2nd AIEE Energy Symposium
Current and Future Challenges to Energy Security

Session **Modeling the new environment**

Assessing the role of innovative farming techniques to reduce energy consumption and carbon emission

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AGRICARE
Innovative Green Farming

Outline

- *Policy framework*
- *Whole food chain*
- *Agriculture energy consumpton and GHG emission*
- *Potential Mitigation actions in agriculture*
- *Precision Farming and Conservation Agriculture principles*
- *Evaluating energy and emission reduction*
- *The RDP role in promoting regional innovation adoption*

Policy scenario framework

The Kyoto Protocol: in 2012, Italy has achieved the target of reducing its CO_2 emissions by 6.5% compared to 1990.

Europe 2020 Strategy: Climate change and energy sustainability (objectives 20/20/20): 20% reduction in greenhouse gas emissions compared to 1990; 20% energy from renewable sources; 20% increase in energy efficiency.

A Roadmap for moving to a competitive low carbon economy in 2050 (SEC (2011)289): an agricultural GHG reduction target of **36-37%** by 2030, and a more ambitious one (**42-49%)** by 2050.

Policy scenario framework

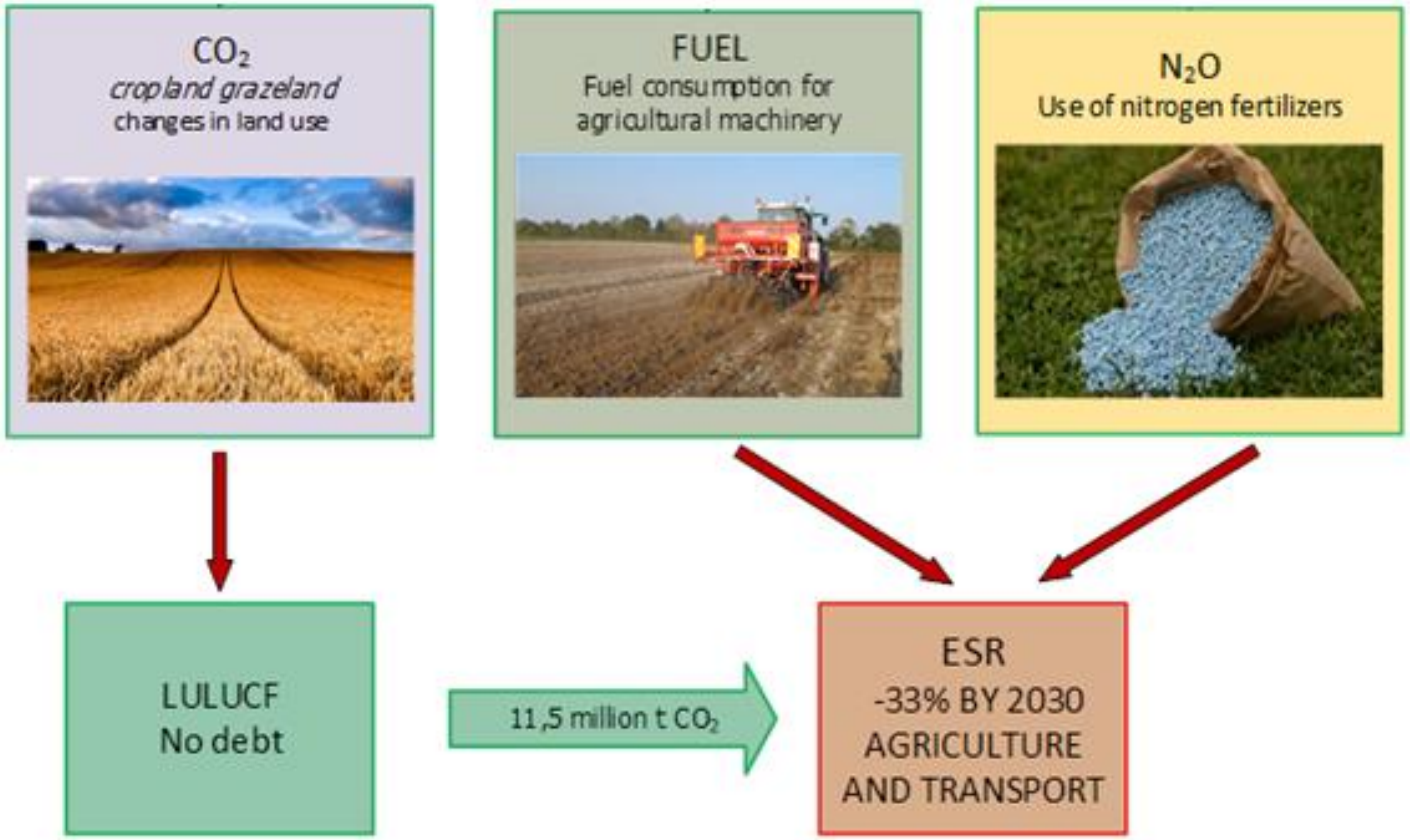
Paris Agreement, EU objectives by 2030:

- a 43% reduction in emissions compared to 2005 for the EU-ETS sector;
- a 30% reduction in emissions compared to 2005 for the non-EU-ETS sector;
- 0 carbon debt commitment (so called "No Debt") for LULUCF sector.

For Italy, the reduction target is set at 33%, which corresponds to 111.7 $MtCO_{2eq}$.

