The No-till path during the last 20 years in Argentina

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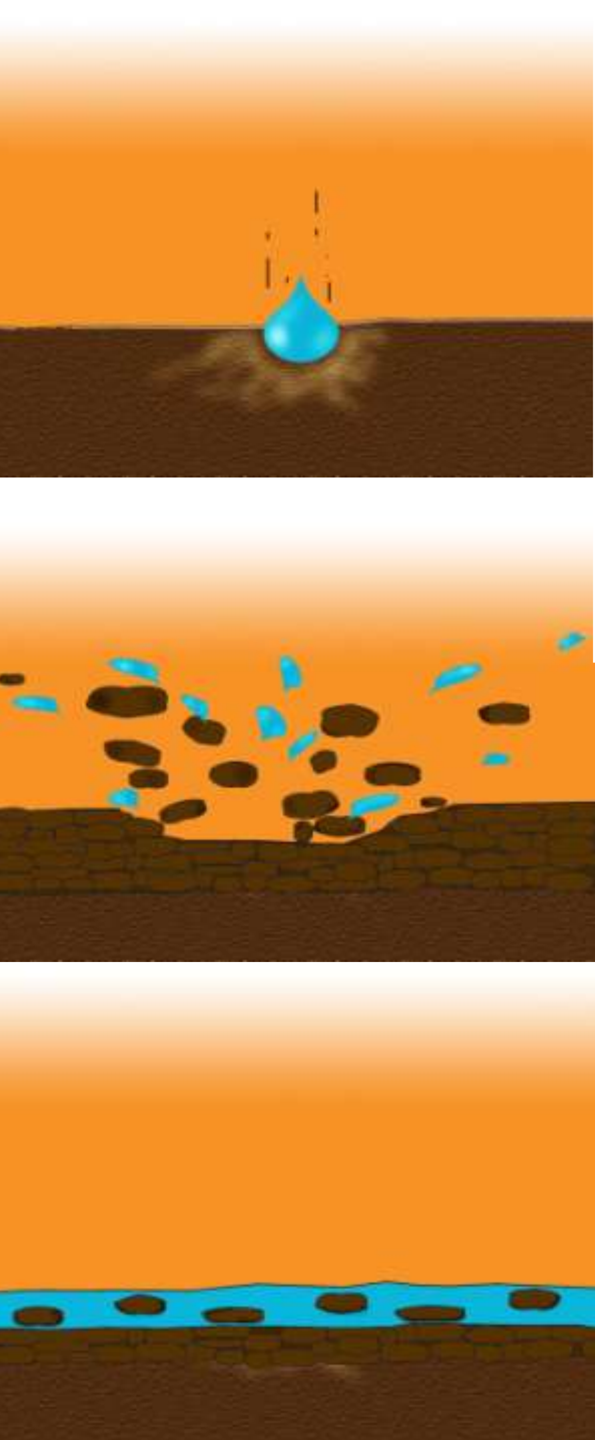
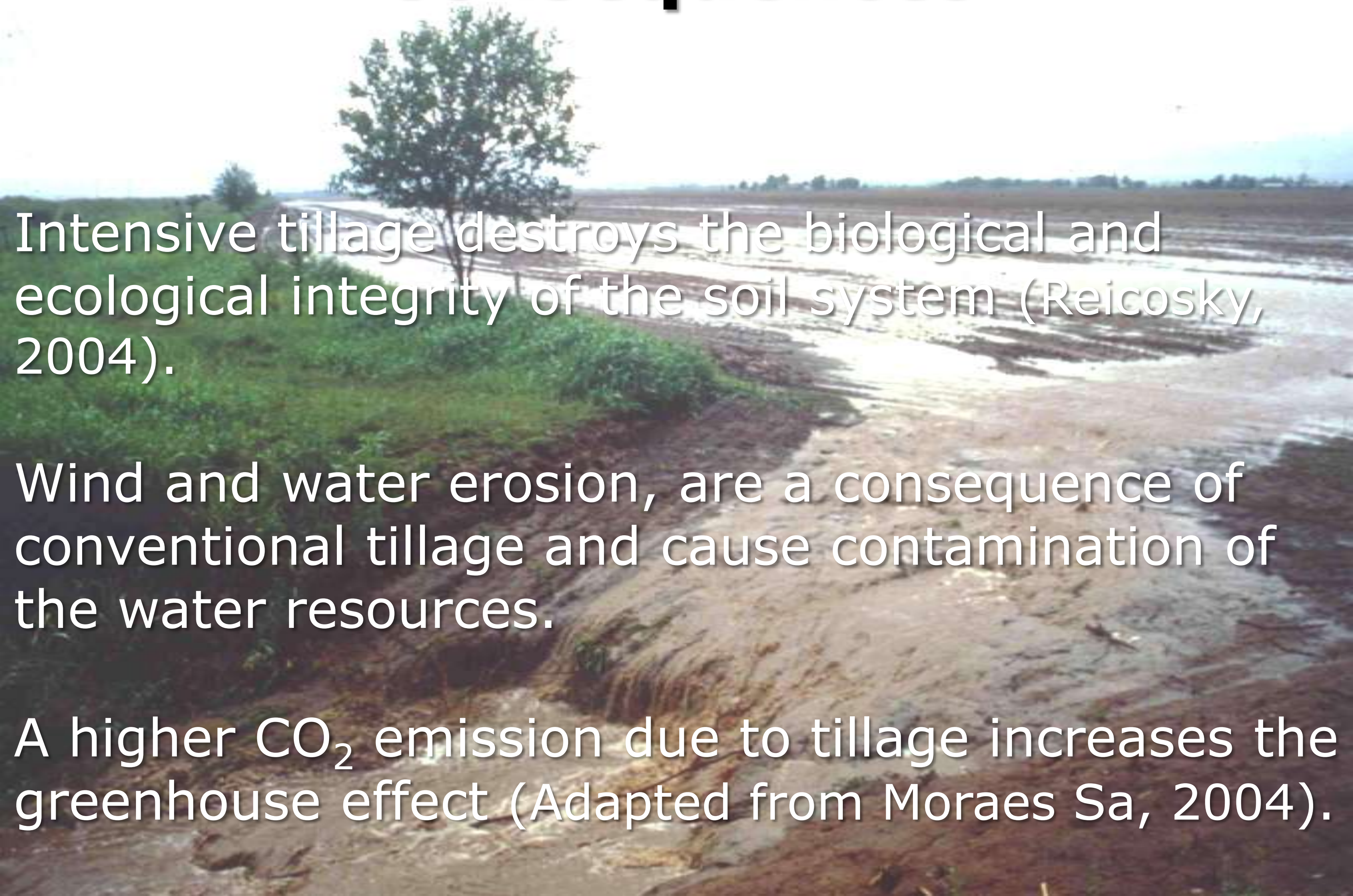
1. We started with no-till to reduce soil erosion…

…because this was a serious problem for our farmers!!



Physical Degradation

Consequences



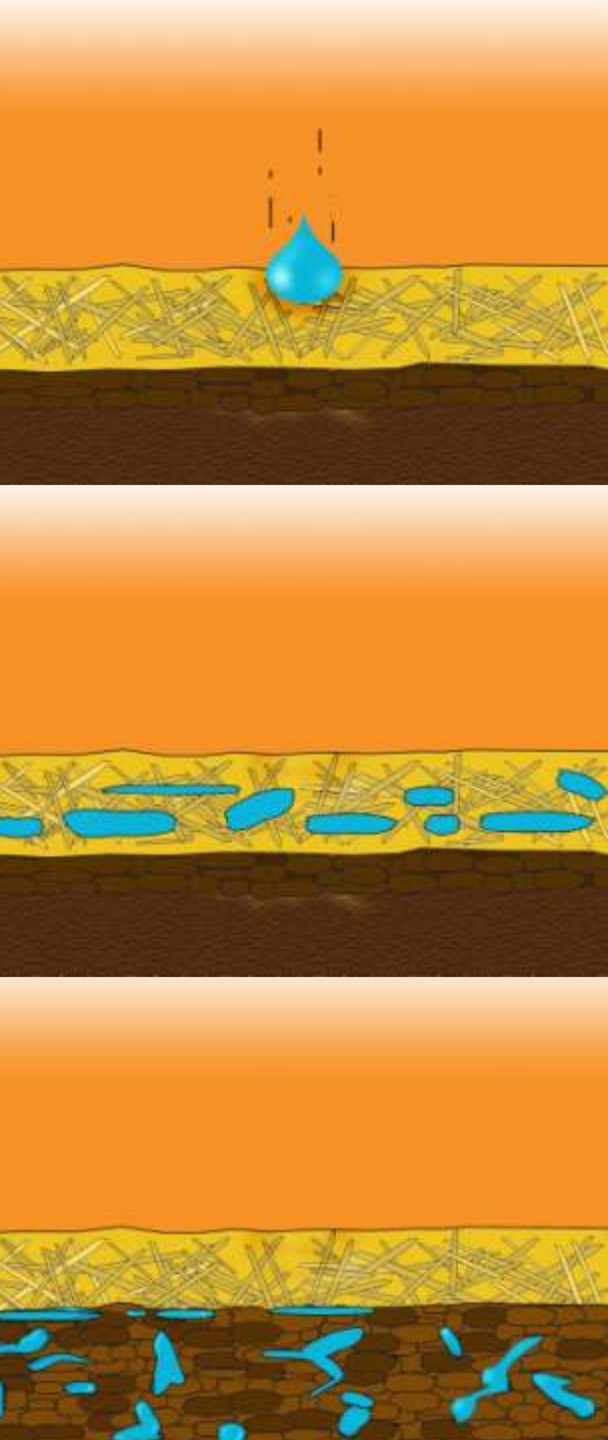
Intensive tillage destroys the biological and ecological integrity of the soil system (Reicosky, 2004).

