Innovative biomass production systems – Sequencial cropping

GREENMEUP

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CIB

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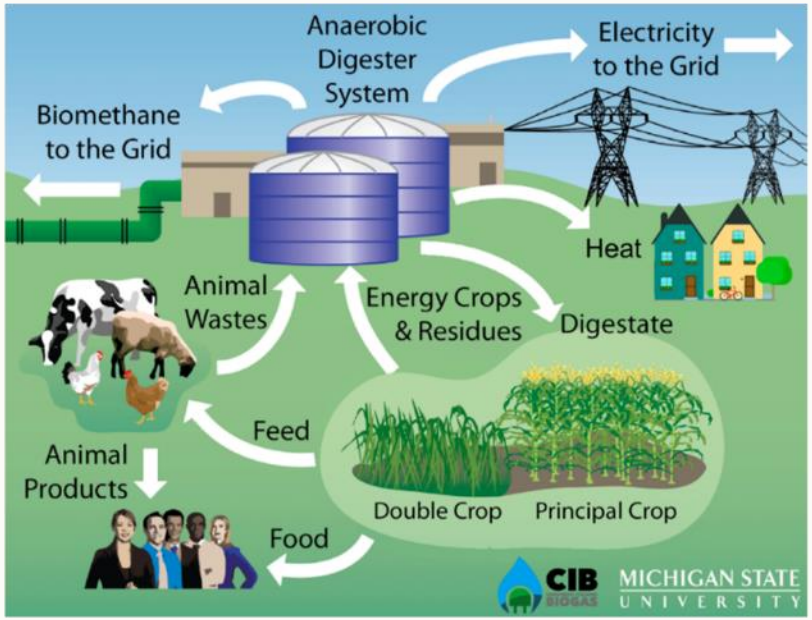
BIOGASDONERIGHT: FOOD&FUEL
bioeconomy and regenerative agriculture

In the Italian experience the Biogasdoneright model is a different way of farming improving economic and environmental performances of farms. The pillars of this approach are:

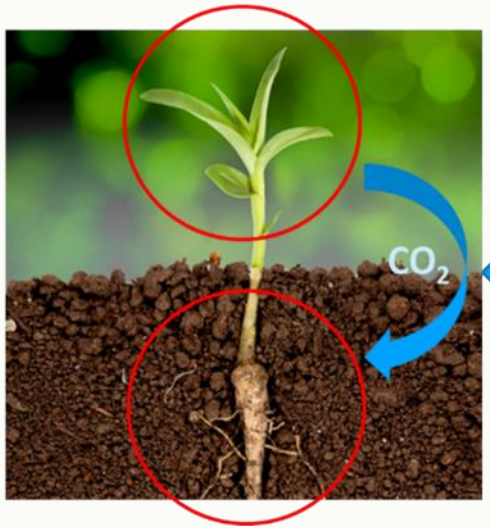


- The mitigation of emissions from livestock effluents and other residual biomasses
- Keeping the soil covered the whole year applying new and improved crop rotations with a larger fraction of nitrogen fixing crops and other double crops
- Organic fertilisation with digestate, soil nutrient balance and new machinery avoiding nutrients losses and soil compaction
- The shift from deep plowing to precision farming and minimum tillage agriculture
- Increased share of renewable energy in agriculture (power, heat, biomethane)

BIOGASDONERIGHT: FOOD&FUEL

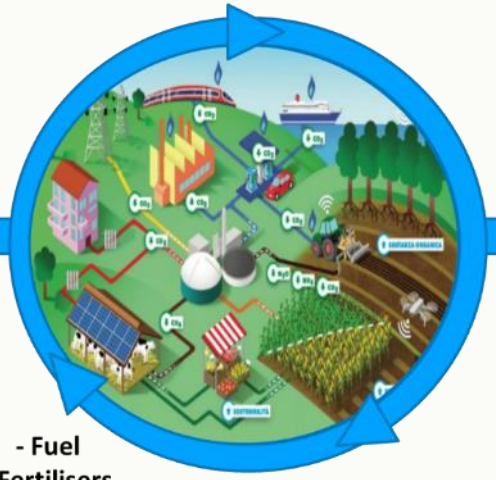
Synergy beetween natural cycles

CROPS
Photosynthesys and CO_2 capture



SOIL
CO_2 sequestration as Stable Organic Matter

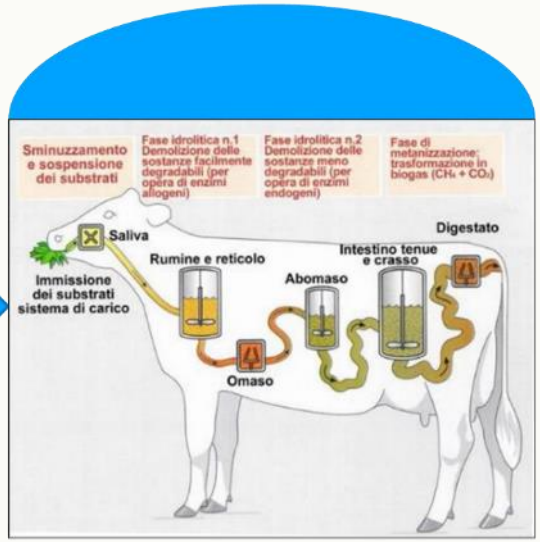
DOUBLE CROP CULTIVATION
+ Food, Feed, Energy
+ Rotations
+ Photosyntesys



- Fuel
- Fertilisers
- Emissions

Organic fertilisation
Nutrient recycling
Conservative agriculture
Closing Carbon Cycle

ANAEROBIC DIGESTION,
A "patent free" natural process that works in every day in every mammal

