

VARIATION IN PRODUCTION COSTS BETWEEN 2000/01 AND 2011/12 DUE TO CHANGES IN MANAGEMENT OF SOYBEAN CROPS AND GRAIN PRODUCTION SYSTEMS IN TUCUMAN, ARGENTINA

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The province of Tucumán is located between 26°04' and 28°06' south latitude, and 64°28' and 66°10' west longitude, in the region known as north-western Argentina (NWA). Commercial soybean production in this province dates back to the late 1960s. In the period 2000/01-2010/11, average yield reached 2.73 t/ha and both production and planted area grew at an average annual rate of 8.35% and 3.54%, respectively. Soybean crop management in the region experienced significant changes. At present, over 99% of the cultivated area is under no-tillage, planted with transgenic glyphosate-resistant cultivars with a yield potential, and mainly remains under soybean monocropping, with negative consequences. These practices have changed the complex of pests, weeds, and diseases affecting the crop, and have prompted the use of more or different chemicals for their control, causing variations in production costs. The aim of this study was to analyse the variation in costs, gross margins, indifference yield, and average yield of soybean production in Tucuman, from 2001/01 to 2011/12, while identifying sustainability issues.

Production and marketing costs, gross margins and indifference yields for each growing season in the analysed period, were determined. The expenses scheme reflects the general situation of production in each season, and was based on public data plus inquiries to qualified informants. Expenditure on machinery and labour corresponding to contractor values and taxes were not included. To determine gross product in each cycle, average soybean yield in Tucumán and average soybean price in the port of Rosario were considered.

Between 2000/01 and 2011/12, costs incurred from planting to harvest grew at a 6% average annual rate. Planting, agrichemicals, transportation and administration costs increased at rates of 5%, 6%, 8%, and 10%, respectively. Fertilizer and insecticide applications and seed costs grew at rates of 9% and 5%, respectively. Expenditure on herbicides remained unchanged, considering the most common scenarios. However, in recent seasons glyphosate-tolerant and resistant weeds have become more widespread, so weed control costs rose by 120%. The soybean domestic price increased at a rate of 7.2% (being affected by government export taxes of 35%). Between 2000/01 and 2010/11 mean crop yield grew from 2.75 t/ha to 3.2 t/ha, at a 1.6% rate per year, but in 2011/12 it dropped to 1.23 t/ha, due to a severe drought. Throughout the period, indifference yields ranged between 1.1 and 1.4 t/ha on land tenure and between 1.5 and 2.1 t/ha on leased land.

Soybean price and yield increases have allowed covering higher production costs, except in the 2011/12 season. However, it is necessary to introduce product and crop rotation practices to improve soil carbon availability, physical and chemical fertility, and to reduce pest incidence and resistance development, which increase costs and reduce the sustainability of the system.

Variation in production costs between 2000/01 and 2011/12 due to changes in management of soybean crops and grain production systems in Tucumán, Argentina

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Objetives



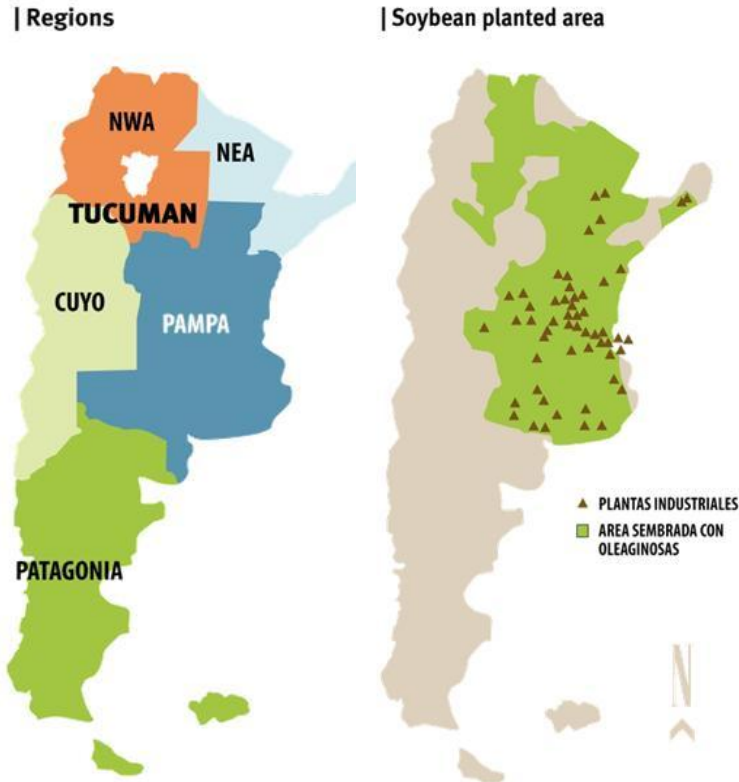
The aim of this study was to analyze variations in costs, gross margin, break-even point (t/ha), and average yield of soybean production in Tucumán, from 2000/01 to 2011/12, while identifying sustainability issues.



Materials and Methods

- Production and marketing costs, gross margins and break-even point (t/ha) for each growing season were determined for the analyzed period.
- The expenses scheme reflects the general situation of production in each season, and was based on public data plus inquiries to qualified informants.
- Expenditure on machinery and field operations correspond to contractor values.
- Taxes were not included.
- Average soybean yield in Tucumán and average soybean price in the port of Rosario were considered to determine income in each cycle.

Tucumán geographical location



•Argentina comprises five regions: The North West (NWA), The North East (NEA), Cuyo, Pampa and Patagonia. Each region has different environmental conditions and develops different economic activities. Soybean crop is present in four of the five regions.

•The province of Tucumán is located in northwestern Argentina (NWA). (Between 26°04' and 28°06' South latitude, and 64 28' and 66°10' West longitude)

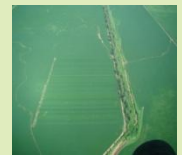


•Compared with La Pampa, the NWA is considered a marginal zone for soybean production.



Tucumán climate and soils

- Soybean plantations in NWA extended over a wide range of soil types. In Tucumán Mollisols prevail.
- Eighty percent of rainfall occurs between November and April, in accordance with the Monsoon regimen. Annual precipitation range from 500 mm to 1,200 mm.
- Average annual temperature ranges from 19° C in the South of Tucuman to 22° C in the North of Salta. However in some parts of northern Salta and Jujuy, temperature decreases with the altitude.