Wind and water erosion, are a consequence of conventional tillage and cause contamination of the water resources.

A higher CO_2 emission due to tillage increases the greenhouse effect (Adapted from Moraes Sa, 2004).

2. Then…
we realized that more water was available…
…and that, with the adoption of no-till,
the "water economy" was changing.

That water had to be used by the farmer!!!



WATER LOSS DUE TO TRANSPIRATION AND EVAPOTRANSPIRATION
NO-TILL AND CONVENTIONAL TILLAGE

	No-Till		Conventional Tillage		Rainfall
Month	transpiration	evaporation	transpiration	evaporation	
May	0	0.8	0	2.5	7.2
June	3.0	0.4	2.6	2.7	3.9
July	5.0	0.1	3.8	0.8	4.0
August	3.7	0.1	2.9	0.6	1.6
September	0.6	0.2	0.4	1.0	3.6
	12.3	1.6	9.7	7.6	20.3
totals	13.9 in.		17.3 in.		

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Source: Aapresid

Crop Rotation Intensity
(D. Beck, 1996)

- Put the stored water in NT to work
- Less fallow and more water used by crops
- Climate, soil, latitude
- Appropriate intensity reduces risks
- Native vegetation is the best indicator of the appropriate intensity

What to do to improve the rainfall water use efficiency?

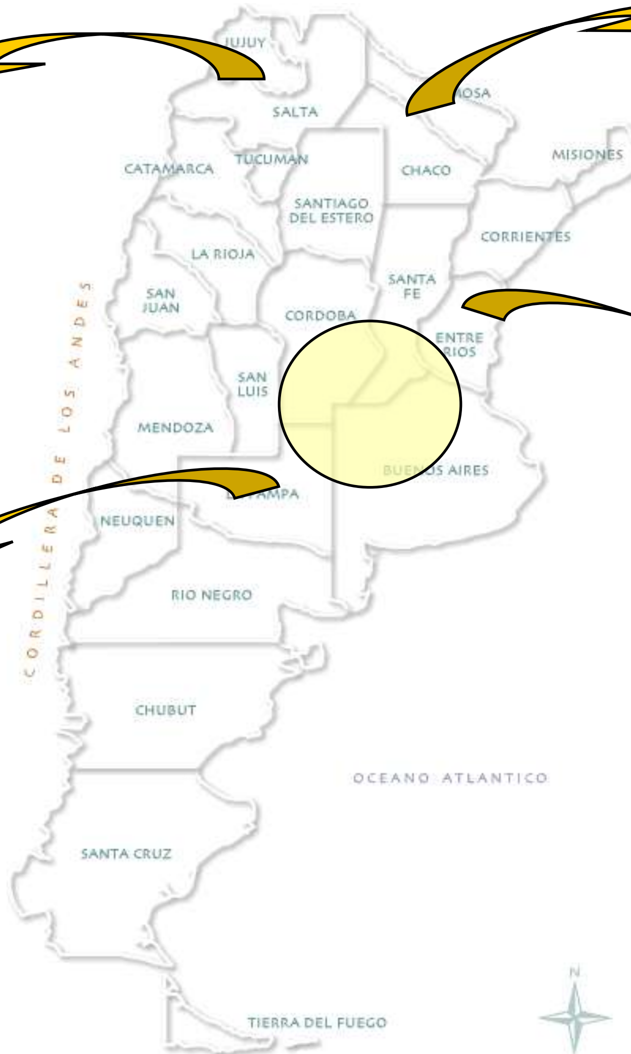
- ✓ **Cover the soil with crop residues in an homogeneous and durable way**

- ✓ **Maintain a stable structure , mainly in the first inches on the soil profile**

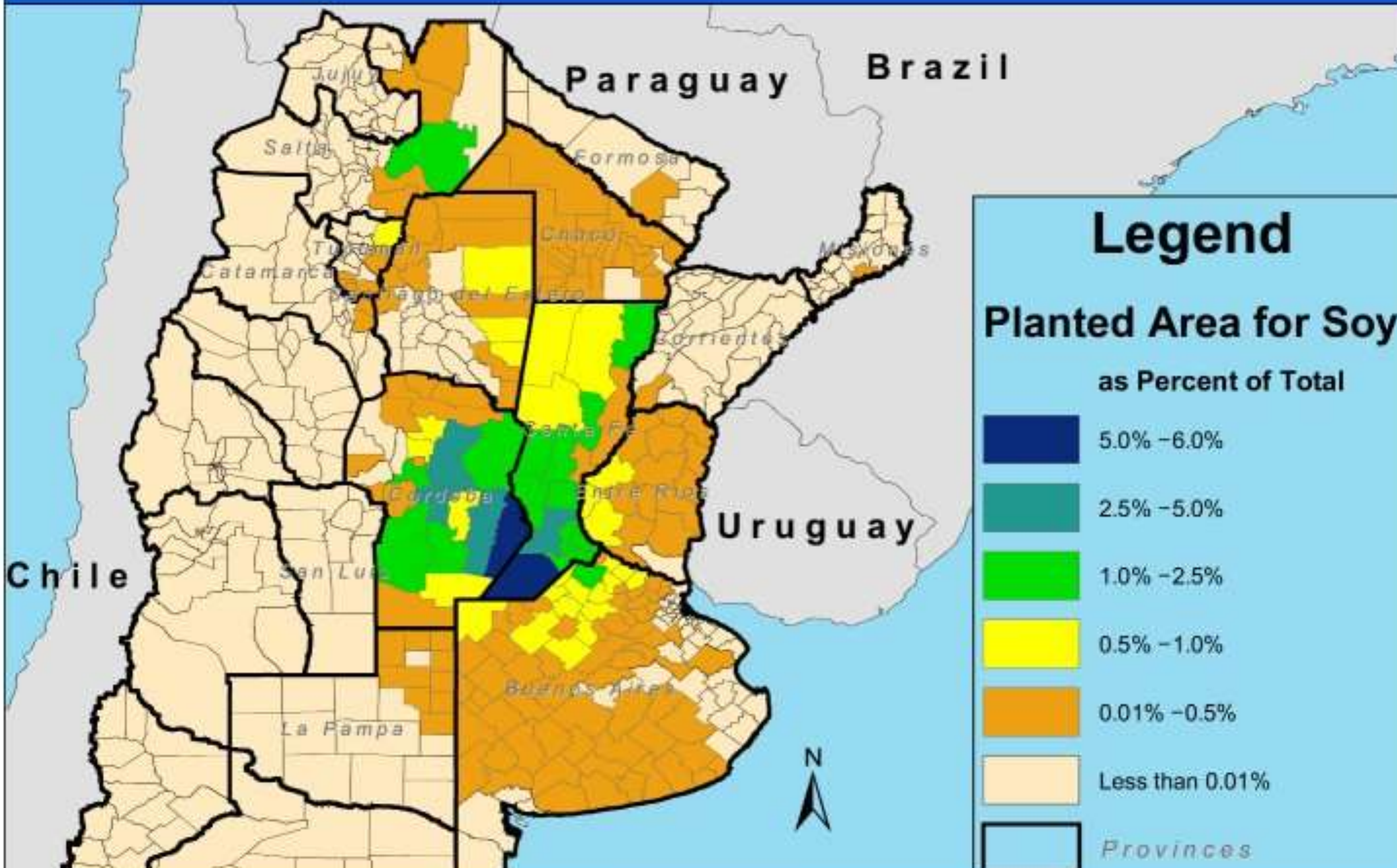
3. New regions could be brought into production with NT,

so this allowed an expansion of our agricultural area.