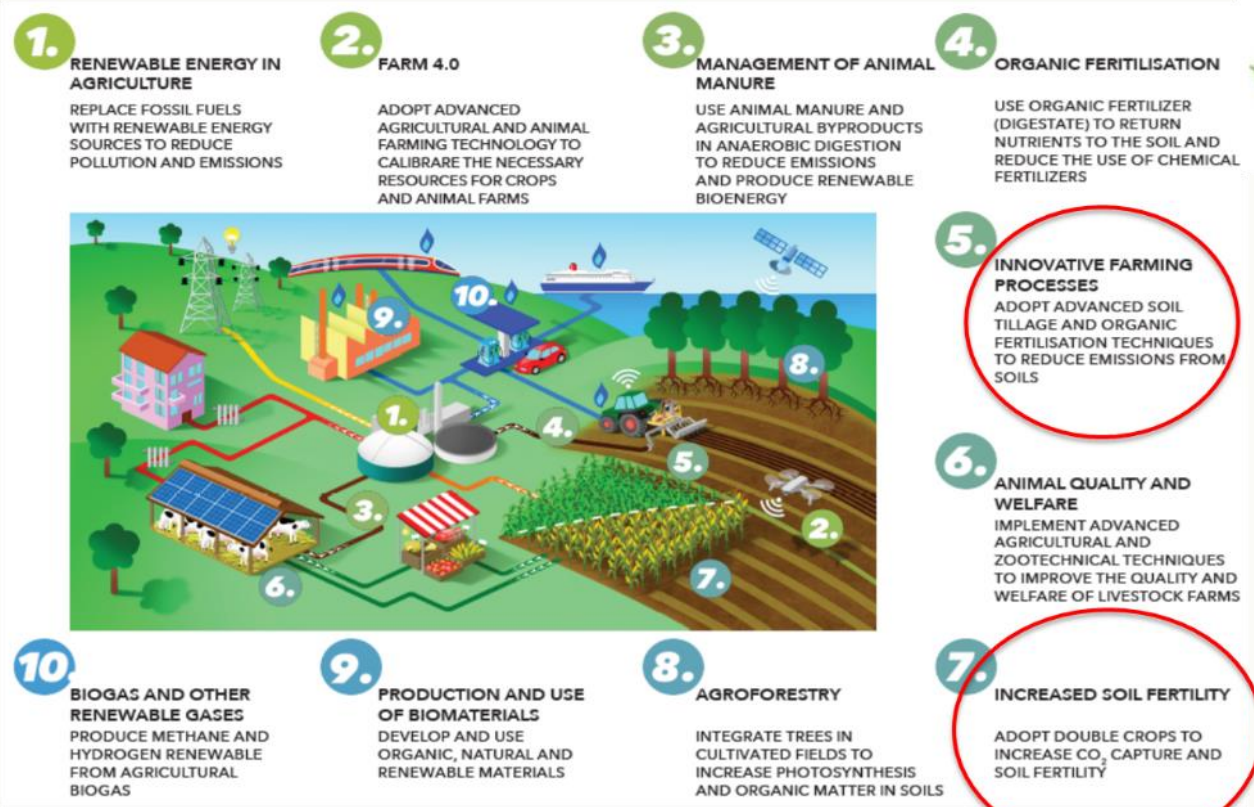


Valorisation of Biomasses and Agricultural/Agroindustrial By-products

BIOGASDONERIGHT TO FARMINGFORFUTURE

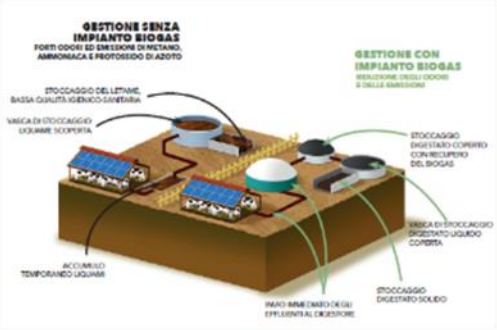
Biogasdoneright as a tool to sustain the agroecological transition of agriculture and livestock with renewable energy production

www.farmingforfuture.it

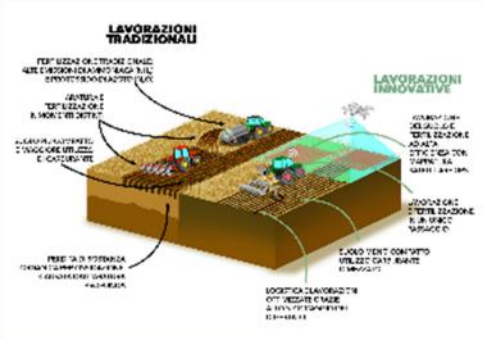


FARMINGFORFUTURE
Fundamentals

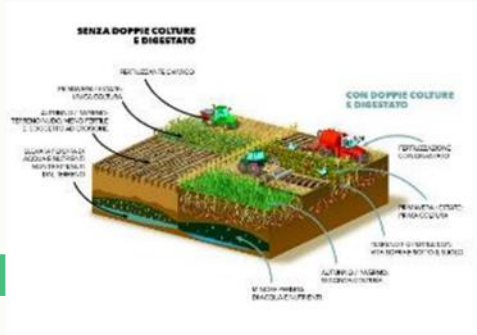
Effluents to AD



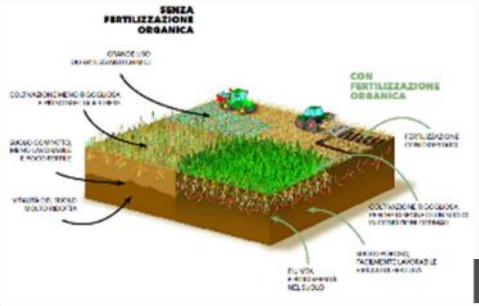
Innovative agricultural techniques



Sequential Cropping



Organic Fertilization via digestate



SHIFTING TO SEQUENCIAL CROPPING

- TWO crops instead of ONE
- More roots in soil
- More digestate for organic fertilisation

