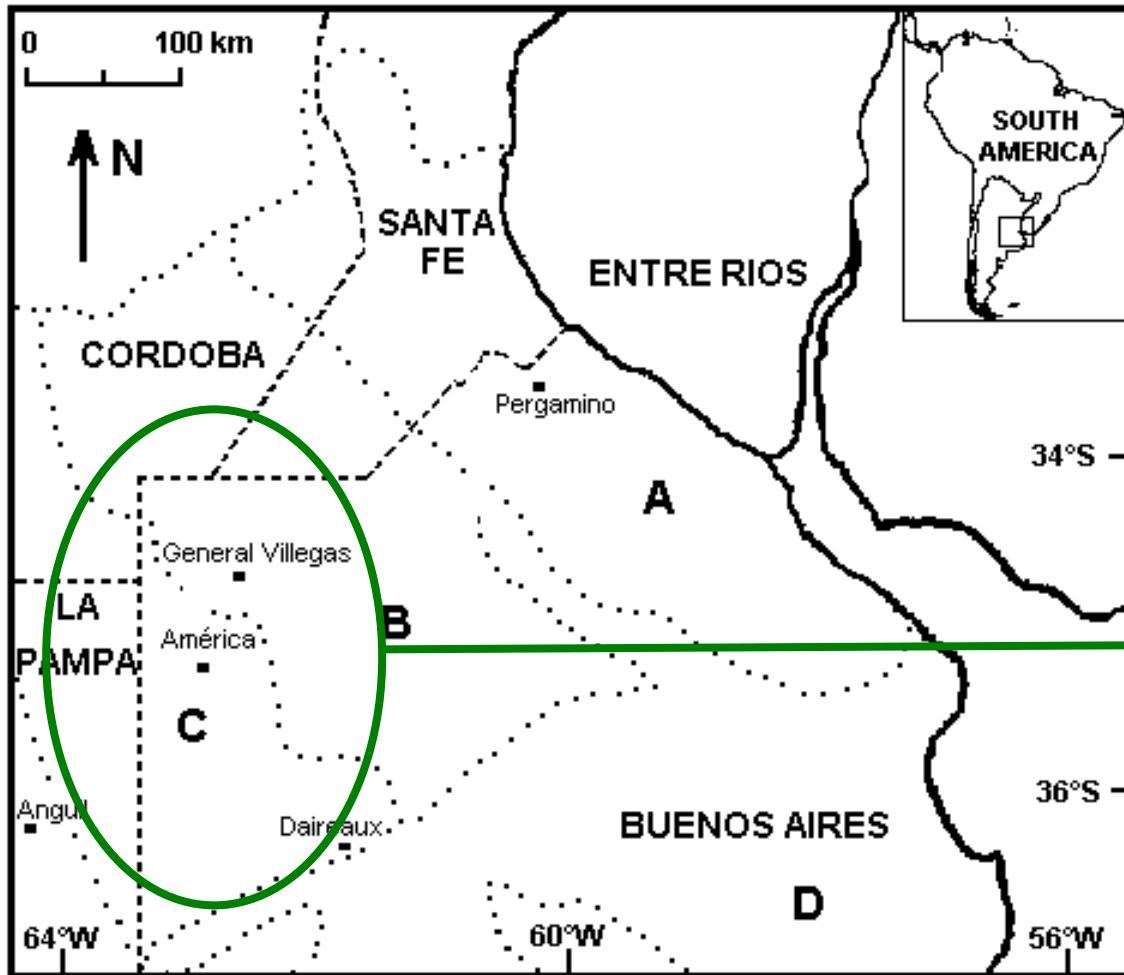


Changes in soil management practices and current soil productivity challenges in the semiarid pampas

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29 de setembro de 2015
São Paulo, SP