Increased cropped area



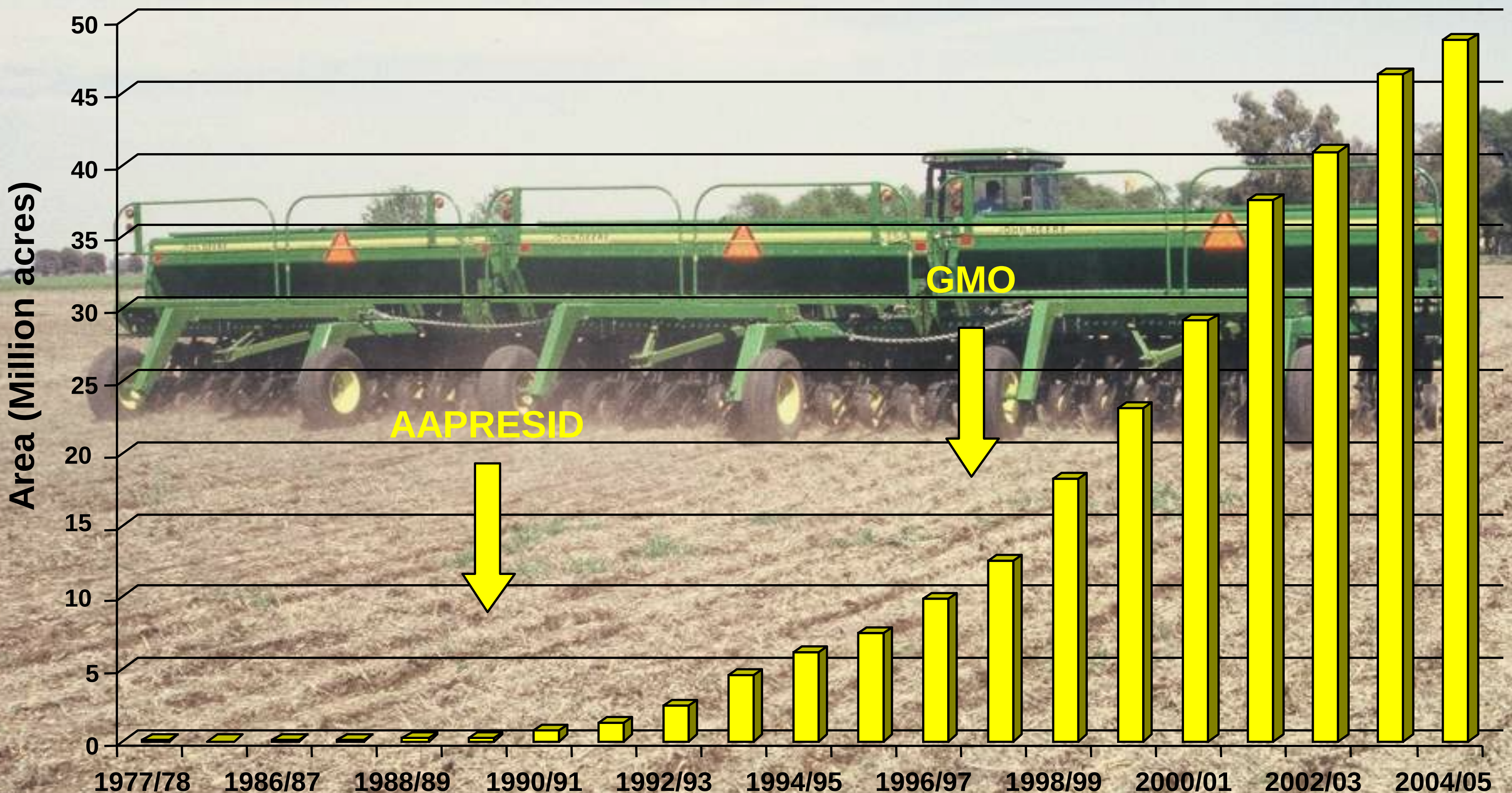
Argentine Soybean Planted Area



U.S. Department of Agriculture
Foreign Agricultural Service
Production Estimates and Crop Assessment Division
http://www.fas.usda.gov/pecad/
Robert.tetrault@usda.gov

Data Source:
Argentine Agricultural Secretariat (SAGPyA)
Department-level statistics for the five-year average of
planted area for soybean (1997/98 to 2001/02)
http://www.sagpya.mecon.gov.ar/

No-Till evolution in Argentina (1977-2005)



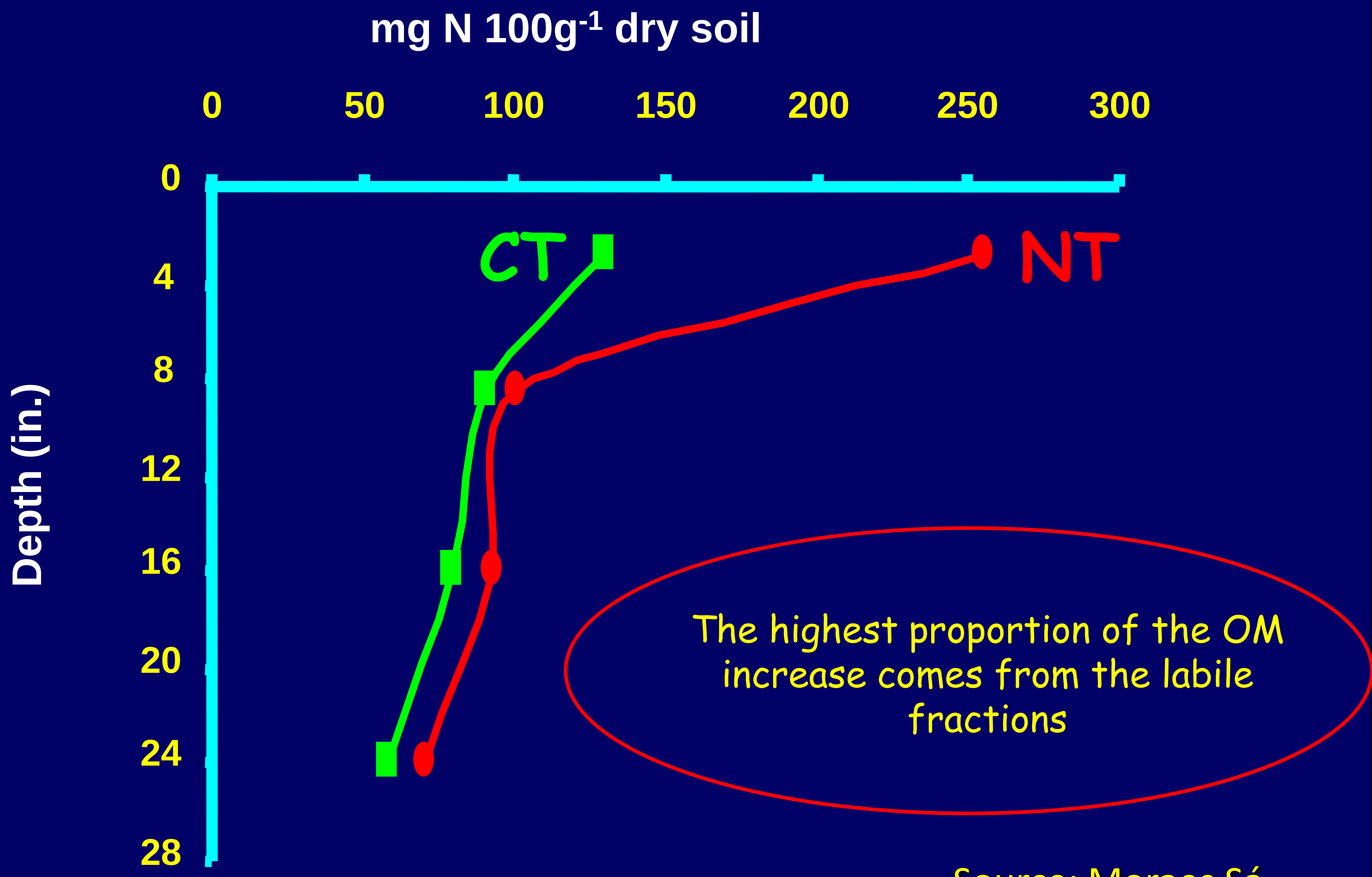
Source: AAPRESID (2005)