- Stability of crop yield
- Less chemical fertilizer
- More water retention capacity
- Reduction of tillage intensity
- Reduction of impact of diseases

SEQUENCIAL CROPPING

Biogasdoneright and agroecological intensification

CROP for "ADVANCED ENERGY"

and

CROP for FEED/FOOD

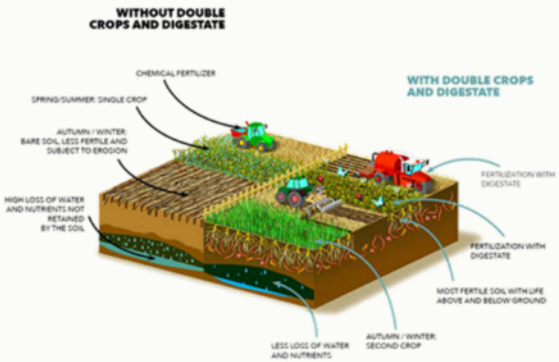
CROP for FEED/FOOD

and

CROP for "ADVANCED ENERGY"

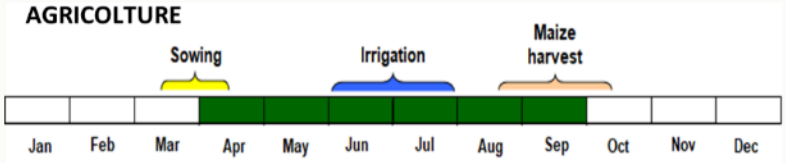
- **Any crop *(whatever it may be),* when in addition to a food crop on the same hectare, must generate "sustainable biomasses" and "advanced biomethane".**
- **The distinction between "food and no-food crops" does not make sense.**
- **More productions (also legumes), more markets and fighting climate change**

SHIFTING TO SEQUENCIAL CROPPING



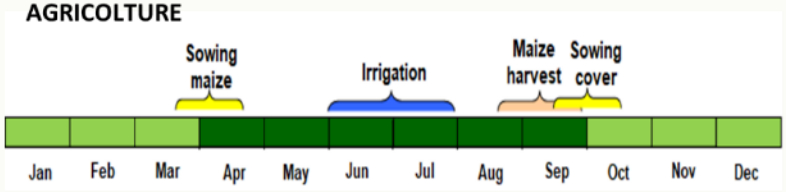
Adopt double cropping e digestate fertilisation to improve Carbon Capture and soil fertility

CONVENTIONAL AGRICOLTURE



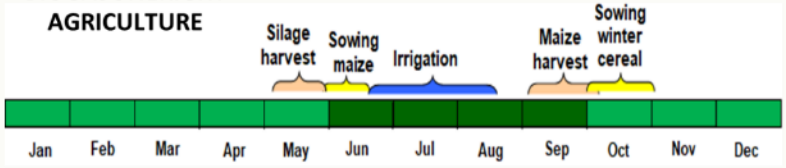
Soil covered 6 months (50% Photosynthesys efficiency)
1 harvested crop per year (es.: Maize)
23 t/ha/year of dry biomass produced
Irrigation/herbicides: necessary Soil tillage: hard (plowing) Soil organic matter: stable or in decrease

CONSERVATIVE AGRICOLTURE



Soil covered 12 months (100% Photosyntesys efficiency)
1 harvested crop (es.: Maize) + **1 cover crop**
26 t/ha/year of dry biomass produced (20+6)
Irrigation: necessary; herbicides: possible need Soil tillage: could be reduced Soil organic matter: stable or improved

BIOGASONERIGHT AGRICULTURE



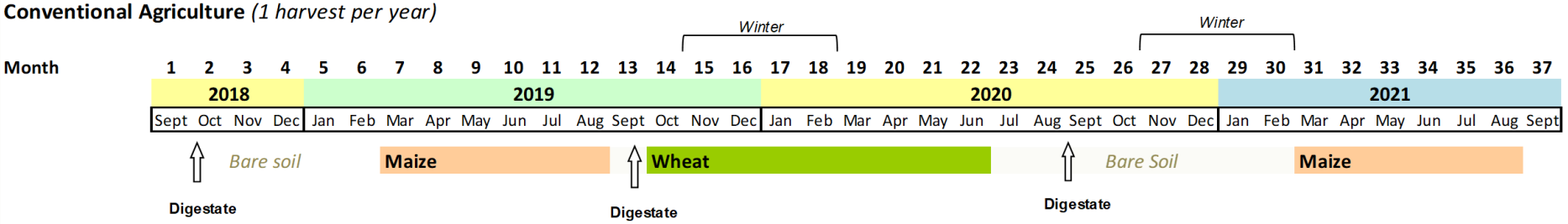
Soil covered 12 months (100% Photosyntesys efficiency)
2 harvested crops (es.: Maize+Triticale)
30 t/ha/year of dry biomass produced (18+12)
Irrigation: necessary; herbicides: reduced Soil tillage: reduced/conservative Soil organic matter: improved