The Pampas region, Argentina



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



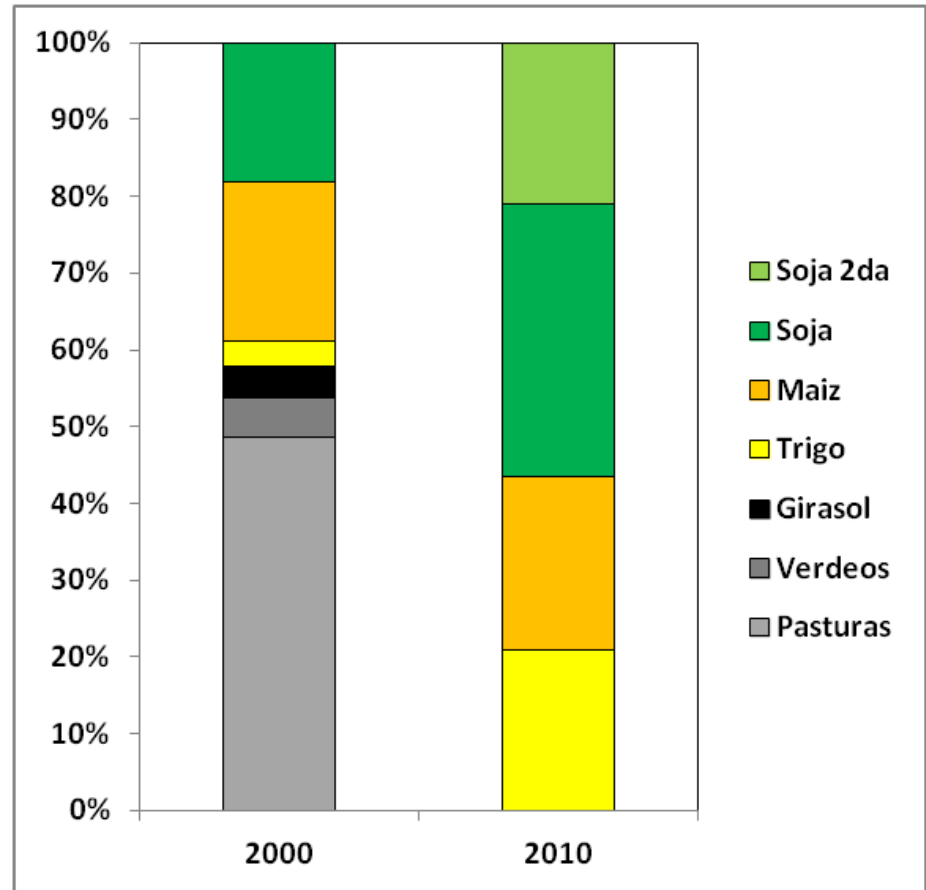
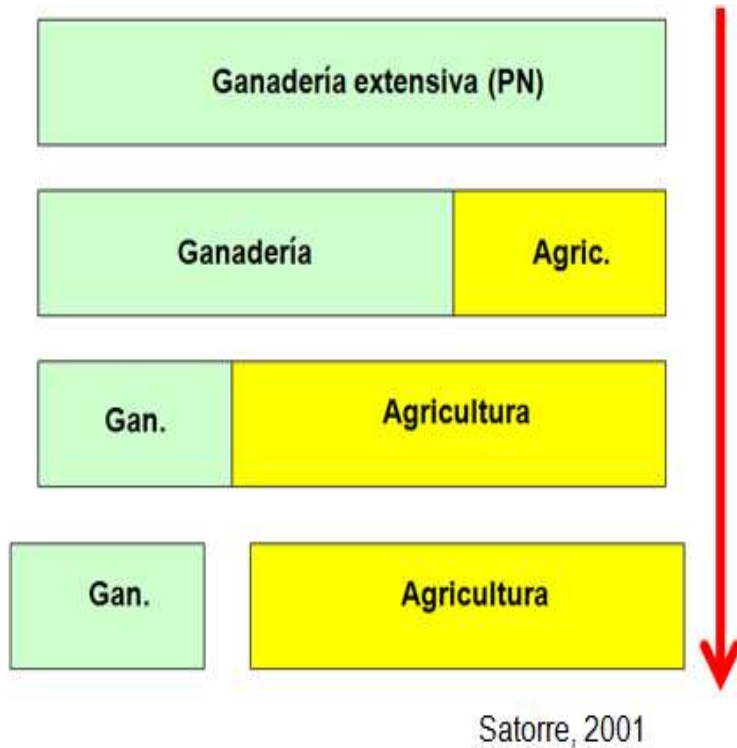
The sandy pampas region

