

# Tillage and No-tillage Effects on Soils, Crops and Ecosystem.

Rolf Derpsch, ex-   
Consultant, Asuncion, Paraguay  
[rderpsch@telesurf.com.py](mailto:rderpsch@telesurf.com.py)

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# What is No-tillage?

No-tillage has different meanings in different parts of the world.

We need to have a common understanding of what NT is and what we are really talking about!

A photograph of a harvested cornfield. The ground is covered with a thick layer of dry, brown corn stalks and leaves, illustrating the 'no-till' practice where residues are left on the surface. In the background, a line of trees and a few farm buildings are visible under a clear sky.

**No-tillage is defined as a system of planting crops into untilled soil by opening a narrow slot, trench or band only of sufficient width and depth to obtain proper seed coverage. No other soil tillage is done.**

**All crop residues remain on the soil surface!**

**Permanent or continuous no-till is meant!**

*(Derpsch, 2007)*

This is not no-tillage  
Too much soil movement  
and too little soil cover.



*(Derpsch, 2007)*

# Quality no-tillage uses discs!



*(Derpsch, 2007)*

# No-tillage in the United States

Pictures have been erased because they are too big in size. Include again in Rostov!

*(Ralph Holzwarth)*

# No-tillage in Paraguay



*(Derpsch, 2007)*

# No-tillage in Argentina



*(Derpsch, 2007)*

# No-tillage in South Dakota, USA



*(Dwayne Beck)*

# No-tillage in high residues in Brazil



*(Derpsch, 2007)*

# No-tillage immediately after harvest

Width = 64 m



# Results

## Comparing conventional tillage to no-tillage

We will discuss the effects of no-tillage on soil chemical, physical and biological properties, as well as the effects on the environment and other factors.

# Influence No-tillage on soil chemical properties

> Organic matter + (positive)