Fonte: P. Mantovi, 2017 Biogas Italy – Elab. CIB

SHIFTING TO SEQUENCIAL CROPPING

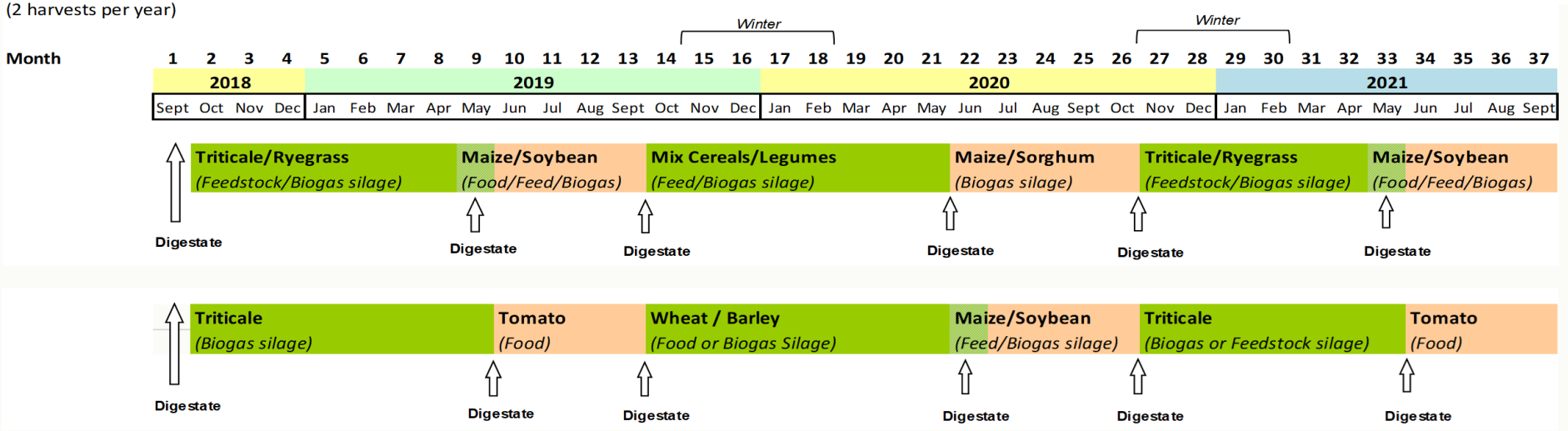
Examples for North Italy

Conventional Agriculture *(1 harvest per year)*



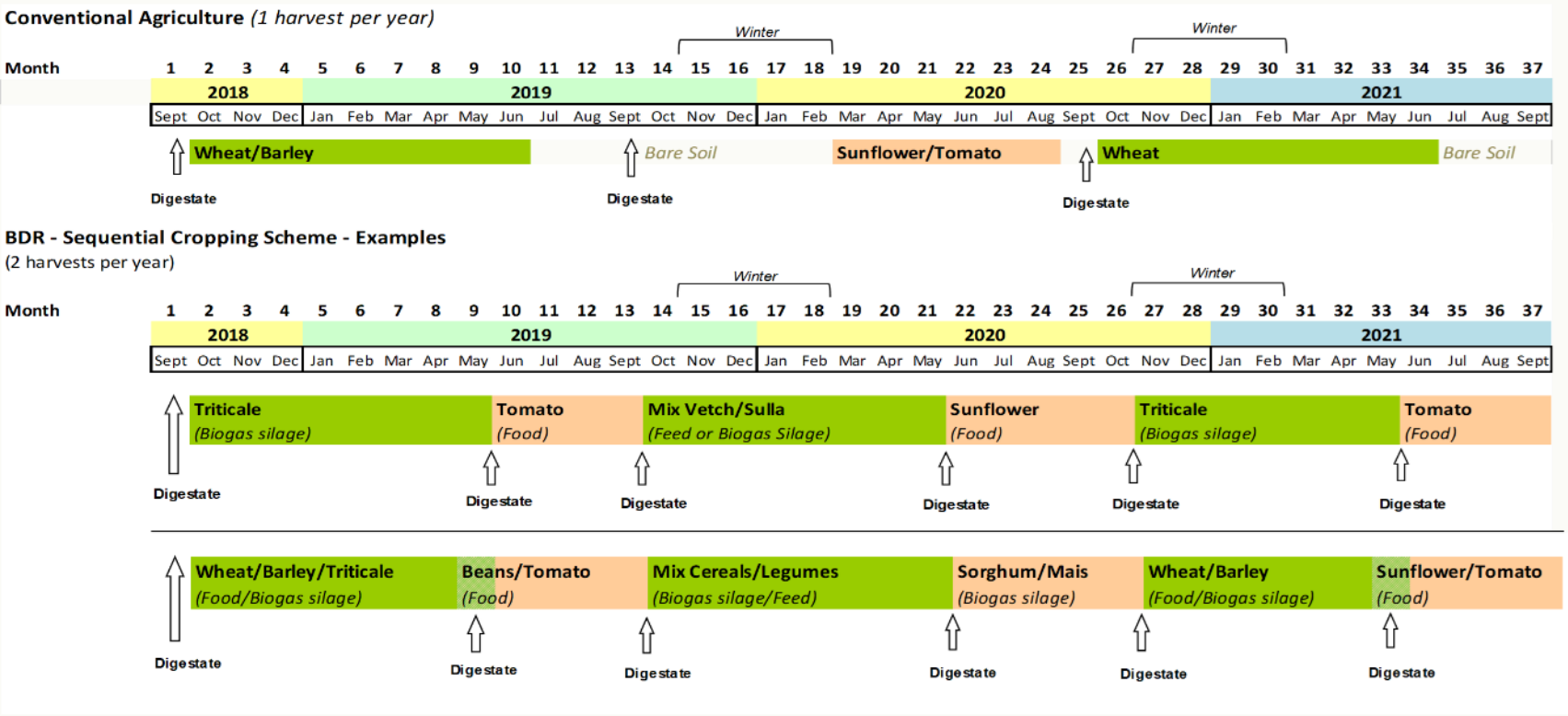
BDR - Sequential Cropping Scheme - Examples

