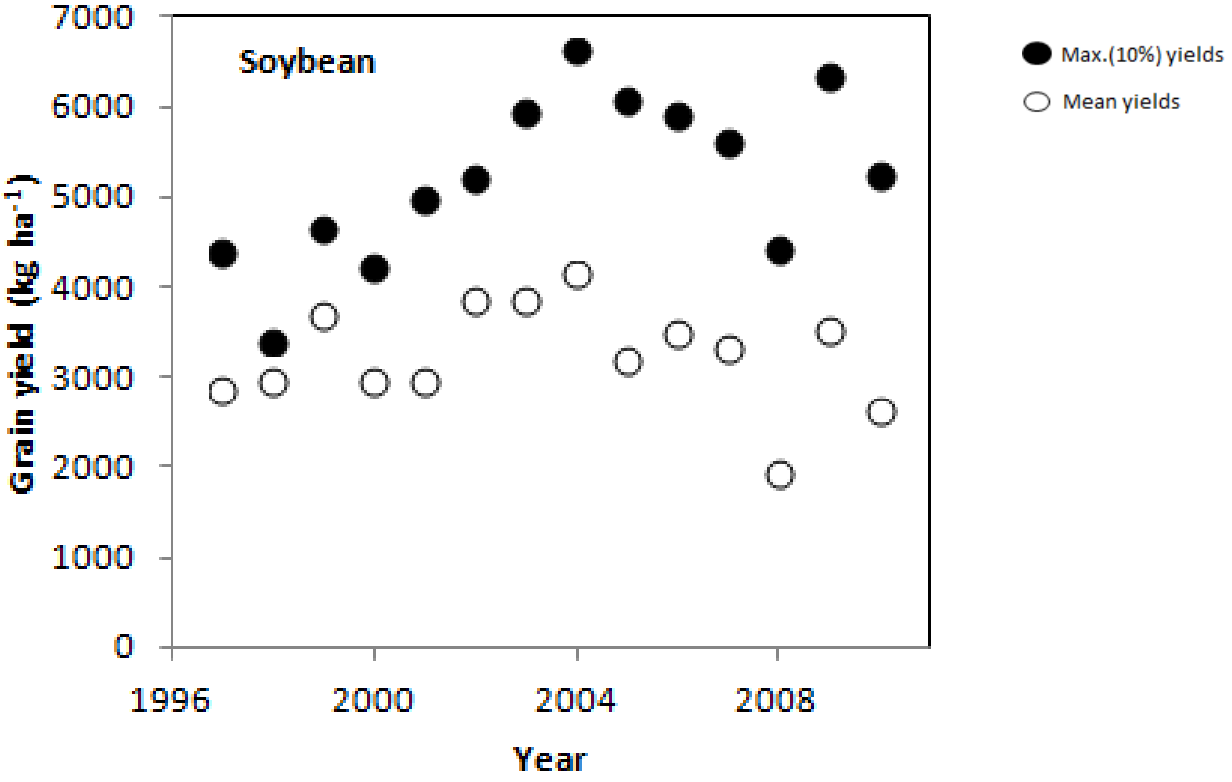


Source: CREA América
Duarte (2001), Trasmonte (2011)

Change from livestock production systems in rotation with annual crops to complete row crops sequences.

High presence of soybean crops
(aprox. 3.5 M has., >50% of the ag.land, 18% of Arg.Soy.area and > 1.5% of global Soy.production)

Sandy pampas region. Soybean yields



During the last decade,

Relatively stable mean soybean yields.