> Nitrogen +

> Phosphorus +

> Potassium +

> Calcium and Magnesium +

> pH +

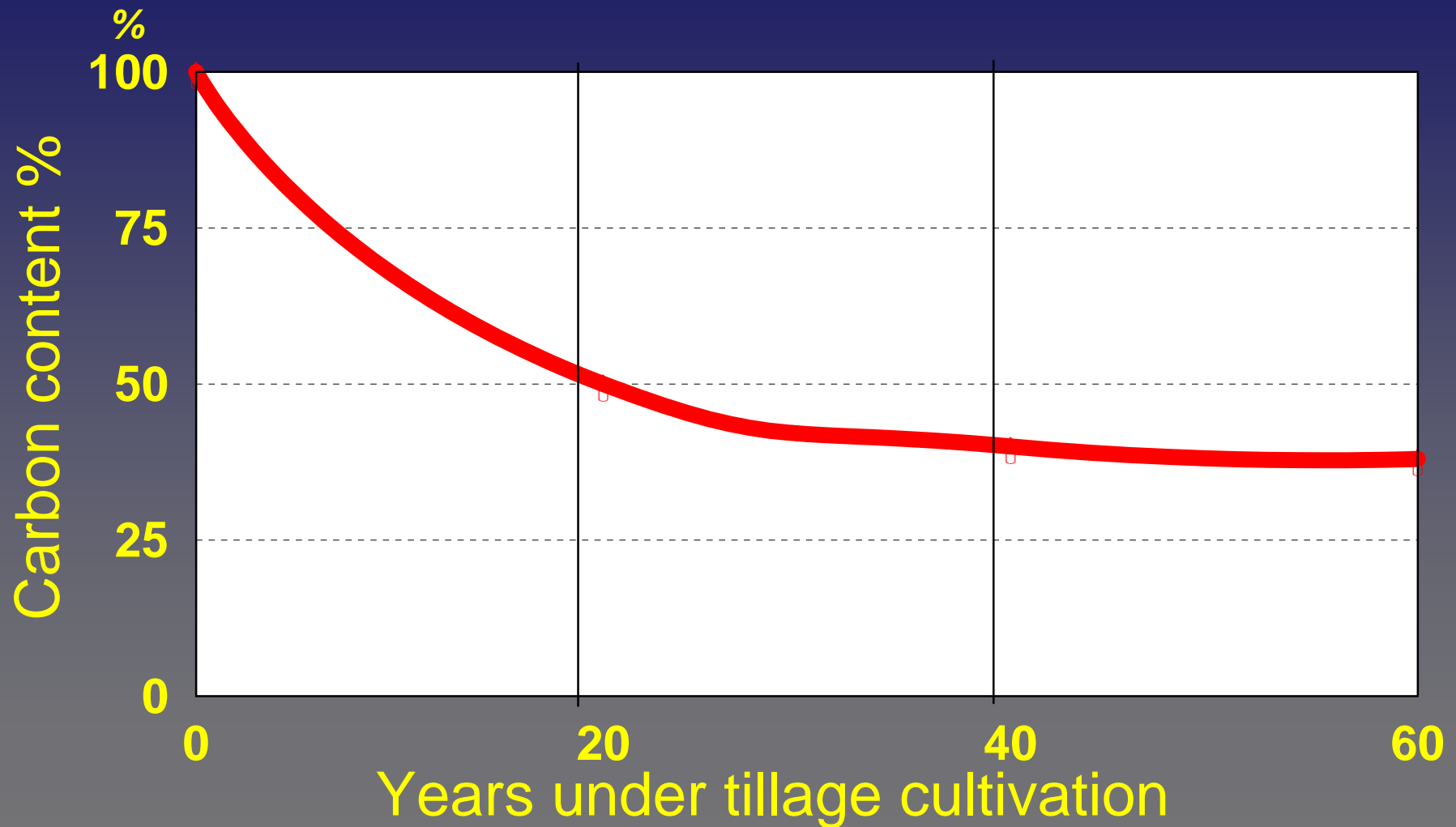
< Al saturation +

> CEC (Cation exchange cap.) +

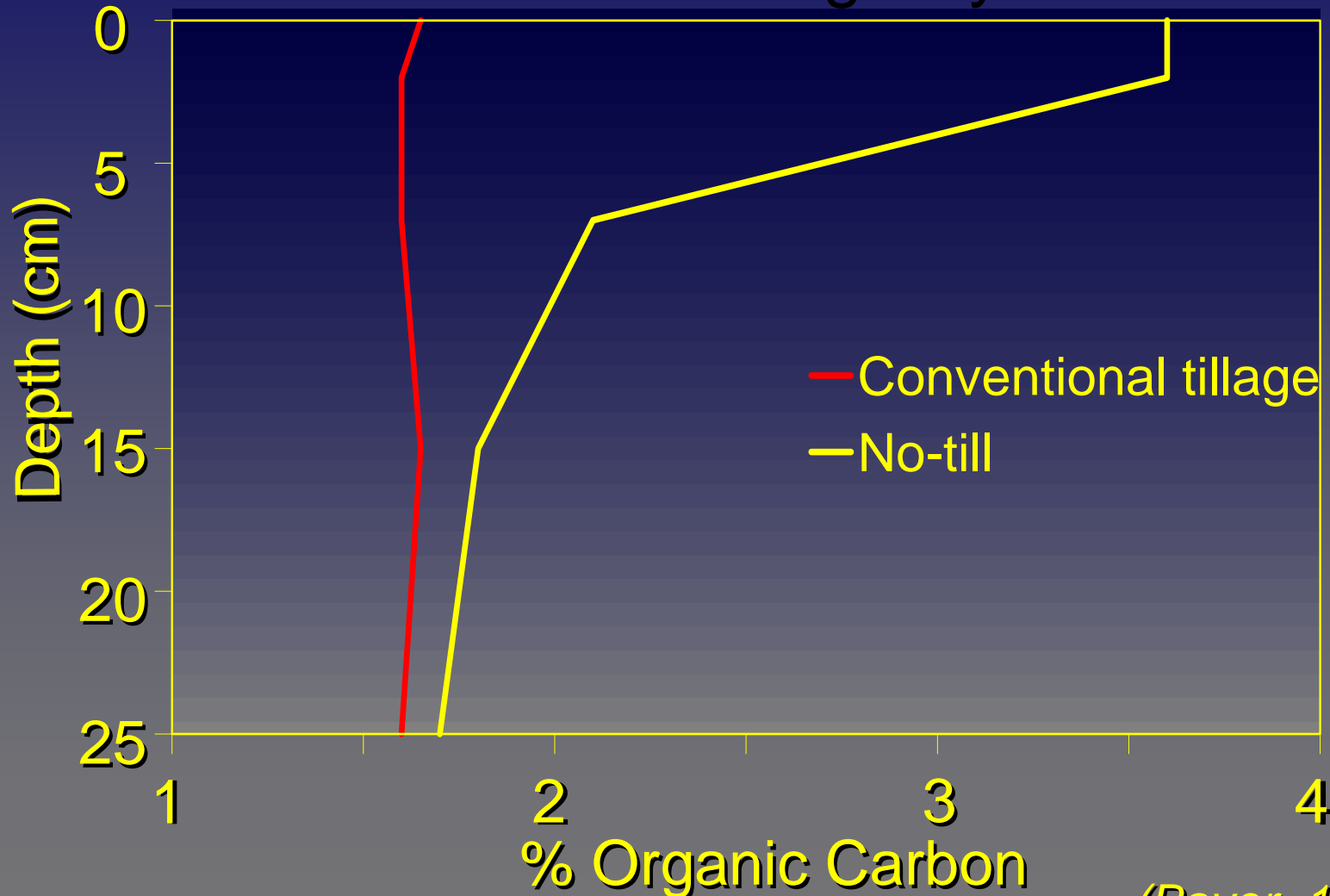
***Improves soil quality***

*(Derpsch, 2007)*

# Reduction in the Carbon content of the soil with time of soil use



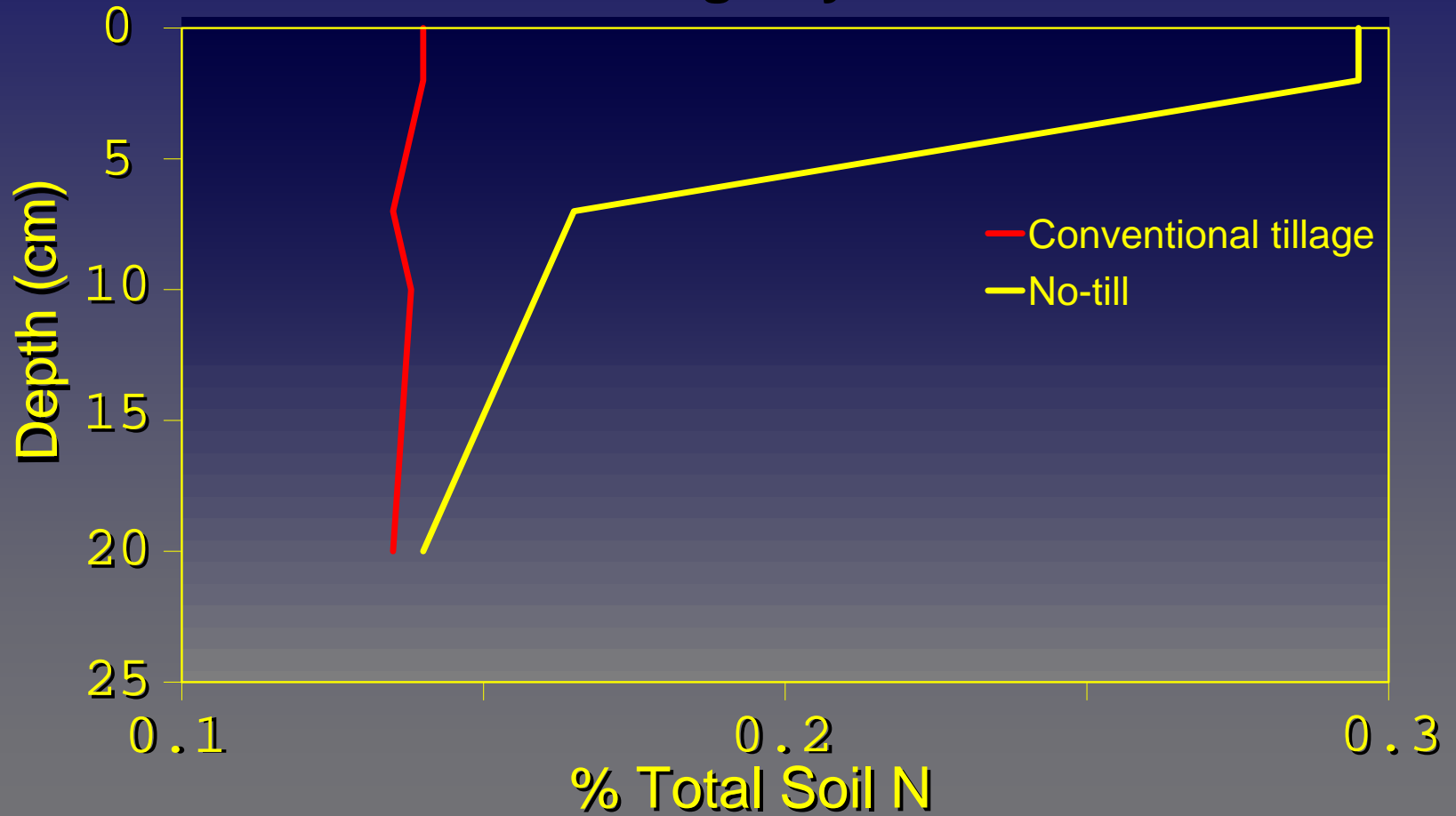
# Soil Organic Carbon Affected by 10 Years of Tillage Systems