(2 harvests per year)



SHIFTING TO SEQUENCIAL CROPPING

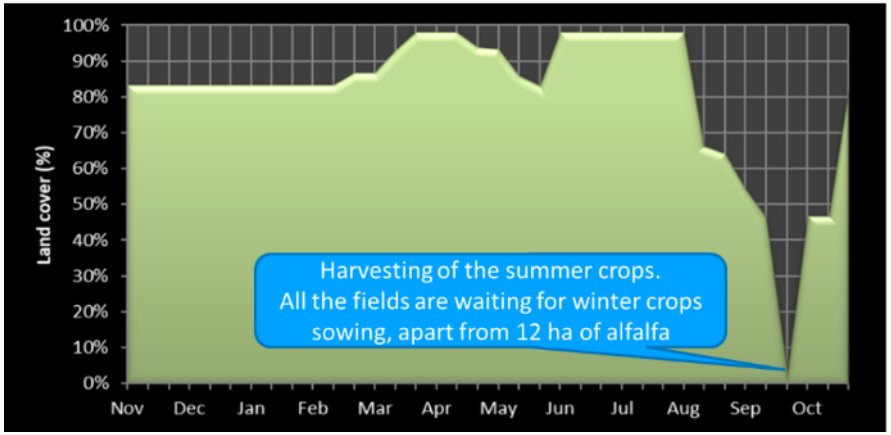
Examples for South Italy

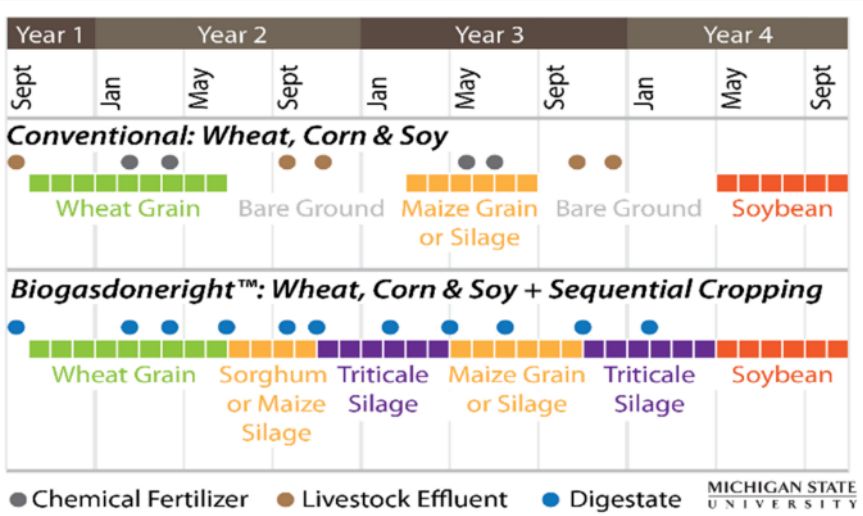


SHIFTING TO SEQUENCIAL CROPPING

A case study in Po Valley

Sequential cropping type	Area	Crop yield	DM yield
	(ha)	(t/ha)	(t DM/ha)
Maize silage as monocrop	129	56.3	19.7
Triticale silage as monocrop	7	48.9	14.7
Lolium+Maize silage	33	53.7	22.1
Wheat+Maize silage	16	80.3	29.1
Triticale+Maize silage	93	85.0	30.3