Policy scenario framework

Agriculture emissions contribution as proposed at Paris Agreement on the non-EU ETS and LULUCF sectors



Sustainability of the whole Agri-food chain

INPUT

Agriculture	Food processing	Transport	Distribution	Domestic preparation
Soil Water Fertilizers Pesticides Energy	water, energy additives refrigeration packaging	Fuel Refrigeration	energy refrigeration packaging fuel	water energy refrigeration packaging
Soil loss Polluting Greenhouse Gases emissions Waste water Organic waste Plastics	Waste water Waste Greenhouse gases Polluting emissions	Greenhouse Gases Polluting emissions	Greenhouse Gases Polluting emissions	Greenhouse gases Polluting emissions Food and Packaging waste

OUTPUT

EU : Agriculture and Energy

The energy share of agriculture is one of the lowest

Countries	Energy consumption by agriculture			Share over total Energy consumption
	1990	**2000**	**2010**	**2010**
	ktoe			**%**
EU27	32698	28174	25074	2.2
Italy	2908	3014	3017	2.4
Spain	1668	2561	2329	2.6
France	3471	3807	3520	2.2
Poland	3384	4618	3781	5.7
UK	1277	1148	939	0.7

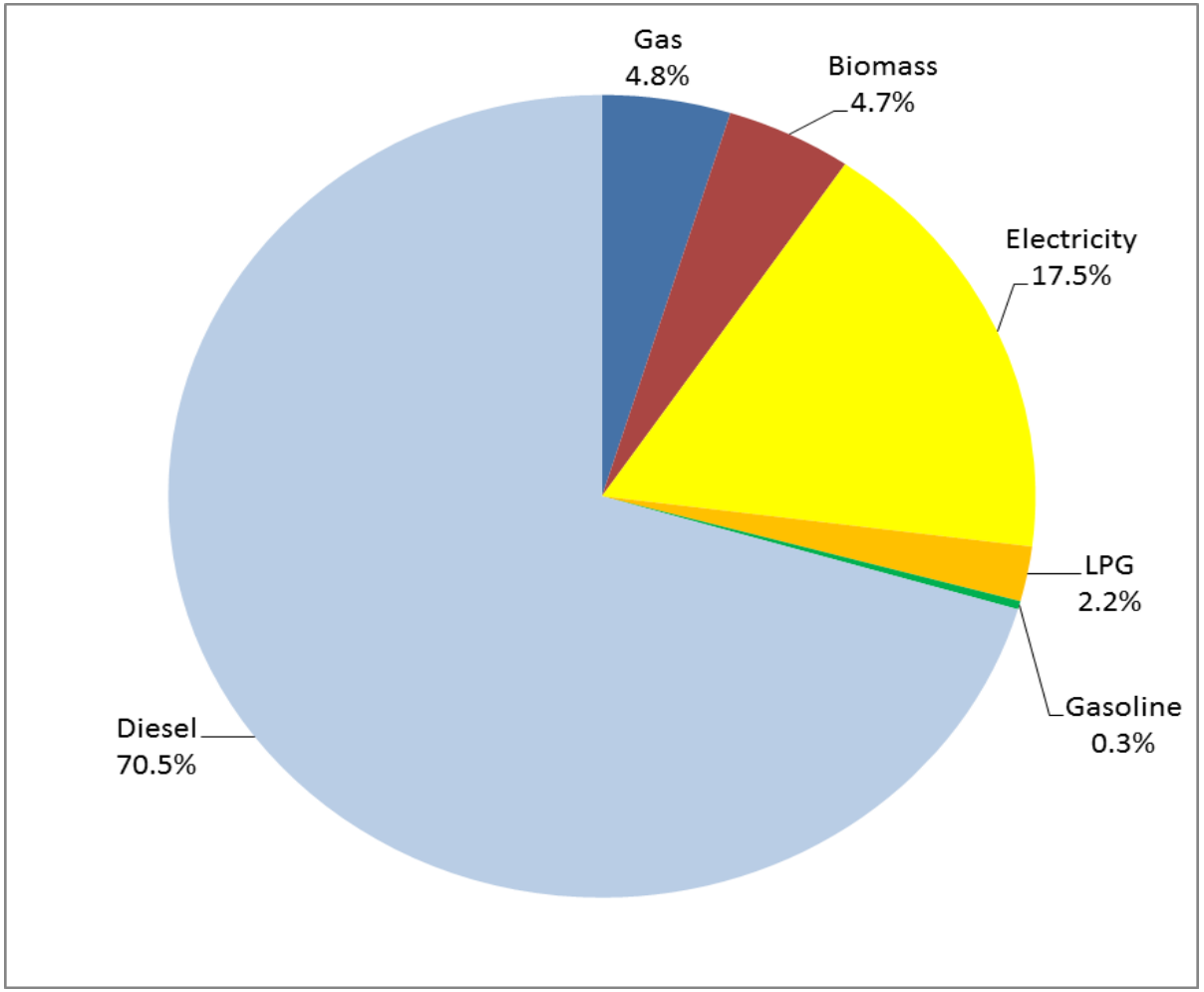
Source: Eurostat data, 2010

Italy: Agriculture vs Energy

Agriculture energy consumption by vector type, average data, 2009 -2012

Fossil fuels are more than 90% of total energy consumption

Diesel accounts for 70% of total consumption

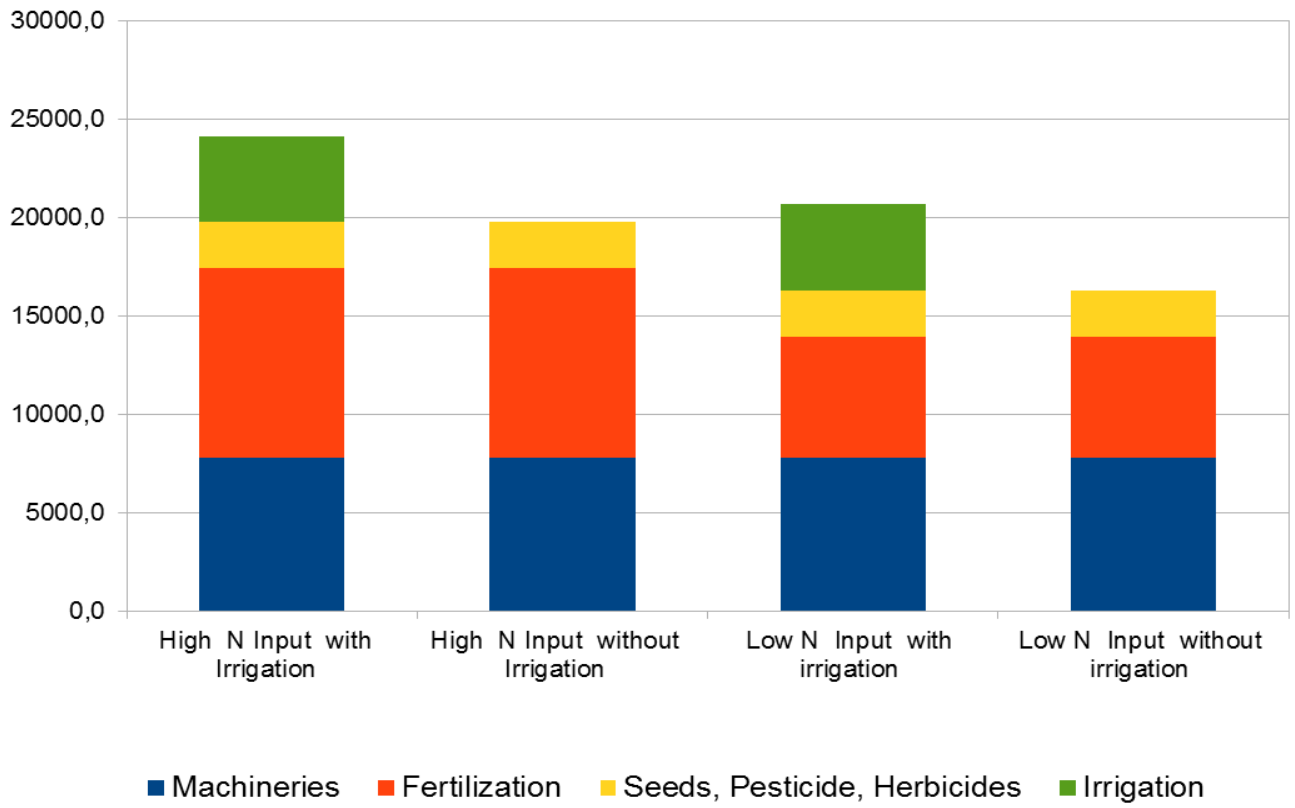


Source: National Energy Balance (BEN). Ministry of Economic Development, 2012

How much energy to cultivate one ha?

The Gross Energy Requirement is the total amount of energy required for a product. Normally it is expressed as MJ per kg or per ha

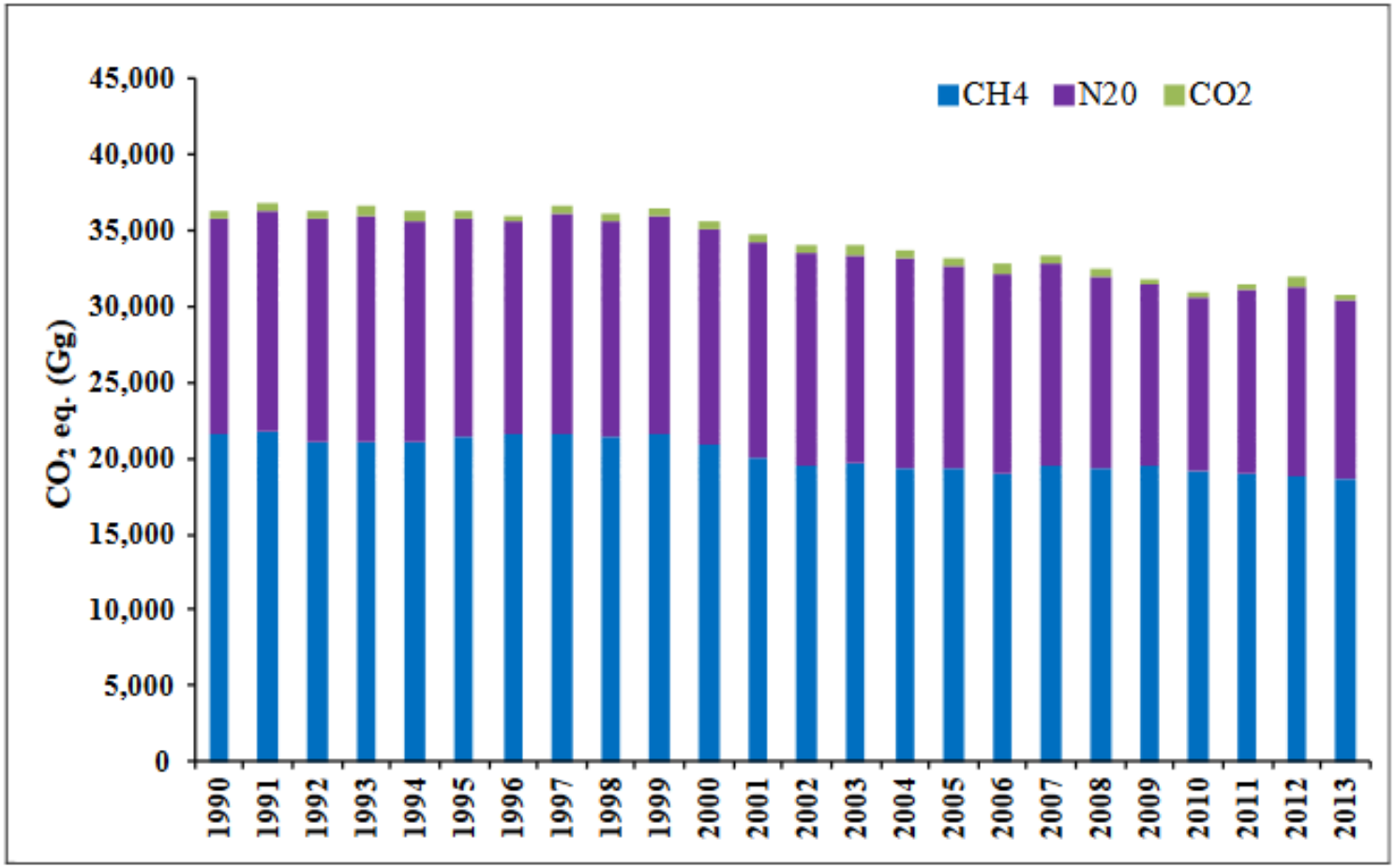
Energy expenditure could change according to input intensity