- 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

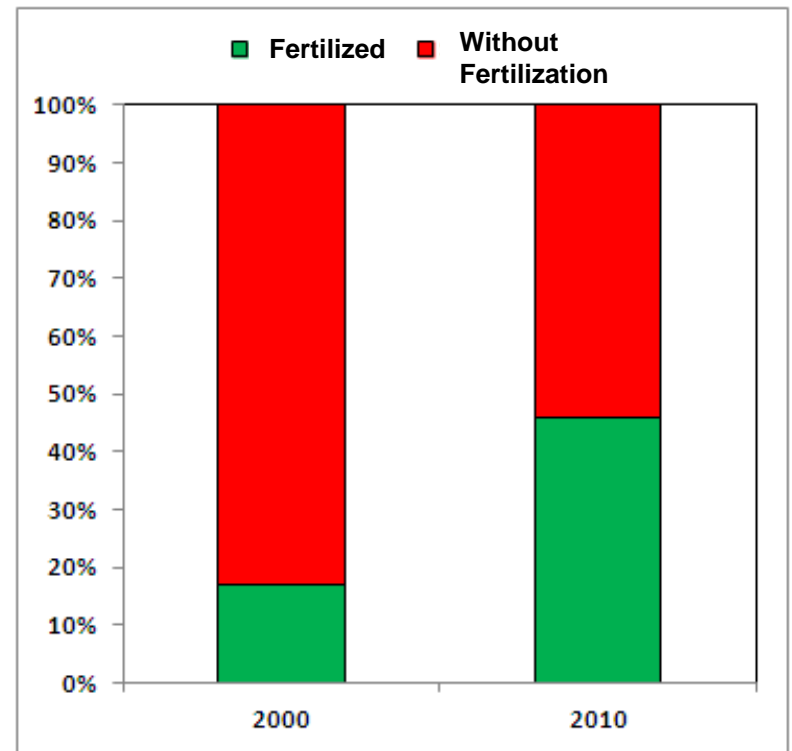
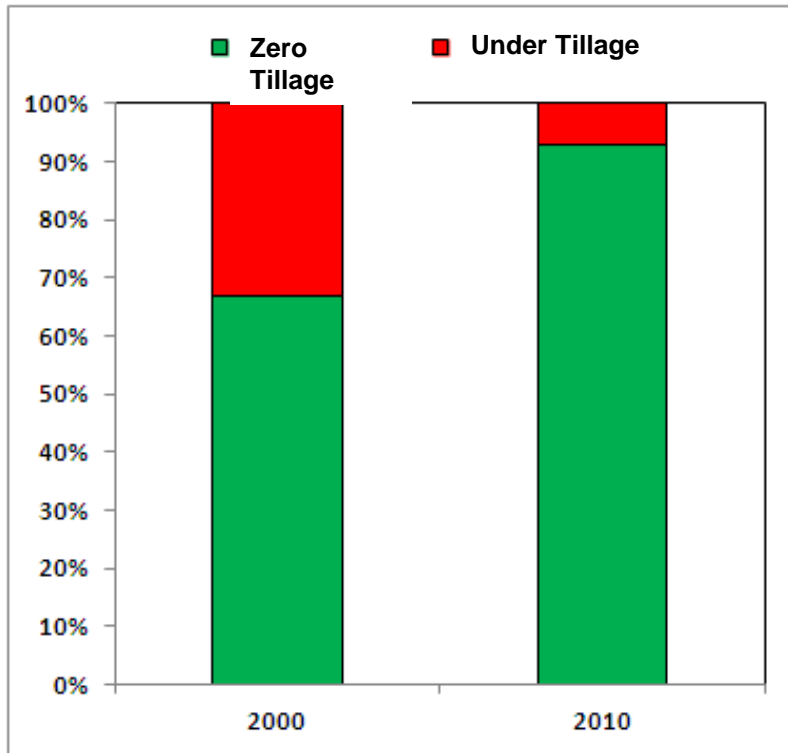


Source: CREA América Duarte (2001), Trasmonte (2011)

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

High presence of soybean crops.