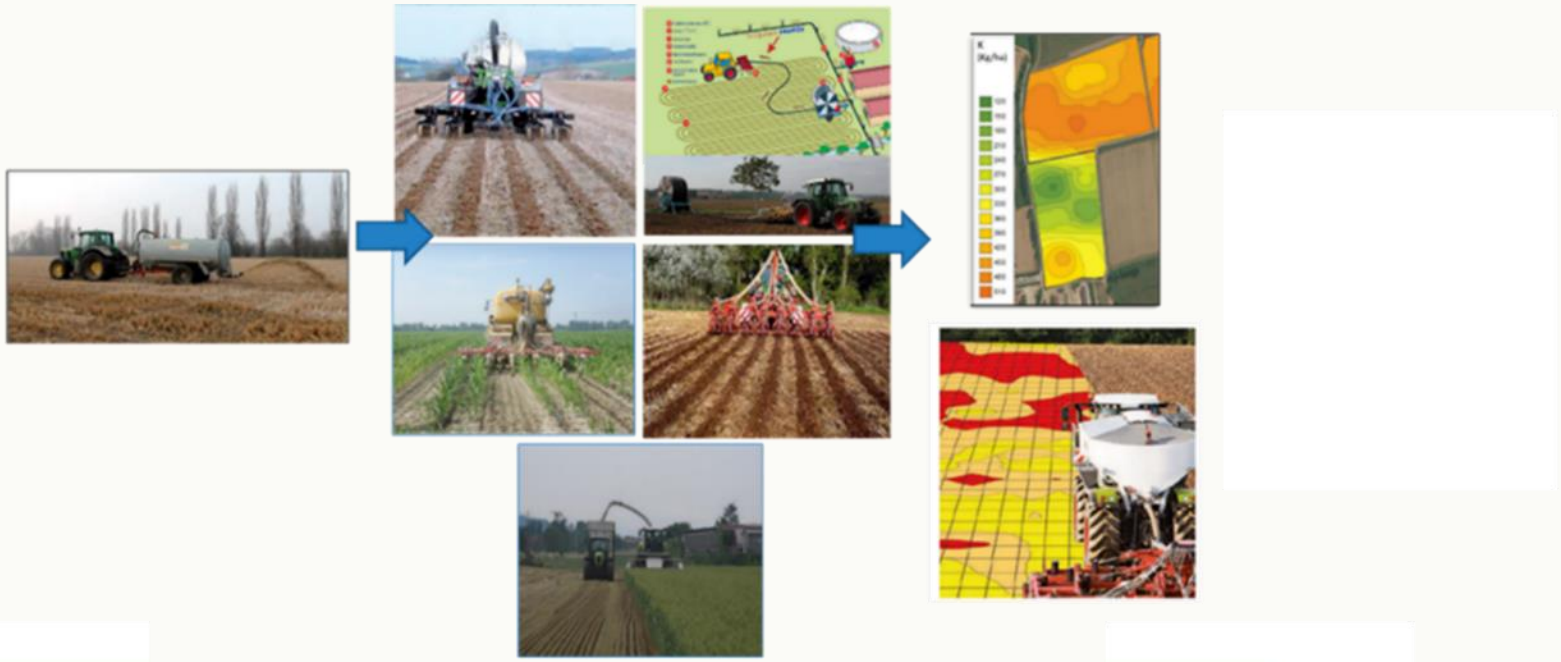




- DM yield per hectare: **+ 49%**
- Chemical fertilisers: **- 80%**
- About **59% farm land covered** for the whole year

SHIFTING TO SEQUENCIAL CROPPING

Switch to efficient and regenerative systems



LOW EFFICIENCY
+ Losses/Emissions

HIGH EFFICIENCY
- Losses/Emissions

SHIFTING TO SEQUENCIAL CROPPING

From NPK to CNK – Closing C Cycle and nutrient recycling

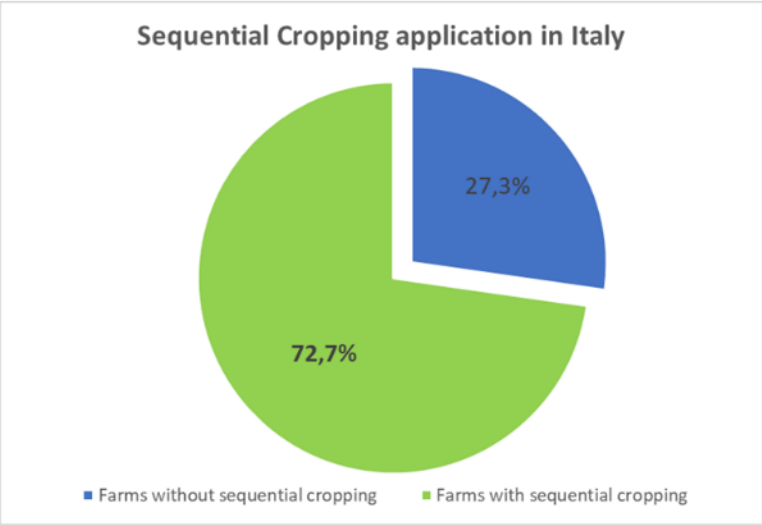


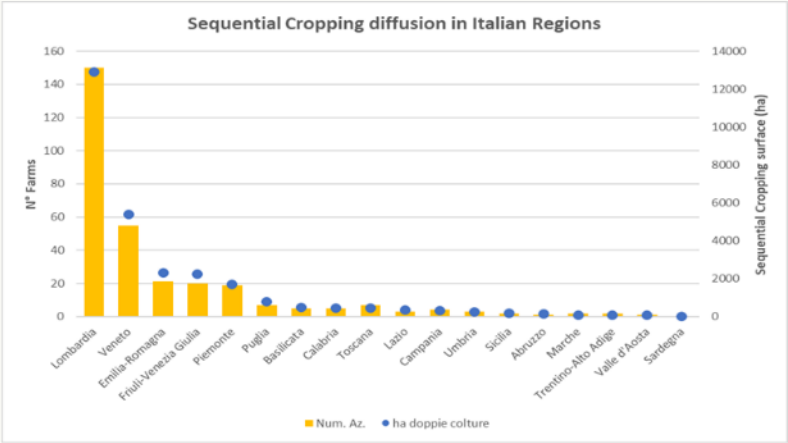
Field distribution systems and equipment with high efficiency and low emissions