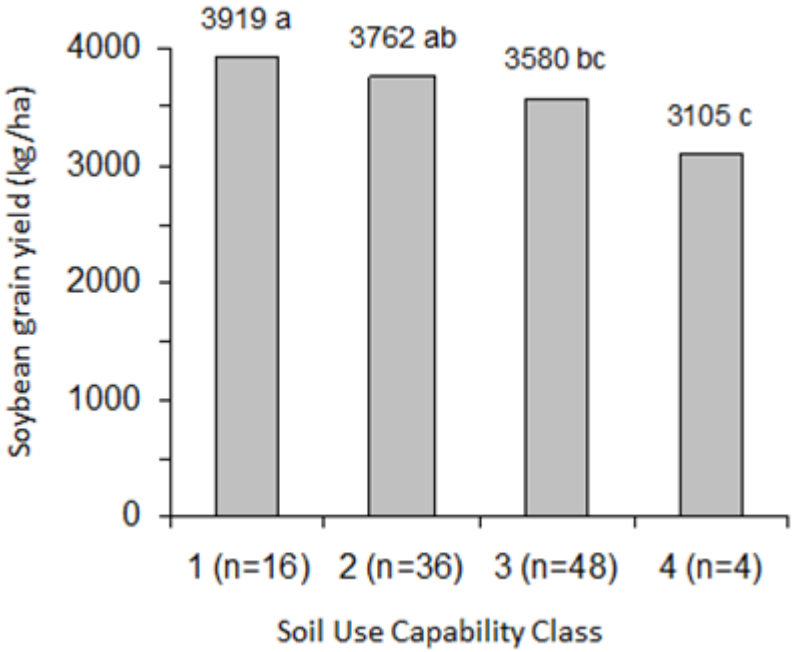
Maximum yields increased until 2004.

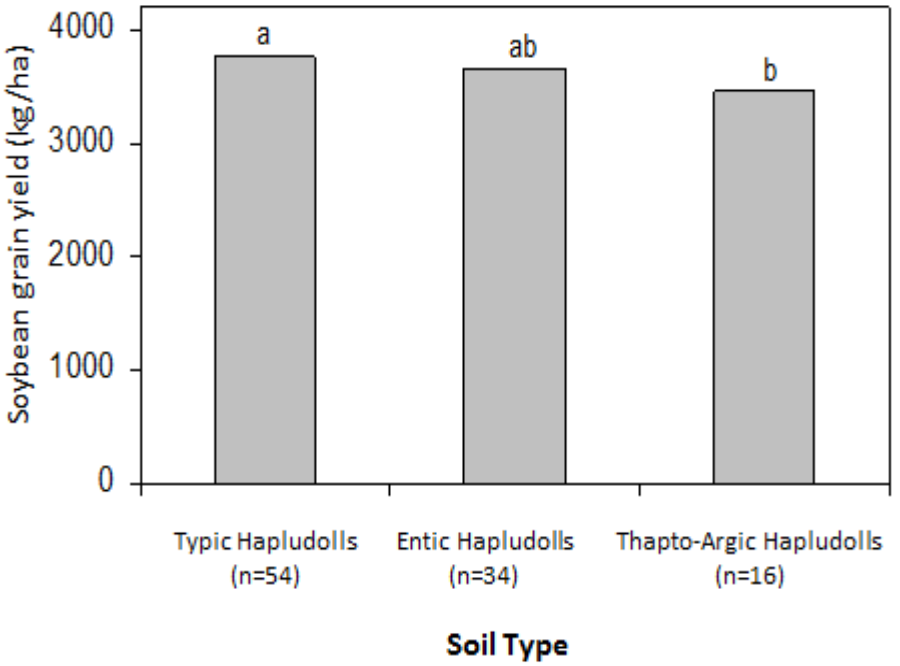
Source: CREA América Trasmonte (2011)

Why the regional soybean yields are stable?

Can we identify the production factors that explains the soybean yields variability?