E.g. Sugar beet cultivation according to different input levels

Italy: Agriculture vs GHG emissions

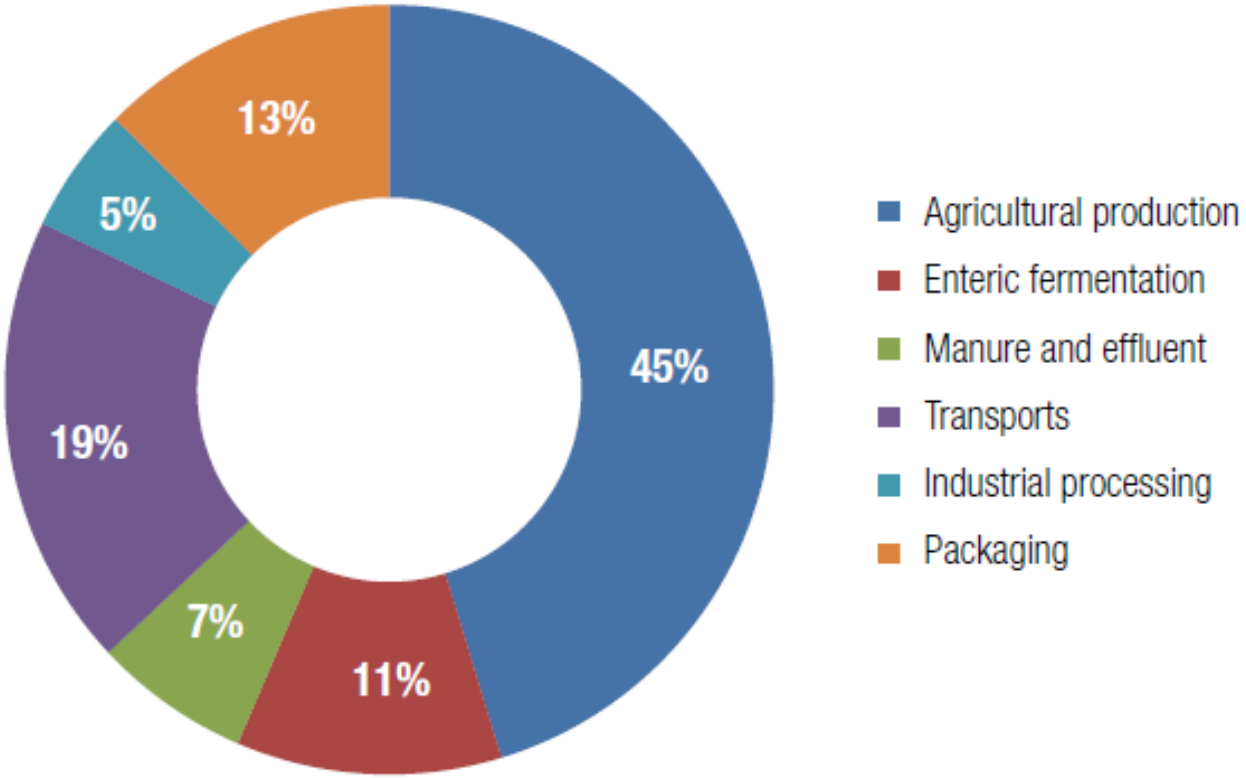
CO2 is very low while CH4 from enteric fermentation and N2O from soils and fertilizers use are more considerable



Source: ISPRA National Inventory report 2015

Overall agrifood chain emission

% of GHG emission for the whole agrifood chain



Source: Agricarbon project ISMEA, 2009

Agriculture and mitigation policies

Agriculture sector must reduce its GHG emission and contribute significatively to world and EU environmental goals

Main options could be:

- *To reduce **direct** emission (e.g. tractors. gasoil – fertilizers, N_2O)*
- ***Store**, keep and/or increase Soil carbon content*
- *To decrease **indirect** emission (input: fertilizers, pesticides, seeds)*

We have some methods and innovation to deal with but we have to demonstrate, evaluate and support their implementation and diffusion

Project LIFE+ "AGRICARE"

AGRICARE

Innovative Green Farming

Under the call LIFE+ Environment Policy and Governance

Introducing innovative precision farming techniques in Agriculture to decrease Carbon Emissions

Project :

Timetable mid 2014 – 2017 (3 years)

Budget: € 2.577.825 (total); € 971.480 (EU contribution)

AGRICARE project

<u>Main scope</u>: to **test** and **implement** innovative techniques for more environmental friendly cropping systems and encouraging the transfer of innovation to farms.