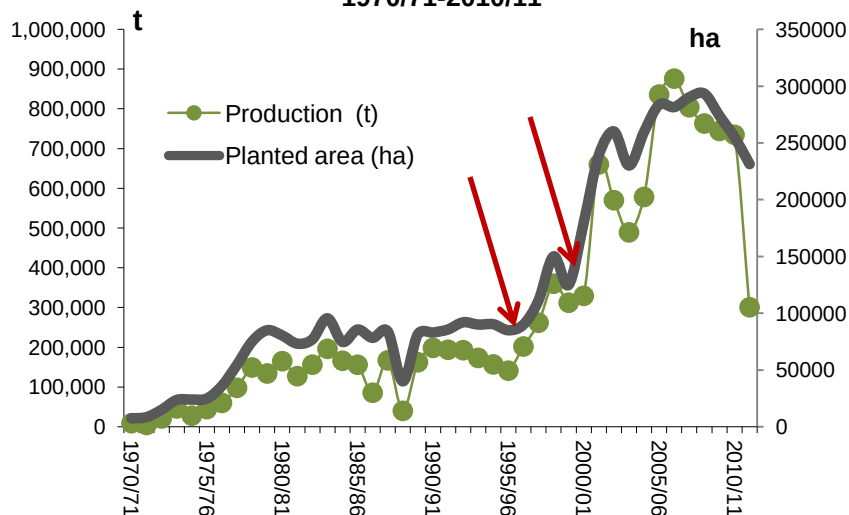




Soybean current status in Tucumán and NWA

Although NWA is considered a marginal zone for soybean planting, commercial production in the region and in Tucumán province dates back to late 1960s

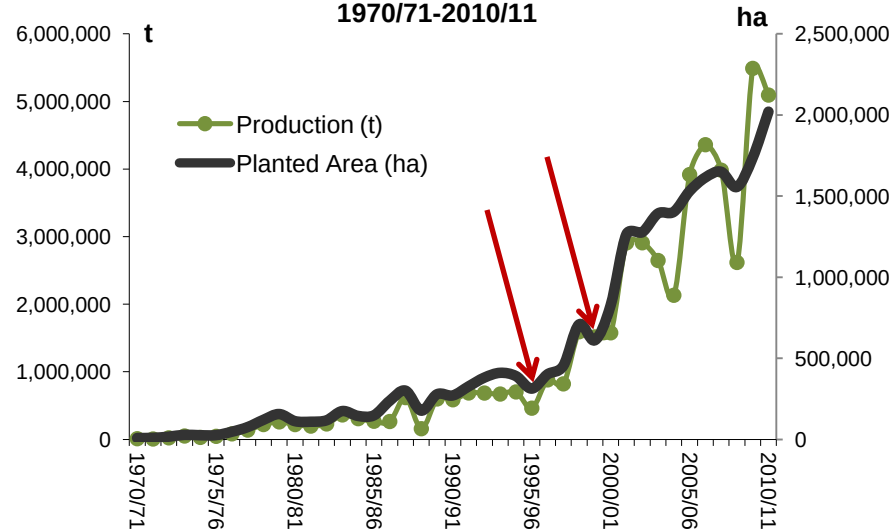
Tucumán, soybean production and planted area
1970/71-2010/11



Production **11.67 %**
Planted area **9.25 %**

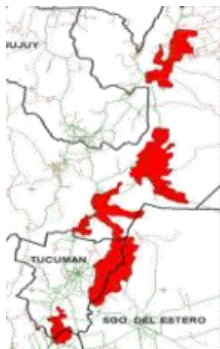
Period 1970/1971-2010/11
Average annual rates

NWA, soybean production and planted area
1970/71-2010/11



Production **17.09 %**
Planted area **14.91 %**

Soybean current status in Tucuman and NWA



The NWA region has 1.9 million ha planted with soybean, with an average yield of around 2.5 t/ha, and a total production of about 5.2 million tonnes. In particular, Tucumán has 255,000 ha with soybean and production reaches approximately 800,000 t.

The province stands out due to its active share in the research, development, and promotion of this crop in the region and bordering countries.

Soybean growing season lasts 120 to 160 days.

Principal limitations for soybean production in NWA are

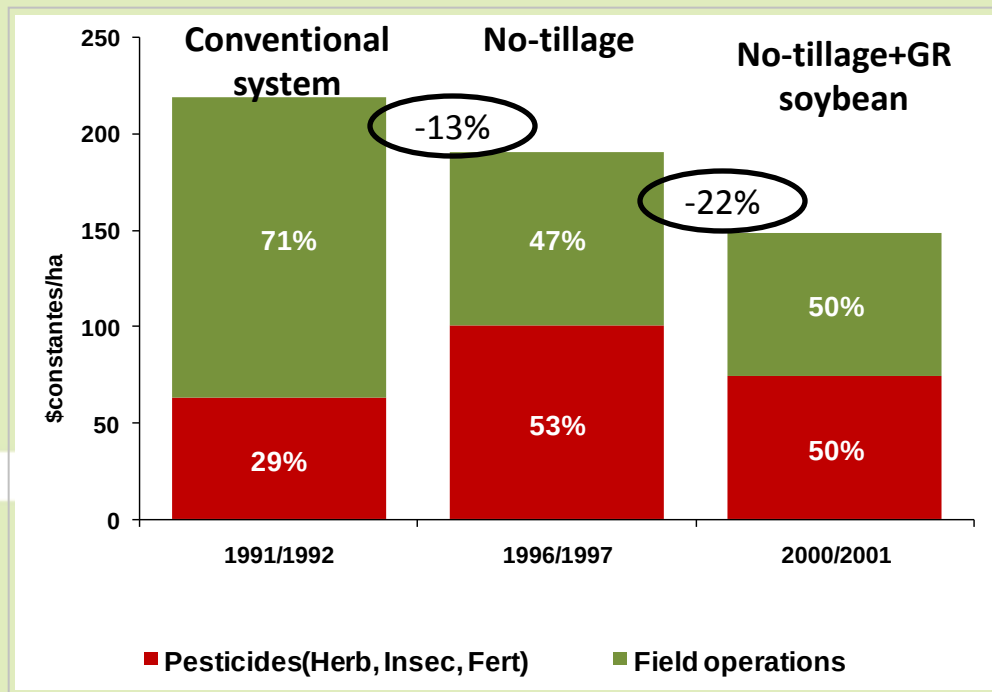
- water deficit
- soil erosion by water or wind.
- internal costs of transportation
- poor local use and processing of soybean