4. Carbon dynamics were modified:

NT alone was not enough for increasing the C levels, we needed to think on crop rotation intensification, balanced fertilization, etc…


The soil organic matter is considered the most important simple indicator to define the soil quality
Larson & Pierce, 1991
OM is a key component in NT
Moraes Sa, 1993

Organic N in a no-till field and conventional tillage after 10 years



Source: Moraes Sá

Crop Rotation

Planned and ordered crop sequence with the objective:

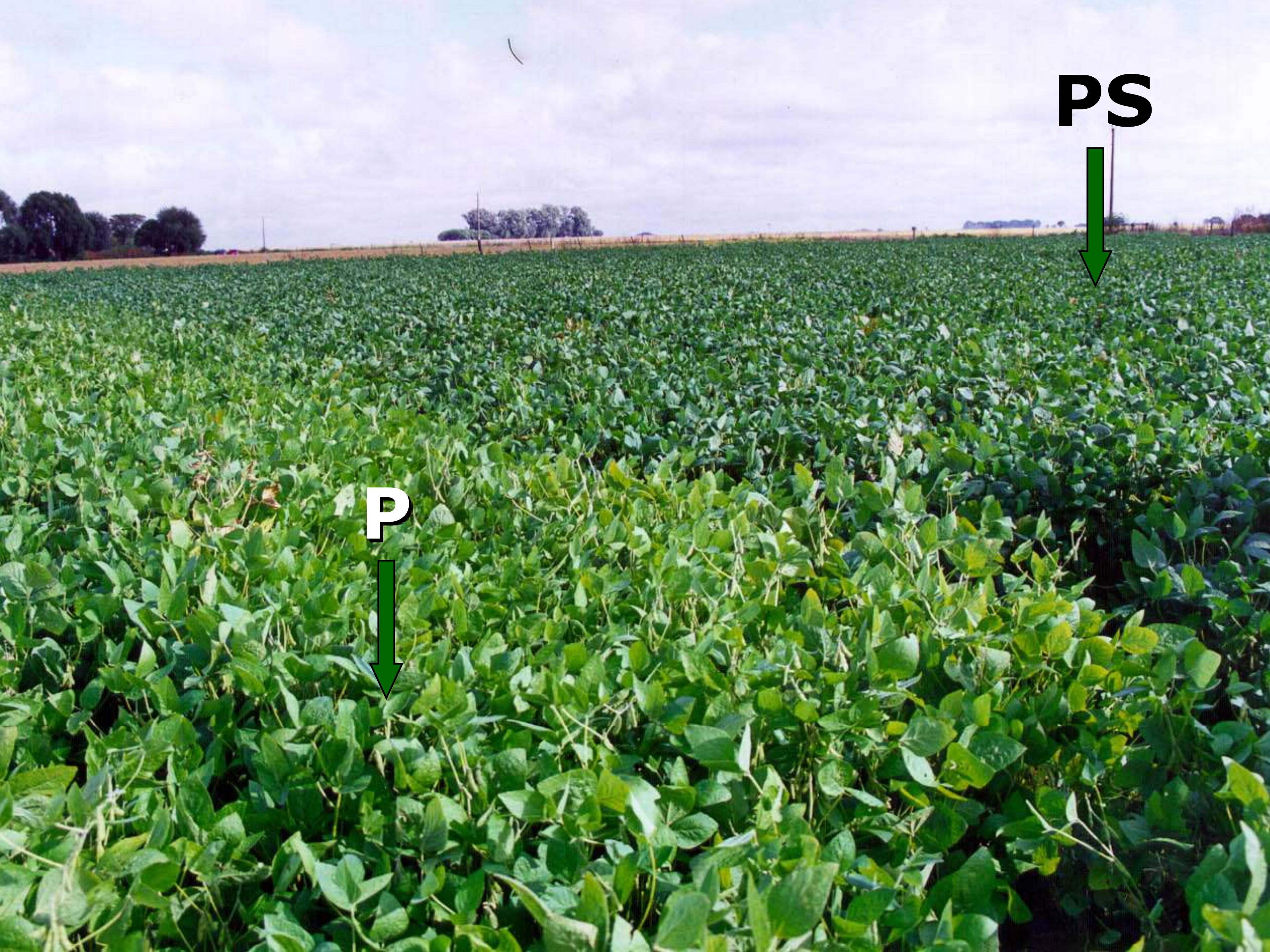
- **Maximize productivity,**
- **minimize risks,**
- **and preserve the involved resources.**

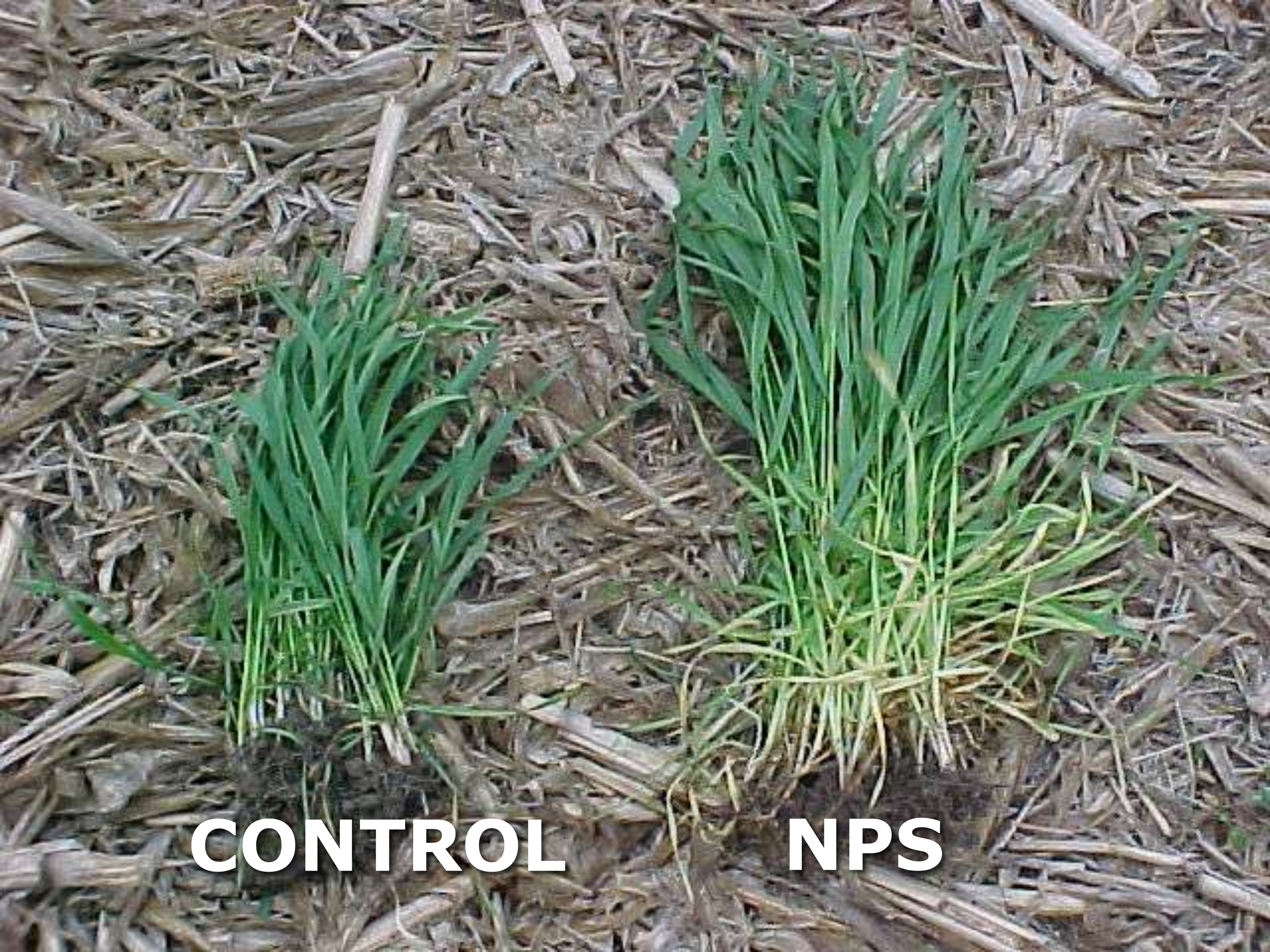





Fertilization of the crop rotation

- **Balanced fertilization**
- **Higher yield response in the rotation**
- **Nutrient residual effects**
- **Balance inmovilization-release**
- **Soil biological activity**