Soils from the sandy pampas region (Argentina) and soybean grain yields



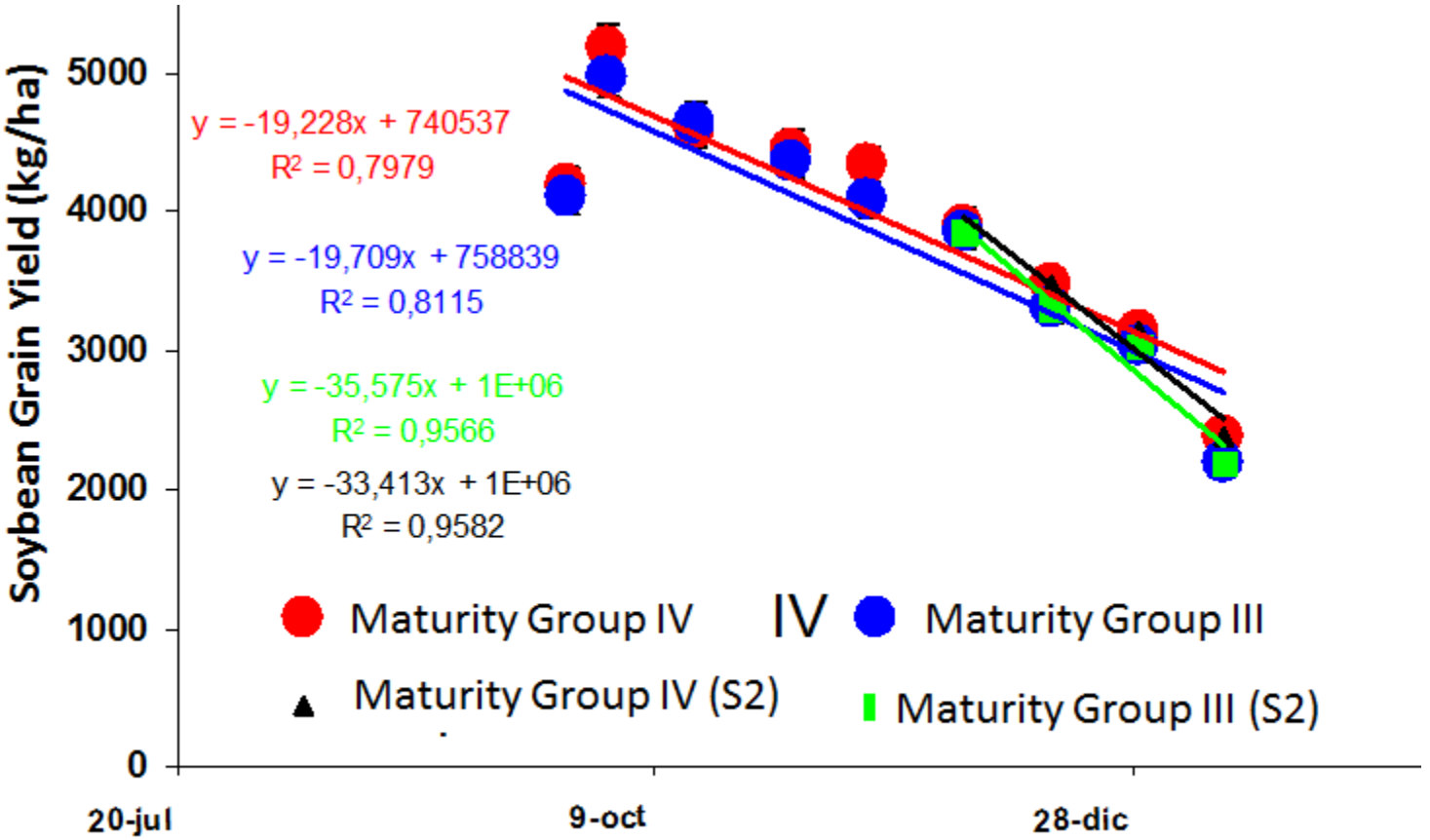


Barraco (2010)

Soil type (depth to limiting rooting layer and soil quality) partially explains soy.yield variability

Planting dates and maturity groups effects on soybean yields in the sandy pampas region, Argentina

(11 growing seasons, 2001/2 to 2011/12)



DZD Agro (2012)

Late planting reduces attainable yields.

Maturity groups NS. But, (not shown) relevant differences due to genotypes (today s challenge)

Present soybean production scenario in the sandy pampas,

- Main summer crop in the region.
- Crop expansion supported for environmental (more rainfalls) and the availability of new technologies (varieties, rizobia inoculants, fertilizers, agrochemicals, etc.). But,
  - Stable mean and maximum grain yields.
    - Grain yield variability mostly related to soil type and planting date.
    - The abundant new available technologies are moderately applied at farmer s level.

Objective

- to quantify the single and the cumulative effects of frequently recommended soybean production practices for achieving high yields in the sandy pampas region of Argentina.