Soybean/ NWA/ Tucumán/ Costs/ Systems

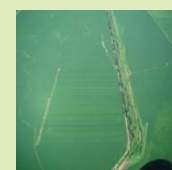
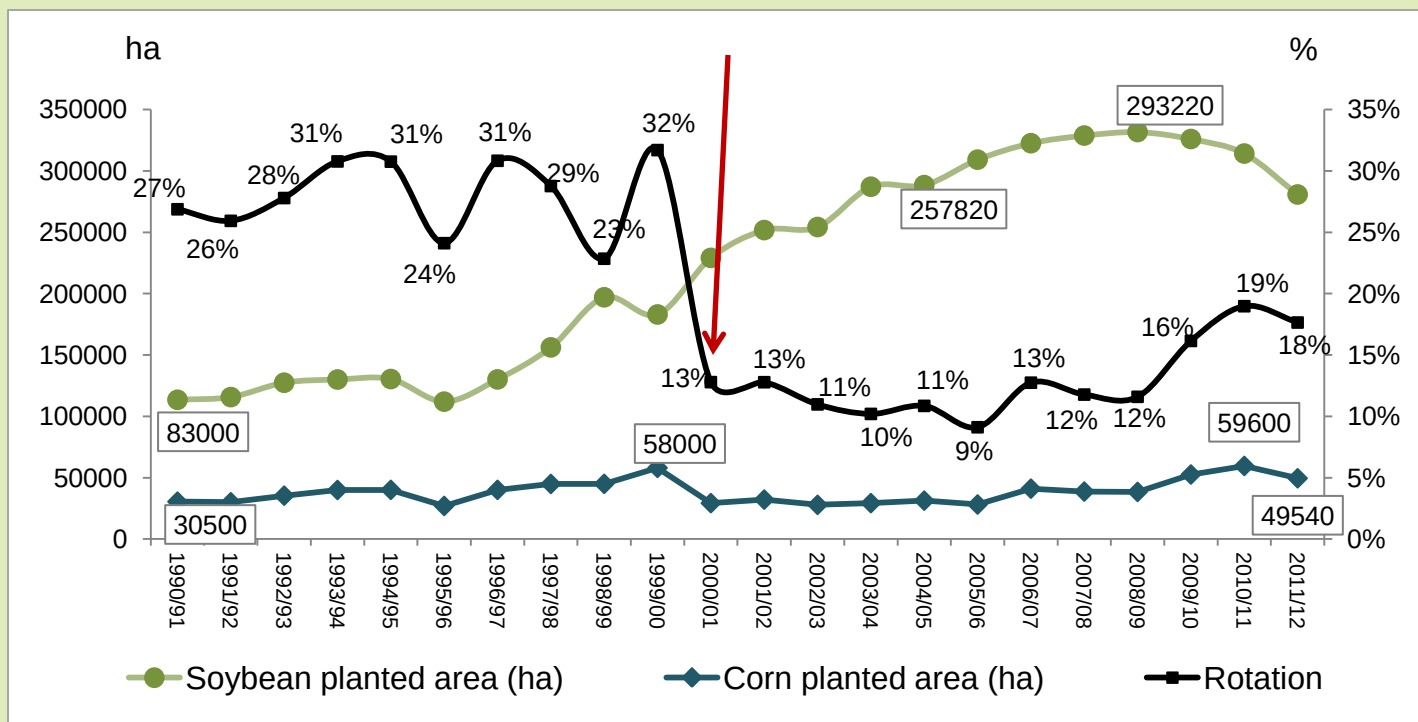
Soybean production costs under different planting systems in Tucumán and in NWA



- No-tillage systems started to be used in the early 1990s.
- In the late 90s farmers, rapidly adopted glyphosate-resistant (GR) soybean.
- No-tillage system improved water soil storage and crop yields, reducing production costs.
- These changes promoted soybean monoculture.
- Currently, more than 99% of the soybean area is under the no-tillage system and is planted with GR high yield potential cultivars.

Soybean/ NWA/Tucumán/ Costs/ Systems

Tucumán: evolution of soybean and corn planted area, and crop rotation level between 1990/91 and 2011/12

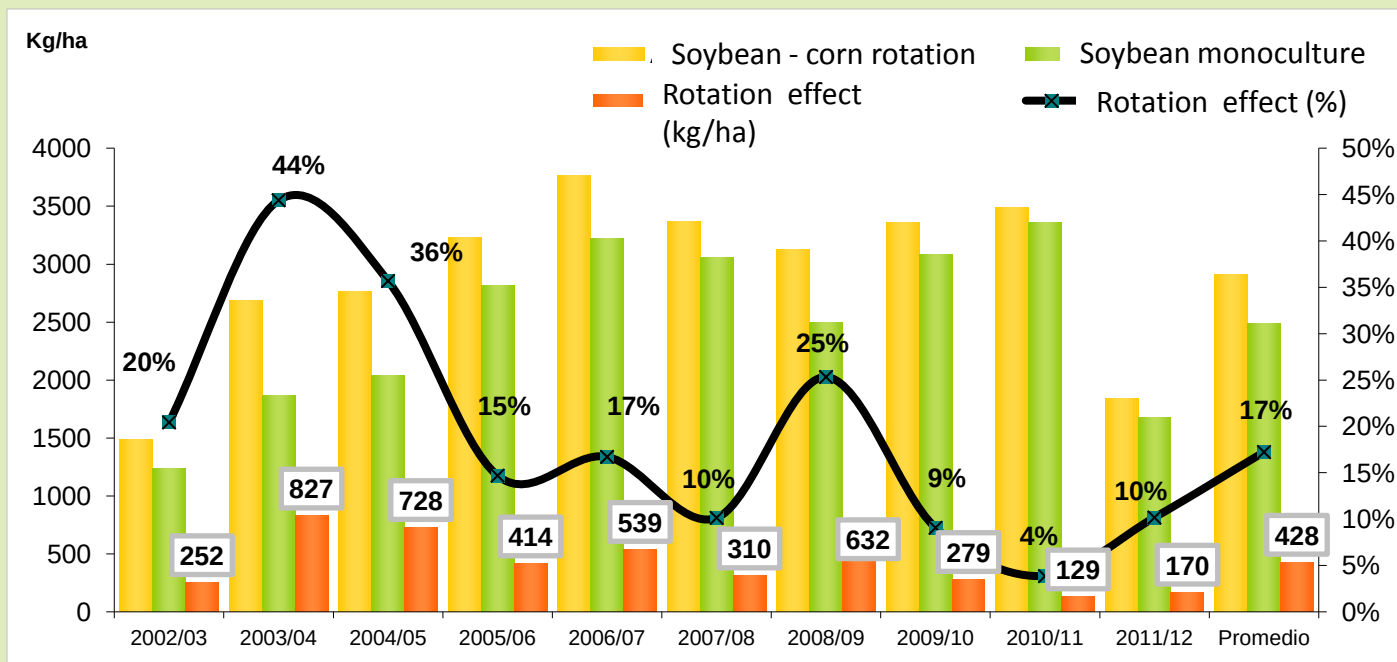


- For no-tillage to be a sustainable practice in NWA, rotation levels that ranging from 20 to 50% in the total planted area are required.