PS
P


CONTROL
NPS

Management to increase Soil Organic Carbon

Paustian, 1997

- Reduce or eliminate tillage
- Rotations with corn, grain sorghum, pastures.
- Include permanent gramineae and legumes
- Increase time of soil covered with vegetation
- Increase production and return residue to the soil

✓ No Till

✓ Crop Rotation

✓ Diversity

✓ Intensity

✓ Fertilization

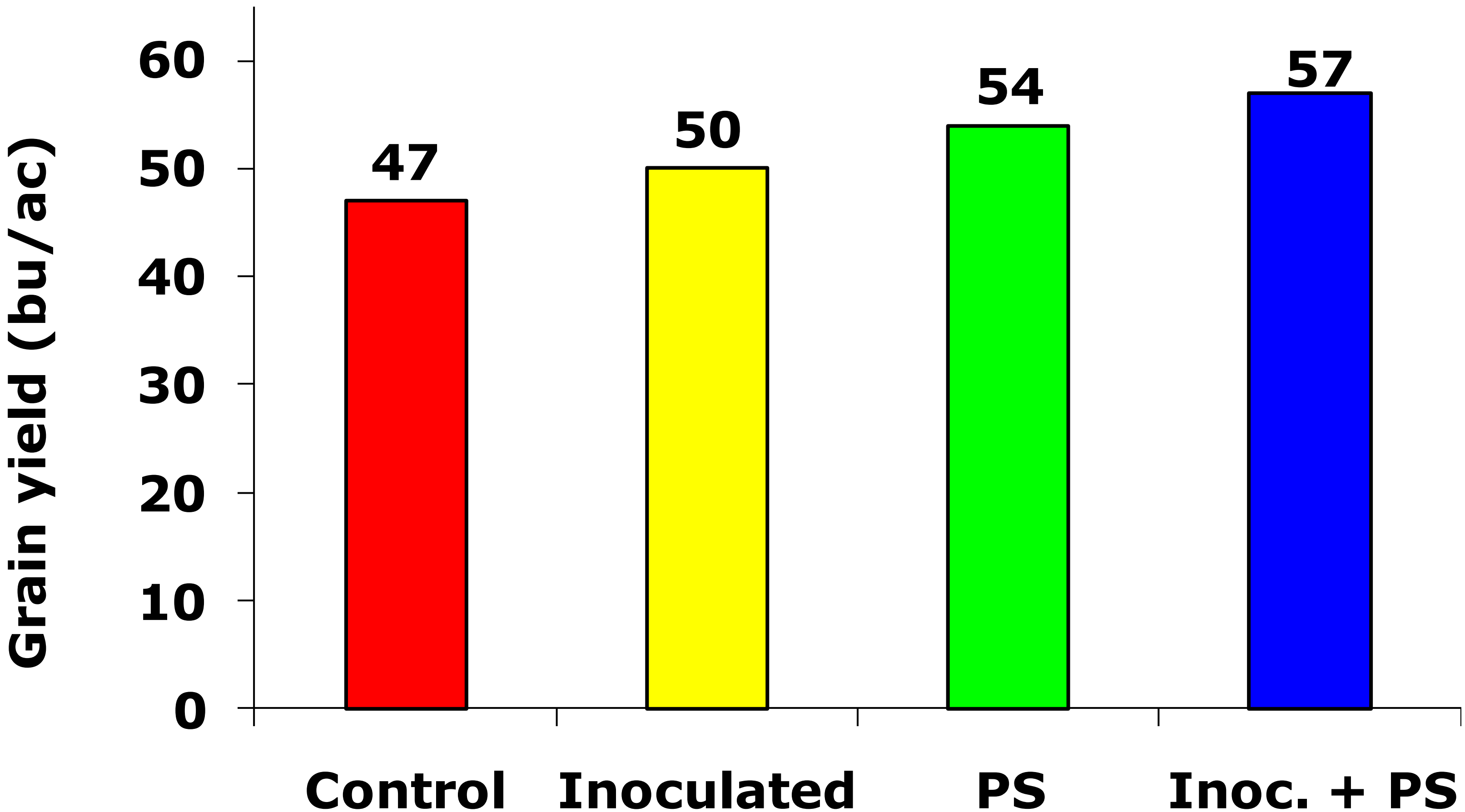
5. A new paradigm started with Nitrogen, because in NT, N dynamics are modified and more "biological" N is available for crops, but difficult to quantify.

Biological Nitrogen Fixation with legumes

Inoculation and PS fertilization in soybean

AAPRESID-Nitragin-Rizobacter-ASP 2004/05

4 sites: Santa Fe and Buenos Aires Provinces



Cover crops: Hairy vetch (*Vicia villosa*)

Why hairy vetch?

Because no-till conceptually evolves.

Crop rotation intensification and diversification.

Transform water in dry matter: zero fallow + increase the size of the water storage tank.

Soil covered with residues and presence of live roots.

Nutrient cycling and deep water utilization.

Improve Carbon, Nitrogen and Organic Matter balances.

Lorenzatti, 2008

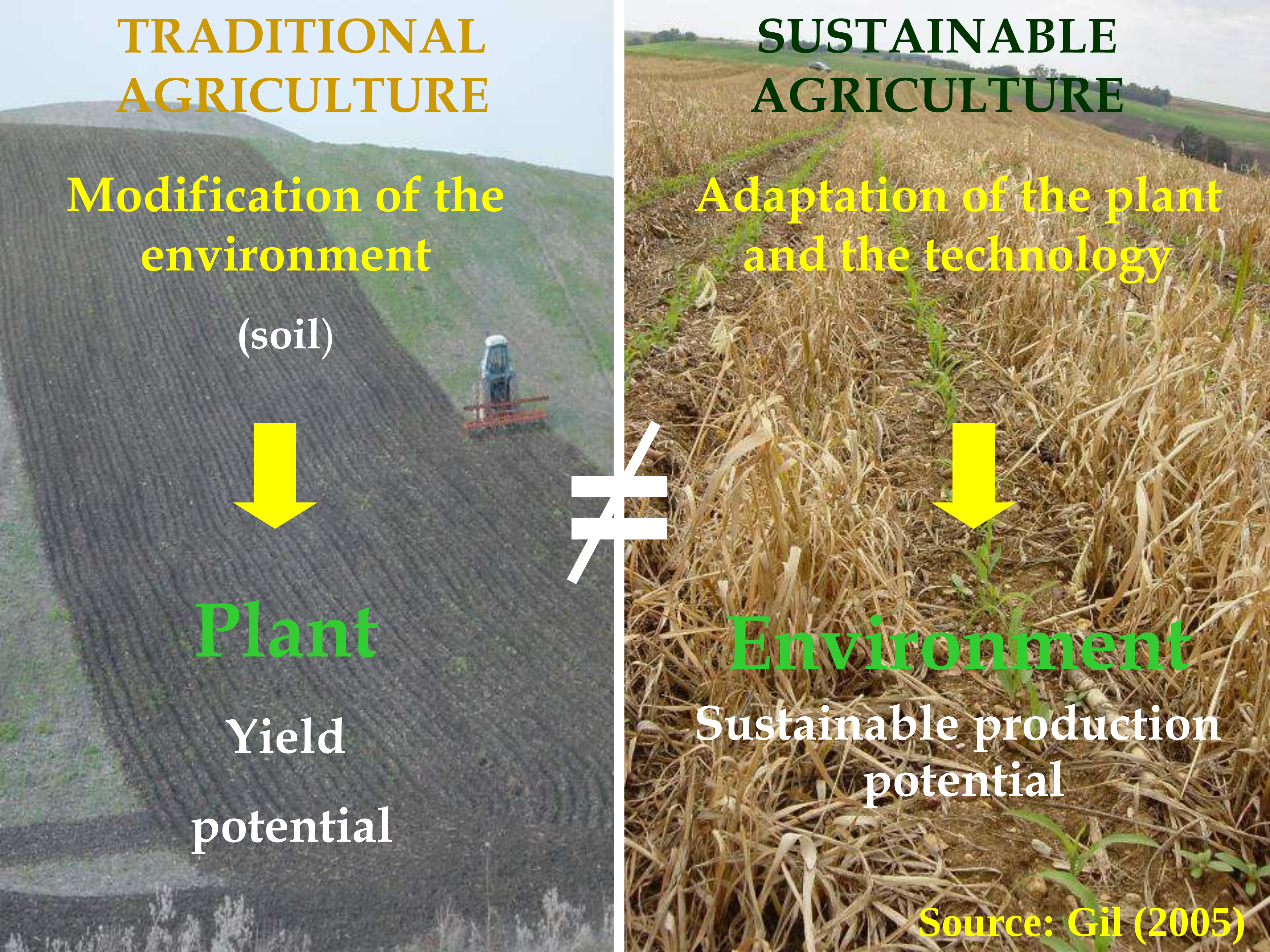
How much N can hairy vetch add to the system?

