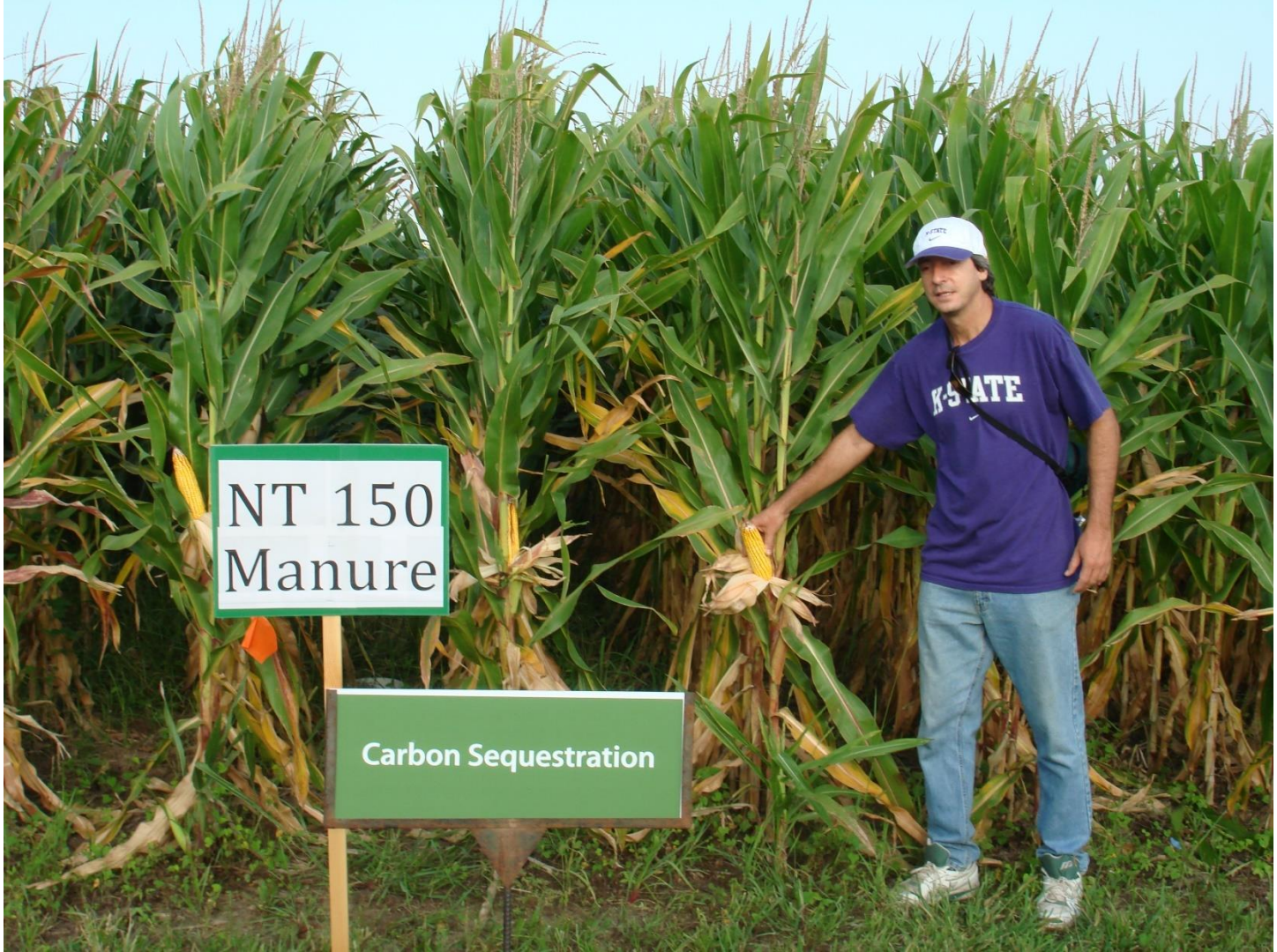
FERTBIO 2016
"RUMO AOS NOVOS DESAFIOS"
16 a 20 outubro 2016
Centro de Convenções de GOIÂNIA - GO

O carbono como moeda de troca – Experiências e mecanismos para remunerar os agricultores

Telmo J. C. Amado & Charles W. Rice

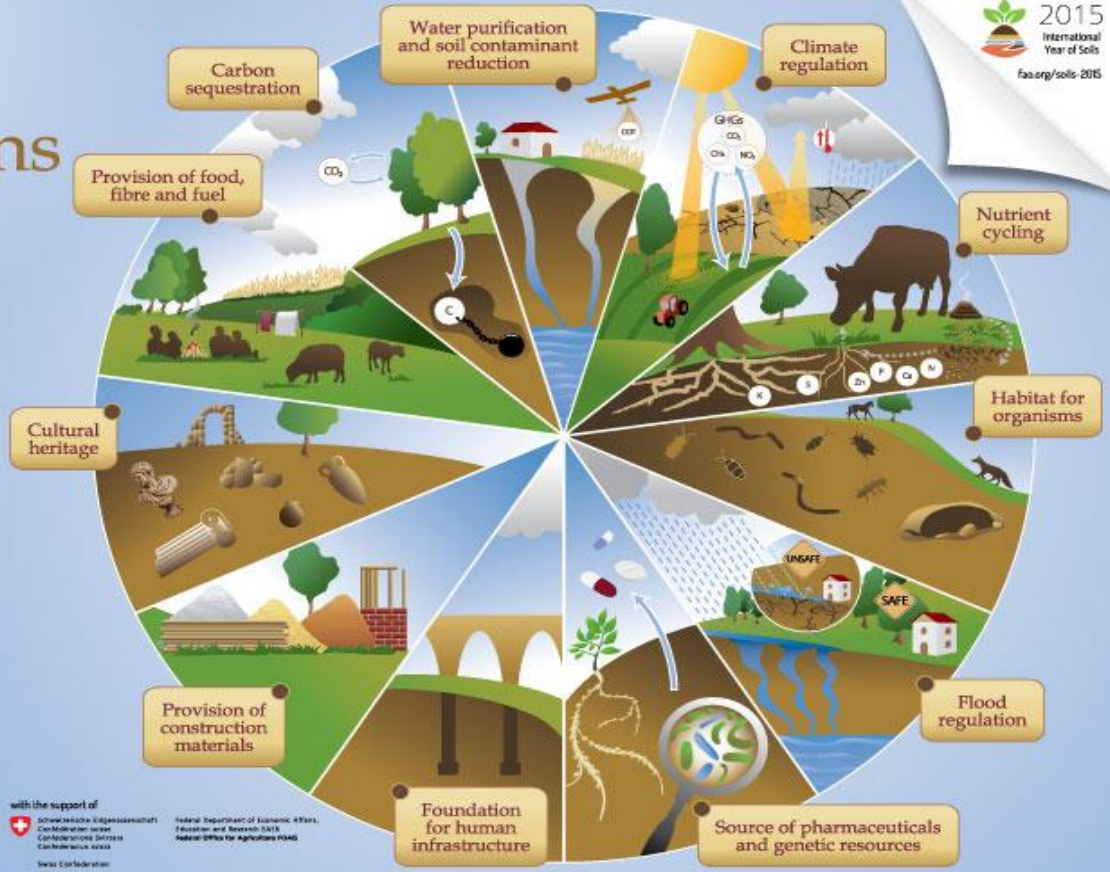
CASMGS Forum

CONSORTIUM FOR AGRICULTURAL SOILS MITIGATION OF GREENHOUSE GASES


NT 150
Manure
Carbon Sequestration

Soil functions

Soils deliver ecosystem services that enable life on Earth



2015 International Year of Soils

fao.org/soils-2015

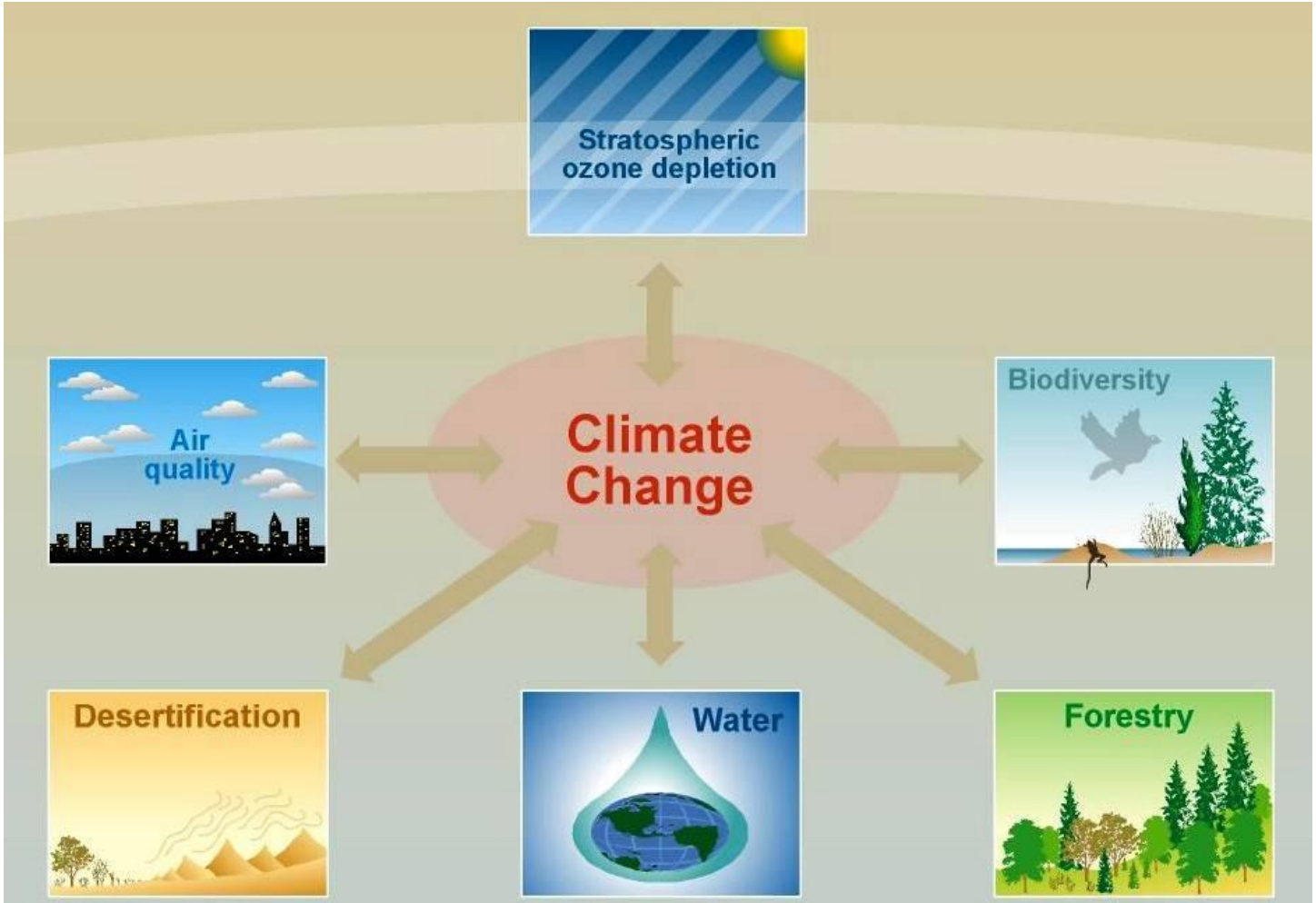
Food and Agriculture Organization of the United Nations

