



Dipartimento di Scienze e Tecnologie Agro-Alimentari
Università di Bologna



Alessandro Ragazzoni

The ecological and economic "footprints" of agricultural crops

SORGHUM



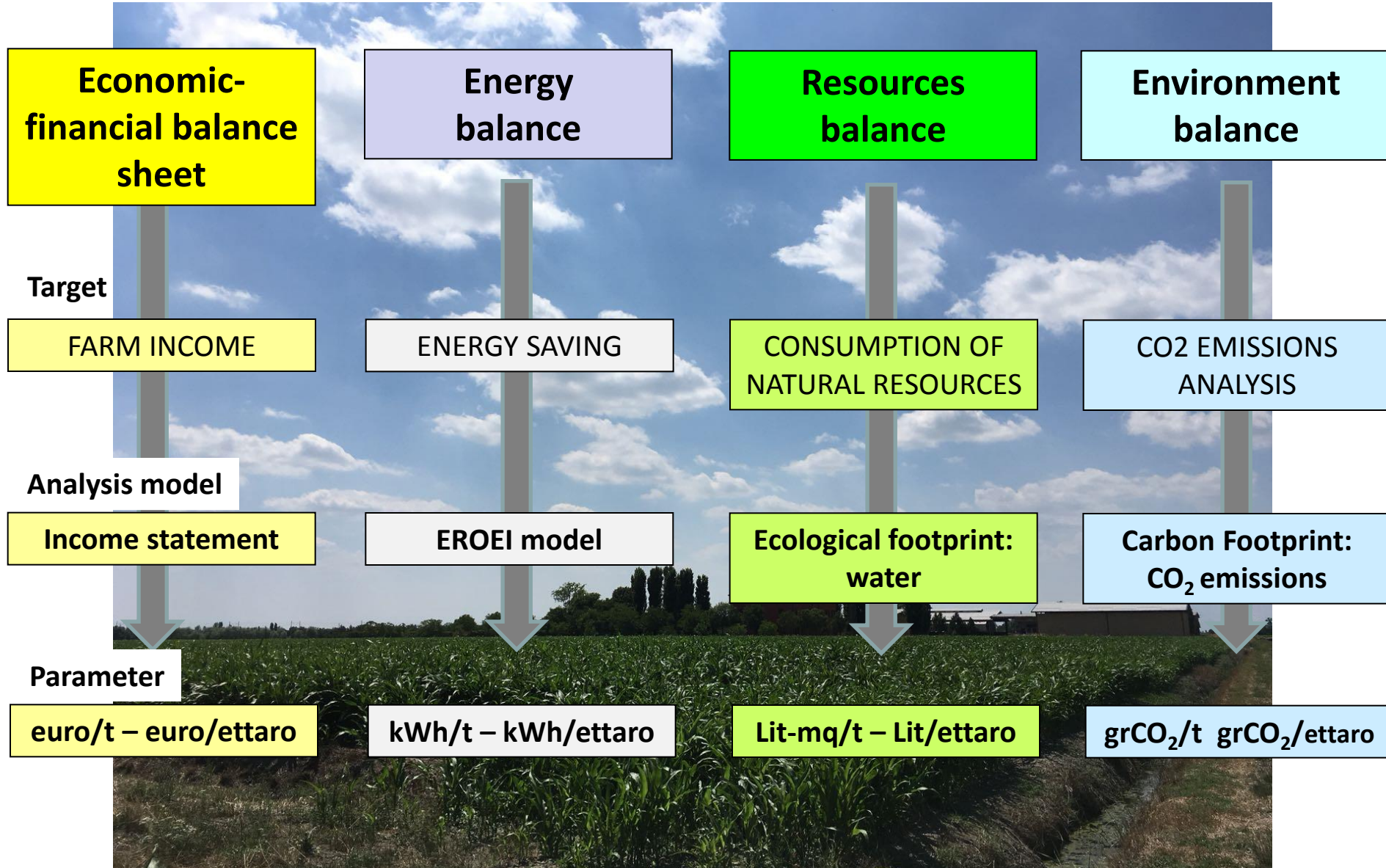
Workshop 2

Agronomia, economia, ambiente: i vantaggi reali della coltura del sorgo nel panorama odierno