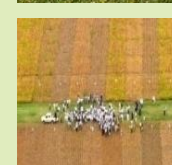
Soybean/ NWA/Tucumán /Costs/Systems

NWA soybean yield under corn rotation and in monoculture from 2002/03 to 2011/12



Source: Consorcios Rurales de Experimentacion Agricola , Region NOA

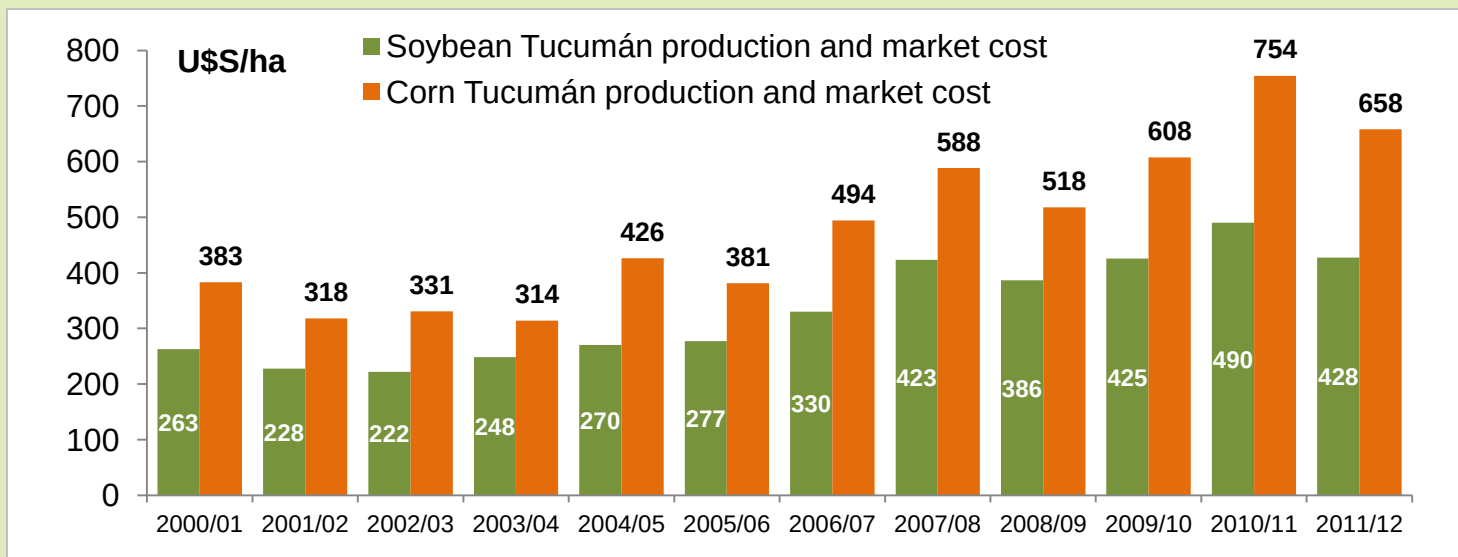
- In NWA soybean/corn rotation increases soybean yield by 20%.
- Rotation crop improves soil conditions and its water storage capacity, and to reduce pest incidence and resistance development, which increase costs and reduce the sustainability of the system.





Soybean/ NWA/Tucumán /Costs/Systems

Tucumán: evolution of soybean and corn planted area, and crop rotation levels between 1990/91 and 2011/12



- Although, in average, soybean yield are 20% higher under rotation with corn than under monocropping. Since corn production implies more costs and risks than soybean, farmers still prefer the latter.
- But, no-tillage, soybean monocropping, and GR varieties changed the complex of pests, weeds, and diseases affecting the crop, thus prompting the use of more or different chemicals for their control.

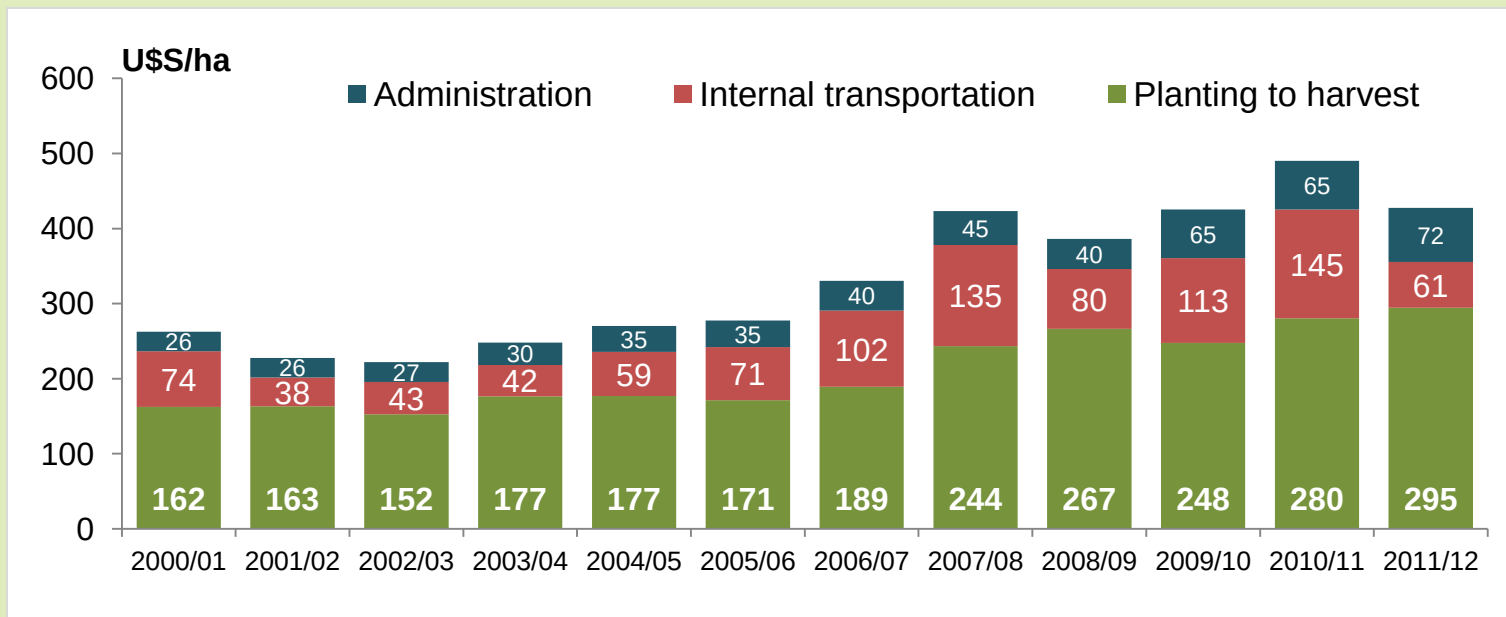




What happened with soybean production costs?