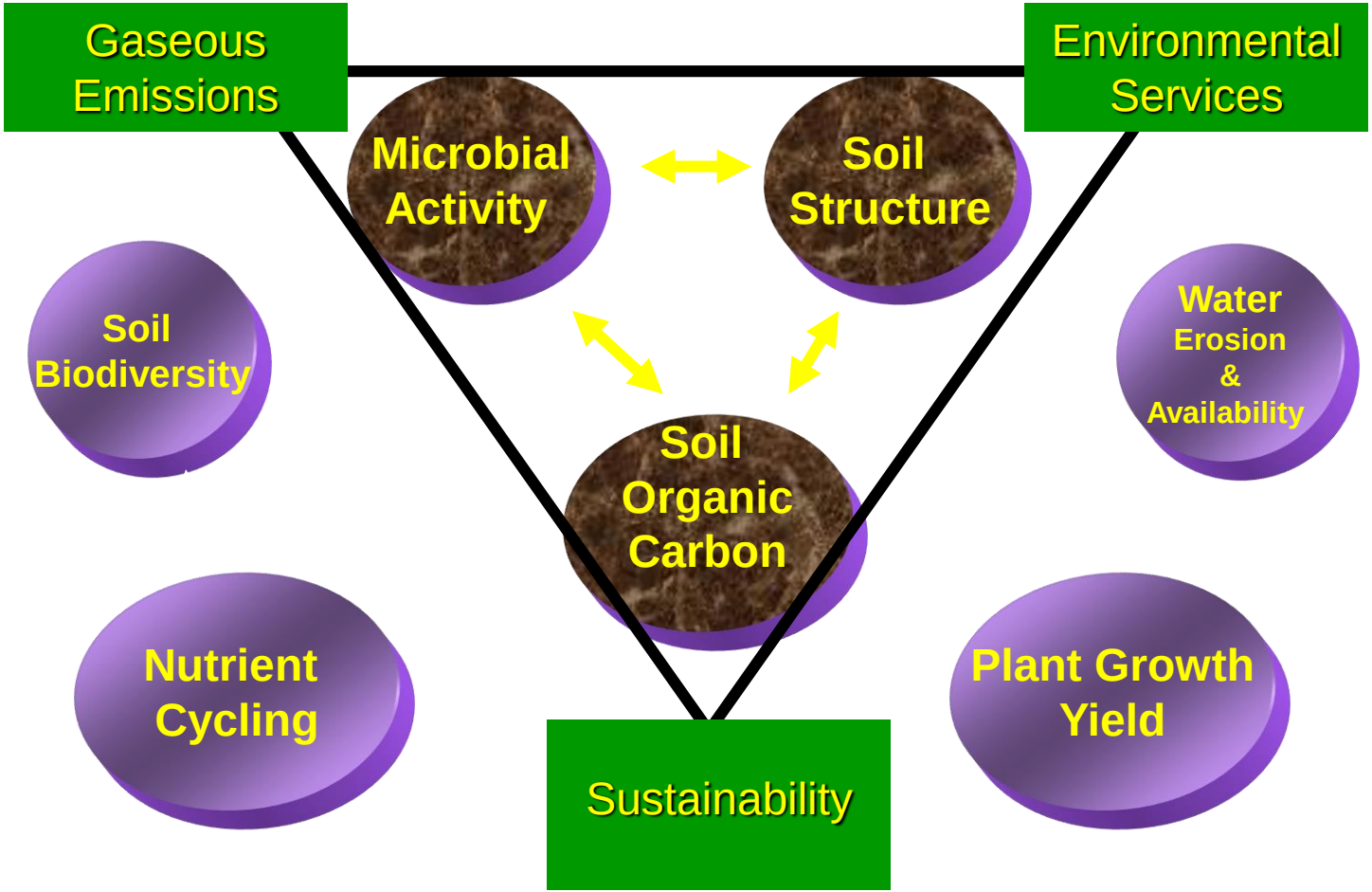
with the support of

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
Federal Office for Agriculture FOAG

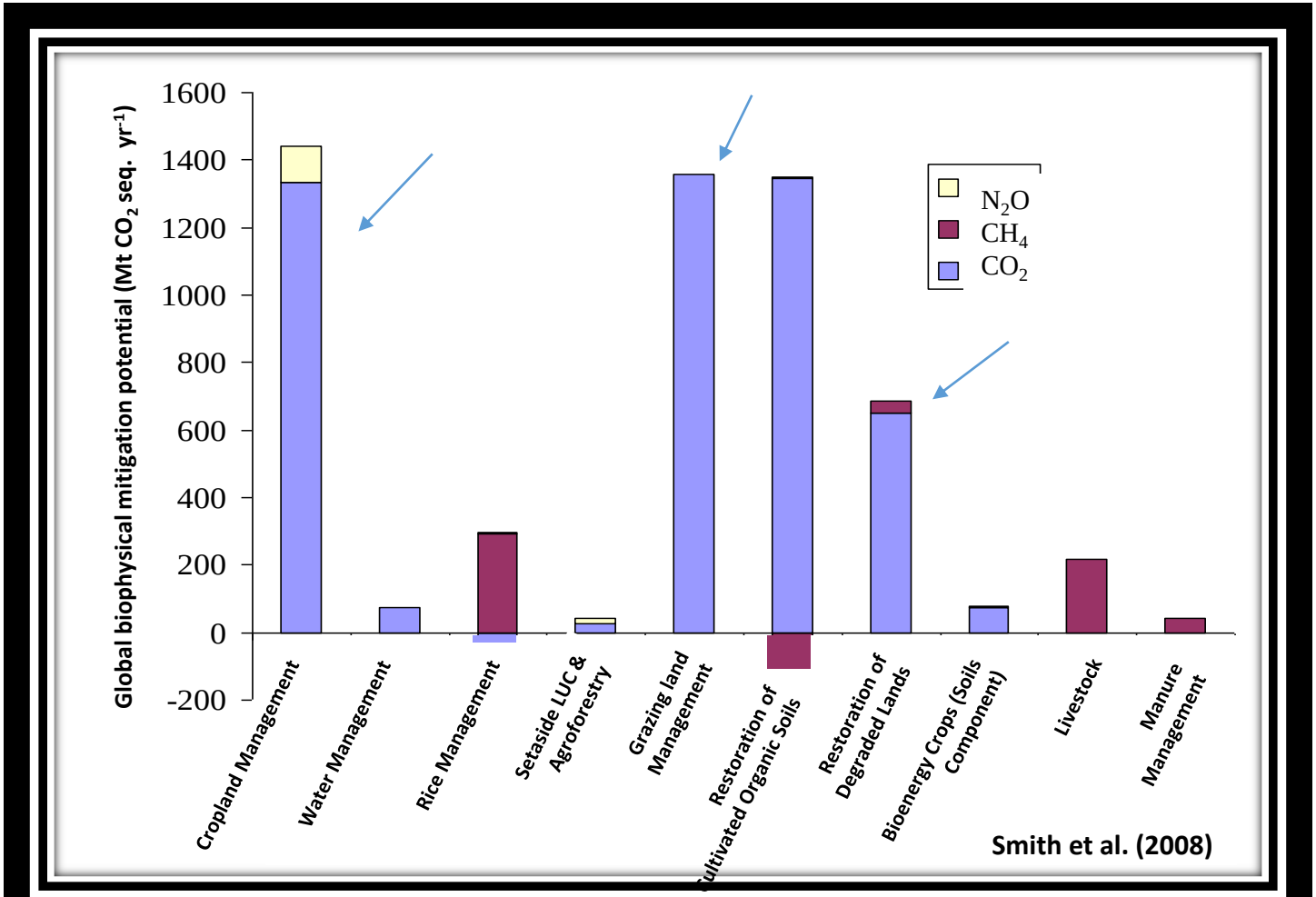
Global Warming Connections




Gaseous Emissions
Environmental Services
Microbial Activity
Soil Structure
Soil Biodiversity
Water Erosion & Availability
Soil Organic Carbon
Nutrient Cycling
Plant Growth Yield
Sustainability

Rice, 2016

Global mitigation potential in agriculture



Carbon trading

- Market based mechanism
- Cap and trade
  - More certain about volume of carbon reduction
  - Those firms that are good at reducing CO2 will have permits to sell – these become an asset on the balance sheet