Methodology

Sites (3): located close to América (Buenos Aires, Argentina)

Soils: Typic Haplustolls

Soybean Management:

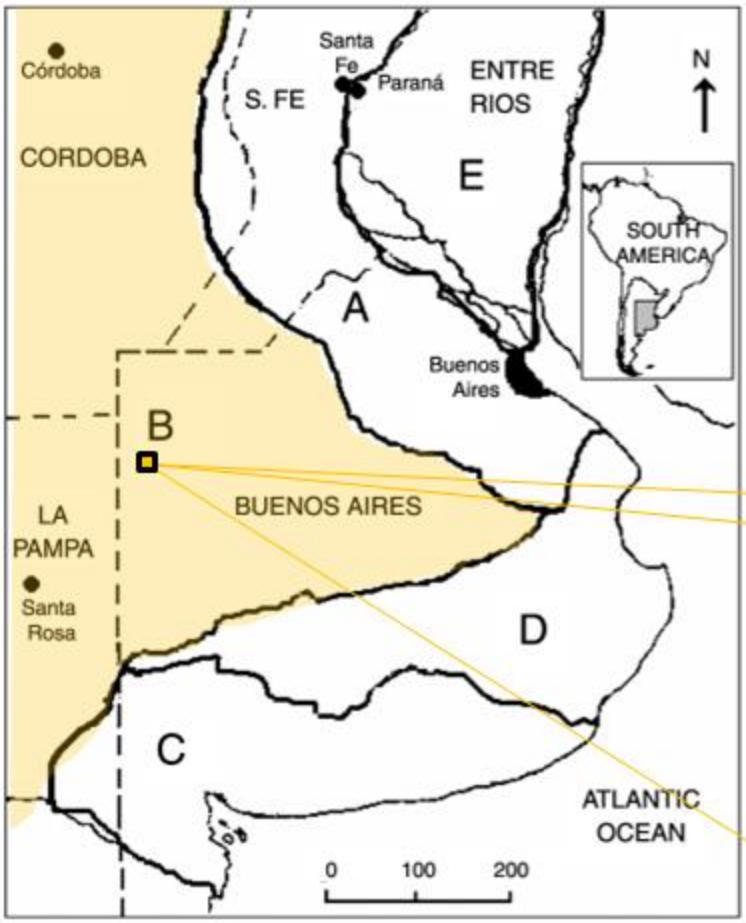
- Previous crop: Maize
- Planting system: No tillage
- Planting date: between 30/Oct/2011 and 5/Nov./2011.
- Variety: DM3810
- Distance between rows: 40 cm

Evaluated treatments (10): combinations of seed and crop treatments under uniform soil types and planting dates conditions.

Measurements: plant stand, nodulation, disease and pest pressure, crop growth and grain yields.

Experimental design and statistical analysis: replicated trials, combined site and contrasts analysis.

Location of the studied sites



Site		
La Justina	El Amparo	La Emilia
35°29´55,48´´S	35°30´04,62´´S	35°36´16,58´´S
63°08´31,10´´O	63°09´07,30´´O	63°04´115,32´´O

Evaluated treatments

	Seed Treatment			Weeds	Pests	Diseases control		Fertilization	
Trt.	Inoculation	Fungicide	Co Mo	control	control	Fungicide	Fosfites	At planting	Foliar
1	no	no	no	Glyphosate	Chlorpyrifos + Cypermethrin	no	no	no	no
2	Nitragin Optimize	no	no	Glyphosate	Chlorpyrifos + Cypermethrin	no	no	no	no
3	Nitragin Optimize	Acronis	no	Glyphosate	Chlorpyrifos + Cypermethrin	no	no	no	no
4	Nitragin Optimize	Acronis	no	Alteza	Chlorpyrifos + Cypermethrin	no	no	no	no
5	Nitragin Optimize	Acronis	no	Alteza	Voliam Targo	no	no	no	no
6	Nitragin Optimize	Acronis	no	Alteza	Voliam Targo	no	no	MAP	no
7	Nitragin Optimize	Acronis	no	Alteza	Voliam Targo	Opera	no	MAP	no
8	Nitragin Optimize	Acronis	no	Alteza	Voliam Targo	Opera	no	MAP	yes
9	Nitragin Optimize	Acronis	no	Alteza	Voliam Targo	Opera	yes	MAP	yes
10	Nitragin Optimize	Acronis	yes	Alteza	Voliam Targo	Opera	yes	MAP	yes