CONSERVATION

PRECISION

Integration
Testing
Demonstration

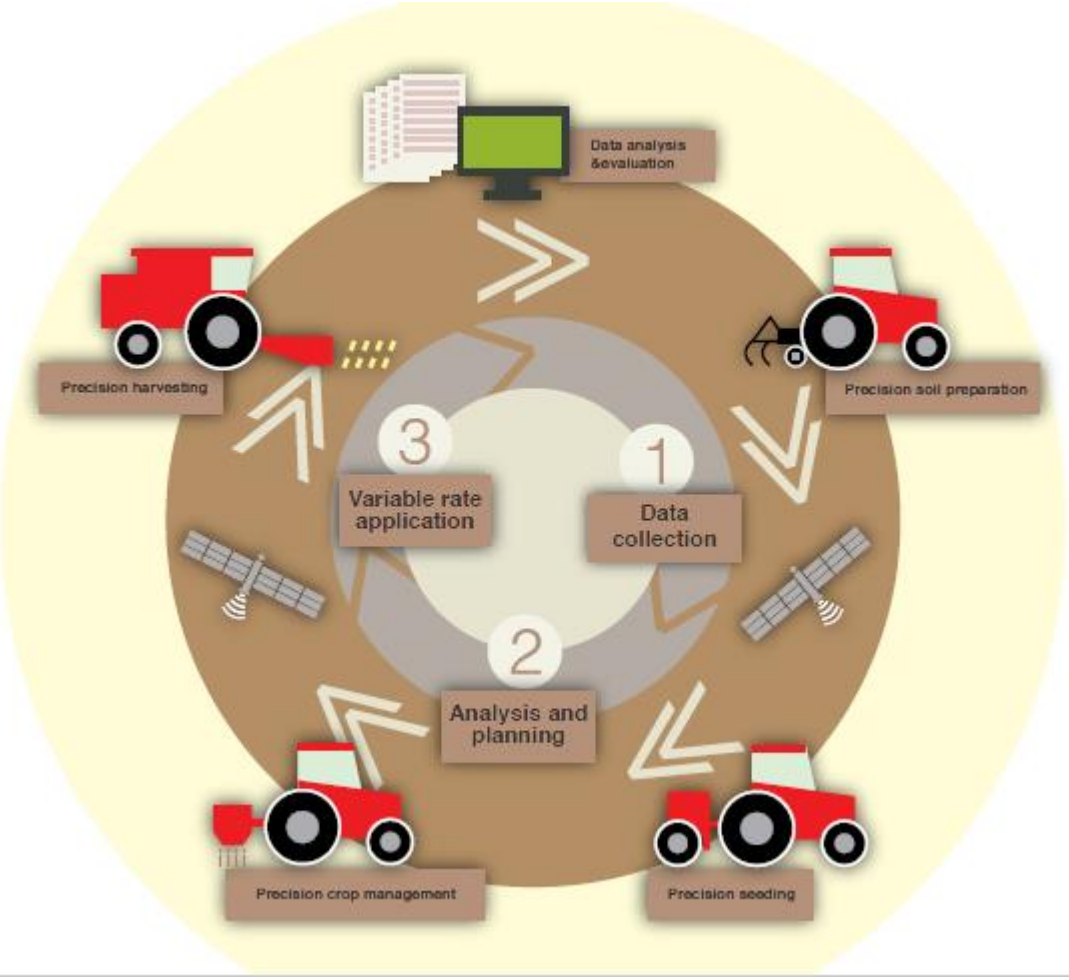
COMPETITIVENESS

MITIGATION

The challenge to apply innovation to thousands of farms overcoming technical and non technical barriers

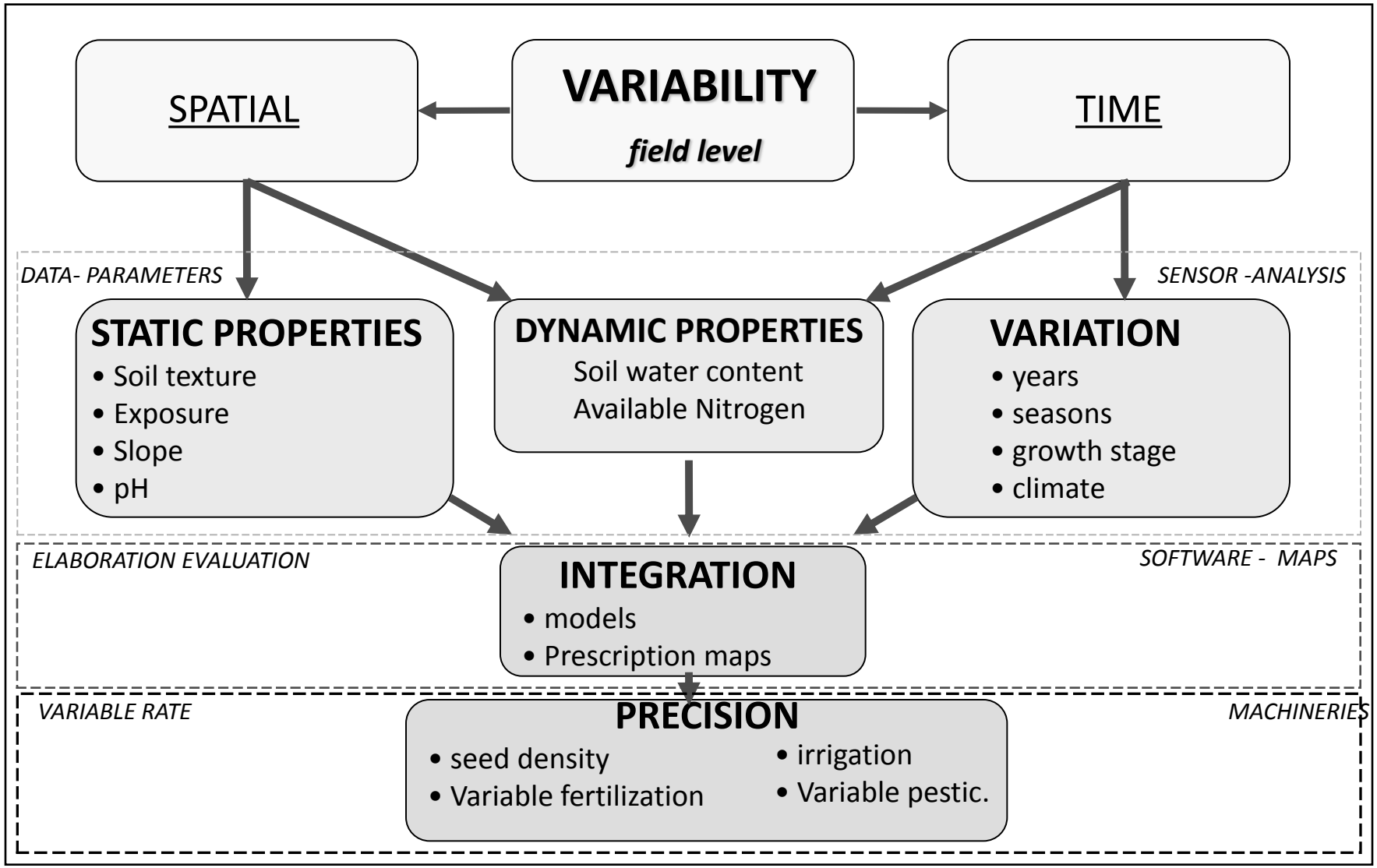
Precision Farming Application

What crop needs, when it needs and in the right amount !