CASMGS Forum

CONSORTIUM FOR AGRICULTURAL SOILS MITIGATION OF GREENHOUSE GASES

What is needed

- Sellers of C credits: Land managers
- Aggregator
- Buyers
- Monitoring/Verification

Putting a price on carbon

Importance of

- Verification and commitment
- Scarcity
- Price expectations
- Clean Development Mechanism
- Rewarding efficiency and action

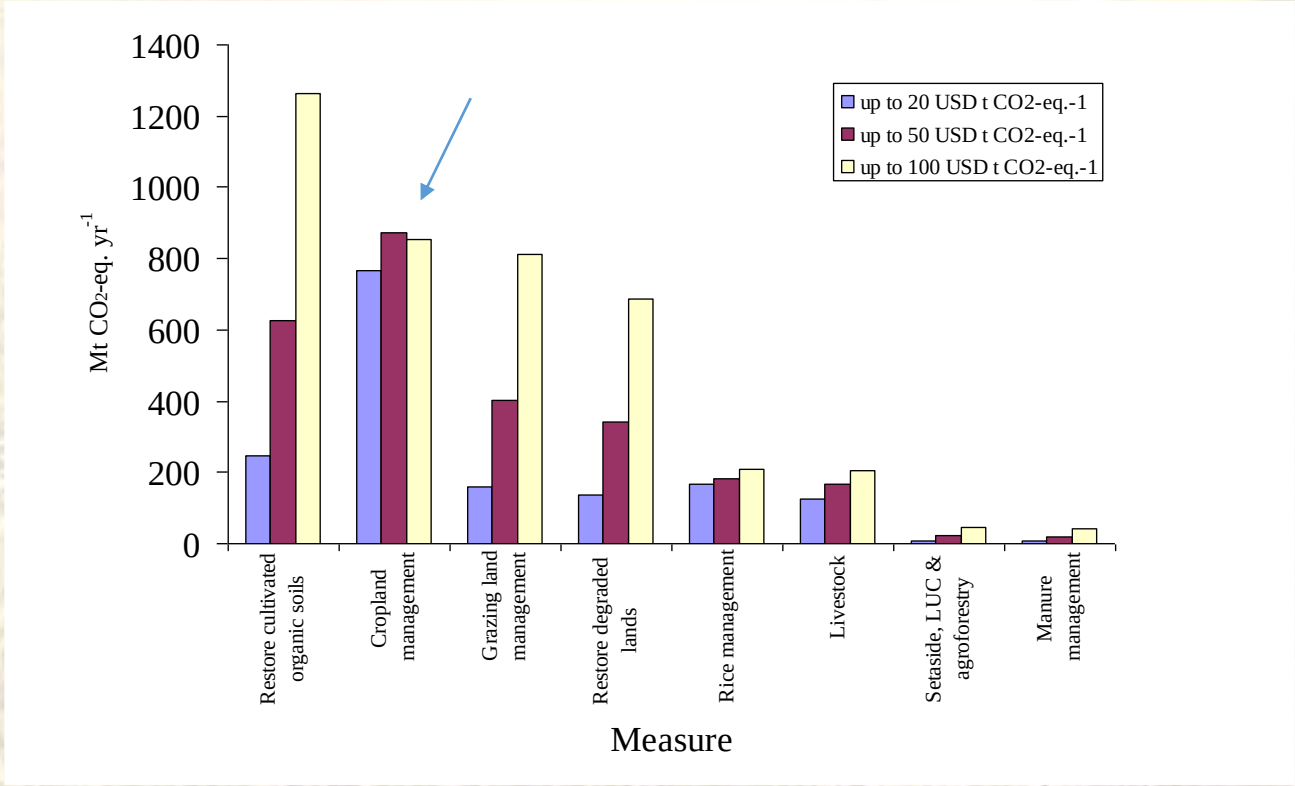
Estimates of various Ecosystem Services

Ecosystem services	Value (trillion $US)
Soil formation	17.1
Recreation	3.0
Nutrient cycling	2.3
Water regulation and supply	2.3
Climate regulation (temperature and precipitation)	1.8
Habitat	1.4
Flood and storm protection	1.1
Food and raw materials production	0.8
Genetic resources	0.8
Atmospheric gas balance	0.7
Pollination	0.4
All other services	1.6
Total value of ecosystem services	**33.3**

Nature

Constanza et al., 1997

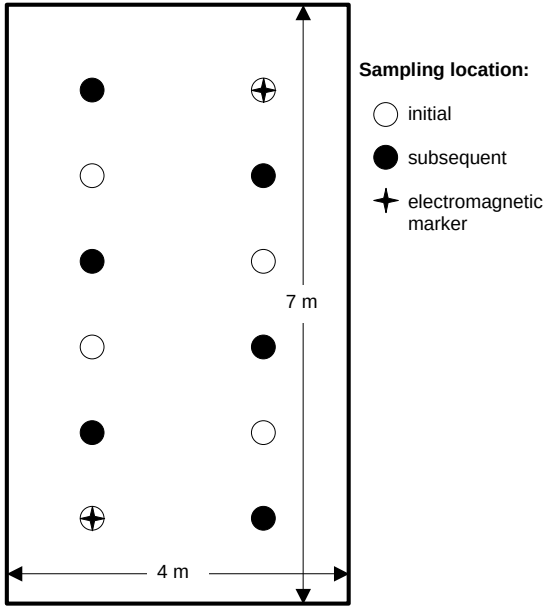
Effect of C price on implementation



Smith et al. (2007)

Geo-reference microsites

- Microsites reduces spatial variability
- Simple and inexpensive
- Used to improve models
- Used to adopt new technology
- Soil C changes detected in 3 yr
  - 0.71 Mg C ha^{-1} – semiarid
  - 1.25 Mg C ha^{-1} – subhumid



Ellert et al. (2001)

ALBERTA AND CLIMATE CHANGE

MEETING NORTH AMERICA'S EVOLVING ENERGY NEEDS

Second Round Results

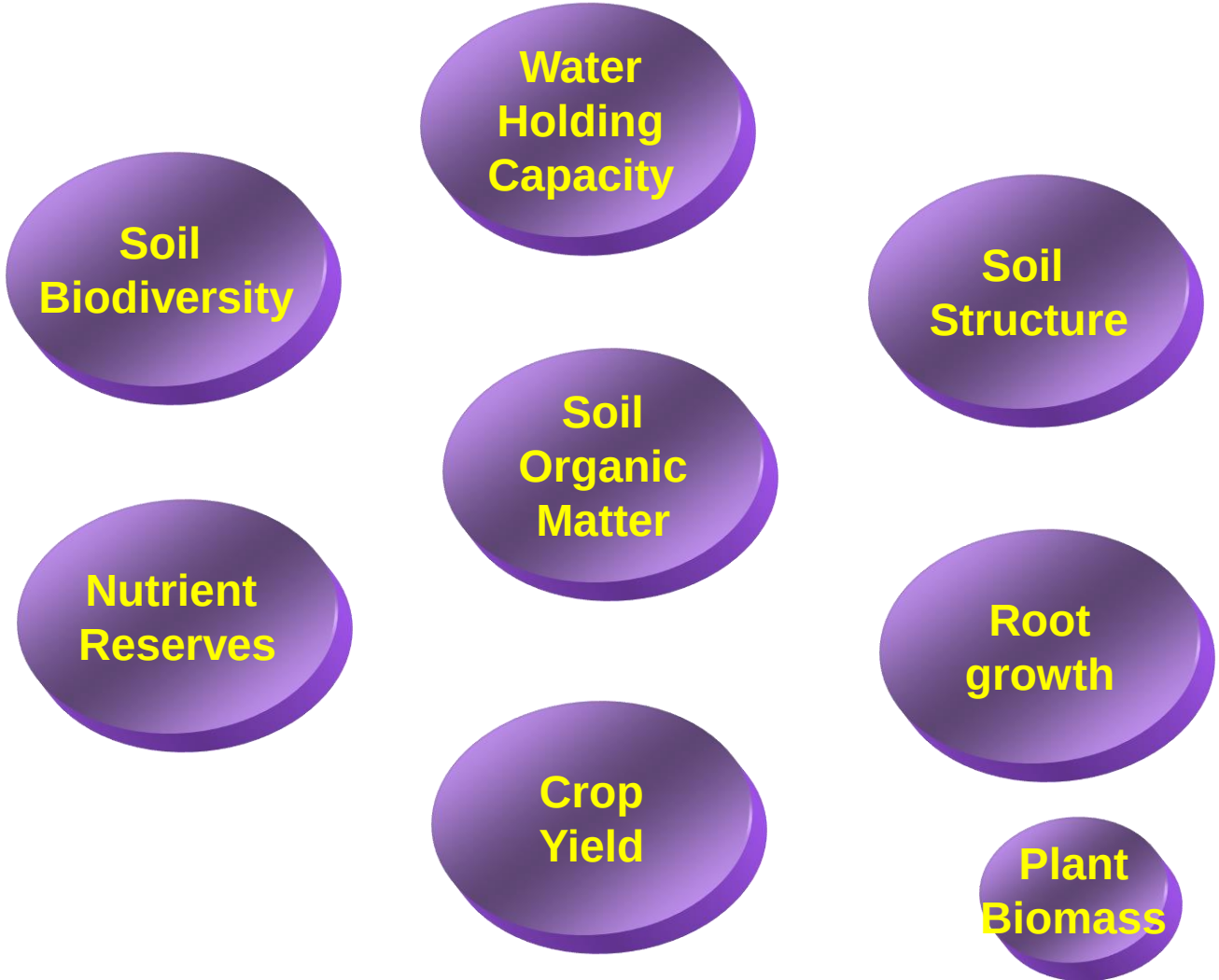
- 2008 reduction obligation - approximately 11 million tonnes of GHGs
  - Based on emission projections
  - Facility improvements addressed approximate 2 million tonnes
- 2.75 million tonnes (31%) of offsets used
  - Tillage, renewables plus a broader range of projects including acid gas, EOR using CO2

- Agricultural sink protocol (reduced/no-till)
  - Based on decades of science
  - Reflects years of carbon policy integration

Alberta Carbon Offset

- Alberta, Canada legislation to reduce Greenhouse Gas (GHG) emissions through the regulation of large emitters (industrial facilities that emit more 100,000 tonnes CO2e/yr).
- Agriculture and forestry are the only two industries that can remove carbon from the atmosphere.
- Approved offset protocols
    - Beef and pork systems
    - Biofuel
    - Energy efficiency
    - Tillage (reduced or No-till)
- $15 per ton of C
    - $6/ha/y

O que precisamos para prover serviços ambientais nos nossos agroecosistemas?