Sandy pampas region. Changes in the agricultural practices

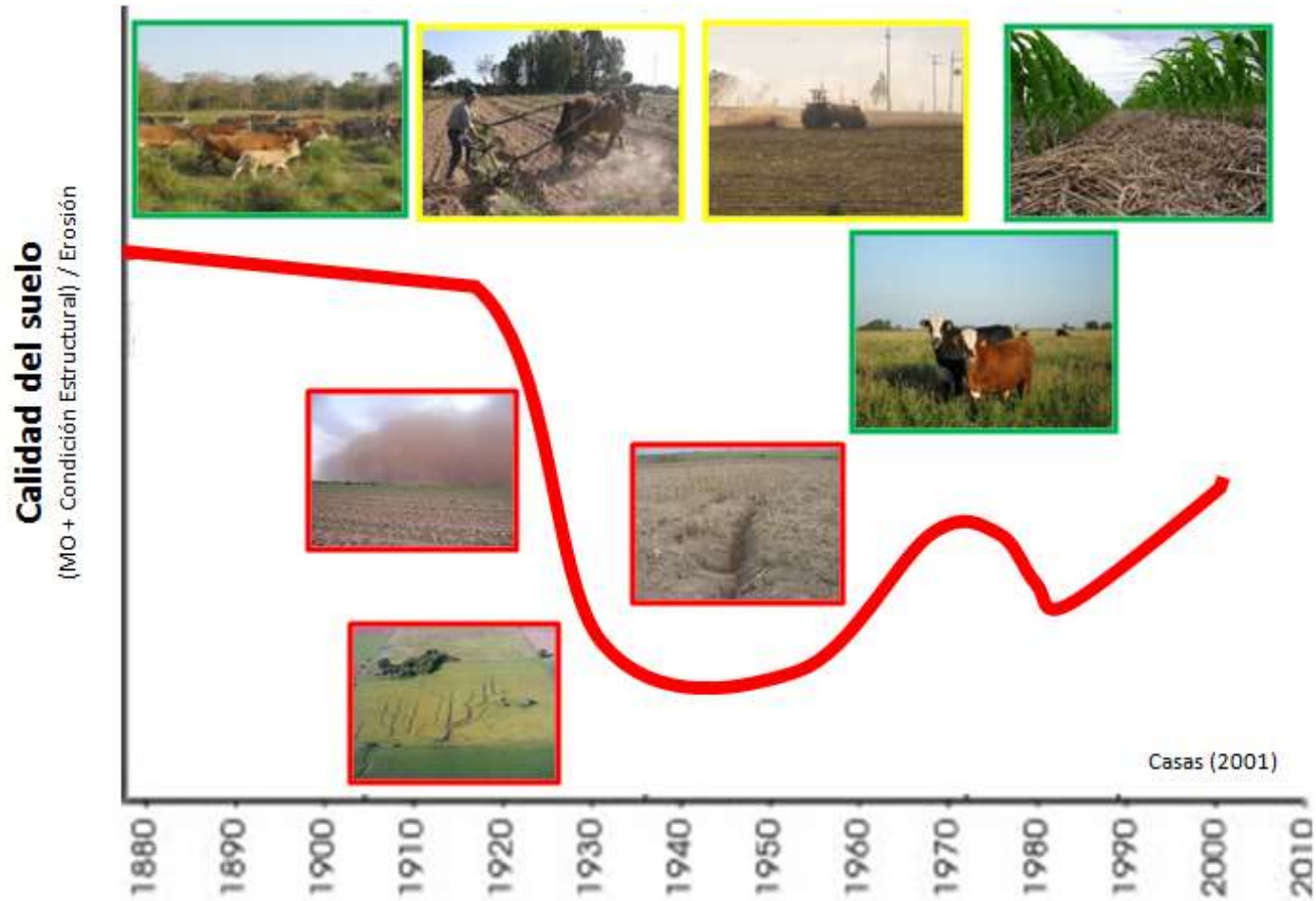


Source: CREA América Duarte (2001), Trasmonte (2011)

Generalized use of zero tillage

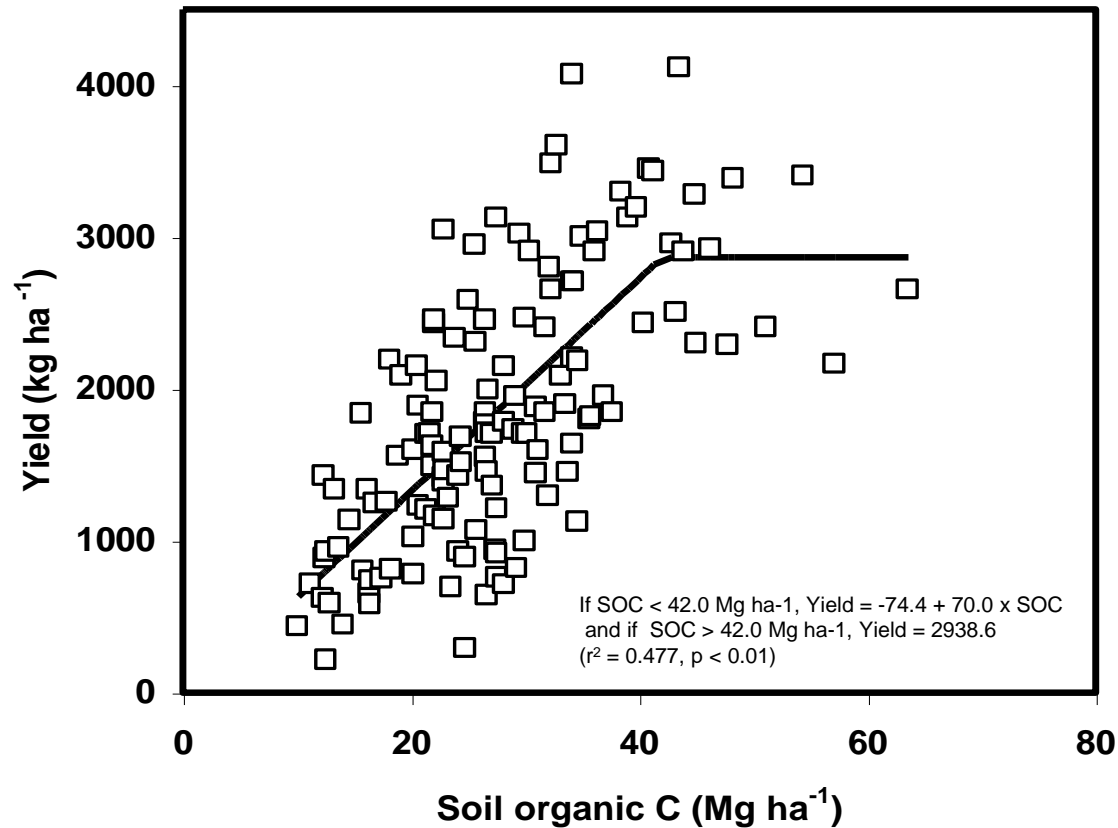
Fertilization practices, although increased relatively to 10 years ago, still not generalized application (mainly “sufficiency” strategies)

In the Pampas, the production systems (soil & crop management) modifies the soil properties (and its productivity)



Sandy pampas region. Soil properties and crop productivity

Wheat grain yield and soil organic C in 134 farmer fields of the Sandy Pampas region, Argentina



Díaz-Zorita et al., 1999

Soil productivity strongly related to the SOC content.