Precision Agriculture could be defined as the application of technologies and principles to manage spatial and temporal variability at field level For the purpose of improving crop performance and environmental quality (Pierce & Nowak, 1999)

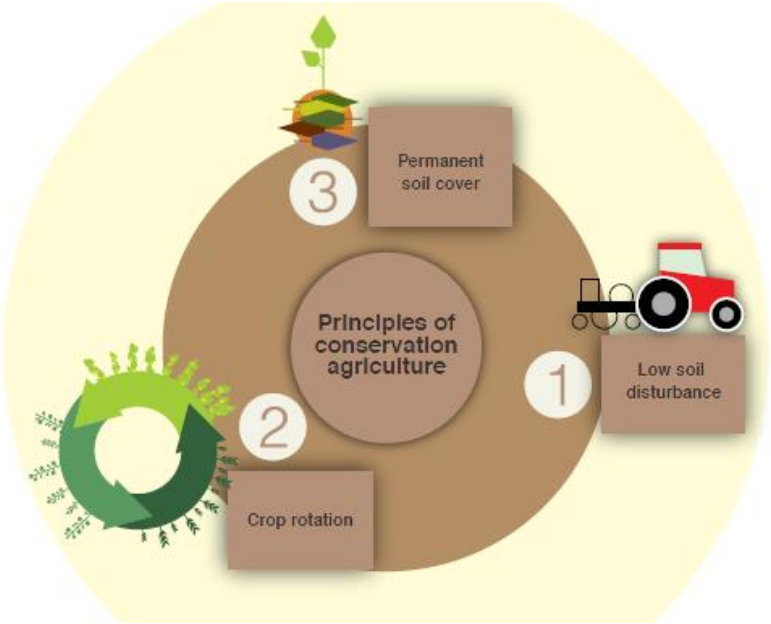
Precision Farming Application



Conservation Agriculture

Three Pillars

- Avoiding ploughing and soil layer inversion
- Appropriate crop rotation
- Using cover crops for permanent soil protection



The aim is to protect the soil and soil organic matter content (C)

New machineries with assisted driving

Stronger electronic integration for operation management

Combined machineries for No, Minimum and Strip tillage

Contessa, combined seeder

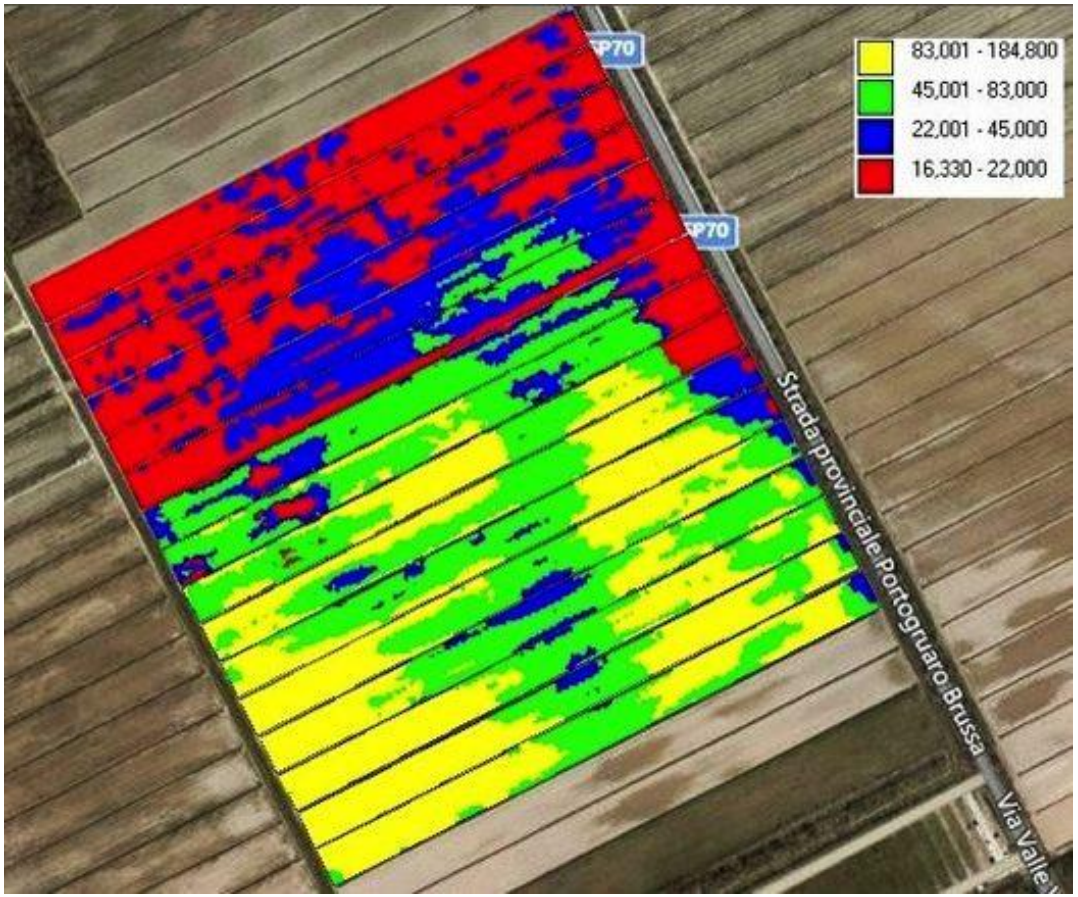
Regina,
Precision planter
for No Tillage

Uragano, large sprayer with 7 autonomous sections

Zebra , strip tillage and fertilization

Field variability assessment

ARP analysis (Automatic Resistivity Profiling)



Deep analysis of physical and chemical soil characteristic to understand variability and apply input at variable rate