Water Holding Capacity
Soil Biodiversity
Soil Structure
Soil Organic Matter
Nutrient Reserves
Root growth
Crop Yield
Plant Biomass

Rice, 2016

Crop rotation to increase nutrient cycling

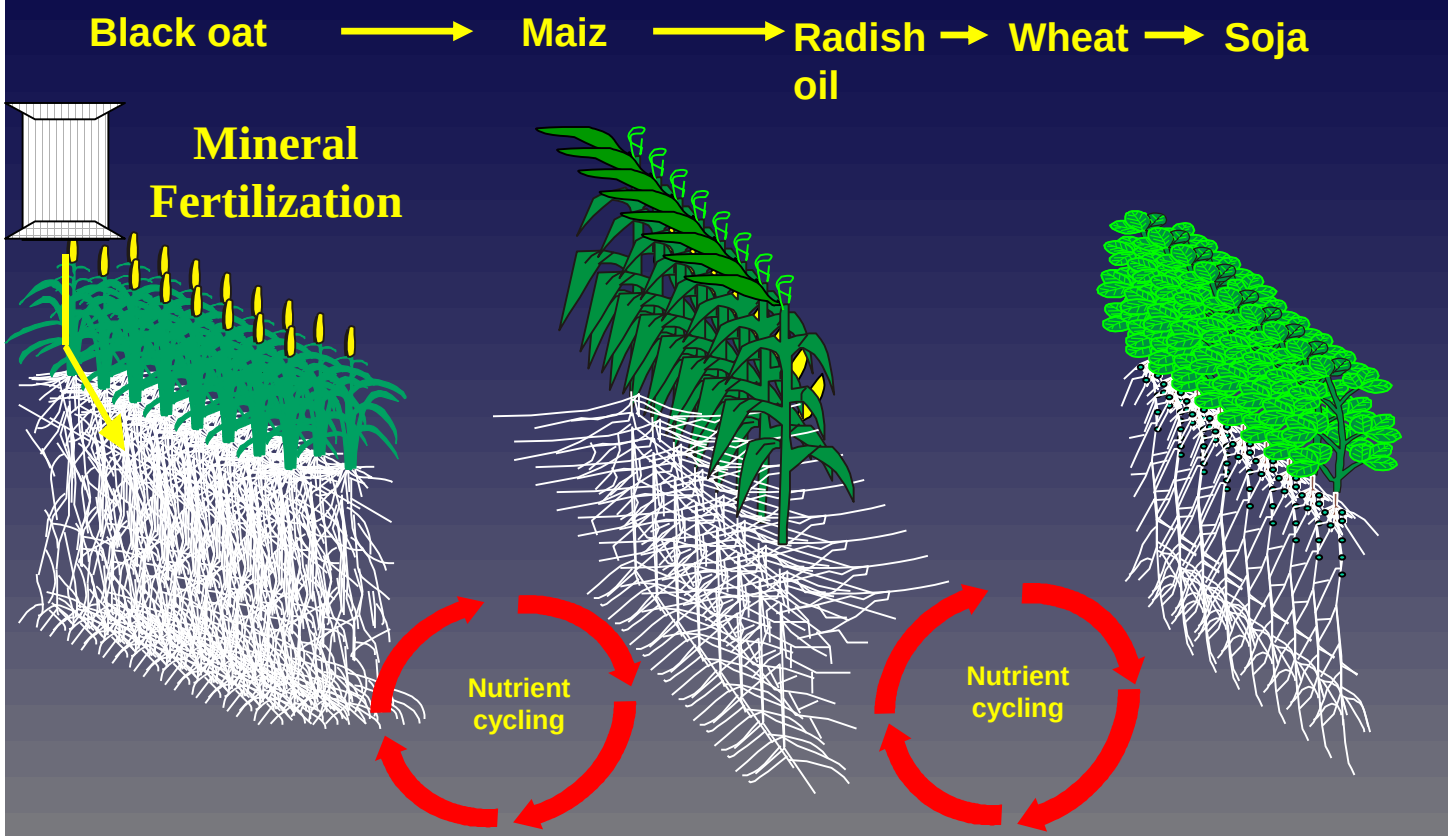
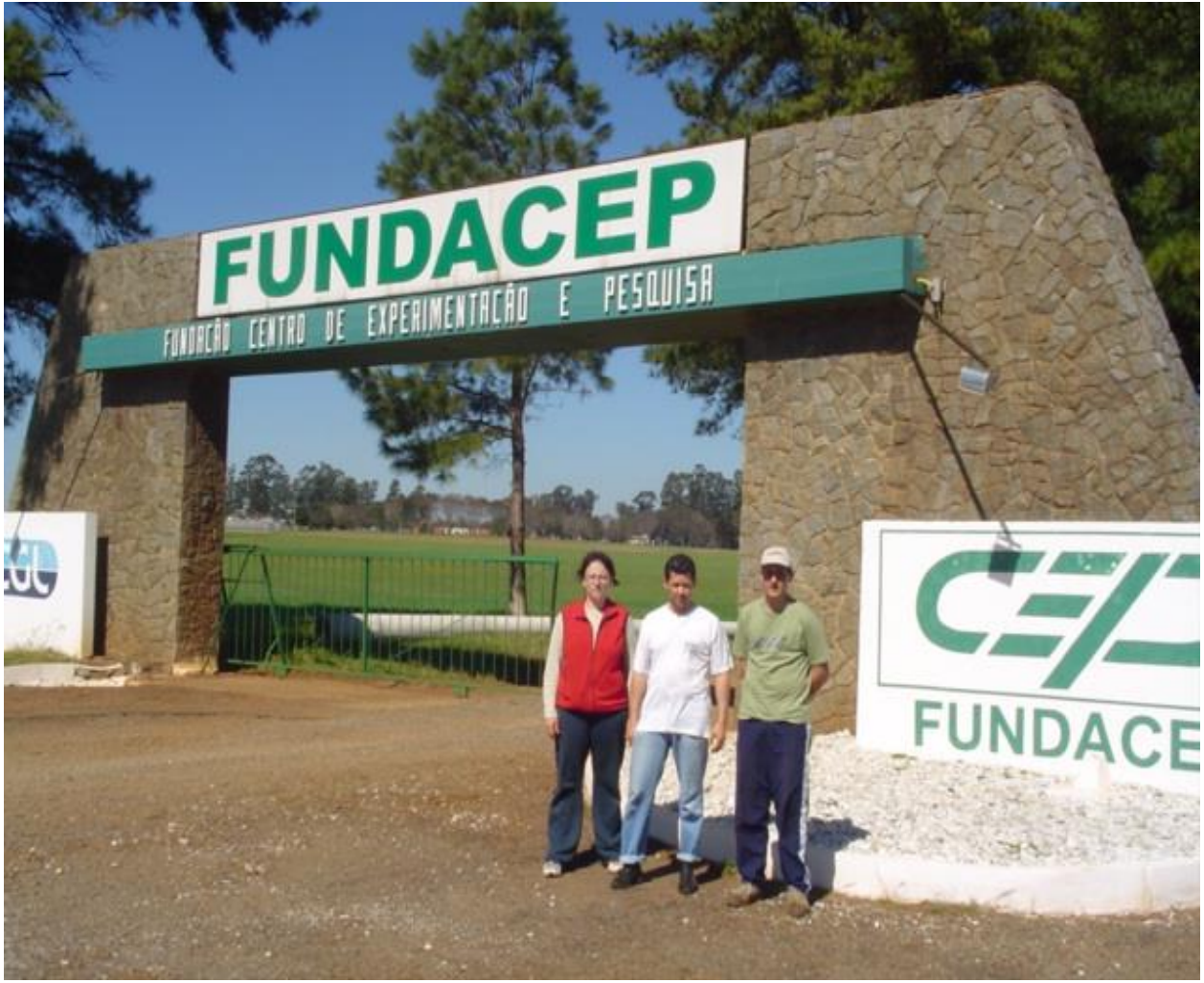


Figura 3. Erosão em área de plantio direto mantido em pousio no período pós-colheita de soja e pré-semeadura de trigo (ao fundo) e área adjacente na qual foi semeado o nabo forrageiro neste período. Tapera, RS. Foto: T. J. C. Amado (2014).