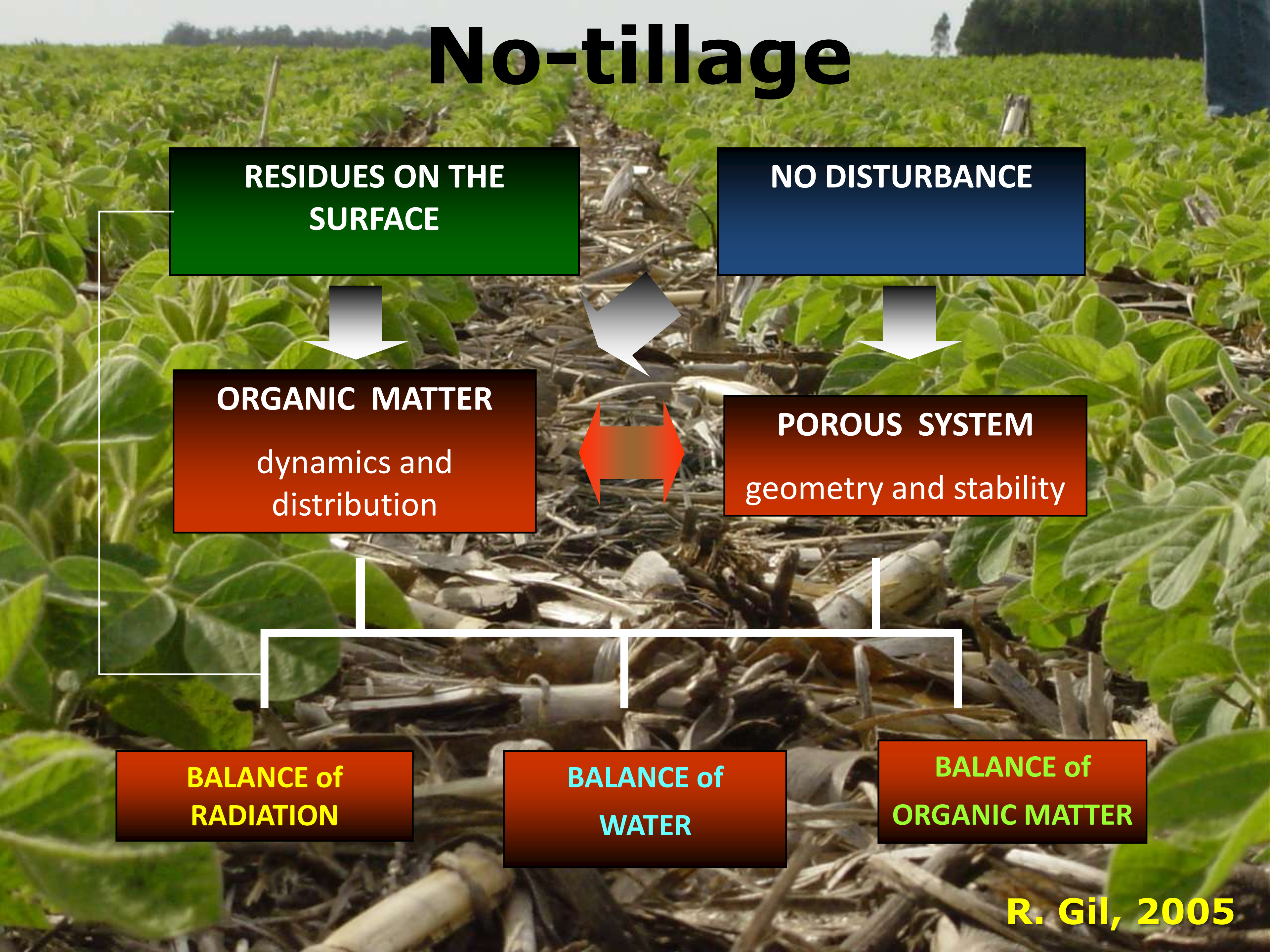
- **80 to 90 lb N/ac. to the following corn crop.
  Ebelhar et al., 1984. Agron. J. 76:51-55**

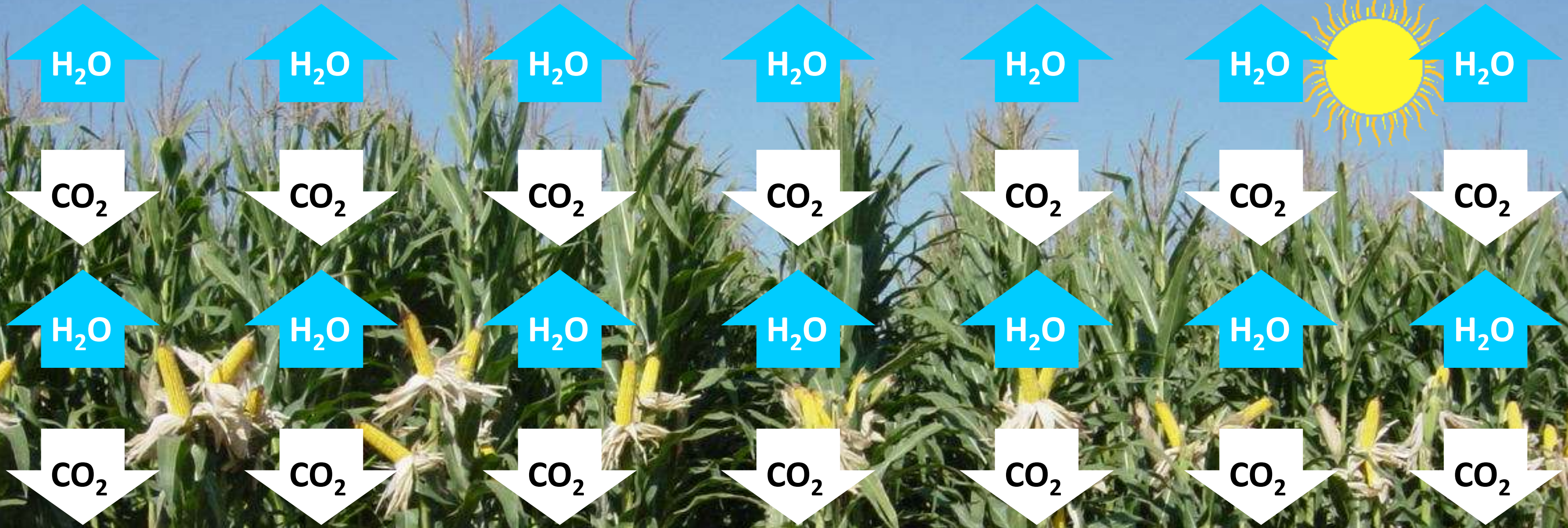
- **67 to 112 lb N/ac. to the following corn or grain sorghum.
  Blevins et al.,1990. Agron. J. 82:769-772.**

- **The accumulation and N contribution via hairy vetch as a cover crop was higher with the late burning (2 weeks). Same trend in corn grain yield planted after the cover crop.
  Sainju and Singh,2001. Agron. J. 93:878-886.**

6. We need to think that we are farmers that are managing an offer of environmental resources (nutrients, water, light, CO_2, etc).