Milano 7-8 novembre 2018



Multi-parameter evaluation models for circular economy



Economic-financial balance **A** sheet



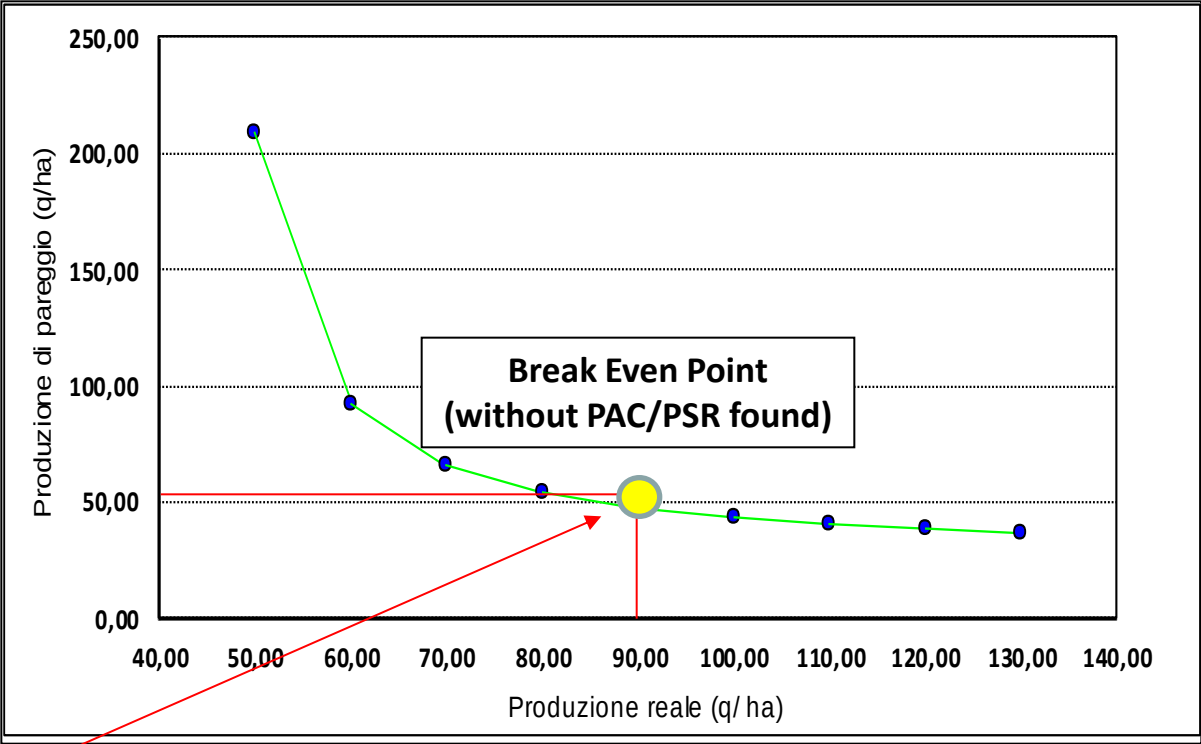
Reclassified balance sheet indices: the case of sorghum (2018)

Reclassification of the budget	Value (euro/ha)
Revenues	2.040,00
- Production (80 q/ha * 18 euro/q)	1.440,00
- PAC/PSR (integrated technique - organic substance increase)	600,00
- External cost (materie prime e servizi)	626,51
- Seed	97,50
- Fertilizer	124,00
- Herbicides	62,00
- Insecticides	60,00
- Fungicides	0,00
- Fuel	81,00
- External services	202,01
= Value added	1.413,49
- Farm employees	148,57
= EBITDA - Margine Operativo Lordo (MOL)	1.264,92
- Depreciation of assets	145,00
= EBITA	1.119,92
- Amortization of intangible assets	---
= EBIT - Margine operativo Netto (MON)	1.119,92
- Interests	18,80
= EBT Risultato ante-imposte	1.101,12
- Taxes and contributions	300,00
= Net income	801,12

Determination of break-even points: price and quantity

	Variable costs	Fixed costs	Total costs
Costs:	793,88	445,00	1.238,88
Price:	18,00		
CAP/PSR:			600,00