Rio Grande do Sul State (BRAZIL)

(Bayer, 1996)

# Total Soil Nitrogen Affected by 10 Years of Tillage Systems



Rio Grande do Sul State (BRAZIL)

*Bayer, 1996*

# Influence No-tillage on soil physical properties

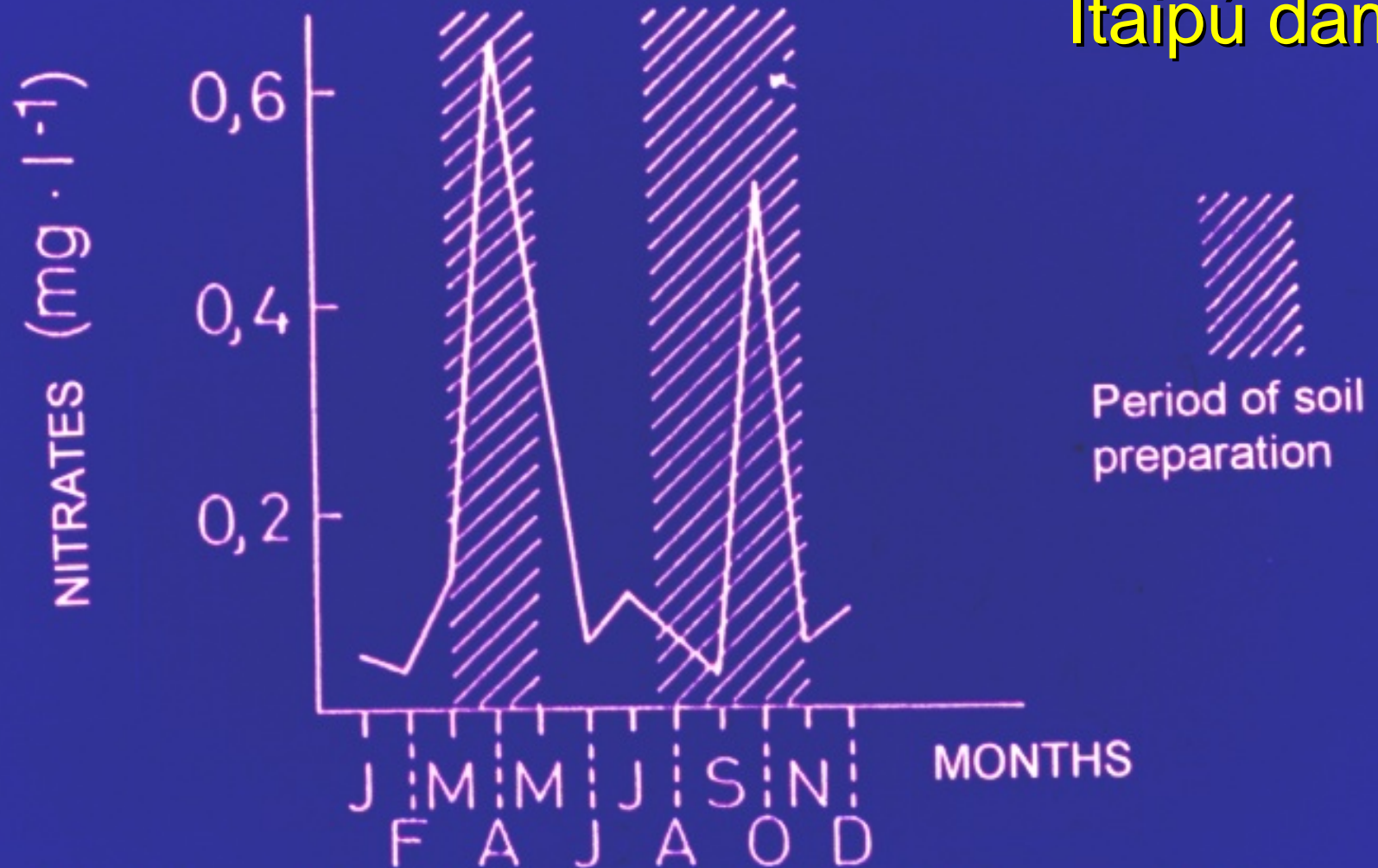
< <u>Erosion</u>	+ (positive)
> Water infiltration	+
< Soil temperature	- +
> Soil moisture	+
> Aggregate stability	+
> Soil structure	+
> Soil density	- +