Evolution of soybean costs in Tucumán



Period 2000/01-2011/12
average annual rates

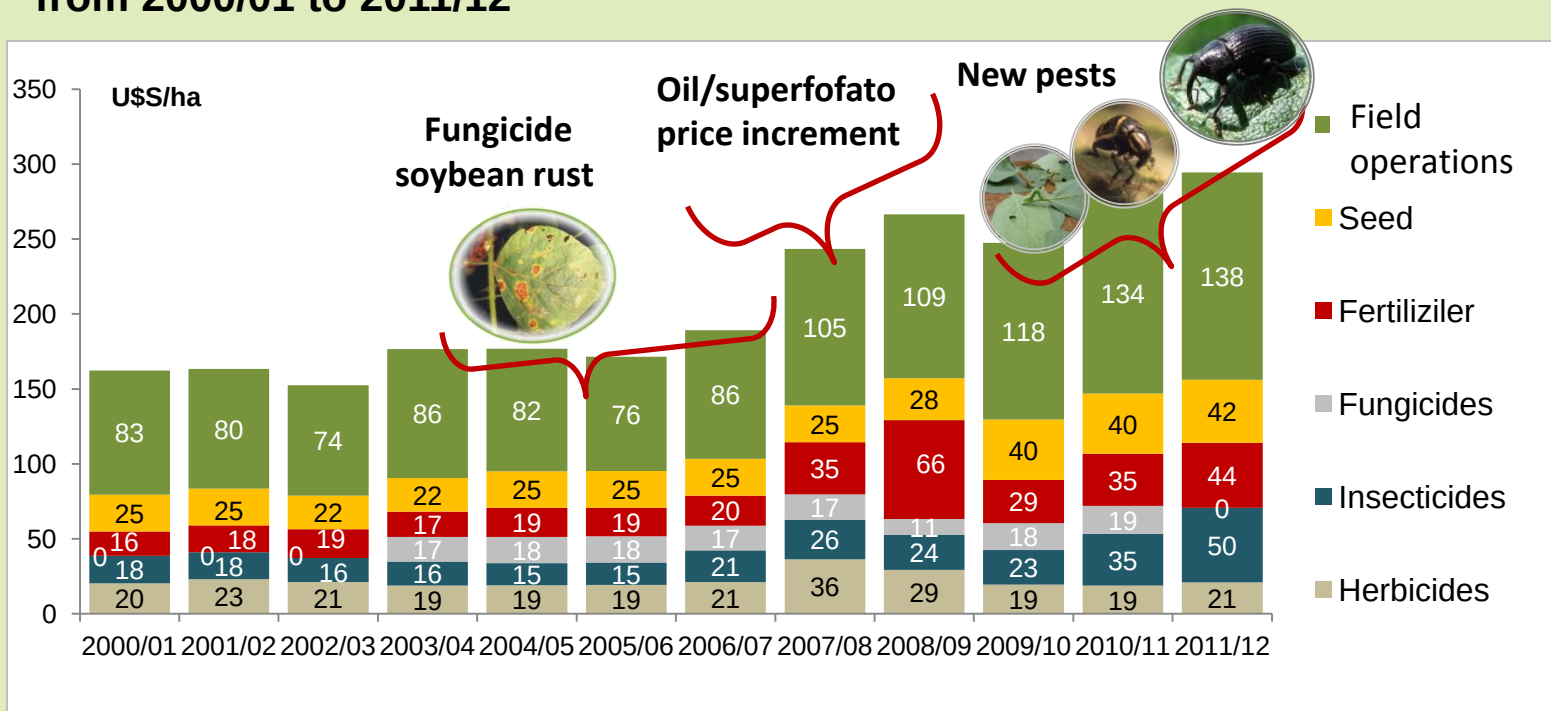
Administration: **10%**

Planting to harvest: **6%**

Total cost: **5%**

What happened with soybean production costs?

Evolution of soybean production costs from sowing to harvest in Tucumán from 2000/01 to 2011/12



Field operations: 6%

Period 2000/01-2011/12
Average annual rates

Fertilizer: 9%

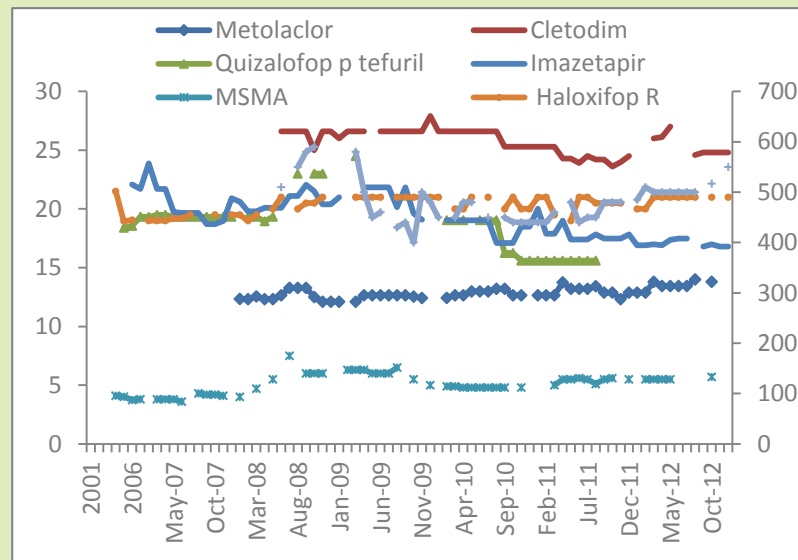
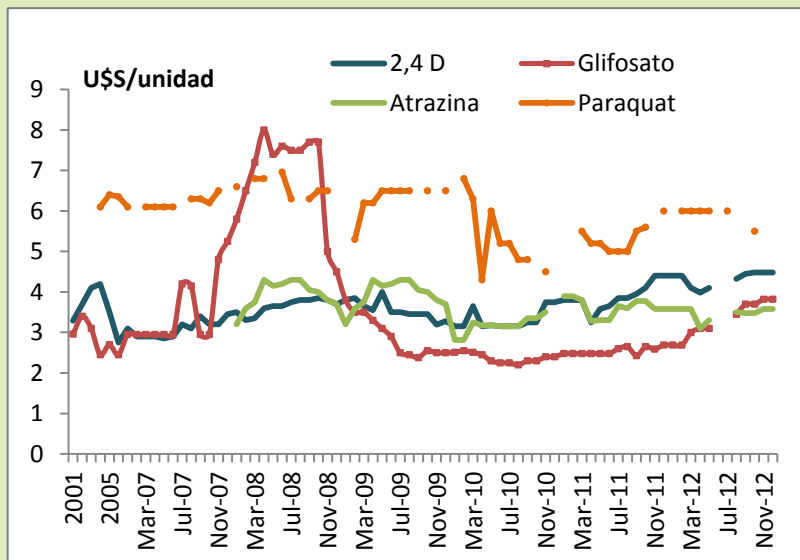
Insecticides: 9%

Seed: 5%

Expenditure on fungicides and herbicides remained unchanged

What happened with production costs?