Carbon sequestration rate (C rate) expressed in equivalent mass (Mg C/ha/y) to a 30 cm depth for Manhattan, KS USA
Conversion from tilled to no-till

Rotation	
Continuous Soybean	0.066
Continuous Sorghum	0.292
Continuous Wheat	0.487
Soybean - Wheat	0.510
Soybean - Sorghum	0.311

Fabrizzi & Rice, 2006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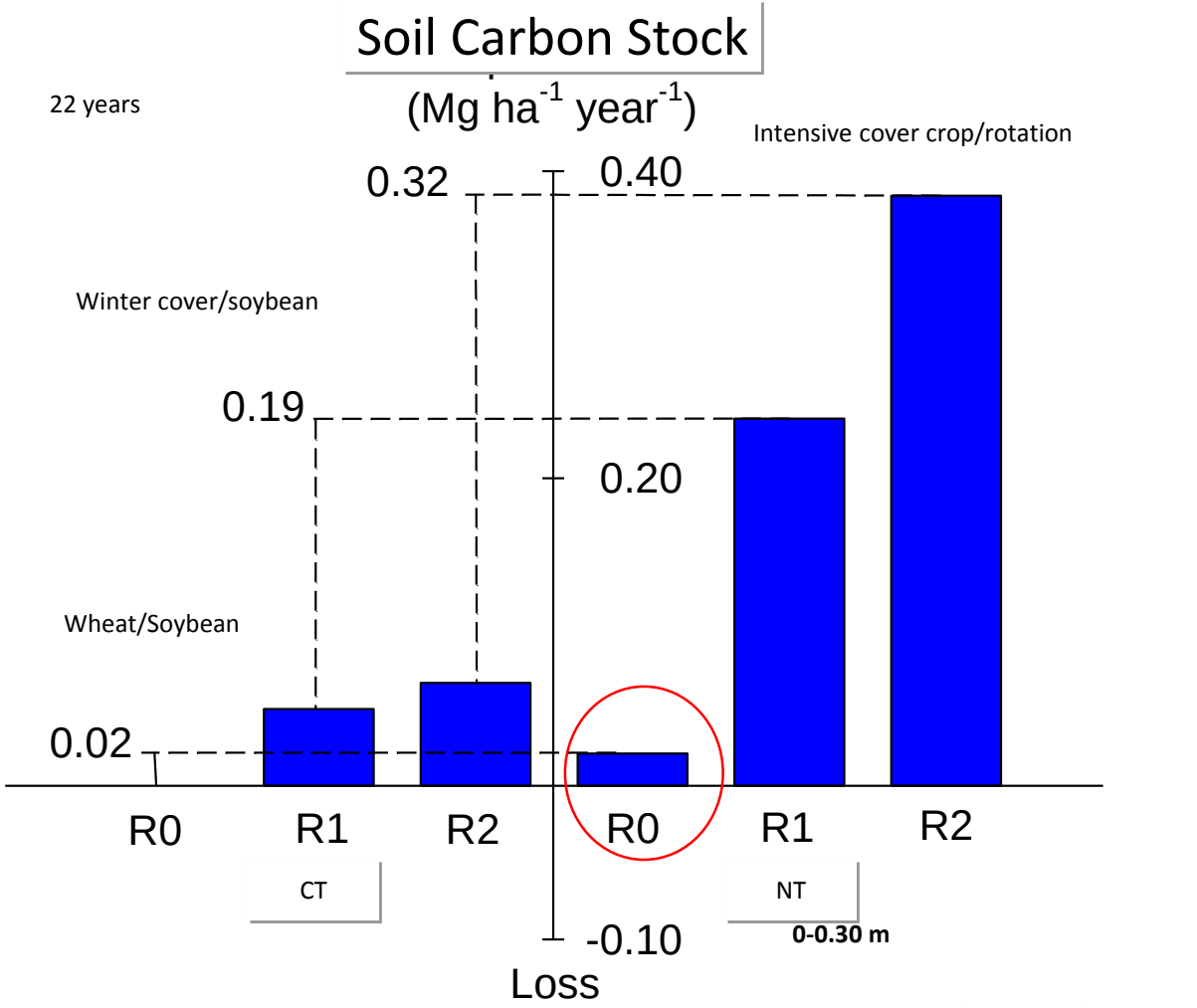
FUNDAÇÃO CENTRO DE EXPERIMENTAÇÃO E PESQUISA
FUNDACE



Fundacep, Nicoloso, 2009

Soybean Ecosystem C Balance

Soybean	Yield	C grain	CO2 Flux	CO2 flux-C grain
		---------- g m^{-2} ----------		
2006/07	321.3	150,95	-158.05	-7.10

Verma et al. (2005) +/- 45 g C m^{-2}

Conclusion: Carbon sequestration? Not with soybean

NT soybean neutral balance

Escobar, 2007 Não publicado

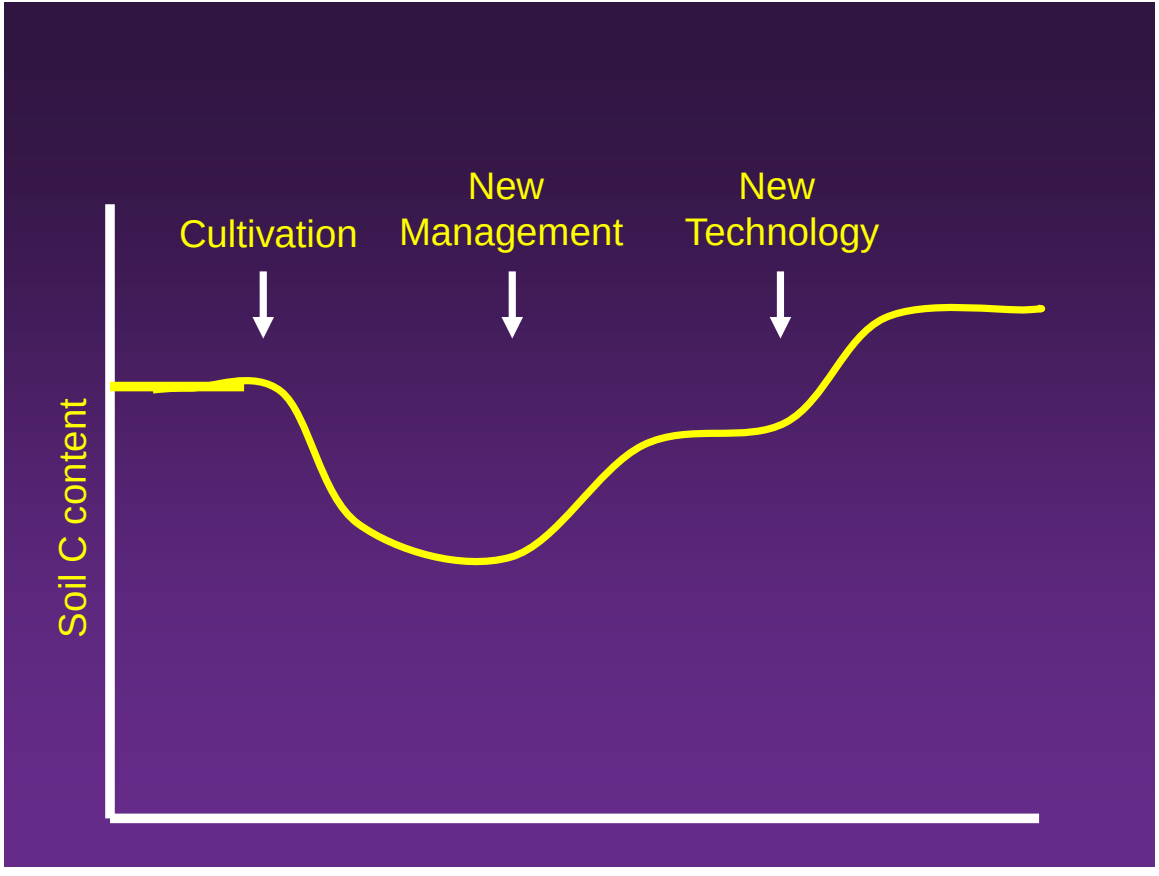
Biophysical GHG Mitigation Potential

	Soil C	N_2O& CH_4 Emissions	Upstream & Process	Net Impact
	---- t CO_2e/ha/yr ------			
No-till*	**1.09 (-0.26–2.60)**	**-0.18 (-0.91–0.72)**	**0.14 (0.07–0.18)**	**1.04**
Winter cover crops*	**0.83 (0.37–3.24)**	**0.25 (0.00–1.05)**	**0.61 (0.41–0.81)**	**1.69**
Diversify Annual Crop Rotations*	**0.58 (-2.50–3.01)**	**0.07 (-0.04–0.65)**	**0.00**	**0.65**