Production (q/ha)	Break Even Point (q/ha)
50,00	209,66
60,00	93,32
70,00	66,83
80,00	55,10
90,00	48,48
100,00	44,23
110,00	41,27
120,00	39,09
130,00	37,42
80,00	55,10



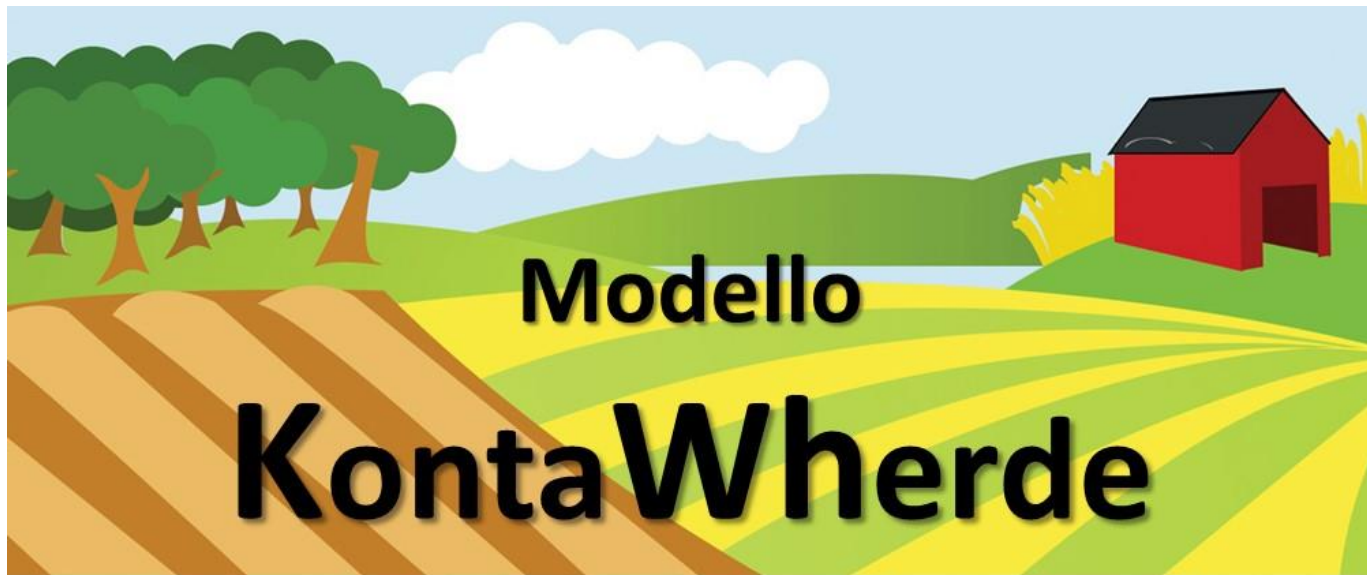
«Indicator panel» of economic convenience

	MAIZE	SORGHUM	
	Value (euro/ha)	Value (euro/ha)	Delta (euro/ha)
PAC - PSR 2014-2020	600,00	600,00	----
Production	2.070,00	1.440,00	-630,00
Real costs	998,14	626,51	-371,63
Total costs (variable e fixed)	1.798,13	1.238,88	-559,25
Added value	1.671,86	1.413,49	-258,37
EBITDA/MOL	1.346,82	1.264,92	-81,90
EBIT/MON	1.201,82	1.119,92	-81,90
Net income	871,87	801,12	-70,75
Break Even Point (q/ha)	73,14	55,10	