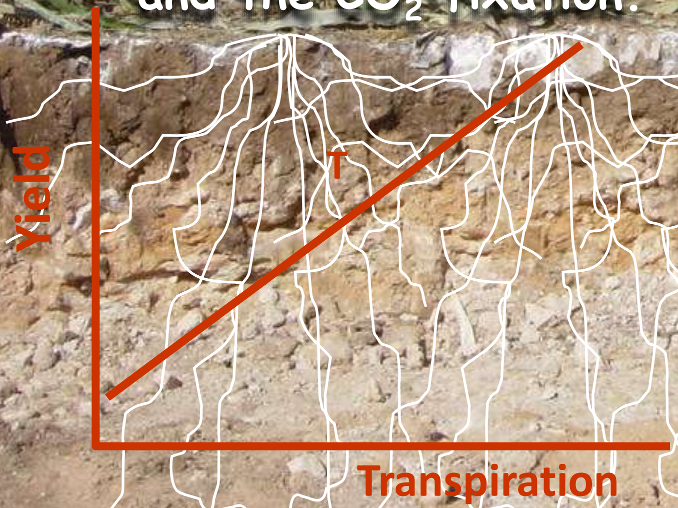

TRADITIONAL AGRICULTURE
Modification of the environment
(soil)
Plant
Yield potential
≠
SUSTAINABLE AGRICULTURE
Adaptation of the plant and the technology
Environment
Sustainable production potential
Source: Gil (2005)


No-tillage
RESIDUES ON THE SURFACE
NO DISTURBANCE
ORGANIC MATTER
dynamics and distribution
POROUS SYSTEM
geometry and stability
BALANCE of RADIATION
BALANCE of WATER
BALANCE of ORGANIC MATTER
R. Gil, 2005



I. The more energy received by a crop, the more water it can transpire, and the more CO_2 it can fix.

II. The biomass production is closely related to the transpiration and the CO_2 fixation.



Source: R. Gil 2006

a. To capture the greatest part of the water resource.

b. To utilize and exchange eficiently the water for the CO_2 at the stomata level to produce photosyntates.

c. To convert eficiently the asimilates in a hasvetable form: forage or grain.

I – Context Analysis
The dilemma

"The humanity faces today a dilemma with no apparent solution, between the ghost of the lack of food for an increasing demand in quantity and quality, or a destruction of the natural resources needed to produce them".

II– The no-till system
Consequences

- 96% less soil erosion.
- 66% less fuel use.
- Maintenance or improvement of the organic matter.
- Higher water use efficiency.
- Increase in soil fertility.
- Lower production costs.
- Higher production stability and higher yield potential.

TANGIBLE BENEFITS FOR THE FARMER

II– The no-till system
Benefits, beyond the farmer

- Better soils
- Less competition for drinkable water (strategic resource)
- Higher water quality (lower erosion and contamination risk)
- Better atmosphere, positive impact in the climate change
- Lower pressure on more fragile areas (by an increase in yields)
- Possibility of producing in more fragile areas without the known risks of Conventional Tillage (CT).

BENEFITS TANGIBLE FOR THE SOCIETY (EXTERNALITY)

III– Productive and environmental quality management system in CA (QMS/CA)

Objectives:

- To provide tools for a <u>professional agronomical management</u>, by the ordered registry of information and the analysis of the soil quality and efficiency indicators.

- To show to the rest of the society how are the production processes and its impact on the environment, allowing <u>to capture the value of the positive externality</u> that the CA makes in it.

III– Productive and environmental quality management system in CA (QMS/CA)

Components:

- Principles & Criteria:
    - RTRS, RSB, ISGA, RTSPO, FSC, FAO

- Management indicators:
    - in the soil
    - resource use efficiency

- Good Agricultural Practices Protocol (GAP's)

III– Productive and environmental quality management system in CA (QMS/CA)

Potential uses

1. Associated to the agronomical management:

- **Decision making in ag management (crop rotations, fertilization strategies, etc).**
- **Analysis of the evolution of the impact management in the system (time).**

2. Associated to existing business or easily accessible

- **Land rental: as a requirement of the owner or as a differentiation tool.**
- **Real estate (History agronomically certified).**
- **Credit evaluation (environmental and production balance).**
- **Tax reductions.**

3. Associated to new businesses

- **Business by contract with companies that can segregate products (Ex: foods, biofuels, seeds)**
- **Country brand (or provinces):**

  Better price, access to preferential markets.

Certified Agriculture

It is the production alternative that better combines the interests – many times confronted – of reaching a production:

- **Economically viable for farmers.**
- **Environmentally sustainable.**
- **Socially accepted.**
- **Energetically efficient.**

Certified Agriculture

A <u>commitment</u> that Aapresid, as organization assumes, to contribute to the increase of the wellbeing of the local and global society, in the conflict solution Productivity vs. Environment.

Thank you!!!!

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www.aapresid.org.ar/english

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Certified Agriculture

The evolution of NT


For most of the people, agriculture is a synonym of
TILLAGE

No-Till Adoption Benefits

- greater stability and yield increase
- increase in cropped area
- lower production costs

NEW AGRICULTURAL AREAS

No-till

Variety → **RR Soybean**

expansion of the agricultural boundaries

In 1995/96: 6.000.000 ha
In 1999/2000: 9.000.000 ha
Today: 16.000.000 has
Rate increase since 1995 was 1.000.000 ha

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WATER LOSS DUE TO TRANSPIRATION AND EVAPOTRANSPIRATION NO-TILL AND CONVENTIONAL TILLAGE

	No-Till		Conventional Tillage		Rainfall
Month	transpiration	evaporation	transpiration	evaporation	
May	0	21	0	63	179
June	76	10	64	68	97
July	124	3	95	21	101
August	92	2	72	14	41
September	15	5	11	25	91
	307	41	242	191	509
totals	348		433		

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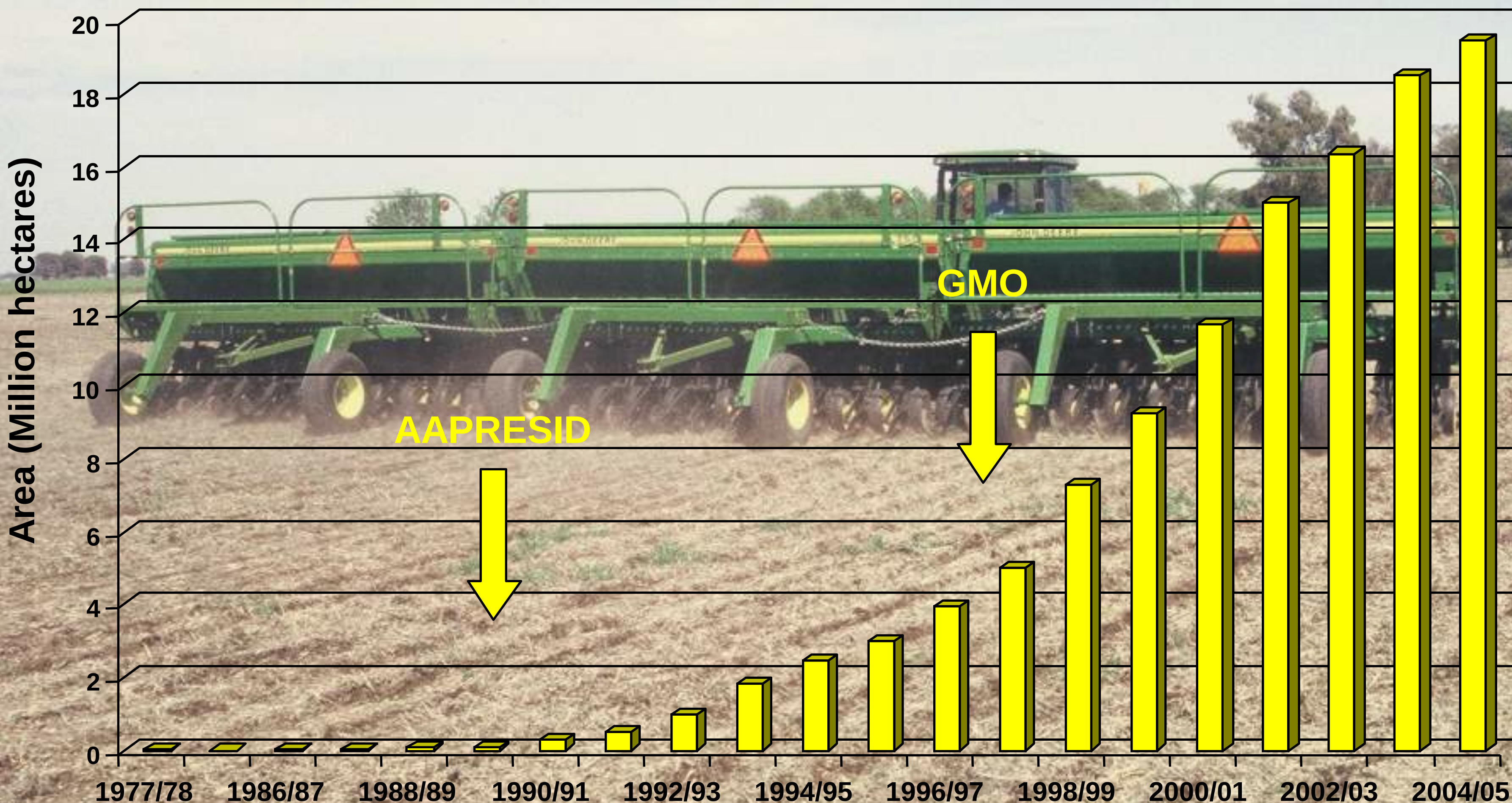
No-Till evolution in Argentina (1977-2005)