Present agricultural scenario in the sandy pampas,

- Generalized agricultural production systems in high fertility soil
- Limited livestock rotations with grain crops
- Agriculture mostly under zero tillage practices
- Fertilization (NP) for cereals and limited use (P) for soybean crops
- strong relationships between crop yields and soil properties, mostly related to water and nutrient storage

Objective

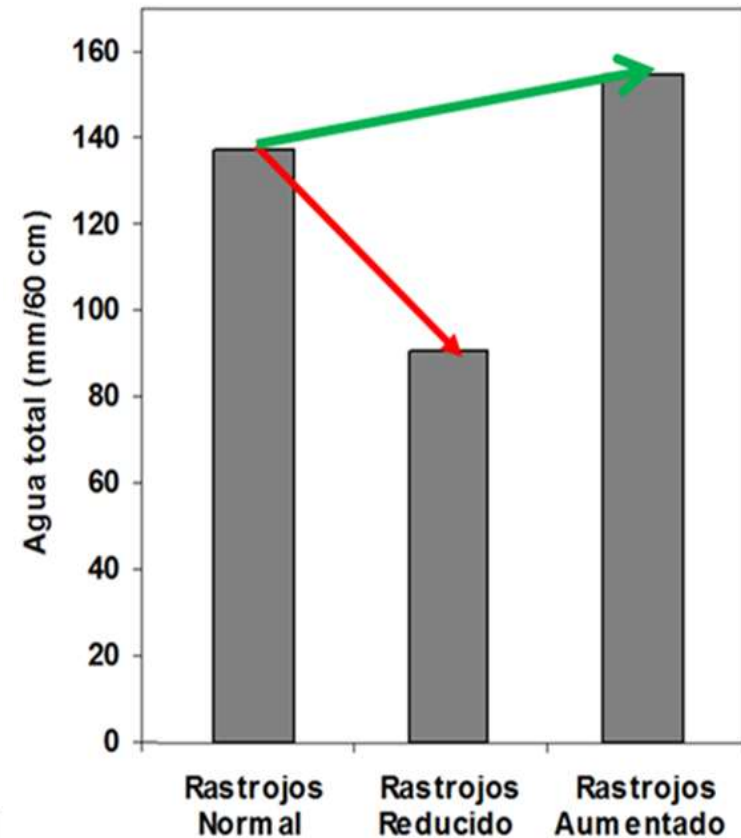
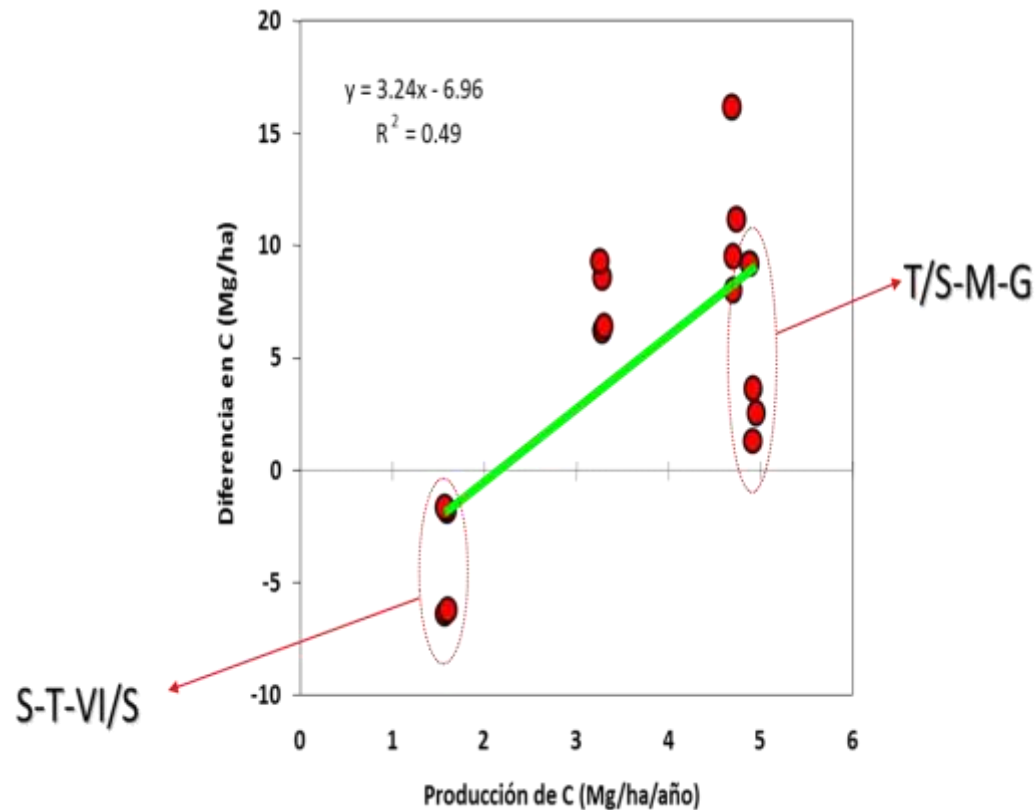
- to expose about several of the changes and trends in the productivity of the soils of the region under the current management practices and to discuss potential challenges for the development of sustainable production practices.