Nitragin Optimize = *Bradyrhizobium japonicum* + LipoChitOligosacharides signal molecules

Acronis = Pyraclostrobin y Tiophanate Methyl

Alteza = glyphosate + Imazethapyr

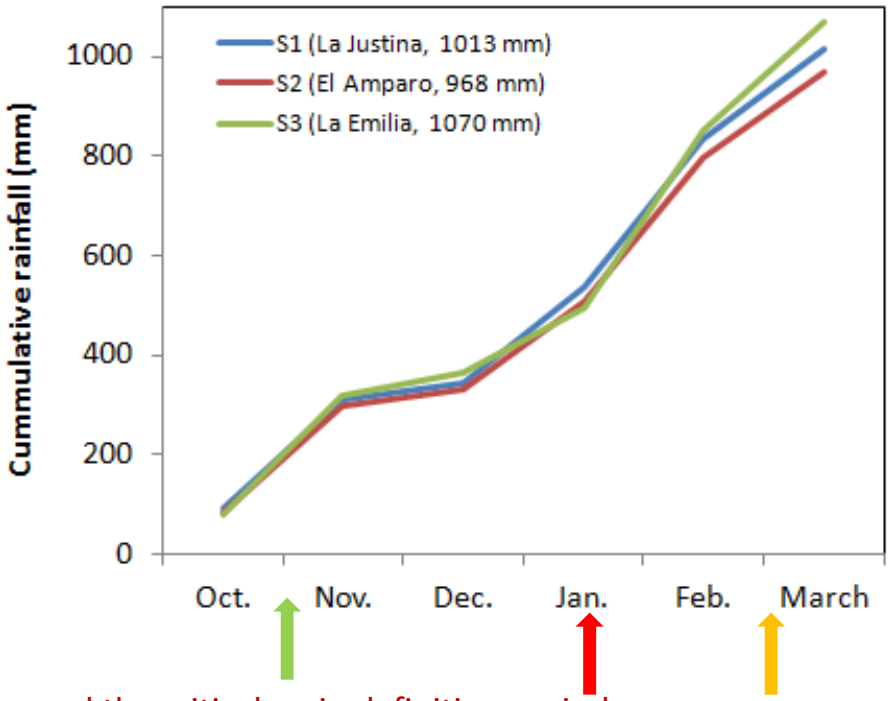
Voliam Targo = chlorantraniliprole + abamectin