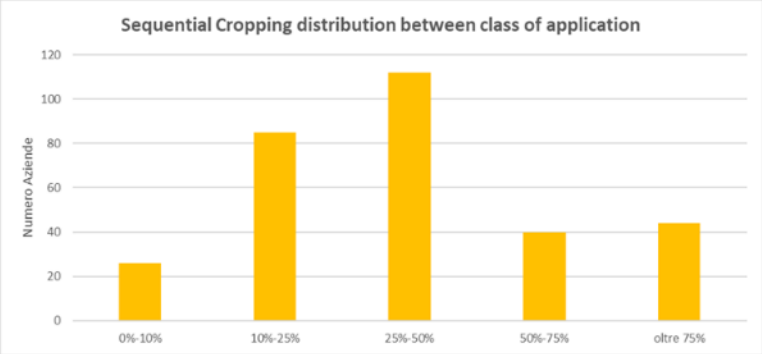


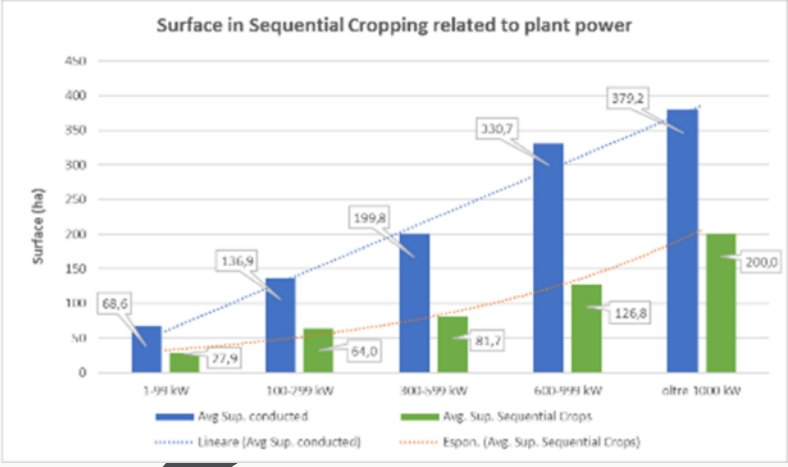
SEQUENCIAL CROPPING IN ITALY

- ✓ Survey on **420 farms** all around Italy
- ✓ **72%** is applying **sequential cropping**
- ✓ Sequential cropping is managed in average from 10% to 50% of total farm surface
- ✓ The application of sequential cropping is related to the plant power and to the farm total surface









SEQUENCIAL CROPPING EU POTENTIAL

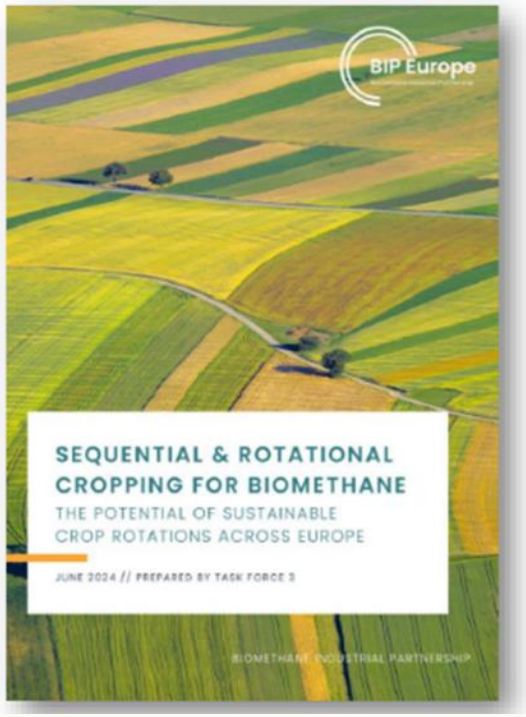
Sequential and rotational cropping for biomethane: The potential of sustainable crop rotations across Europe

Explores the how **sequential** and **rotational** crops can:

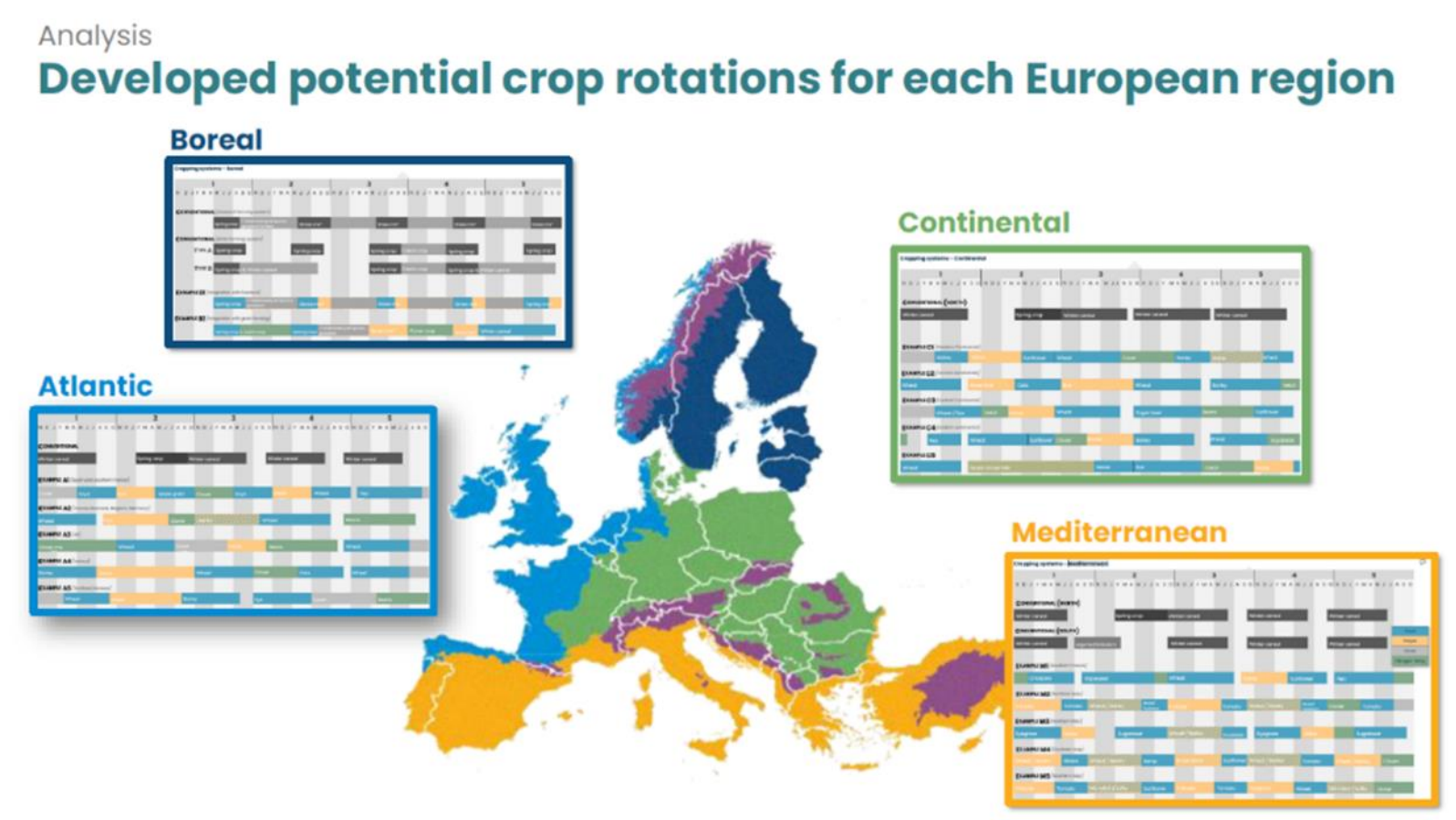
- Improve agricultural resilience
- Restore soil health
- Sequester carbon in soils
- Diversify agricultural incomes
- Enrich biodiversity
- Enhance food security