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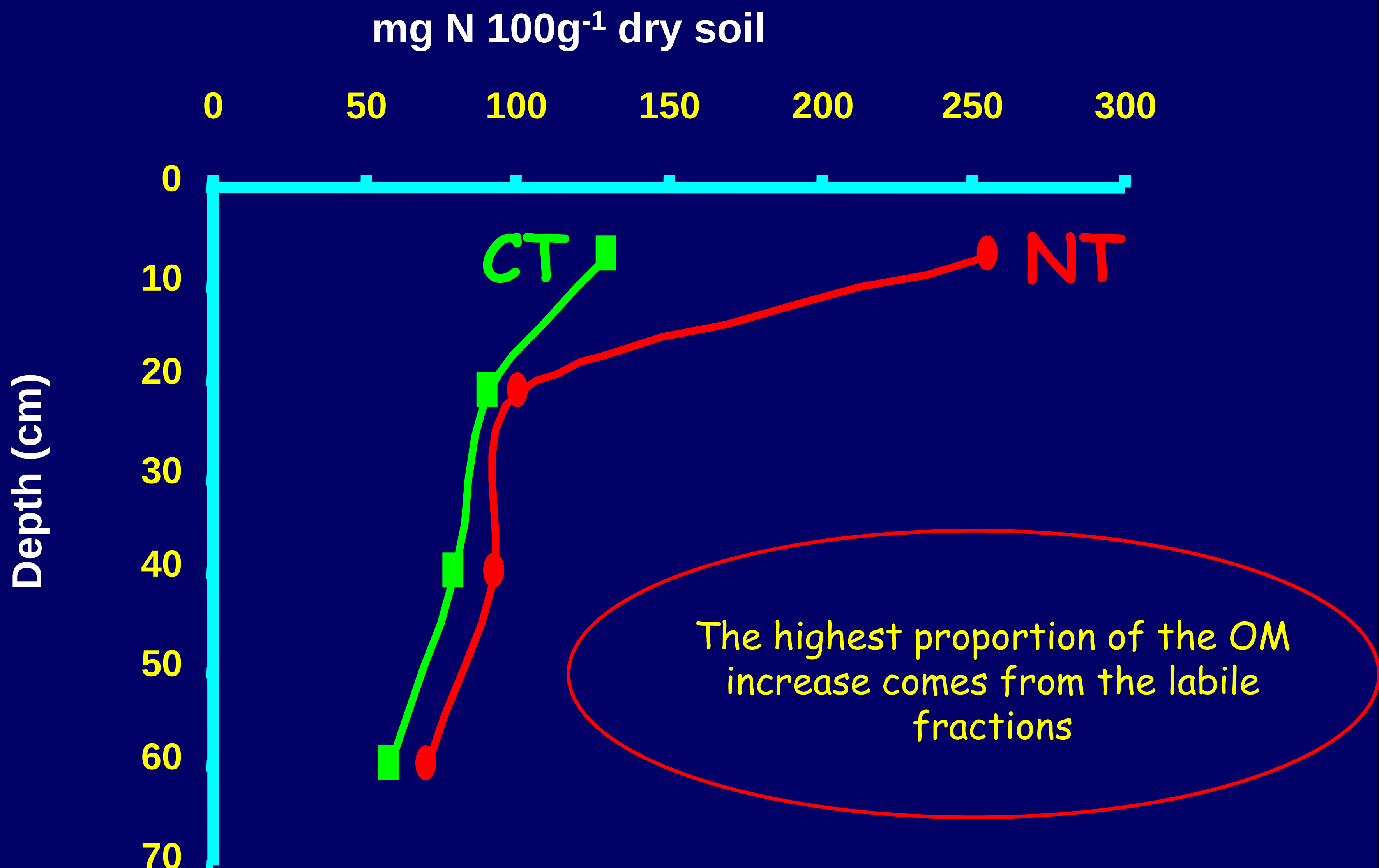

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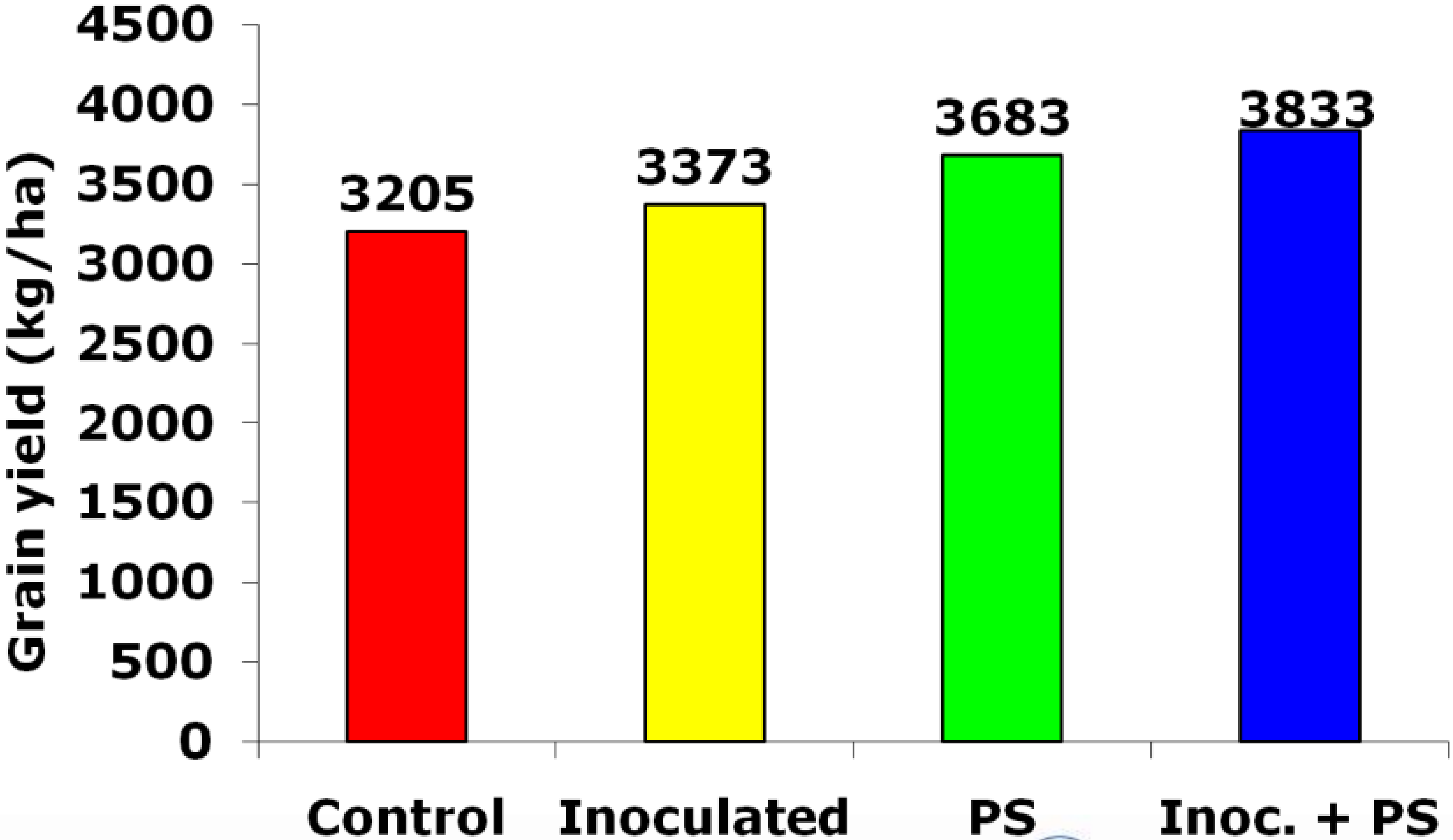

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La evolución de la SD

How much N can hairy vetch add to the system?

- **90 to 100 kg N/ha to the following corn crop. Ebelhar et al., 1984. Agron. J. 76:51-55**

- **75 to 125 kg N/ha to the following corn or grain sorghum. Blevins et al.,1990. Agron. J. 82:769-772.**

- **The accumulation and N contribution via hairy vetch as a cover crop was higher with the late burning (2 weeks). Same trend in corn grain yield planted after the cover crop. Sainju and Singh,2001. Agron. J. 93:878-886.**