Opera = Pyraclostrobin y Epoxiconazol

MAP = monamonic phosphate

Soil properties and rainfalls at the studied sites

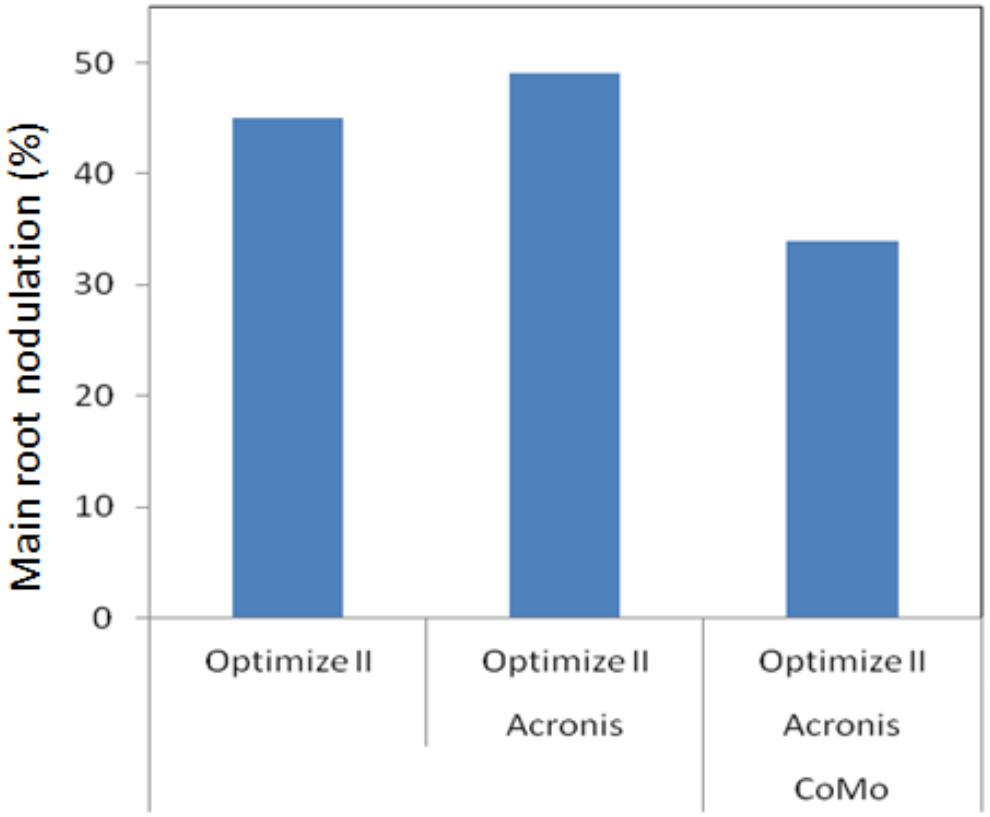
Site	SOM %	pH	Pe ppm	Sand %	Silt %	Clay %
1. La Justina	1.97	6.6	16,0	65	21	14
2. El Amparo	1.62	6.9	12.5	61	28	11
3. La Emilia	1.78	6.4	23.6	56	33	11



Limited rainfall between planting and the critical grain definition period.

Seed treatments and main root nodulation

Evaluation: 45 dap



Nodulation increased after inoculation (also in combination with selected fungicides).
But, risk due to the combination with micronutrients formulations.

Foliar fungicides application and late season disease incidence

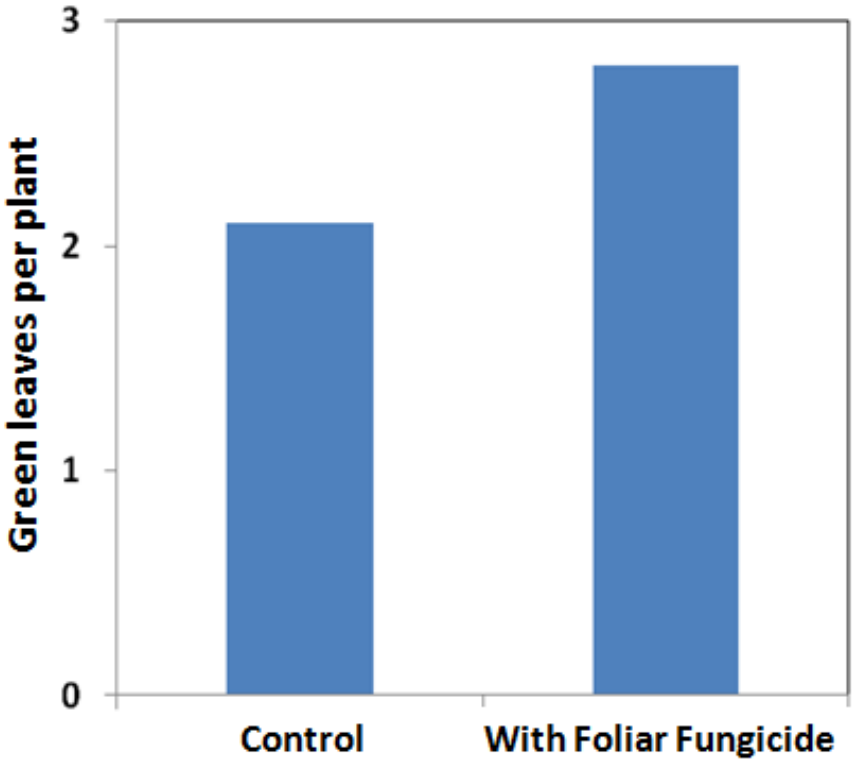
Evaluation: 47 dap

Treatments	*Pseudomonas syringae*	*Cercospora Kikuchii*	*Septoria glycines*	*Phyllosticta sojicola*	Total
Control	27,1	20,8	27,1	1,9	49,8
+ Foliar Fungicide	40,0	18,5	17,2	1,3	37,0
Difference	12,9	-2,4	-9,8	-0,5	-12,7
P(x)	0,004	0,23	0,001	0,59	0,0001

Foliar fungicides reduced almost 20% the diseases incidence. But, it could show an increase in bacterial presence….