Wheat fertilization maps and seed density

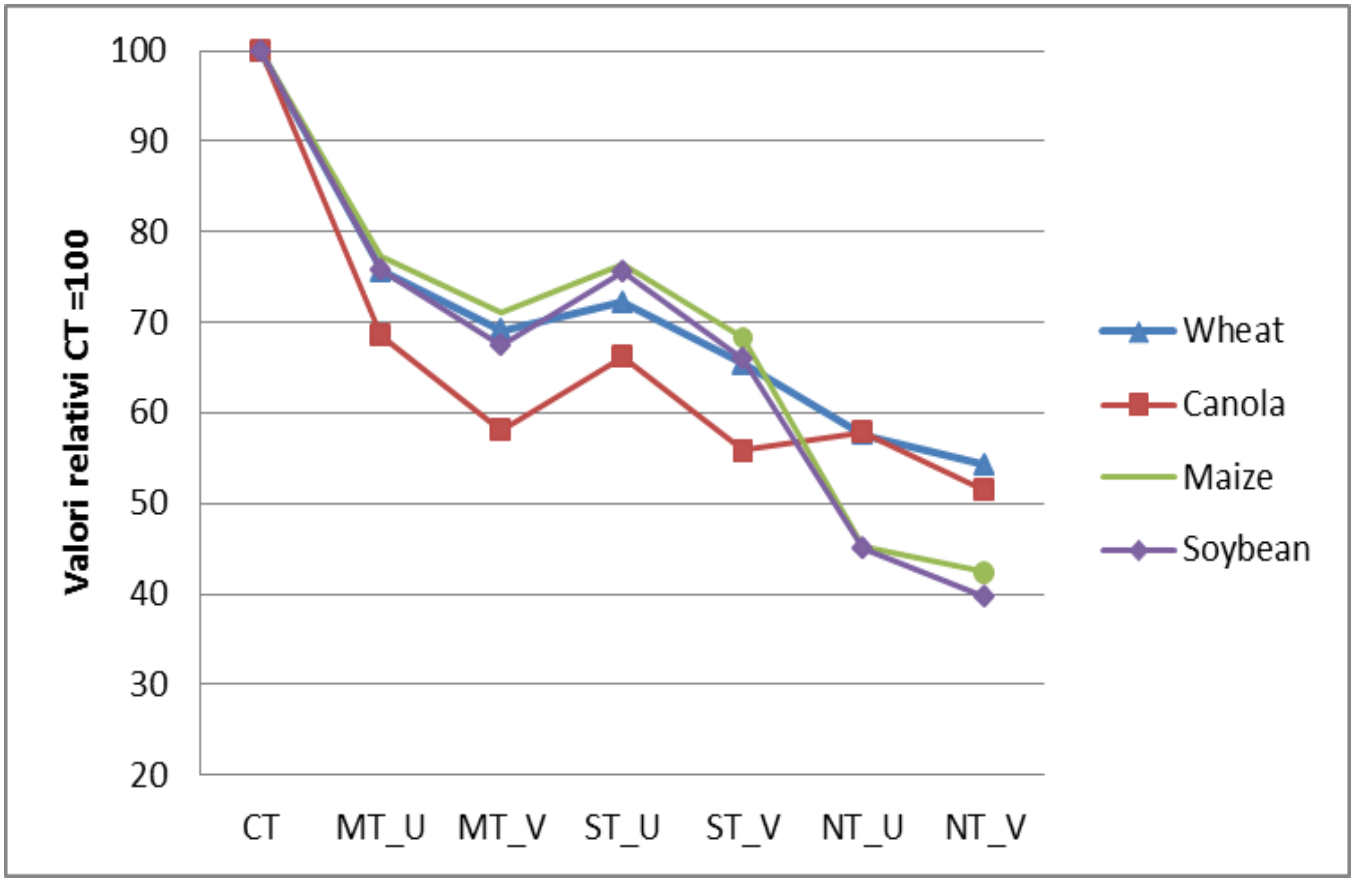
Crop	Demotest	Zone	Rate seed (pp/mq)	N application (kg/ha)
Wheat	CT	-	500	178
	MT	A	500	150
		B	500	190
		C	500	140
	ST	A	260	150
		B	260	190
		C	260	130
	NT	A	550	150
		B	550	190

Choice of different nitrogen and seed application level

Different color different N rate

Energy: diesel consumption

A sharp decrease in fuel consumption!