Rice, 2016

Para termos sequestro de Carbono é preciso

melhorar a qualidade do Sistema plantio direto



Rice, 2016

Novos materiais para cobertura do solo

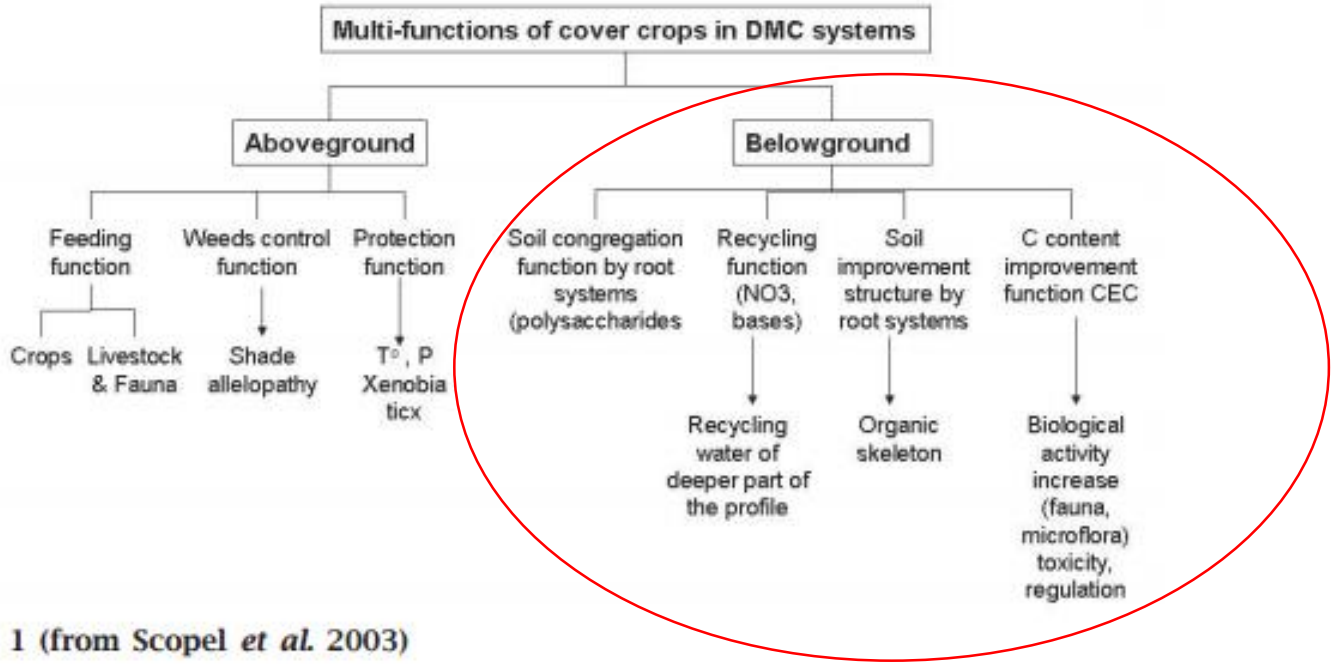
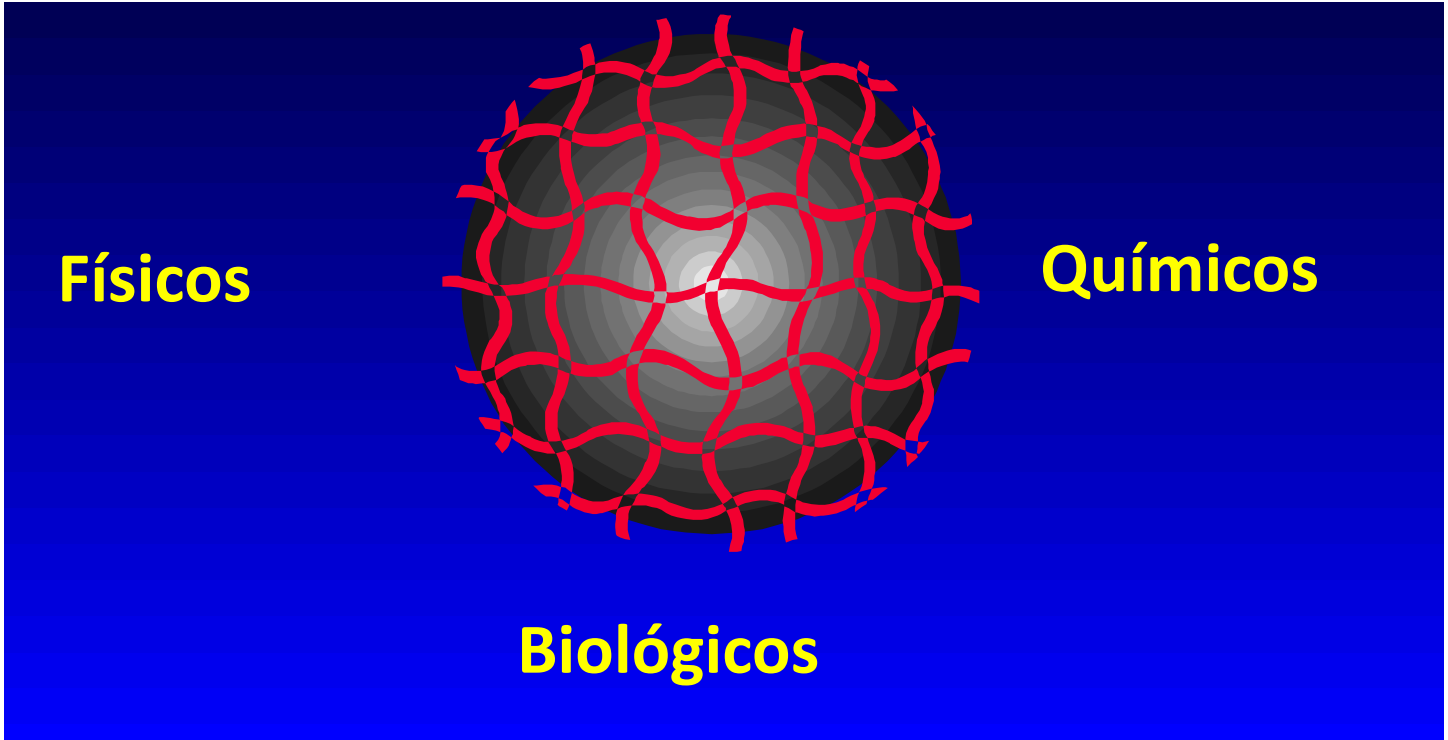


Figure 1 (from Scopel *et al.* 2003)

Citado por Tivet et al.,

Perfil de solo favorável ao enraizamento profundo



Saturação por Cálcio para a Camada de 0,25-0,40m

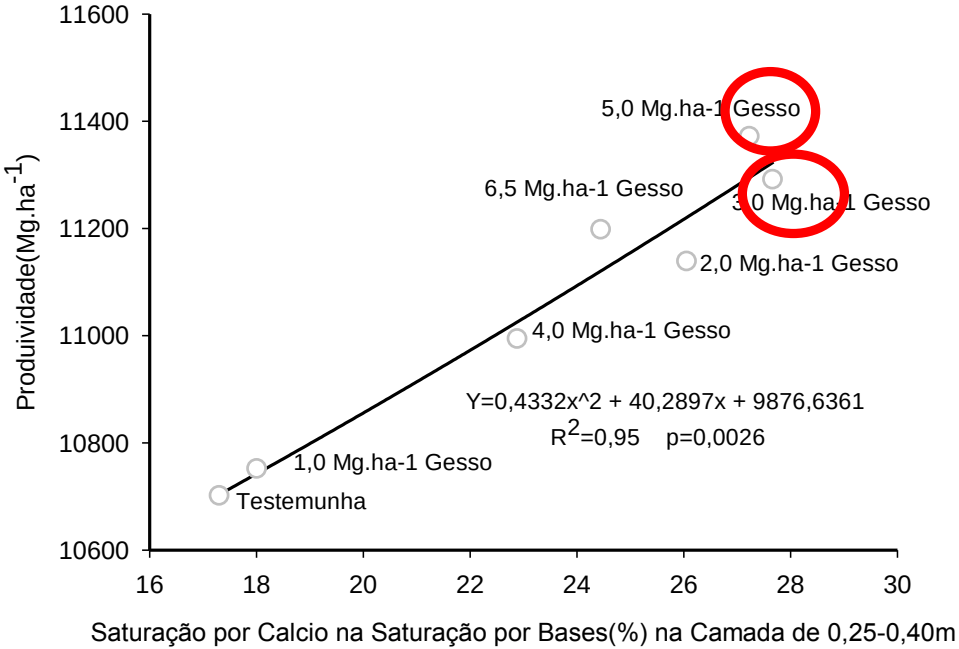


Figura 8. Relação entre Rendimento e a Saturação por Calcio para a Camada de 0,25-0,40m para diferentes doses de gesso.

Dalla Nora & Amado, Agronomy Journal 2013

Saturação por Alumínio na camada de 0,25-0,40m

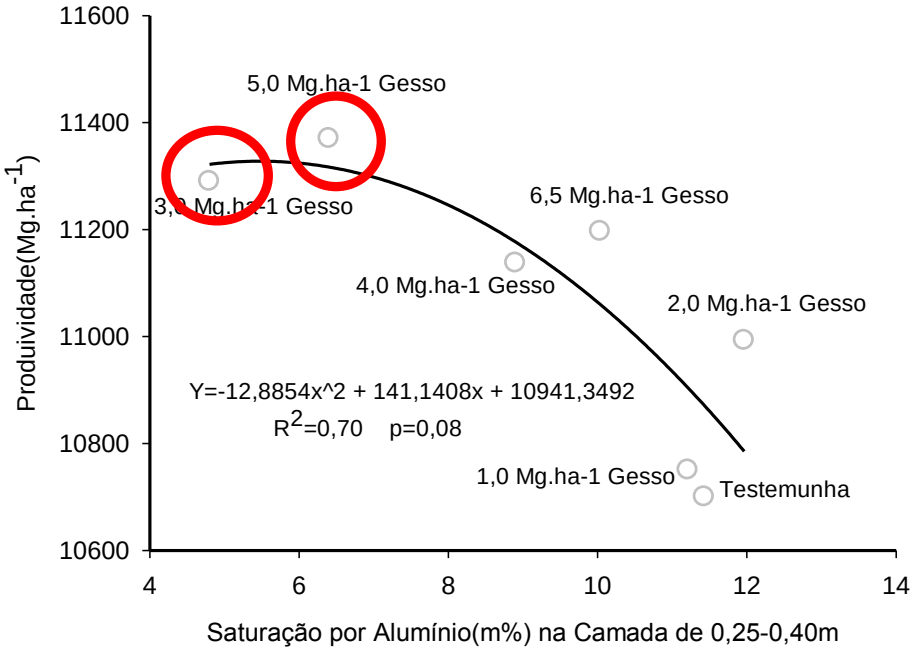
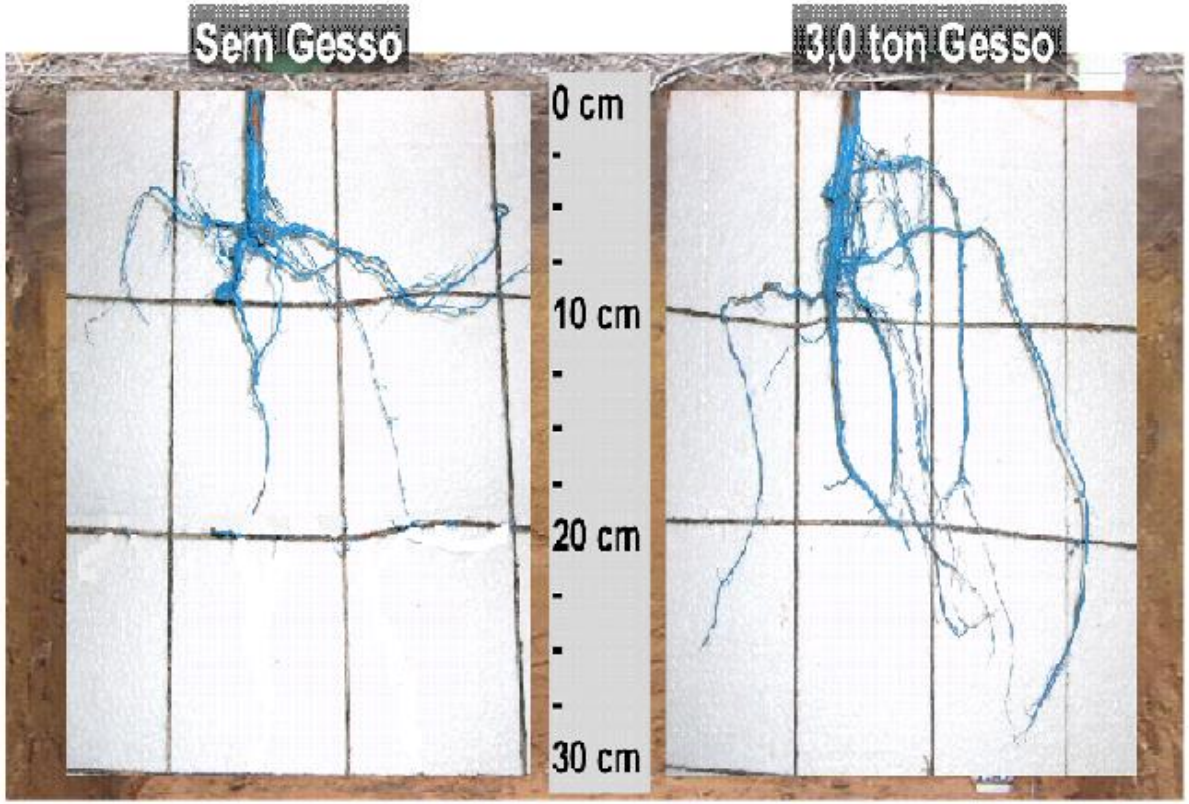