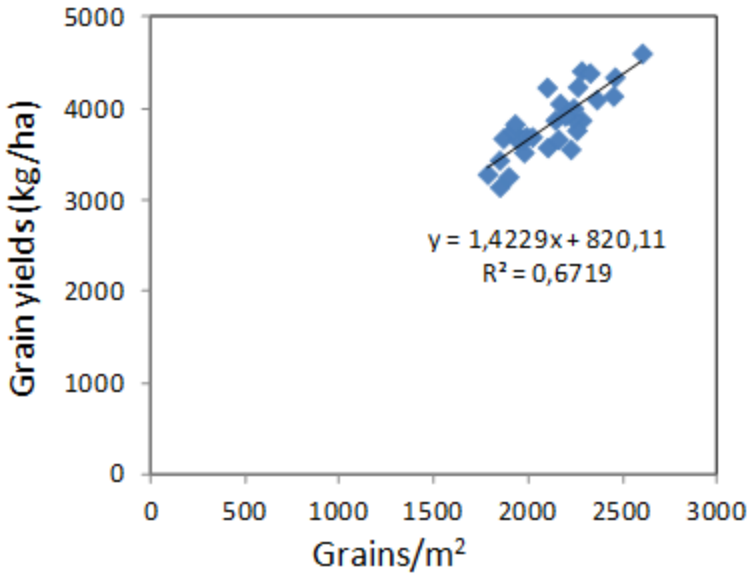
It is a recommended practice with 80% of field efficacy providing more than 150kg/ha of yield response.

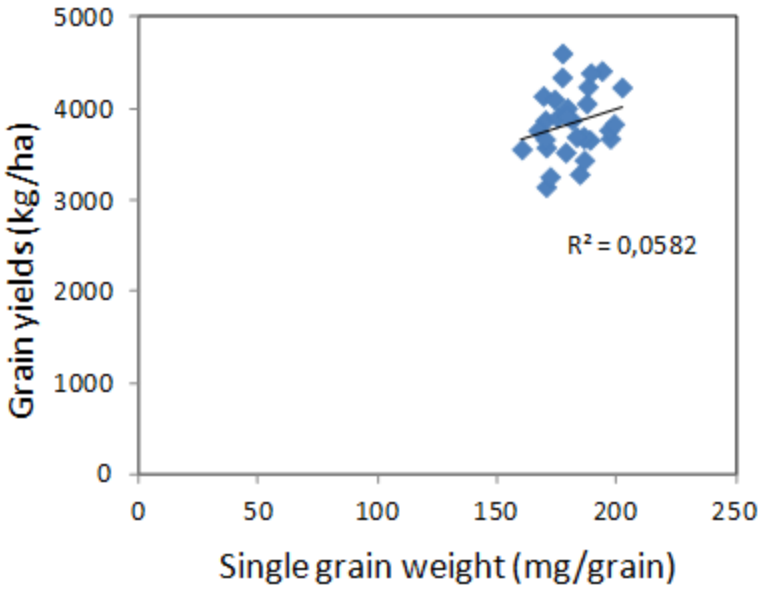
Foliar fungicides application and green leaves at phsyological maturity



Green (“Ps.Activity”) is significantly increased after fungicides application (extended seed filling period, but in a limited rainfall season)