CT Conventional

MT Minimum Tillage

ST Strip Tillage

NT No Tillage

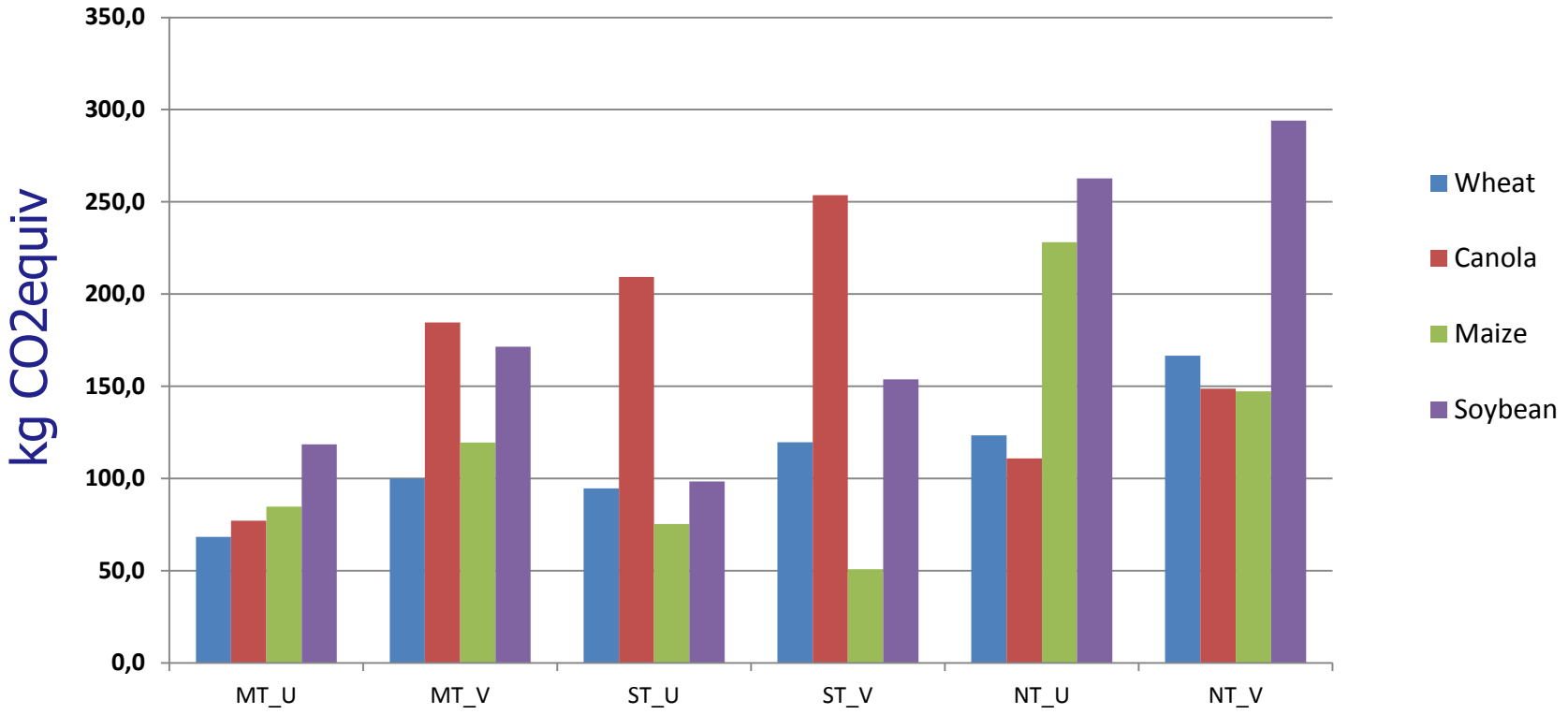
U Uniform application

V Variable application

Source: AGRICARE project

Energy: carbon emission

kg CO_{2equiv} saved x hectare x crop x technique

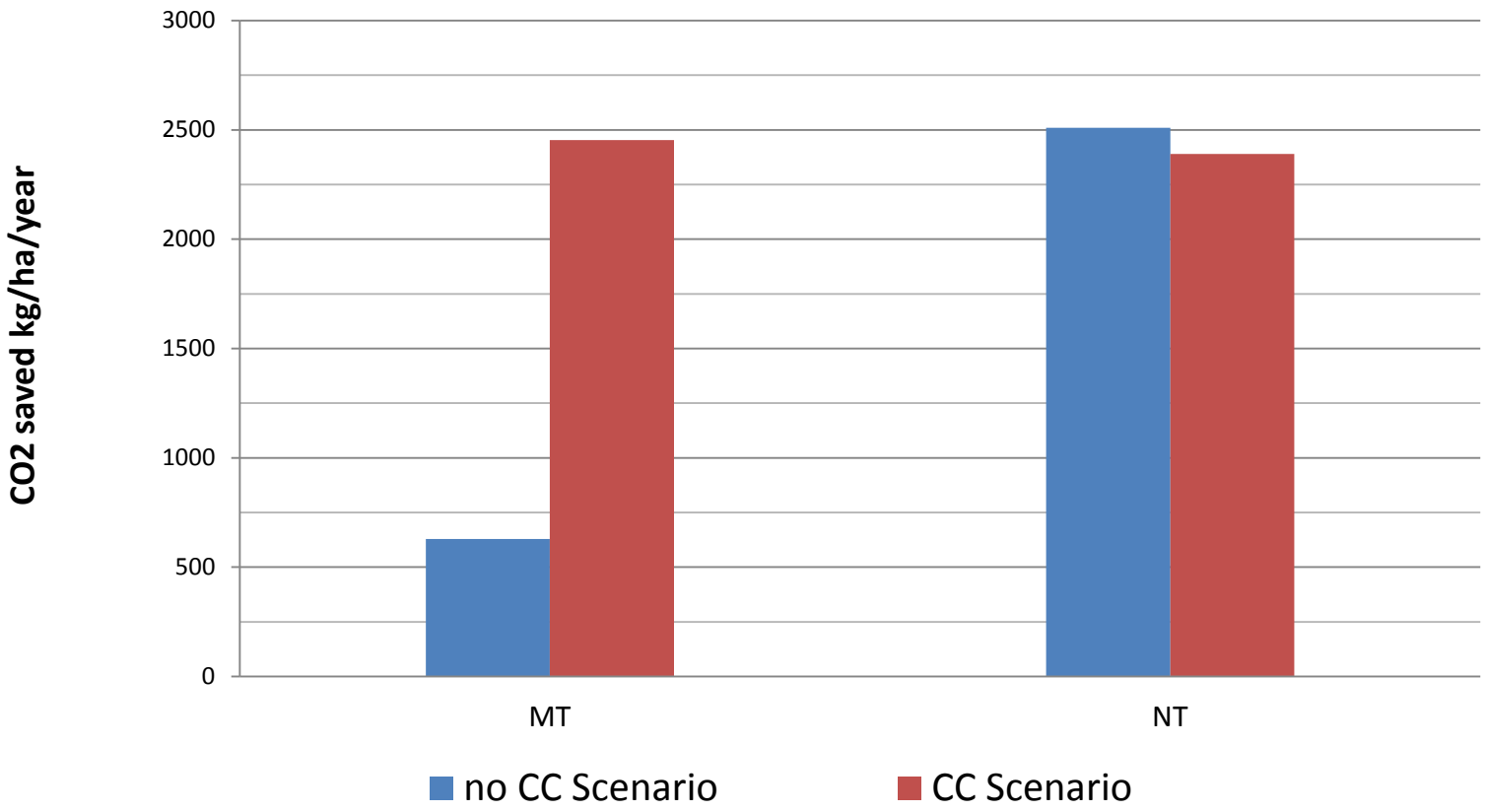


CT Conventional **MT** Minimum Tillage **ST** Strip Tillage **NT** No Tillage

U Uniform application **V** Variable application

Carbon emission avoided by soil

Carbon storage in SOM is a main issue and Conservation Agriculture helps to keep it. It's a good strategy to mitigate GHG emission



RDP 2014-20 for Conservation Agriculture

Planned public expenditure, target surface and premiums awarded for Conservative Agriculture

Region	Measure	Public expenditure (euros)	Target area (ha)	No tillage premium (euros)	Cover crops premium (euros)	Minimum tillage premium (euros)
Emilia-Rom	10.1.4	4.851.410	3.732	250	30	
Sicily	10.1.f	4.000.000	2.240	253		
Friuli VG	10.1.1	2.000.000	800	600		534
Lombardia	10.1.4	38.000.000	51.000	55-240	180	
Piedmont	10.1.3	22.000.000	19.000	280	230	180
Veneto	10.1.1	9.740.260	4.441	530-600		325
Lazio	10.1.5	11.600.000	9.700	130-300		
Tot.		92.191.670	90.913			

92.2 million euros, only 0.5% of the total national budget for 2014-20 programming period

AGRICARE

Innovative Green Farming

Agriculture has significative responsibilities and commitments about climate change issues.
Mitigation and adaptation strategies are challenges to innovate methods, techniques and could be the road to increase farming competitiveness and wider impact reduction by decreasing energy, direct an indirec,t consumption

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