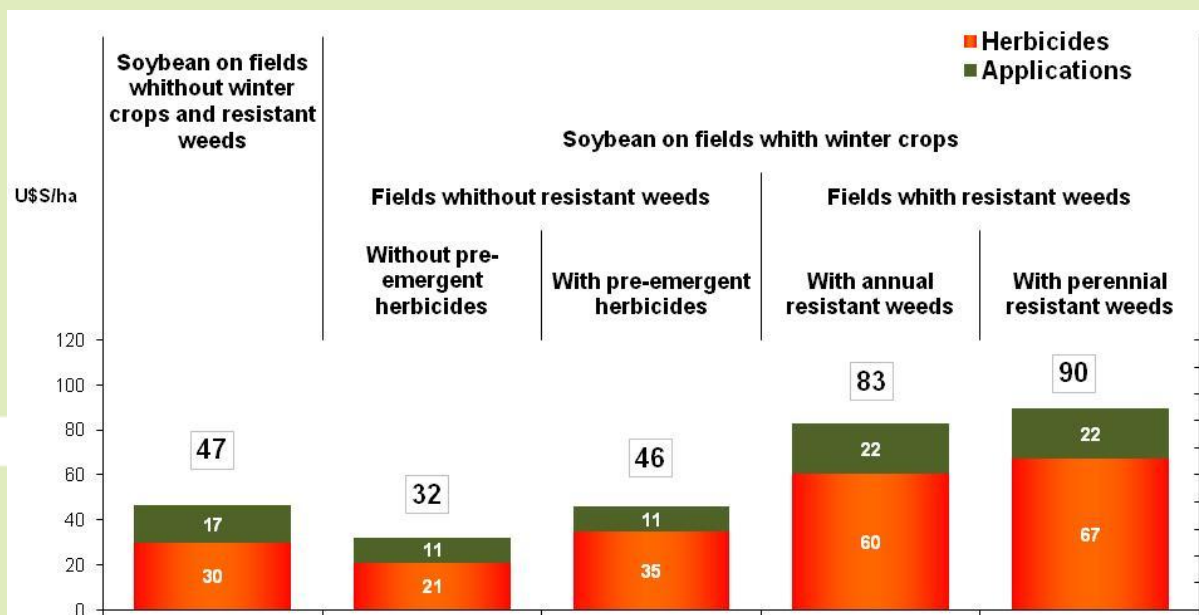
Herbicides price evolution in Tucumán from 2001 to 2012



- Expenditure on herbicides remained unchanged, considering the most common scenarios. Also, the price of different herbicides showed no significant increases.

What happened with production costs?

Weed control costs in 2011/12

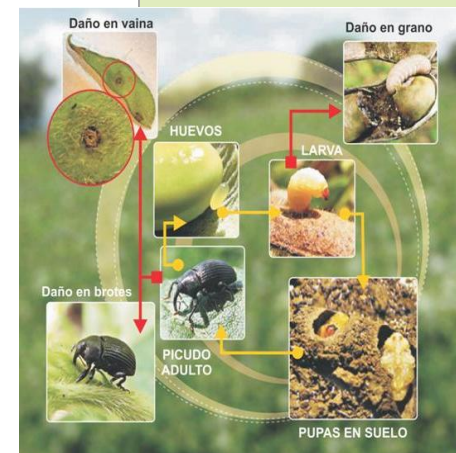
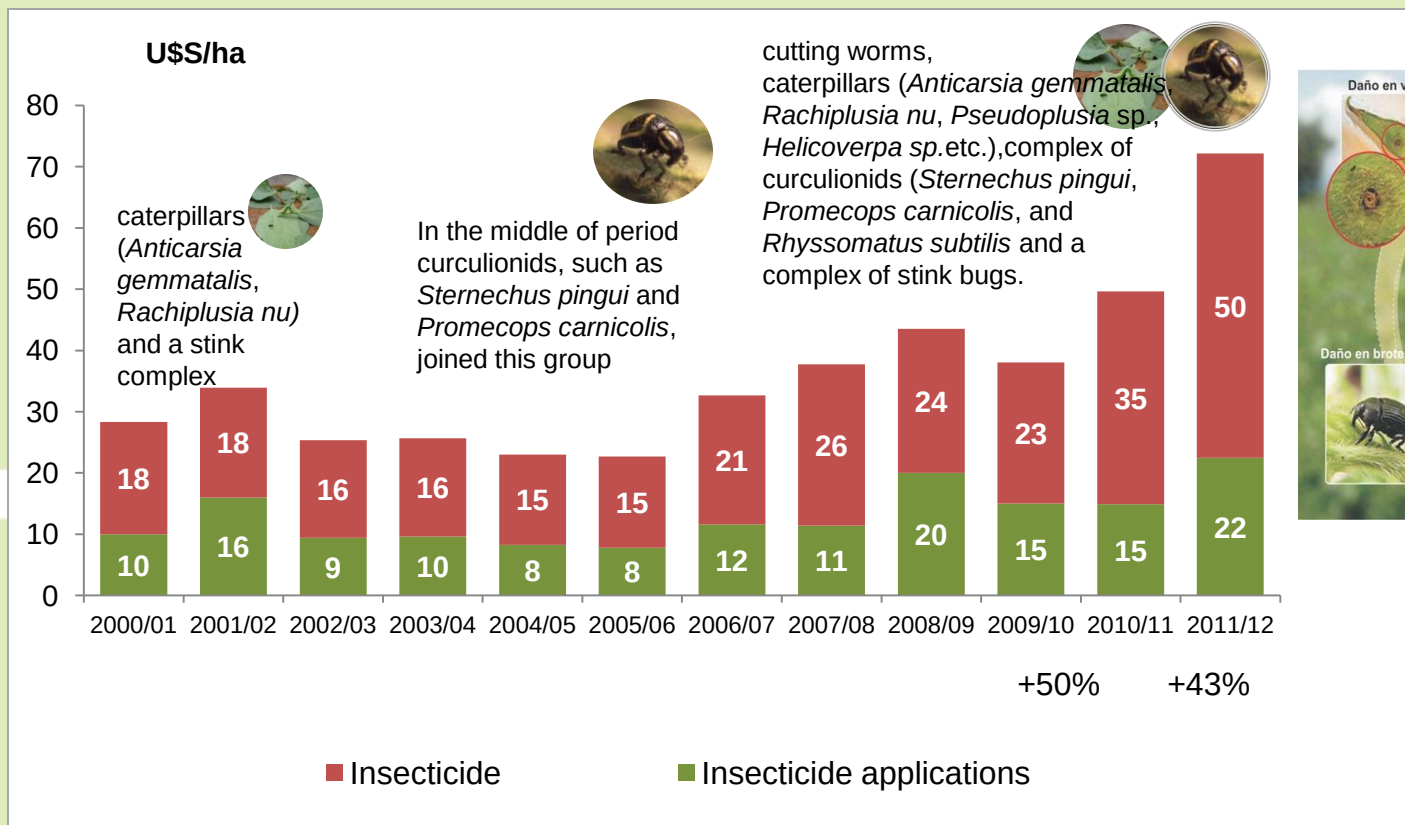


- In recent seasons, glyphosate resistant weeds have become more widespread, so weed control costs have risen by 120%.



What happened with production costs?