***Improves soil quality***

*(Derpsch, 2007)*

# Monthly variations in nitrates

Itaipú dam

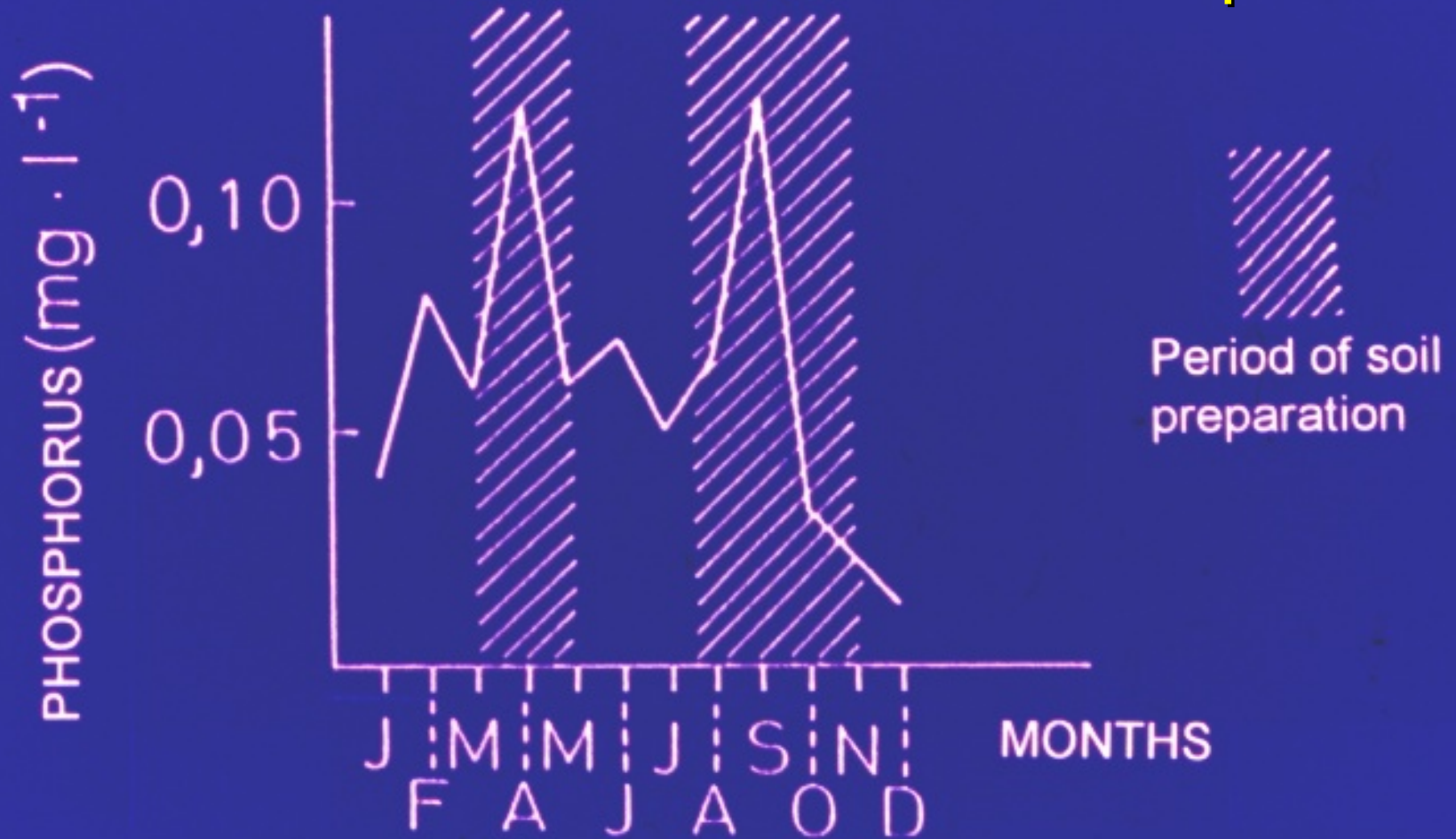


Monthly variations in nitrates, Itaipú dam in the year 1983

(Sorrenson, 1984)

# Monthly variations in phosphorus

Itaipú dam



Monthly variations in phosphorus, Itaipú dam in the year 1983

(Sorrenson, 1984)

# Erosion research under extreme conditions.

In 2 days we had 186 mm of rain  
Research on 4000 m<sup>2</sup> plots with 8% Slope.

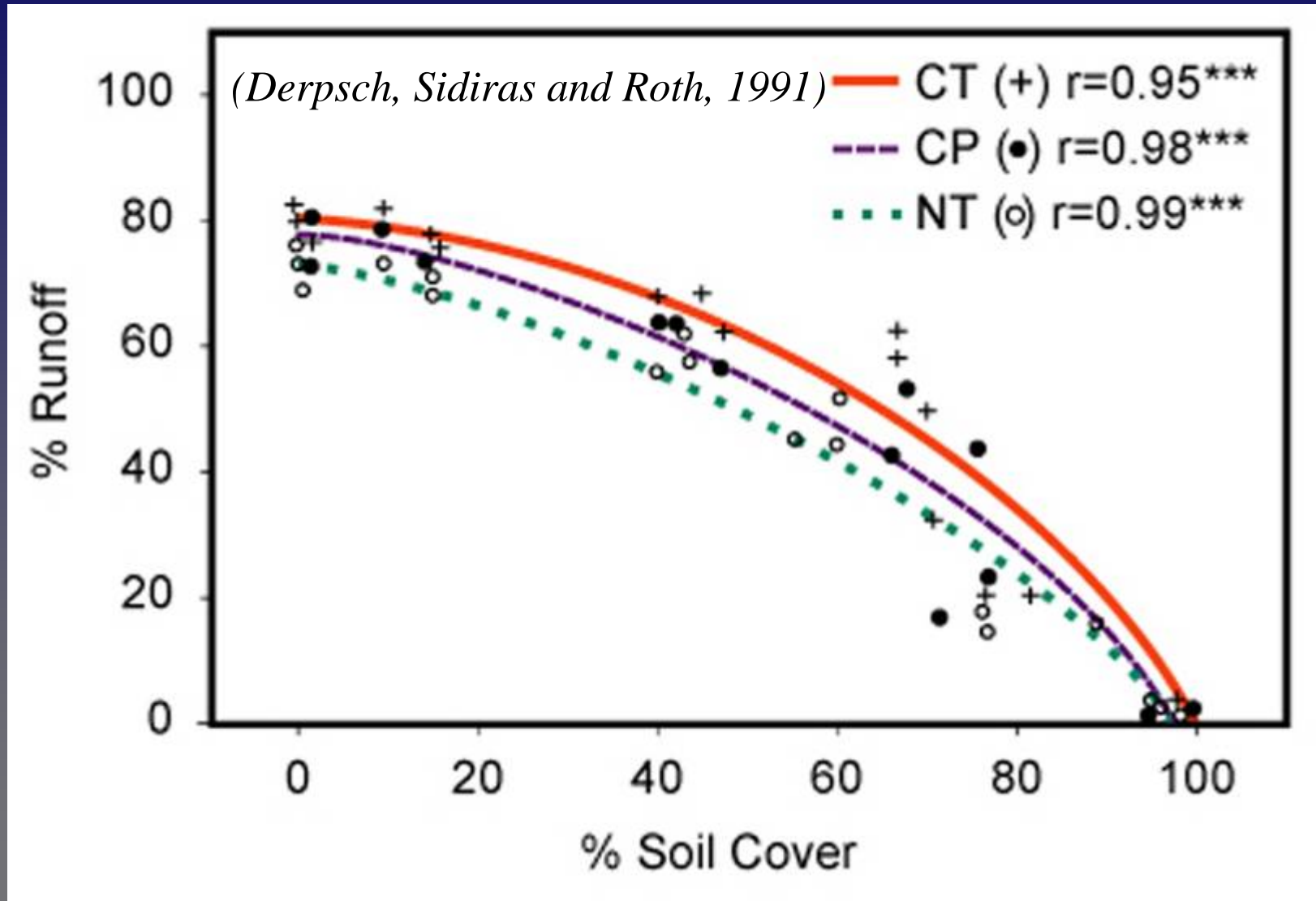
	Soil losses
Conventional tillage	46.500 kg/ha
No-tillage	99 Kg/ha