AND

- Increase the production of biomethane



SEQUENCIAL CROPPING EU POTENTIAL



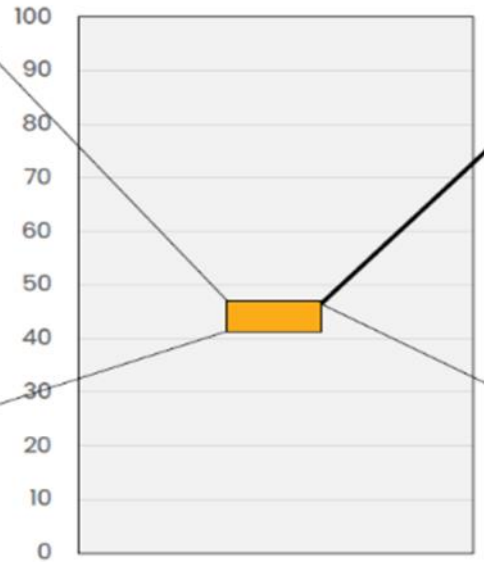
SEQUENCIAL CROPPING EU POTENTIAL

Analysis:

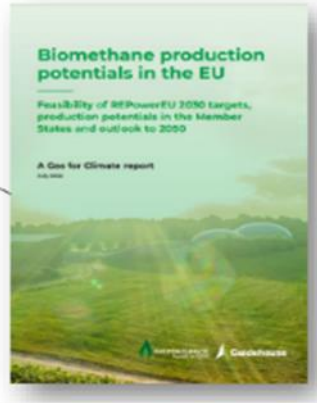
Comparison with other estimates

Max
46 bcm
Magnolo et al. (2021)

Min
40 bcm
Dale et al. (2020)



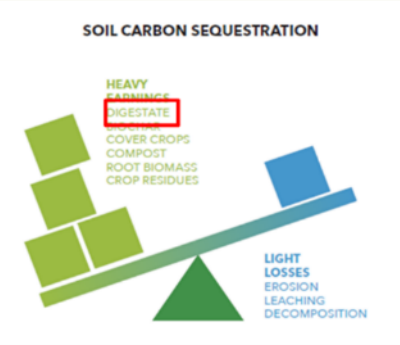
Deliverable
44-46 bcm
BIP (2024)



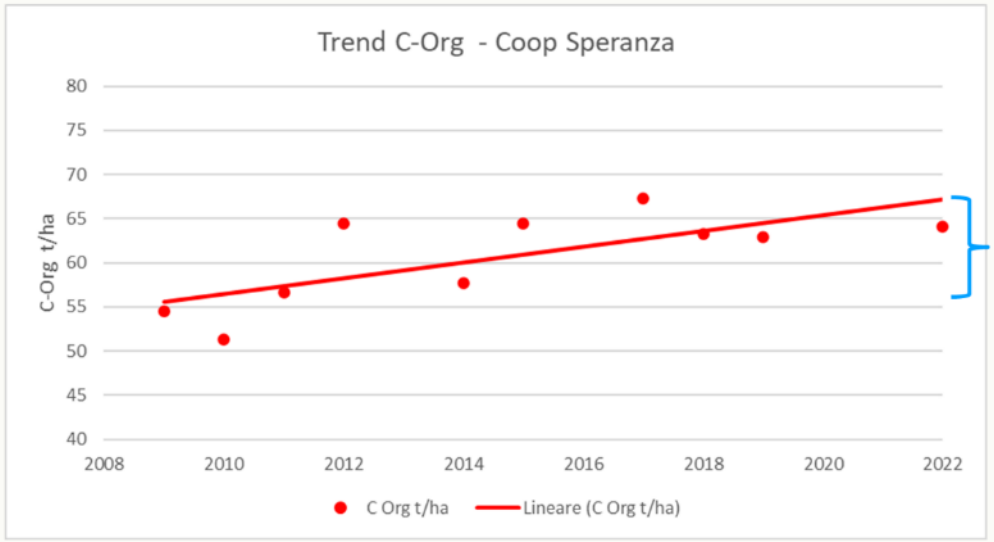
46 bcm
Gas for Climate (2022)

BIP Europe
Biomethane Industrial Partnership

SOIL FERTILITY TRENDS WITH BIOGASDONERIGHT APPROACH



- **Province of Turin**
- **8** Fields
- **41,5ha** Total surface
- **Soil silty/sandy**
- **Double crop (Winter cereal/Maize or Sorghum)**
- **Minimum tillage with direct digestate injection**



Elab. G.Bezzi on data from Corteva soil analysis for Coop. Agr. Speranza (TO)

+ 9,6 t/ha of C Org. Stored

+ 0,7 t/ha/year of C Org stored

Biogasdoneright has transformed my way of farming

FOOD&FUEL: Feasible and necessary

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Thank you!

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