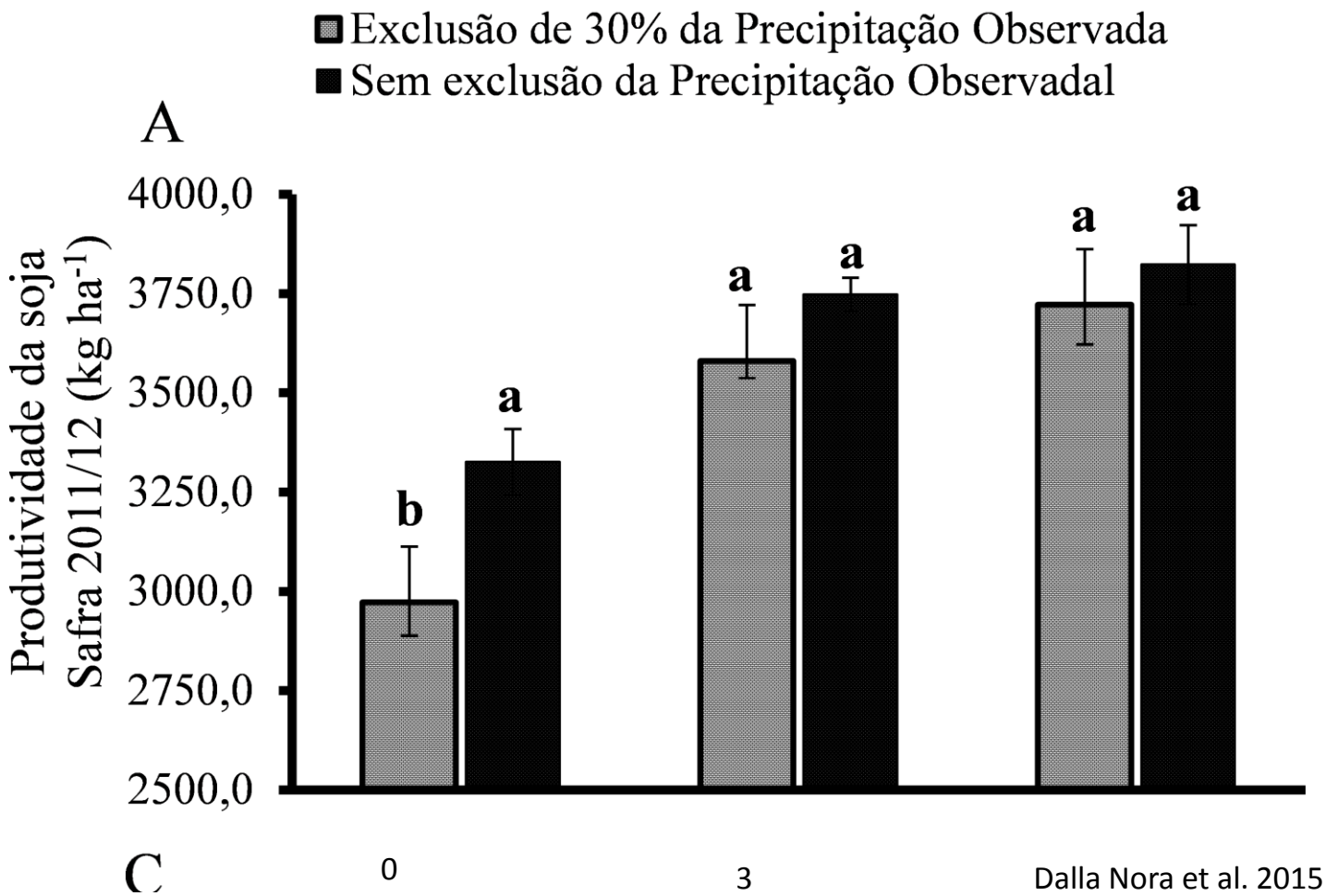
Figura 7. Relação entre Rendimento e a Saturação por Alumínio(m%) na Camada de 0,25-0,40m para diferentes doses de gesso.