Crop production (yields) and soil management practices are good indicators of soil quality and its productivity

More yields
→ More SOM accumulation

Low soil residue cover

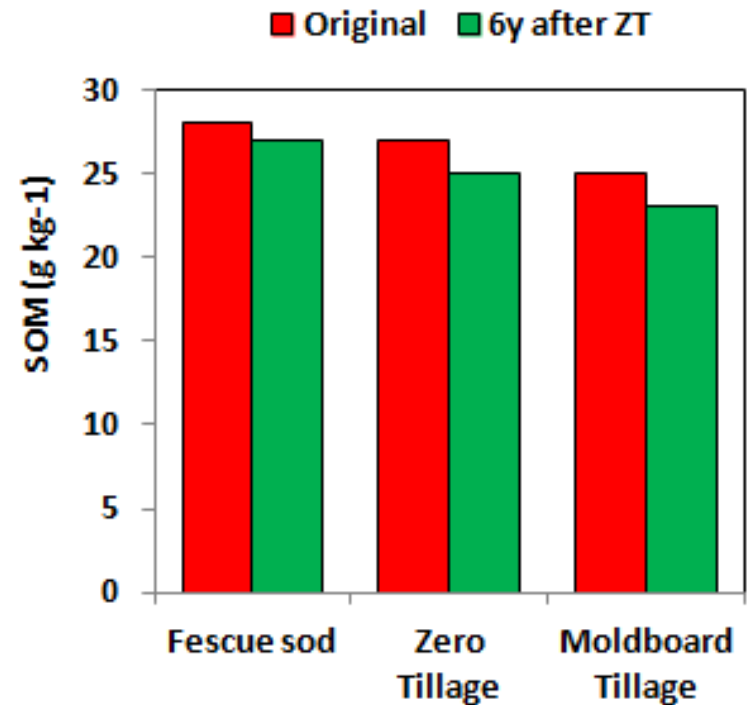
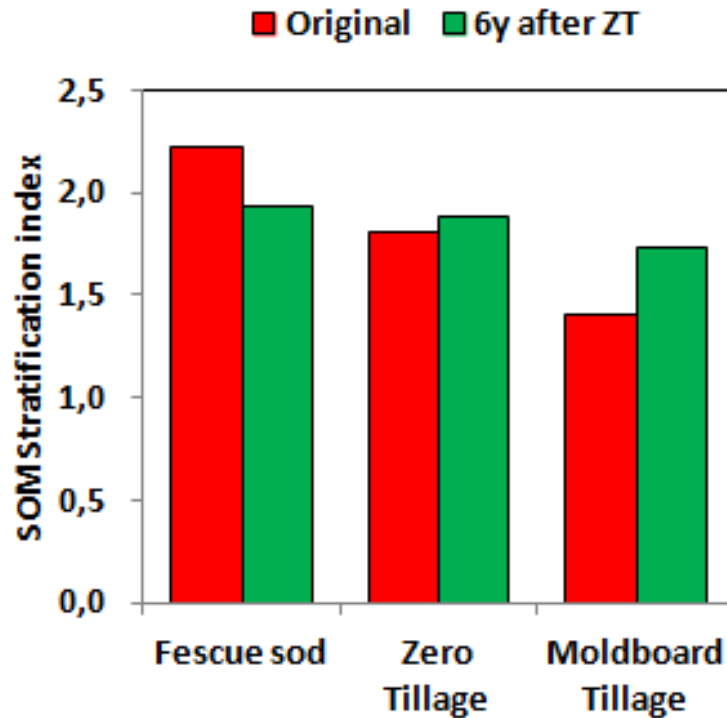
→ Less soil water storage



Díaz-Zorita y Duarte (2004)

Sandy pampas region.

Soil management practices and changes in Soil Organic Carbon



SOC Stratification

Sod > Zero Tillage > Moldboard tillage

6 years of Zero Tillage shows a “particular” Zero Tillage stratification (aprox. 1.85)

Díaz-Zorita et al. (2004)

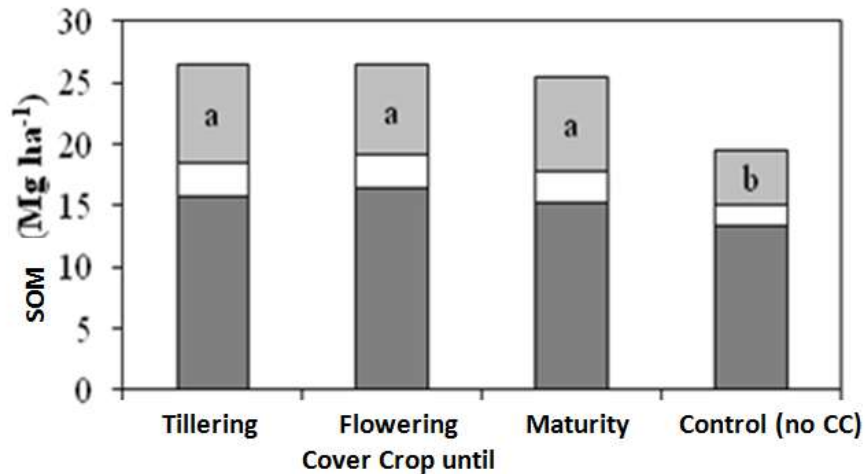
Zanettini et al. (2011)

SOC Contents

Strongly reduced after tillage (- 36%)

Moderate recovery after 6 years of zero tillage (-16%)