Pests control costs 2000/01-2011/12

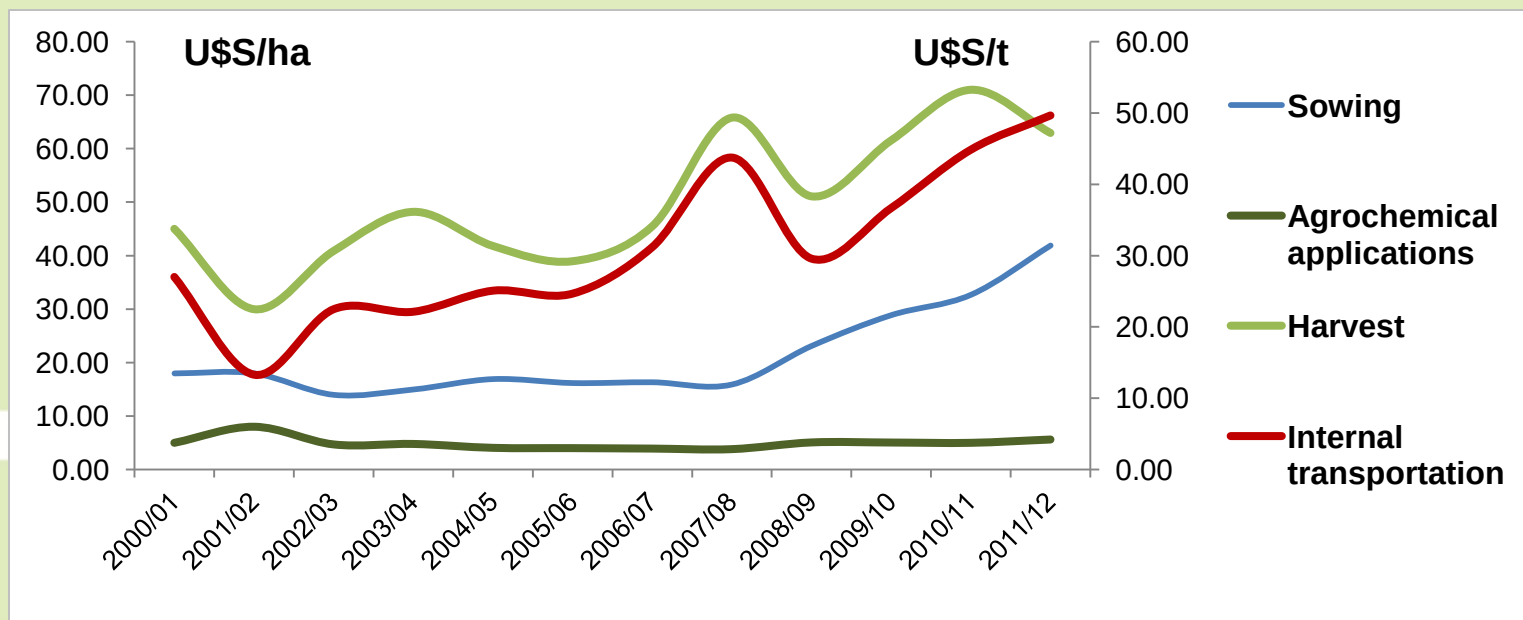


- Pest problem has become worse, because pests have become widespread



Field operations and internal transportation costs

Evolution of soybean field operations and internal transportation costs in Tucumán



**2000/01 and 2011/12
average annual rate**

Field operations (S+H+AA): 6%

Sowing (S): 8%

Agrochemical applications (AA): 1%

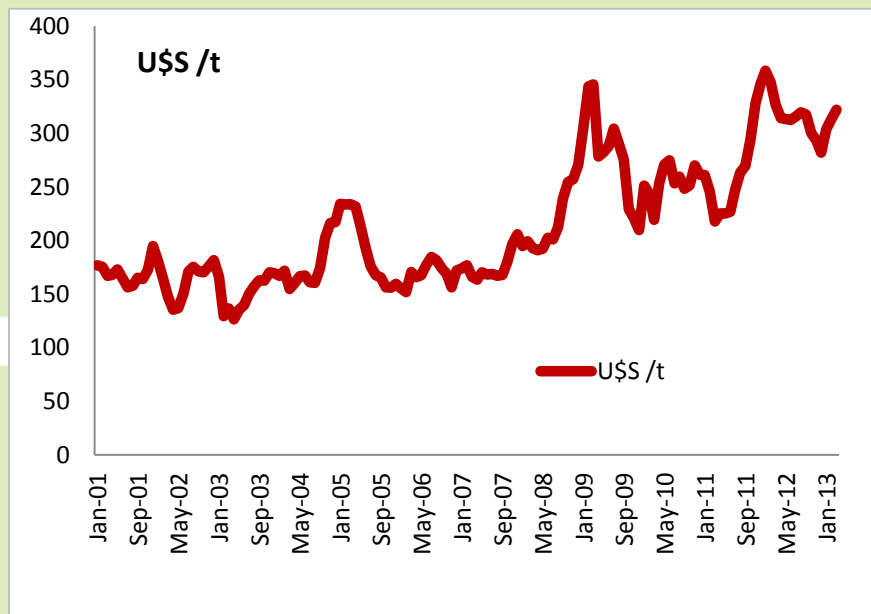
Harvest (H): 3%

Internal transportation: 6%

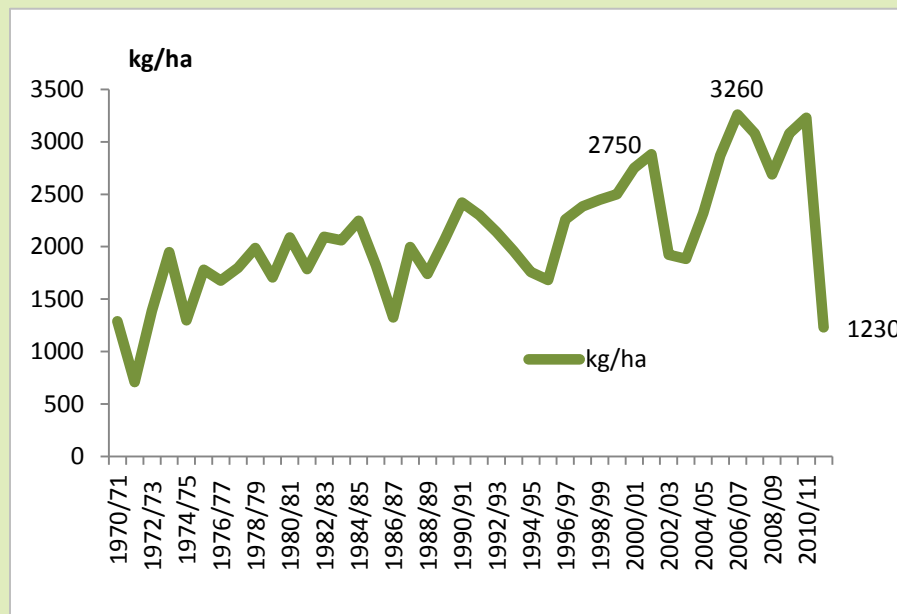


Soybean /price/yield/income

Evolution of domestic soybean price in Argentina (Rosario port)