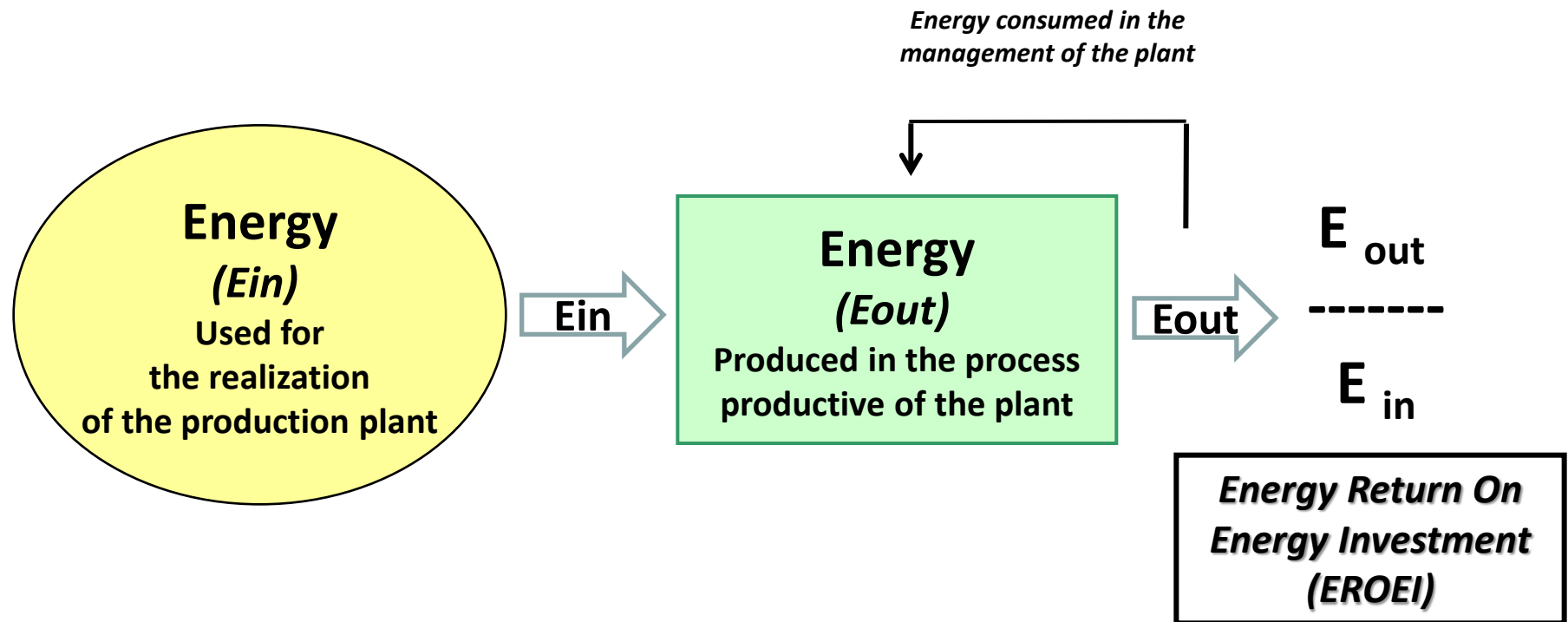
Energy Balance:

EROEI model

B



EROEI model



Comparison between crops and cultivation techniques

	MAIZE	SORGHUM
	kWh/ha	kWh/ha
	Energia da biogas	Energia da biogas
Production	10.584,00	12.920,00
Cultivation input	7.951,15	5.144,05
Depreciation input	791,73	638,94
Extra-farm input	972,30	1.055,64
Total input	9.715,18	6.838,63
INPUT	9.715,18	6.838,63
OUTPUT	10.584,00	12.920,00
= Energy balance	868,82	6.081,37
EROEI	1,09	1,89