Sandy pampas region. Cover crops effects on soil properties and soybean yields



	<u>Trial 1</u>			
	No CC	CC (tillering)	CC (flowering)	CC (maturity)
Soybean yield (kg ha⁻¹)	3223	3207	3176	2830
Relative yield (%)	100	99	99	88
p (x)		0,85	0,63	0,38
	<u>Trial 2</u>			
	No CC	Oat	Rye	Rye Grass
Soybean yield (kg ha⁻¹)	2932	2776	2924	2343
Relative yield (%)	100	95	100	80
p (x)		0,33	0,96	0,24

Barraco et al. (2012)

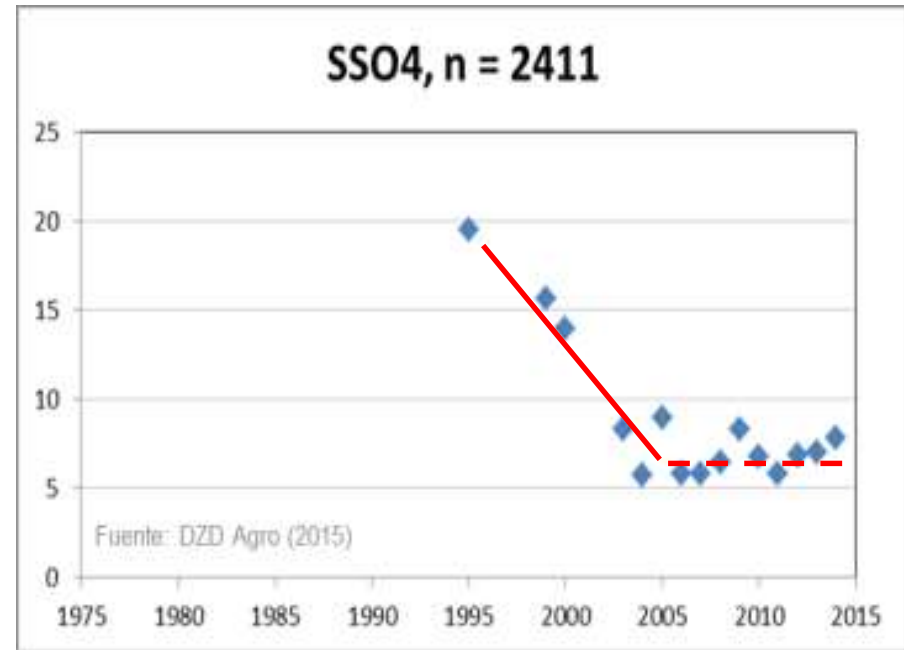
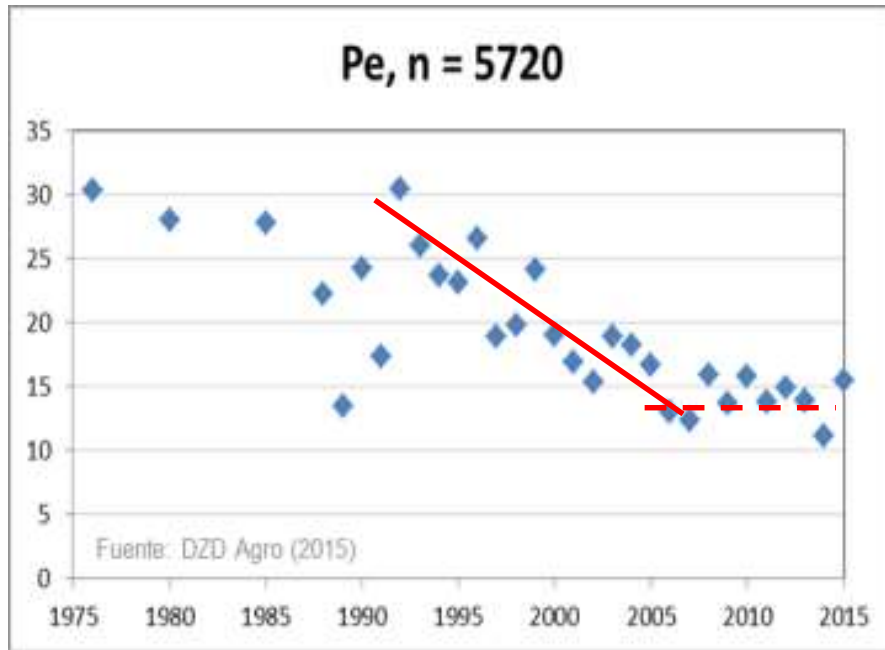
More soil organic carbon (0-5 cm) after 8 years with cover crops in continues soybean sequences.

Main SOC differences in the 106-2000 μm fraction.

But, no significant mean benefits on soybean crop yields.

Reduction in nutrients availability

Evolution of soil extractable properties (P and S) in agricultural lands from the sandy pampas region.