Dalla Nora & Amado, Agronomy Journal 2013

Desenvolvimento radicular da soja após 42 meses

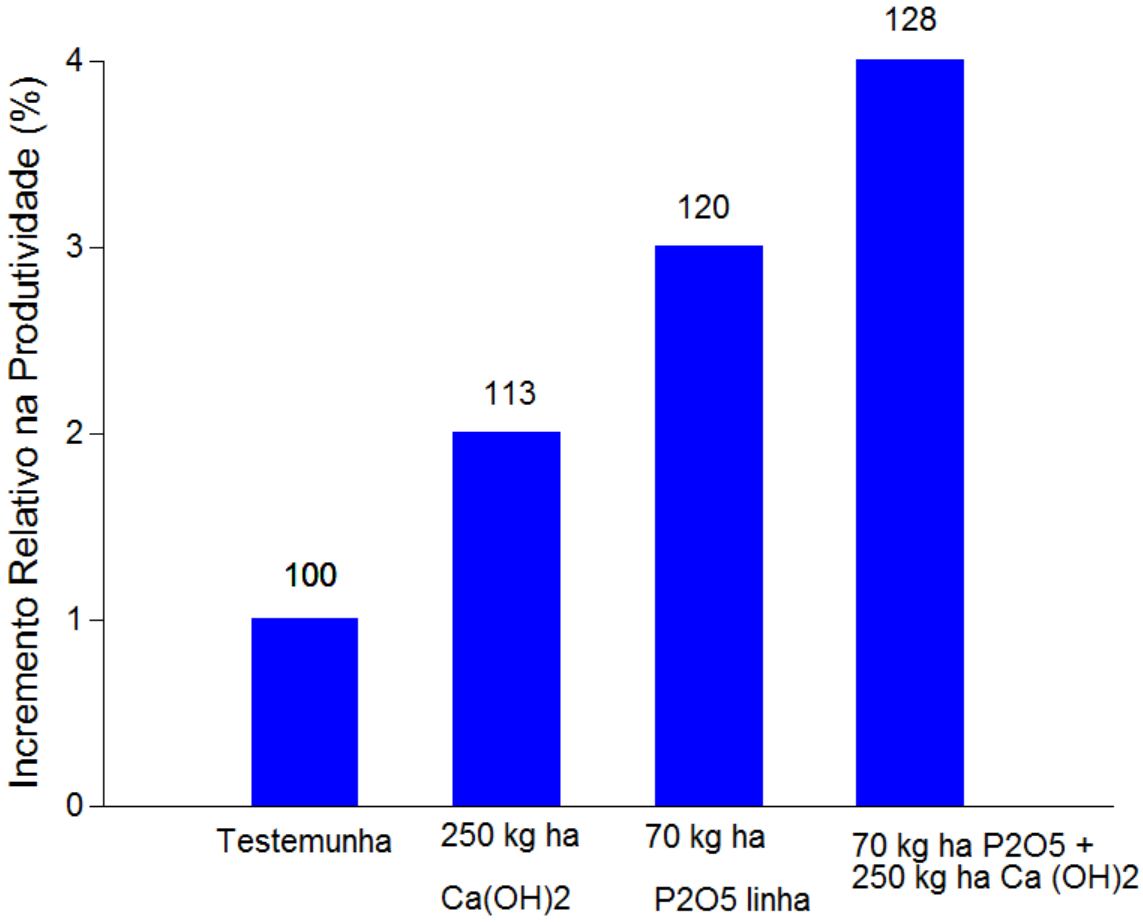


Exclusão da Precipitação



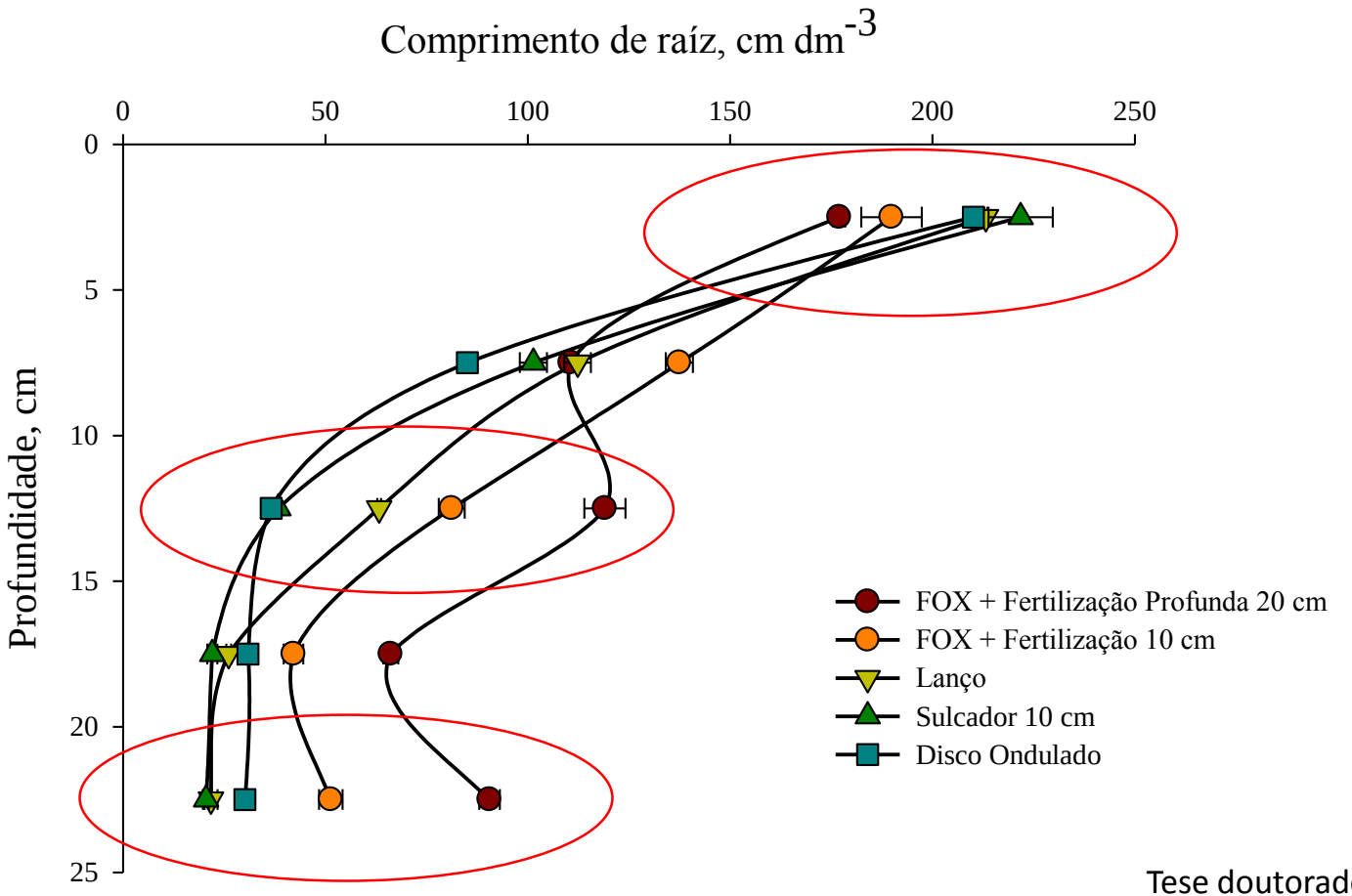
Dalla Nora et al. 2015

Hidróxido de Cálcio



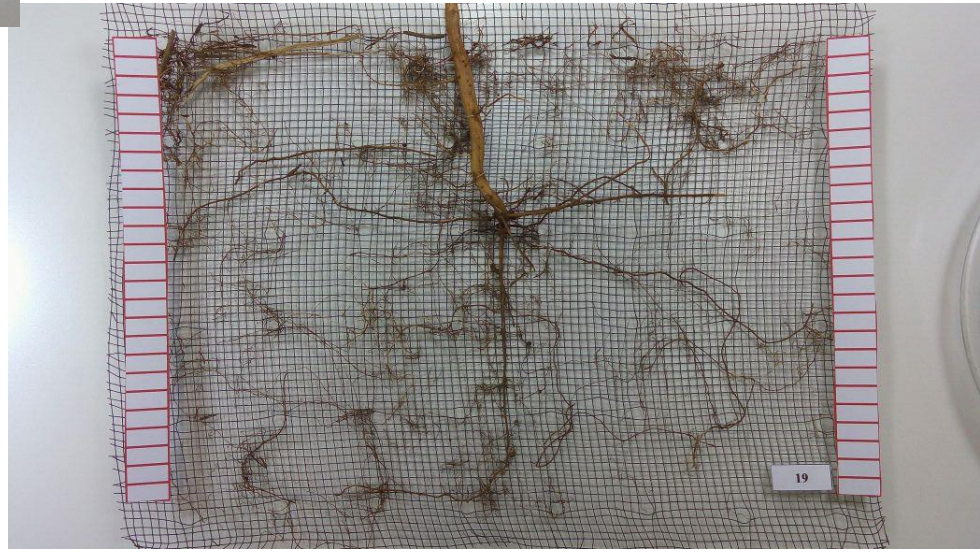
Hansel não publicado

Fertilização Profunda 20 cm



Tese doutorado Hansel, 2016


31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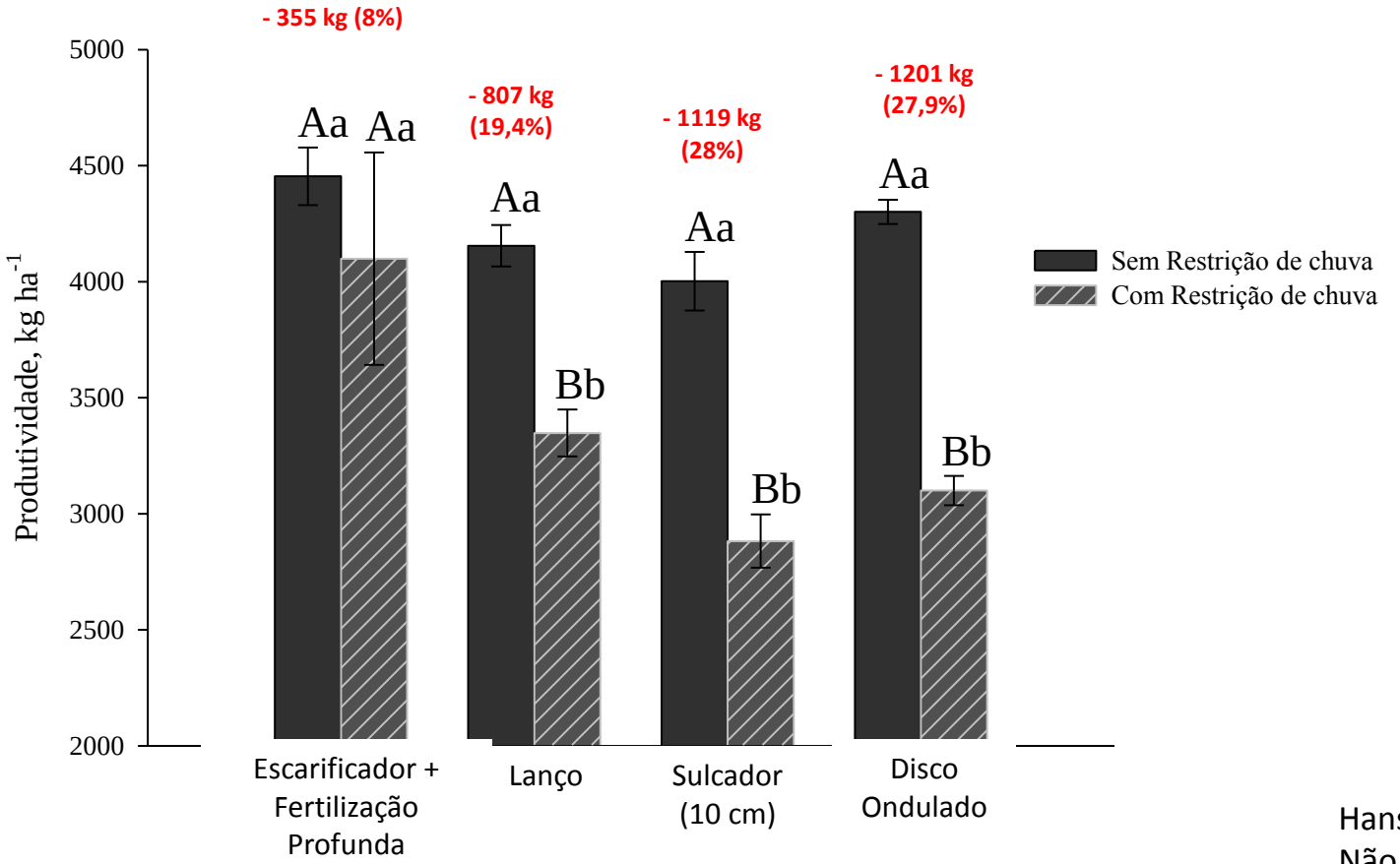
Casas de restrição de chuvas



Hansel, 2016
Não publicado

*Letras maiúsculas diferem entre tratamentos. Letras minúsculas diferem o regime pluviométrico dentro de cada tratamento.

“Coquetel” of cover crops = different root systems

Fonte: Cematter

Fonte: Cemater

Cover crops +chiselling

Source: Cematter


PROJETO
AQUARIUS
Trânsito controlado

Controlled Traffic

Trafego Controlado

Marcos Souiljee + Paulo Pires (Prestador Serv.) + UFSM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Aquarius
15 ANOS

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Muito obrigado!!!