*Very interesting
performance*

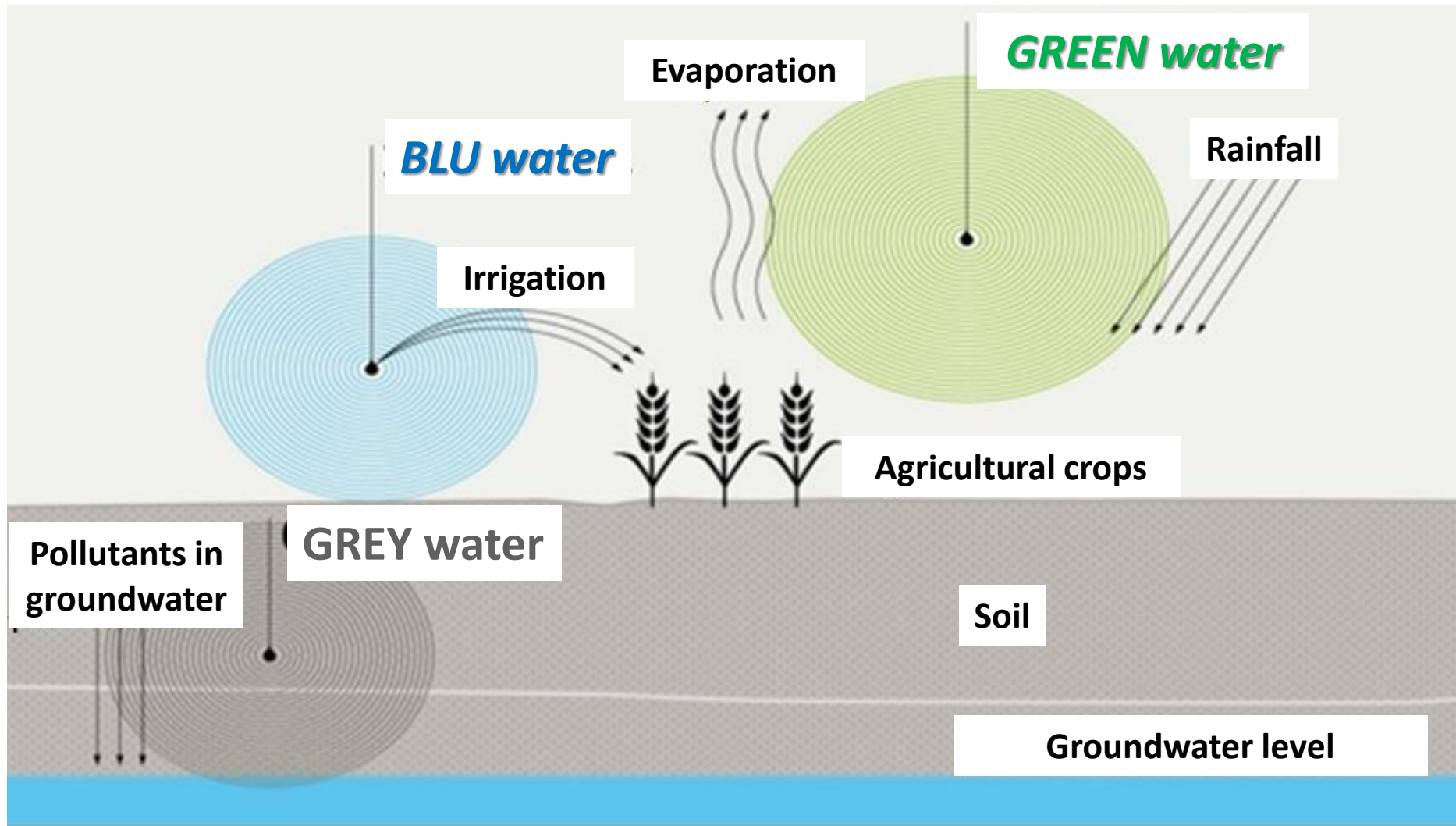
Resources balance:

Water print

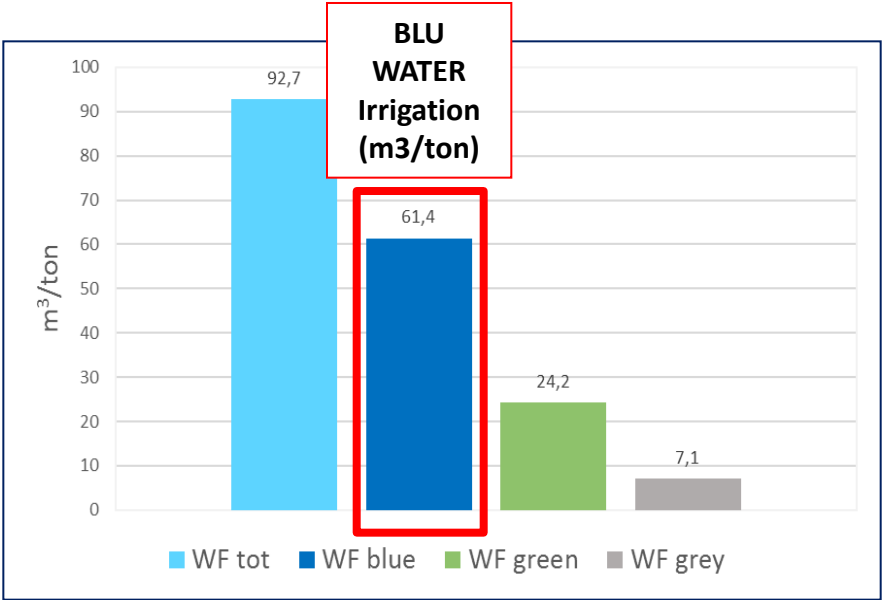
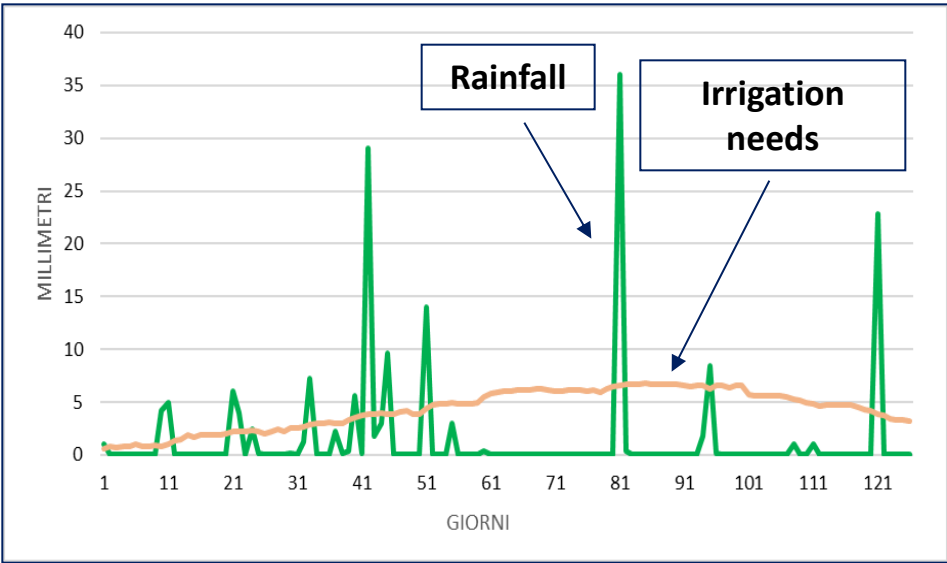
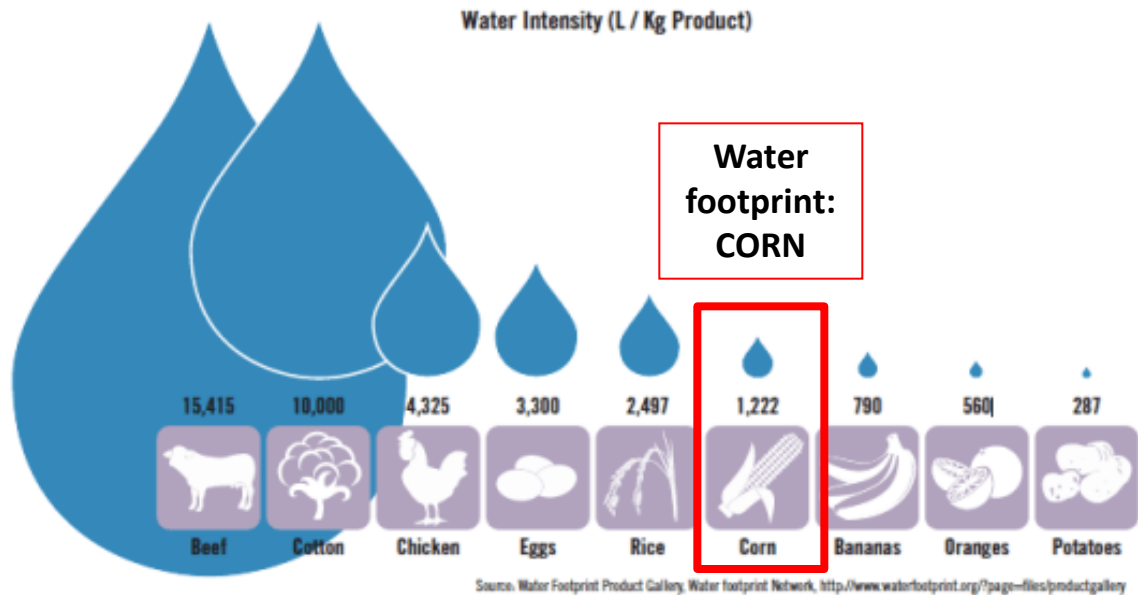
C