*(Venialgo, 1996)*

# Part 2

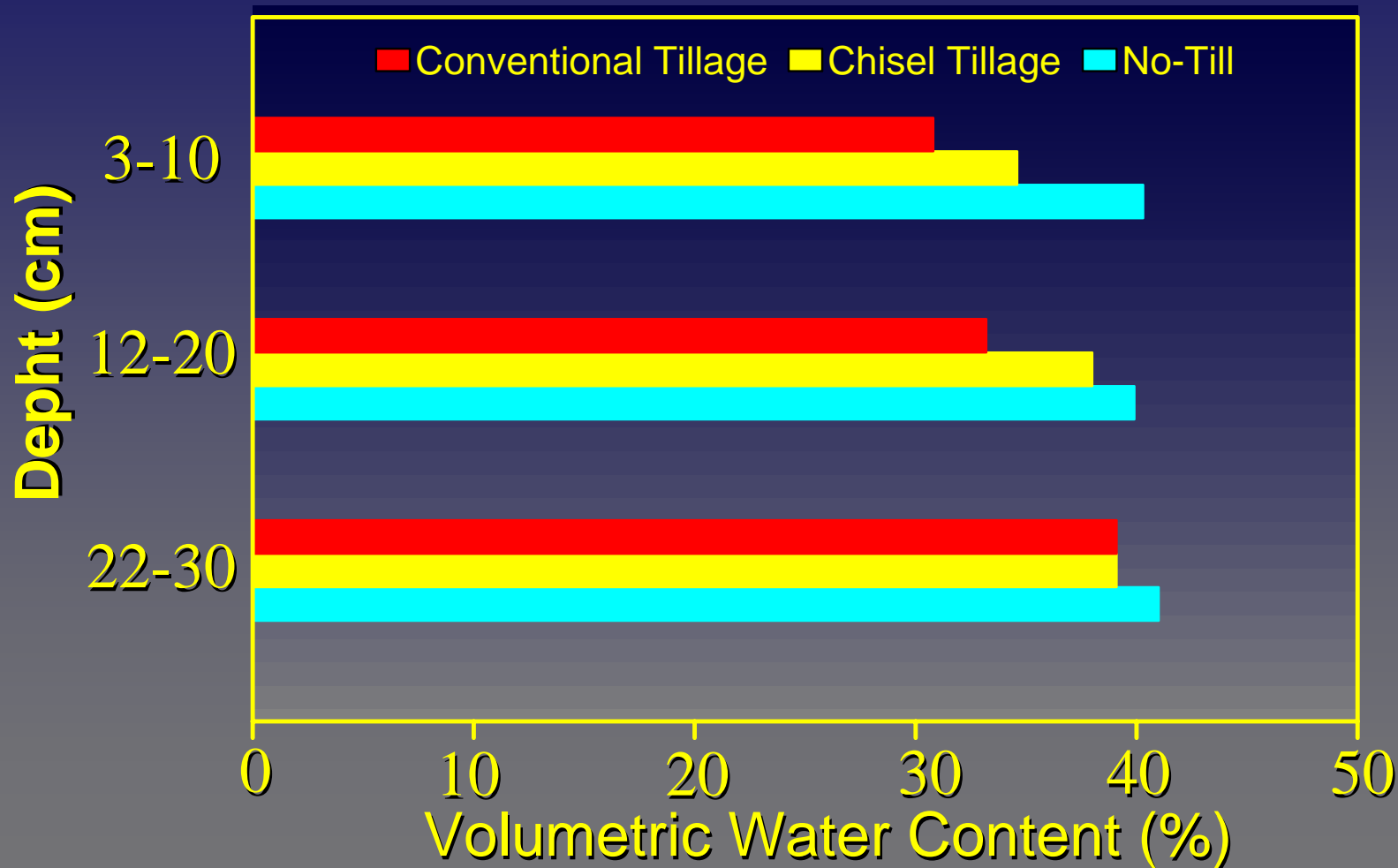
## Rolf Derpsch

# Water infiltration in different tillage systems



Total runoff after 60 minutes of simulated rainfall (60 mm/h) as affected by % soil cover and tillage system

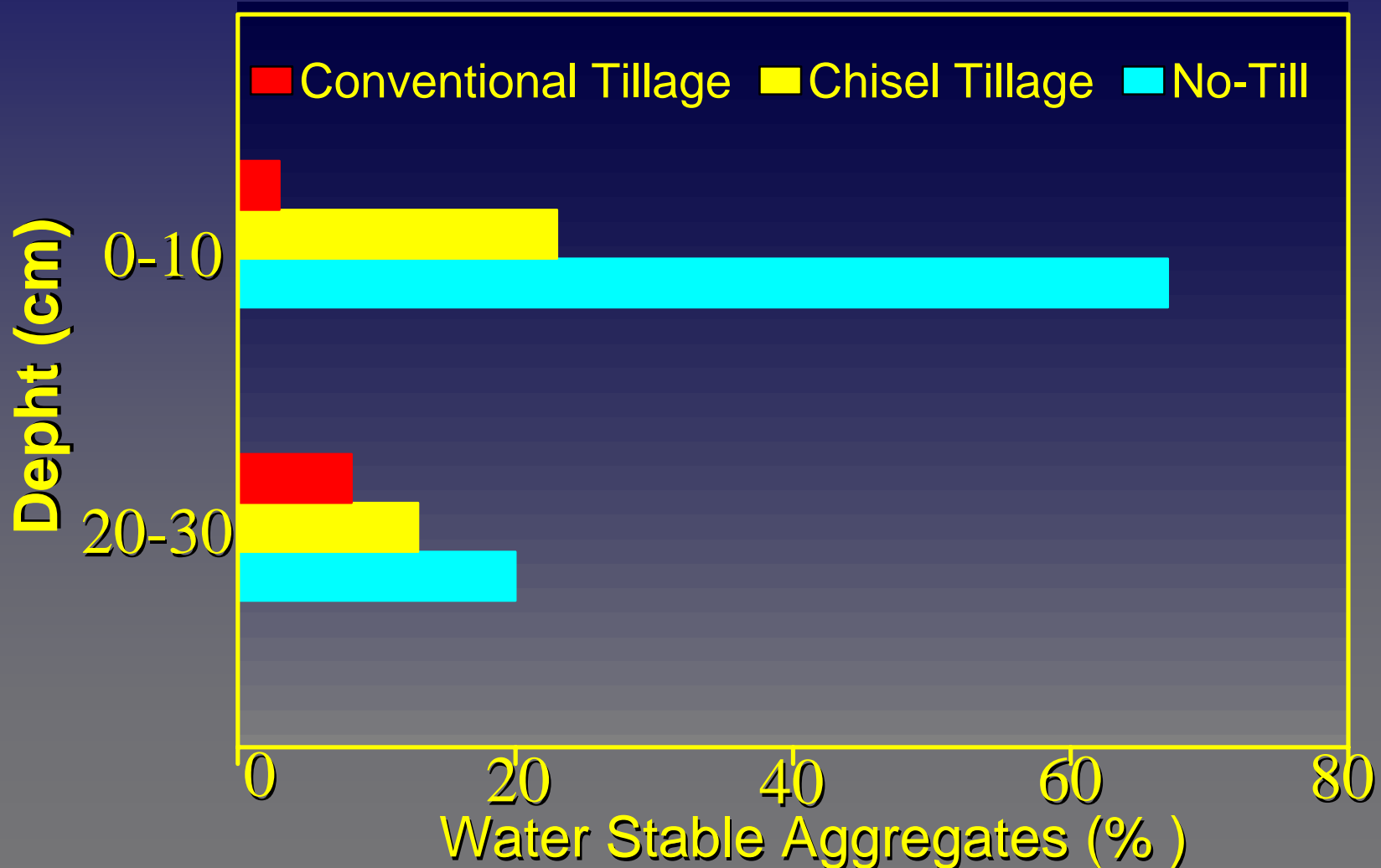
# Soil Water at Field Capacity (0.033 MPa) of an Oxisol as Affected by 4 Years of Tillage Systems