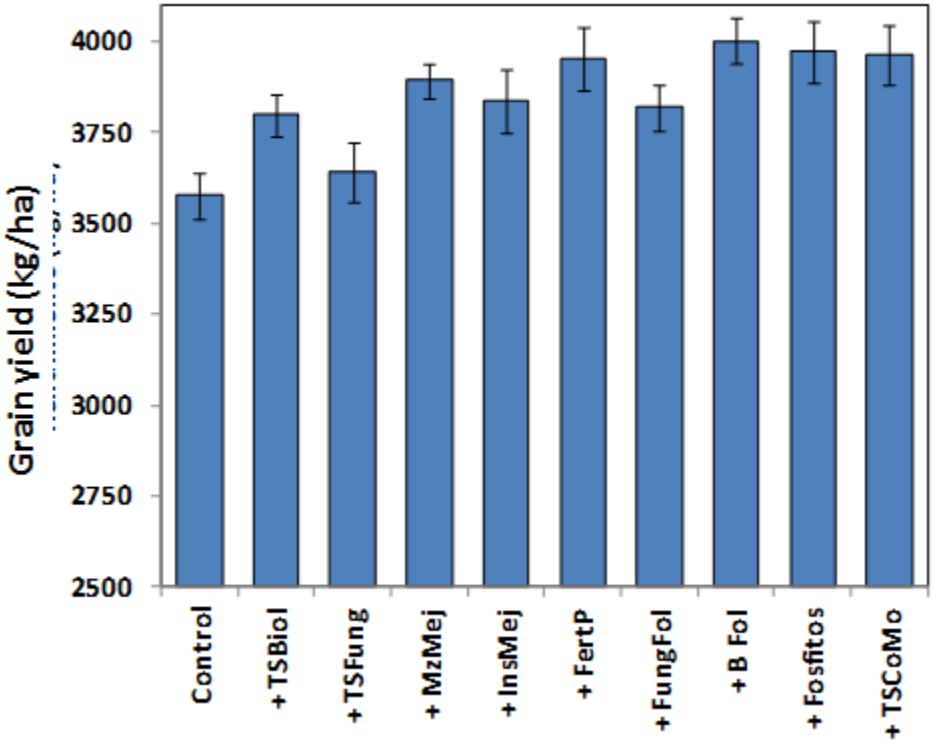
Soybean production practices and grain yields





Grain yield differences are strongly related to changes in the grain number (significant effect of early growth conditions).
Differences in grain weight (changes in seed filling period conditions) are less relevant.

Soybean production practices and grain yields



Production practice	Grain yield (kg ha^{-1}) Regular	Improved	Responses kg ha^{-1}	%	P(x)
+ Biological ST	3575	3797	**222**	**6.2**	**0.06**
+ Fungicide ST	3797	3641	-156	-4.1	0.23
Weed control	3641	3892	**251**	**6.9**	**0.10**
Pest control	3892	3836	-56	-1.4	0.40
+ P fertilization	3836	3953	117	3.0	0.32
+ Foliar fungicides	3953	3819	-134	-3.4	0.20
+ B fertilization	3819	4000	**182**	**4.8**	**0.11**
+ Fosfites	4000	3971	-30	-0.7	0.41
+ Co and Mo ST	3971	3964	-7	-0.2	0.49

Conclusions

In the sandy pampas region, and under uniform environmental conditions (soil type, planting date and rainfalls – limited…),

- Modern soybean **production technologies explains 8.2%** of the attainable grain yields compared with traditional production practices.

- **Biological seed treatments with *Bradyrhizobium japonicum* combined with LCO signal molecules** for plant growth promotion, the use of **residual herbicides** and the **foliar fertilization with Boron** explained more than 80 % of the described benefits in grain yield.

- The use of **modern pest and disease control treatments reduced its incidence**, but because of the low initial presence (in this study) the effects on grain yield were no significant.

Remember, site conditions (soil type, genotypes and planting strategy) explains > 30% of attainable yields.

Conclusions

In the sandy pampas region, the achievement of high soybean yields requires the adequate availability of production resources (nutrients and water) in conjunction with an efficient nitrogen nutrition supported by biological seed treatments and the fertilization with limiting micronutrients and to reduce weed competition for them.

The application of modern pest and disease control treatments can reduce their incidence and minimize the reduction in attainable yields under dynamic changes in reductive production factors (i.e. weeds, pest and diseases).

The use of selected improved technologies practices supports the development of high productive soybeans crops to sustain agricultural systems in the sandy pampas region of Argentina.

Thank you

Questions ?