Díaz-Zorita (2015)

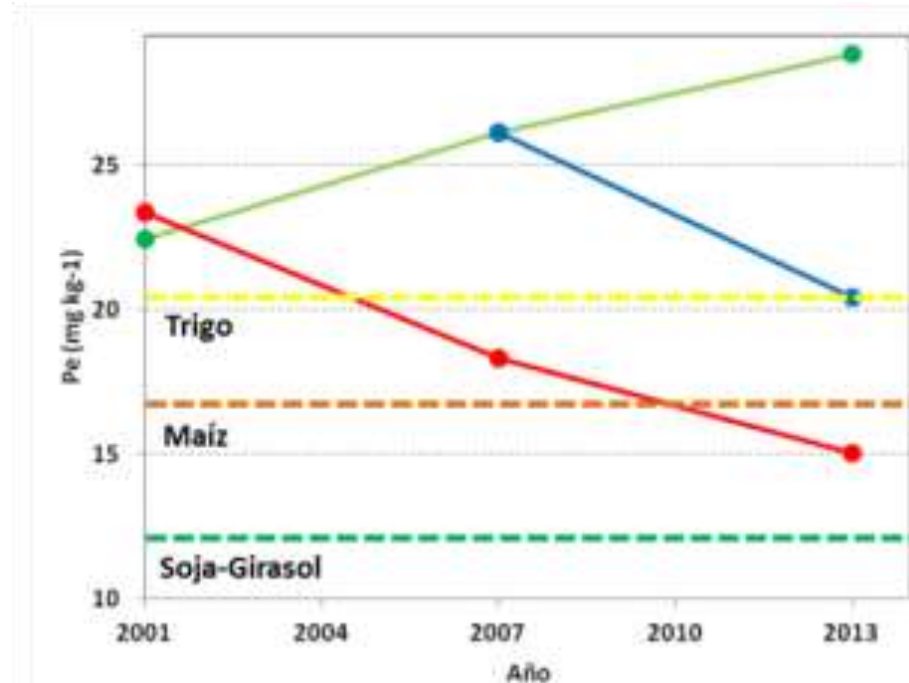
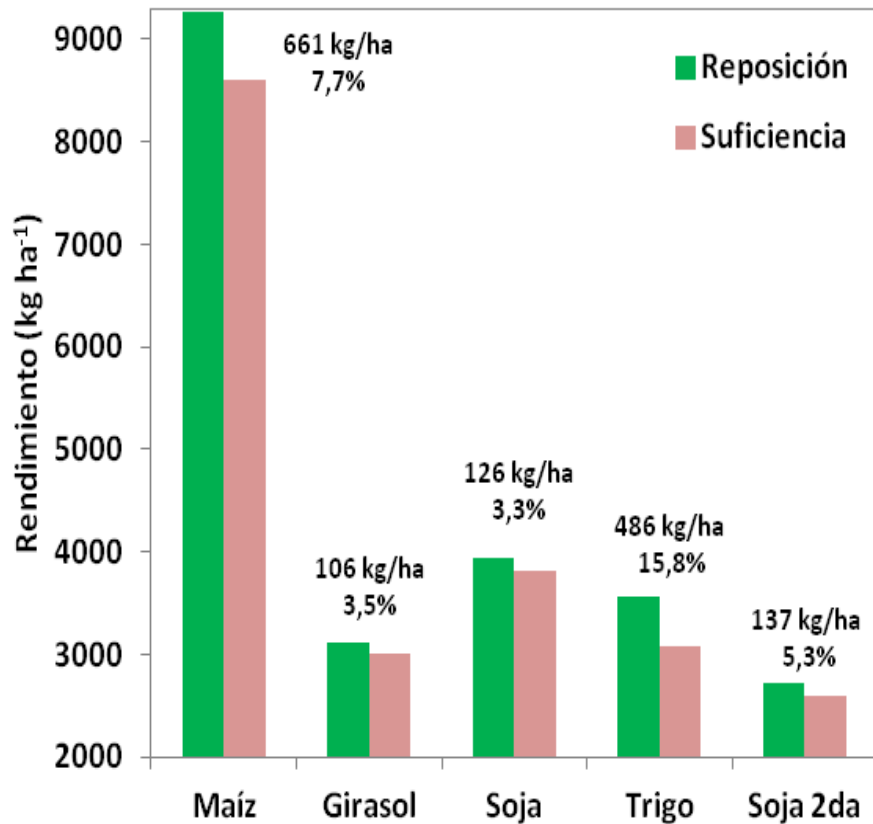
Before mid '90 (livestock and row crops under rotation): moderate Pe reduction

Mid '90 until 2005 (initial of row crops sequences, w/o fertilization): strong Pe reduction

Present (row crops sequences w/fertilization): "stabilization in Pe levels"

Sandy pampas region. P fertilization strategies

Soil fertility maintenance supports greater yields



Source: M.Barraco, unpublished
EEA INTA Gral.Villegas

The application of **crop sufficiency fertilization** programs reduces the levels of soil extractable nutrients and the crop productivity.

Conclusions

In the sandy pampas region, soil and crop management practices have different effects on soil fertility properties

- ✓ **Zero tillage**, contributed to reduce soil erosion and to the conservation of soil properties (SOC contents and stratification, water storage, etc.),
- ✓ **Fertilization** (limited and mainly based on sufficiency strategies), conduces to a **slow but continuous soil extractable nutrients reduction**.

Current challenges requires the intensive application of soil productivity indexes to delimitate homogeneous areas for the efficient use of better soil management practices and the enhancement of the attainable yields keeping soil fertility enhancement and conservation practices.

Thank you

Questions ?