Parana State (BRAZIL)

*Sidiras et al, 1982*

# % Water Stable Aggregates (9.52 - 5.66 mm) in an Oxisol after 4 y of Tillage Management



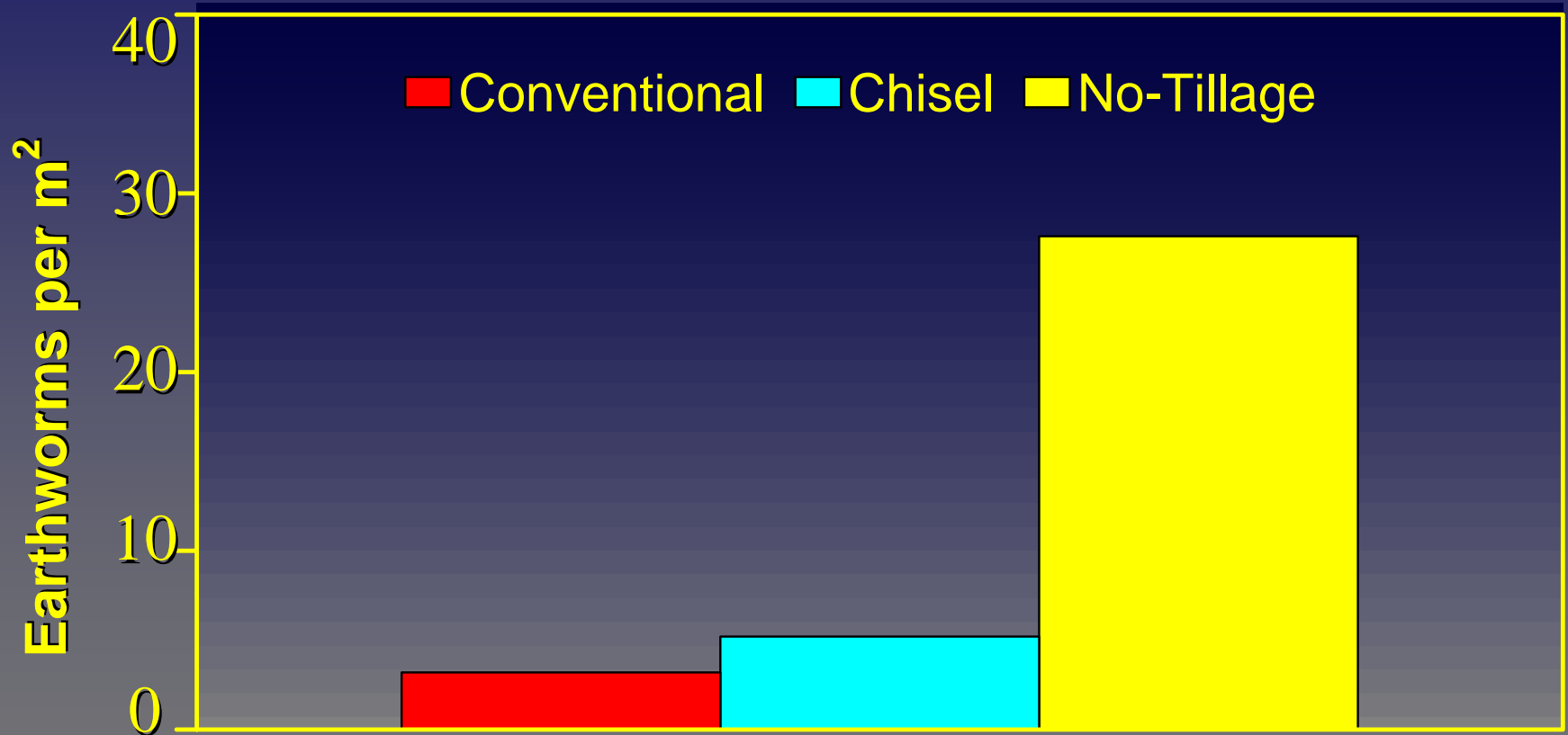
# Influence No-tillage on soil biology

- > *Earthworms* + (*positive*)
- > *Arthropods (soil animals)* +
- > *Nodules (Legumes)* +
- > *Micorrhyza* +
- > *Cellulose degradation* +
- > *Microbial biomass* +