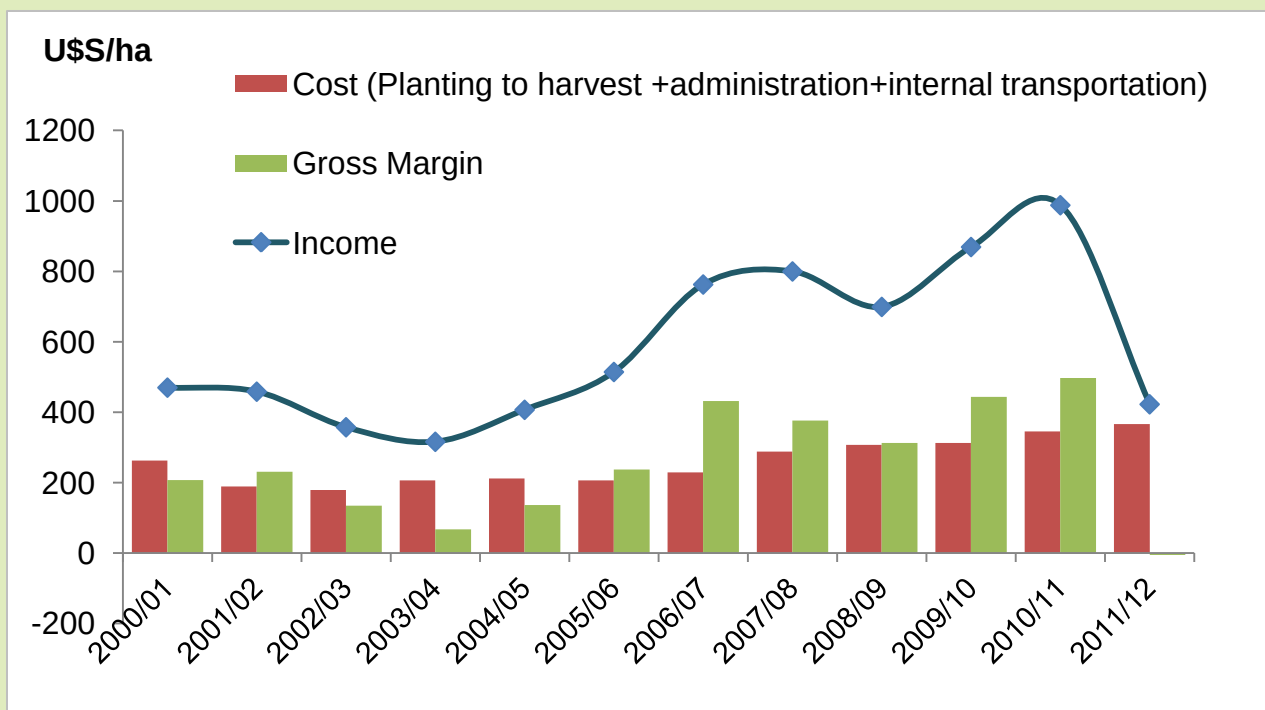
Evolution of average soybean average yield in Tucumán





Soybean / income/gross margin/costs

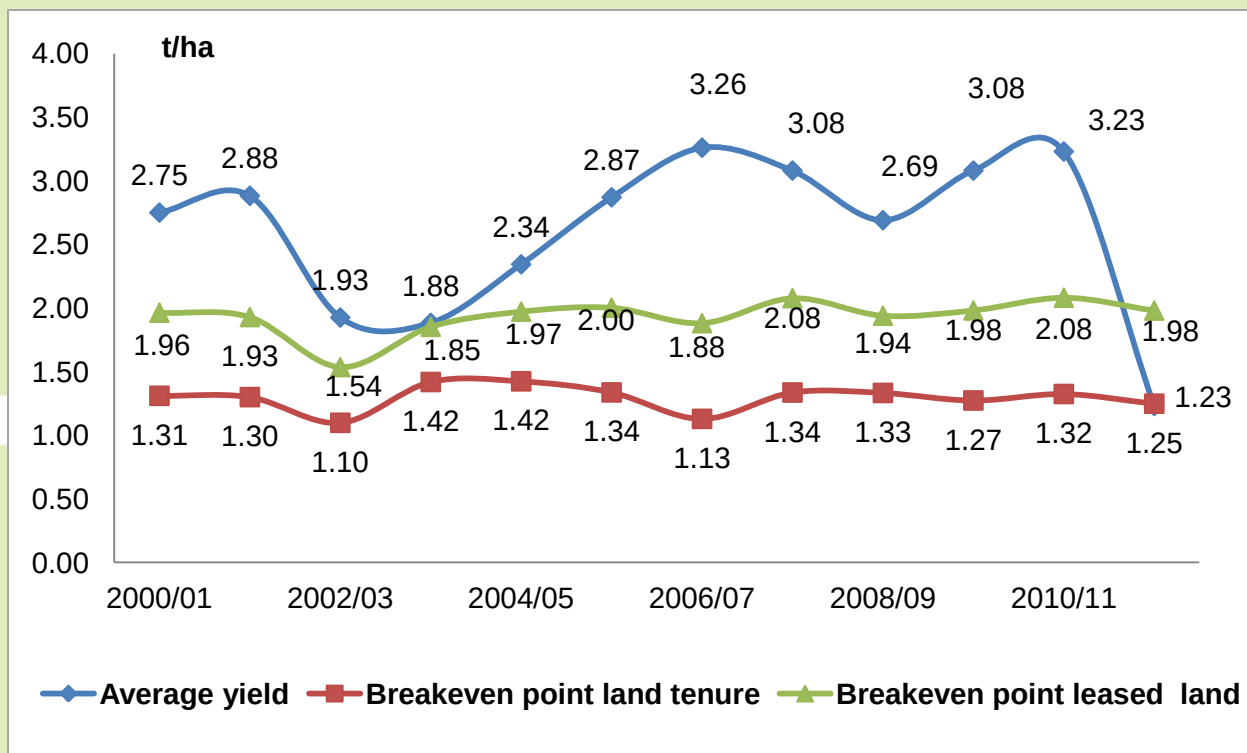
Tucumán: evolution of soybean production cost, gross margin and income from 2000/01 to 2011/12



- Throughout most of the period, gross margin was positive

Soybean / break-even point

Tucumán: evolution of yield breakpoint and average soybean yield from 2000/01 to 2011/12



- Break-even point is the point at which costs and income are equal.
- Throughout the period, break-even point ranged between 1.1 and 1.4 t/ha on land tenure and between 1.5 and 2.1 t/ha on leased land.



Conclusions

- In the analyzed period, soybean production and trade costs in Tucumán grew at an average 5% annual rate.
- In the last seasons, costs grew faster on account of the higher costs incurred to control newly detected pests and glyphosate-resistant weeds.
- Better soybean prices and yields led to more capacity to cover higher production costs, except for the 2011/12 season.
- Although during most of the period break-even yield was below average yield, in drought years these yield values were very close. This situation was worse in the case of soybean planted on leased land.



Conclusions

- NWA soybean farmers rapidly adopted technologies that reduced costs. However, and in spite of recommendations, they resorted to practices such as crop rotation, when they faced critical situations such as the detection of *Rhyssomatus*.
- Soybean production growth in NWA is a result of work done in research, and of farmer's investments in technologies that help to improve yields. Nonetheless, it is necessary to increase agrochemicals and crop rotation practices.
- Rotation crop improves soil conditions and its water storage capacity, reduce pest incidence, consequently improves yield and reduce costs incurred for their control. Agrochemical rotations reduces resistance development, a problem which increase costs and reduce the sustainability of the system.

Thank you all for your kind attention

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