Water cycle in agriculture



Consumption of fresh water for the production of food goods

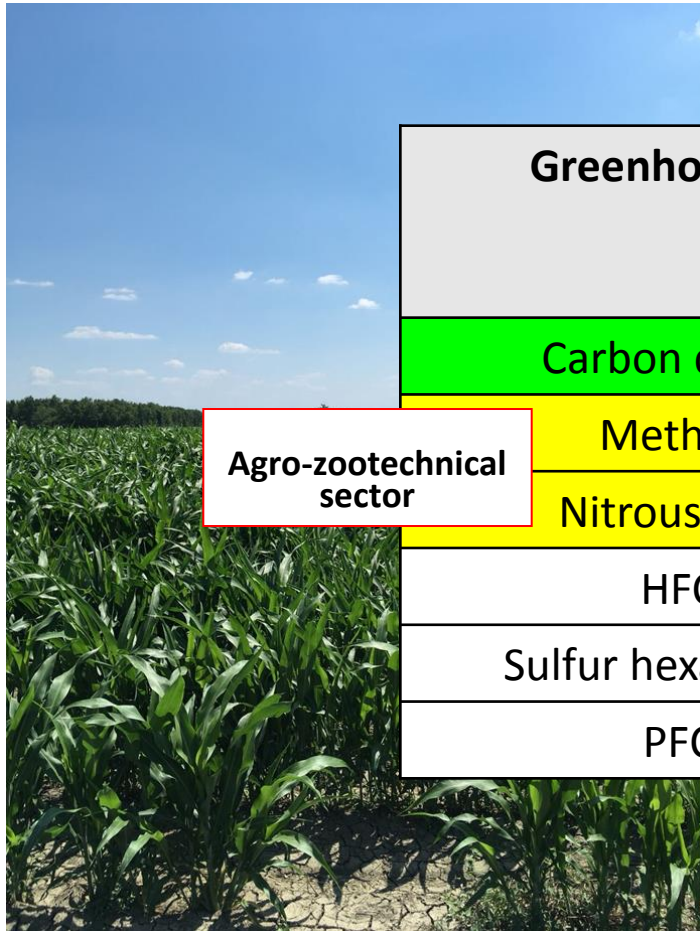


Environment balance: **Carbon Foot Print**

D



Ratio between the heating caused by a greenhouse gas in a specific time interval (normally 100 years) and the heating caused in the same period by the CO₂ in the same amount



Greenhouse gas	Chemical formula	Ratio between gas and CO ₂ emissions (100 years)
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298
HFCs	-	124-14.800
Sulfur hexafluotide	SF ₆	22.800
PFCs	-	7.390-12.200

Comparison of agricultural techniques for cereals

Agricultural technique	Agricultural area	Productive yield	Fuel	Pesticidi	Azoto minerale	GES
	(hectares)	(ton/hectar)	(lit/hectar)	(kg/hectar)	(kg/hectar)	(tCO2e/hectar)
Medium (sorghum)	126,92	3,20	121,00	1,50	92,00	1,90
Low (wheat)	26,50	1,30	44,00	0,00	0,00	0,66
High (corn)	520,00	5,20	221,00	5,00	160,00	3,29

Some comparative data and conclusive reflections

Index	MAIZE	SORGHUM	Notes
Economic-financial Index	Net income: 871,87 euro/ha	Net income: 801,12 euro/ha	The balance sheet values are similar. <u>Sorghum production costs are much lower</u>
EROEI Index	Input = 9.715,18 kWh/ha Output = 10.584,00 kWh/ha 1,09	Input = 6.838,63 kWh/ha Output = 12.920,00 kWh/ha 1,89	The energy balance of maize is very limited
WATER Index	BLU WATER 61,4 m ³ /ton	NO IRRIGATION	The advantage of sorghum cultivation is linked to the need for irrigation, if not in cases of drought
CO ₂ emission Index	Greenhouse 3,29 tonCO ₂ /ha	Greenhouse 1,90 tonCO ₂ /ha	Sorghum produces about half the corn's emissions