*Improves soil quality*

*(Derpsch, 2007)*

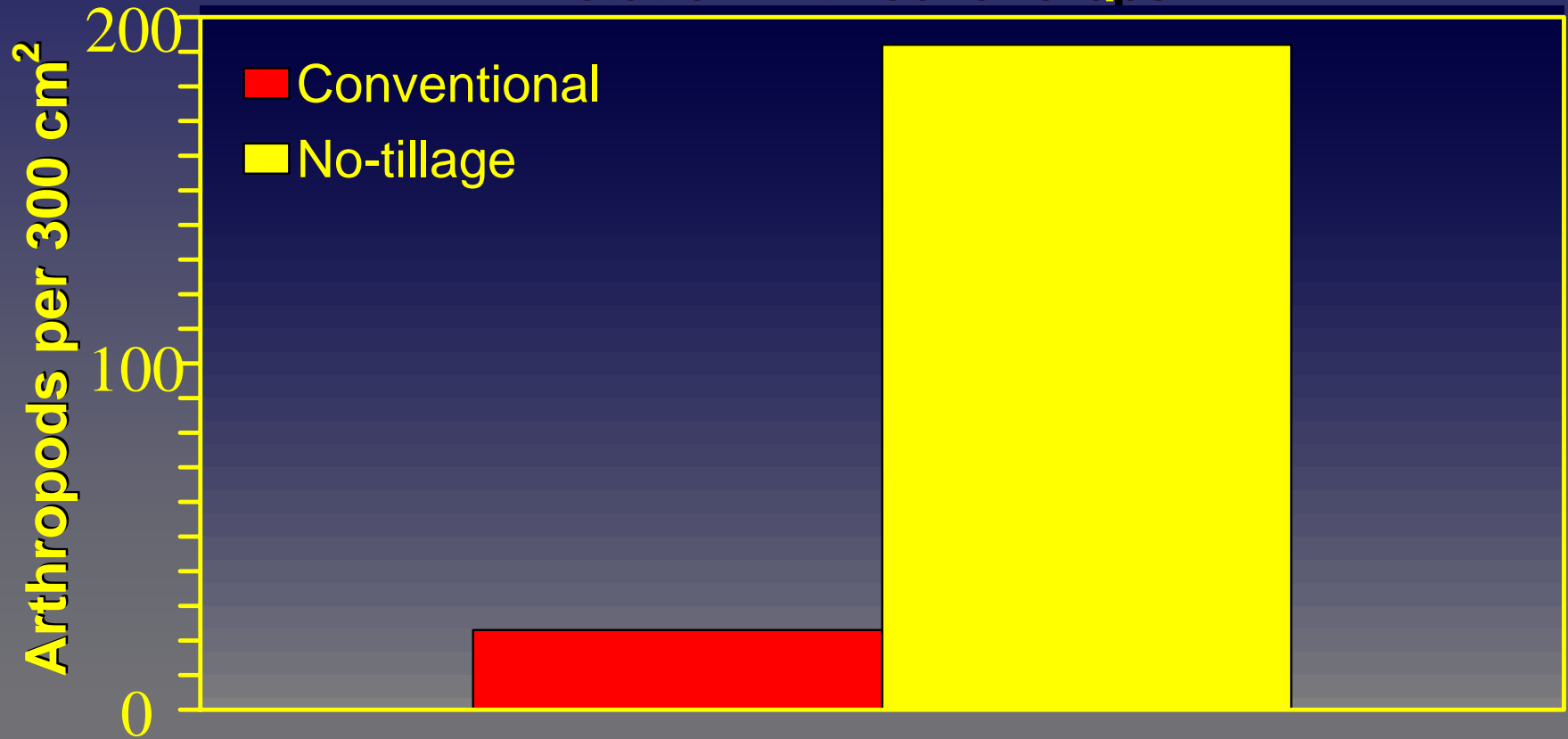
# Population of Earthworms Affected by Tillage System



Parana State (BRAZIL)

*Derpsch et al., 1991*

# Population of Arthropods as Affected by Tillage System in rotation with cover crops



Parana State (BRAZIL)

*Derpsch et al., 1991*

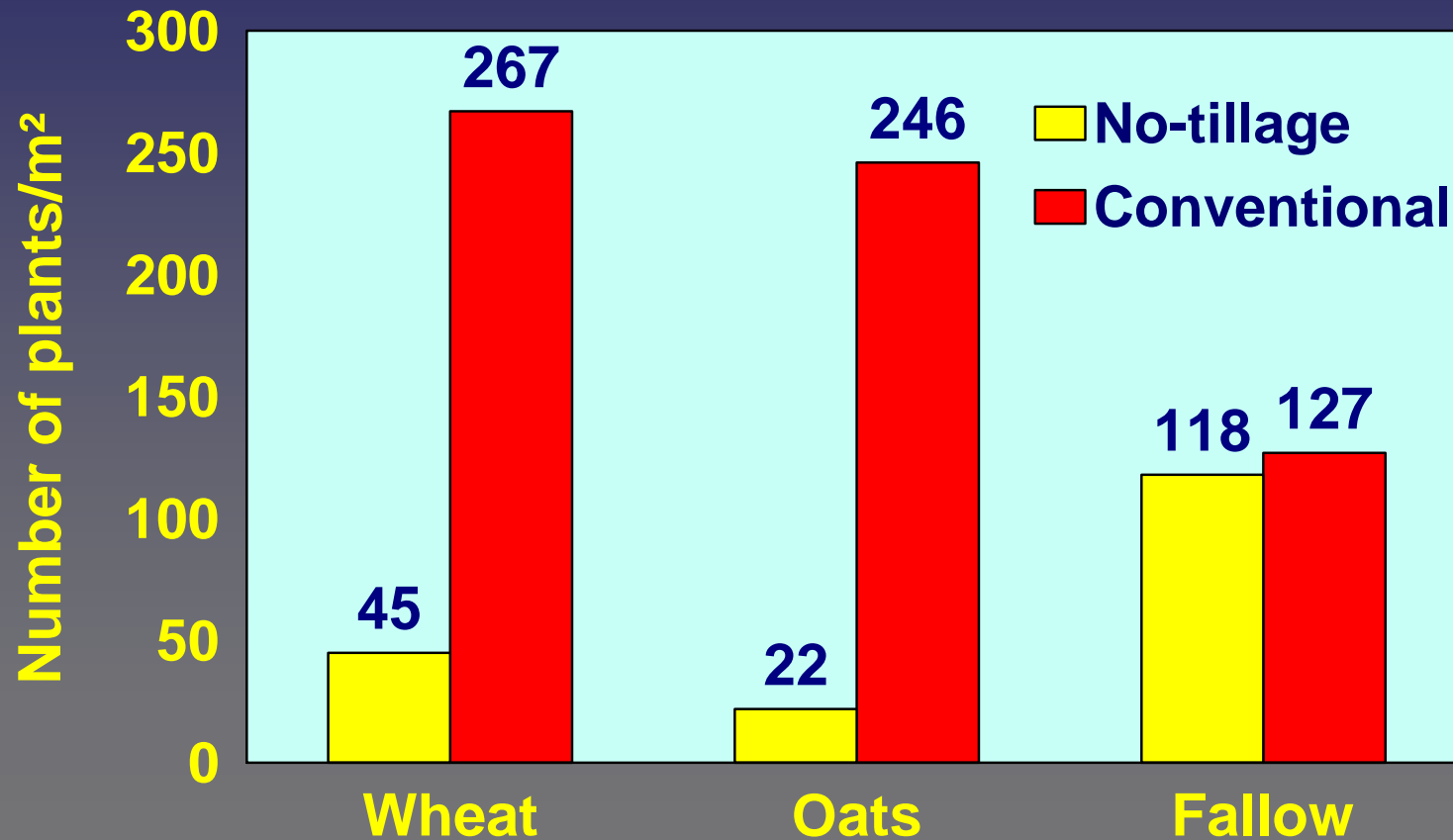
# Influence No-tillage on crop sanitary aspects

- > *Biological pest control* + (positive)
- > *Pests* < - +
- > *Diseases* - (negative)
- < *Weed germination* +

(Derpsch, 2007)

# Number of weeds (*Brachiaria plantaginea*) per m<sup>2</sup> in soybeans under two tillage systems and three different crops

(Average of three soybean sowing dates (18/10, 18/11, 12/12))



(Gazziero, 1991)

# Influence No-tillage on other factors

- < *Fuel consumption* + (*positive*)
- < *Mechanization hp/ha* +
- > *Life of tractors* +
- < *Labour* +
- > *Trafficability* +
- > *Yields* +
- > *Profitability* +
- > *Time for recreation and management*

(Derpsch, 2007)

Fuel consumption is reduced by 66%

Conventional tillage 42.3 l/ha

Heavy disc harrow 34.3 l/ha

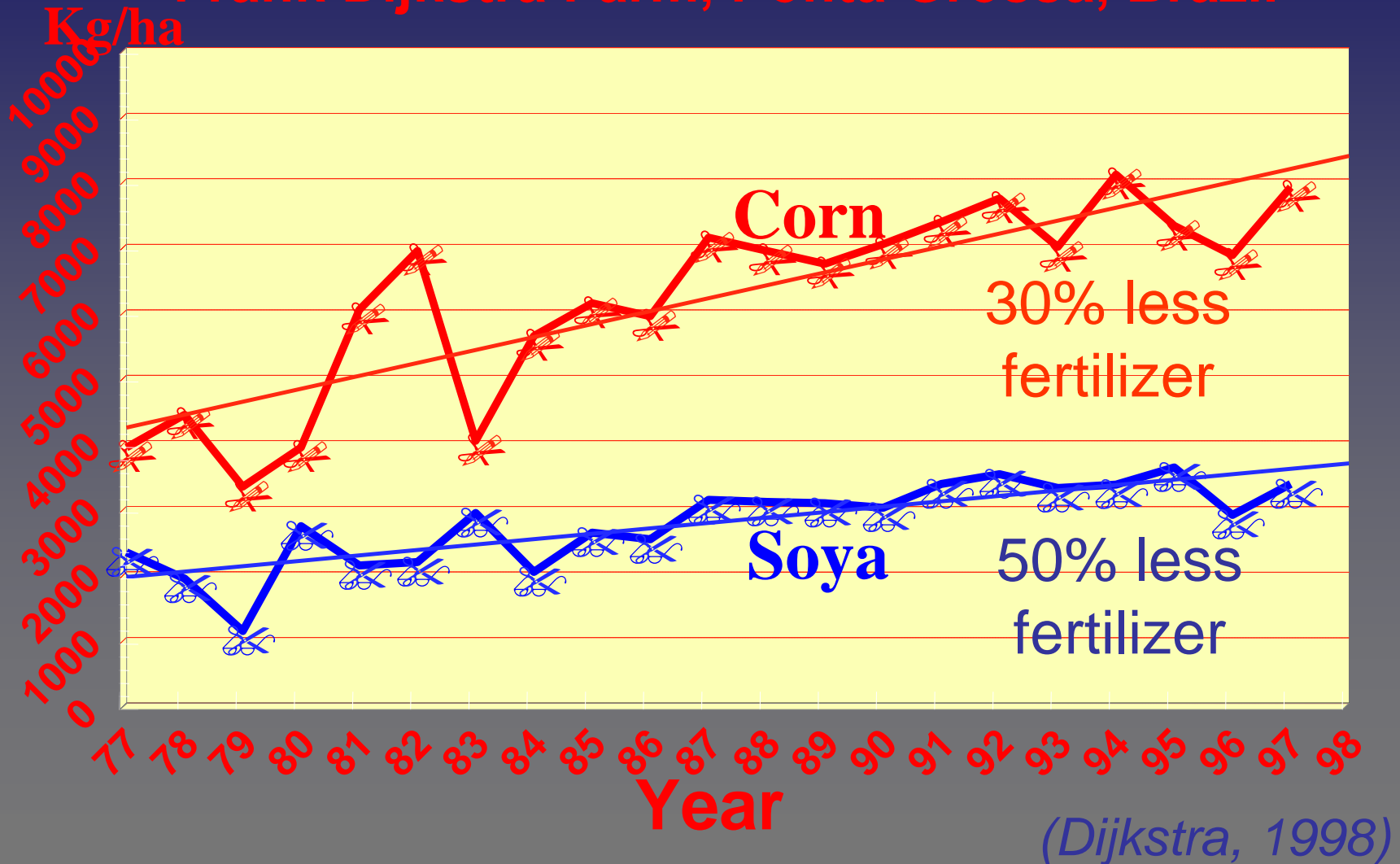
No-till 13.9 l/ha

*(Sorrenson, 1984)*

# Yields

## Crop Productivities in No-tillage

Frank Dijkstra Farm, Ponta Grossa, Brazil



# Influence No-tillage on the environment

< <i>CO<sub>2</sub> emissions</i>	+ ( <i>positive</i> )
> <i>Herbicides</i> <	+ -
> <i>Water quality</i>	+
> <i>Wildlife (birds)</i>	+
> <u><i>Sustainability</i></u>	+

(Derpsch, 2007)

# Sediment loaded water in conv. tilled watershed



*(Derpsch, 2007)*

# Clear water in a no-tillage watershed



*(Derpsch, 2007)*

# Birds come back to no-till fields = > environment




*(Derpsch, 2007)*

# Conclusions:

No-tillage improves chemical, physical and biological soil properties. It reduces time, labor and fuel for agric. operations. It is more economic and good for the environment.

These are enough good reasons to convince farmers and decision makers on the urgent need to widespread no-till adoption.

*(Derpsch, 2007)*

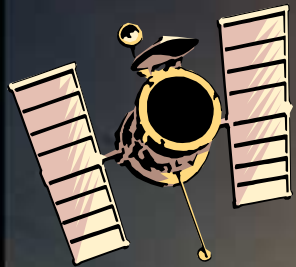


No-tillage in mulches of previous crops is the production system of the future if sustainable agriculture is really to be achieved.

*(Derpsch, 2007)*

# Thank you for your attention.

## Questions, more information?



[www.rolf-derpsch.com](http://www.rolf-derpsch.com)

Rolf Derpsch

Conservation Agriculture &

No-tillage Consultant

Asunción, Paraguay

